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INTERNATIONAL DECADE FOR NATURAL DISASTER REDUCTION

The United Kingdom Science, Technology and Engineering Committee for the International Decade for Natural Disaster Reduction (IDNDR) announces a conference, 'Natural Disasters: Protecting Vulnerable Communities', to be held at the Royal Society in London from 13 to 15 October 1993. Supported by the Royal Society, the Royal Academy of Engineering, the Society of Earthquake and Civil Engineering Dynamics and British Nuclear Fuels plc, this will be the first major conference to be planned as an official UK contribution to the IDNDR. Further information can be obtained from Rachel Coninx, The Conference Office, Institution of Civil Engineers, 1 Great George Street, London, SW1P 3AA, UK.

MANAGING EMERGENCY MEDICAL SERVICES, an intensive four-week advanced management course, will be held from June 1–30, 1993 on the Campus of the University of Maryland Baltimore County (UMBC), Baltimore, Maryland. It is being sponsored by the University of Maryland Baltimore County Department of Emergency Health Services in cooperation with the Maryland Institute for Emergency Medical Services Systems.

For further information, please contact:

Dr Richard Bissell
Department of Emergency Health Services
University of Maryland Baltimore County
Baltimore
MD 21228, USA.
Tel (410) 455-3776 or Fax (410) 455-3045.
Deaths in Natural Hazards in the Solomon Islands

R.J. BLONG AND D.A. RADFORD

Archival and library search techniques have been used to establish extensive databases on deaths and damage resulting from natural hazards in the Solomon Islands. Although the records of fatalities are certainly incomplete, volcanic eruptions, tropical cyclones, landslides, tsunami and earthquakes appear to have been the most important. Only 22 per cent of the recorded deaths have resulted from meteorological hazards but a single event could change this proportion significantly. Five events in the fatality database account for 88 per cent of the recorded deaths. Future death tolls are also likely to be dominated by a small number of events. While the expected number of deaths in a given period is dependent upon the length of record considered, it is clear that a disaster which kills one hundred or more people in the Solomons can be expected more frequently than once in a hundred years.

The Solomon Islands occupy an area of approximately 29,785 square kilometres in an ocean area of 800,000 square kilometres. There are approximately 992 islands stretched out over more than 1,800 km from northwest to southeast. The islands of the group formed the British Solomon Islands Protectorate until 1978 when the country became an independent state. At the last census, in 1986 the population of the islands totalled 285,796 with an estimated annual growth rate of 3.5 per cent. Honiara, the administrative capital, with a population of 30,499 is located on the island of Guadalcanal (Figure 1).

Most of the islands of the Solomons form a series of NW–SE trending arcs, reflecting the tectonic collision zone between the Indo-Australian and Pacific Plates. Collision, and the rapid subduction of the minor Solomon Sea Plate, indicate that earthquake, volcanic, and tsunami hazards are important geophysical events. Young mobile rocks, steep slopes and high rainfall totals suggest that floods and landslides are also likely to be important hazards.

The location of most of the islands at latitudes 5–13°S in tropical waters with sea surface temperatures above 26°C indicate that tropical cyclones are spawned in the area. Finally, periodic El Niño events contribute episodes of drought with severe consequences for the low atolls of Ontong Java, Sikaiana and a number of islands in the Eastern Solomons (Figure 1).

This article forms part of a wider study, carried out for the Australian International Development Assistance Bureau, which aimed to establish the record of past hazards and disasters and the likely mixture of future events. The record of human deaths allows identification of the most important...
hazards, the areas that have proved most hazardous, the likely character of future risks and the probable merits of some mitigation measures.

DATA ACQUISITION

The consequences of past events were established using typical library and archival search techniques including a computerised search of international databases. Natural disaster files maintained by the Natural Hazards Research Group at Macquarie University from the Sydney Morning Herald and the Pacific Islands Monthly were examined alongside the British Solomon Islands Protectorate News Sheet, the British Solomon Islands Reports for the Year, Solomon Islands newspapers and some Fijian newspapers. Publications of the Solomon Islands Geological Survey and Meteorological Service, numerous international scientific journals and books, anthropological reports and church and missionary magazines were perused.

All relevant data were recorded in a NOTEBOOK II database so that duplicate, contradictory and confirmatory information could be identified to provide as complete and accurate an account as possible of human deaths resulting from tropical cyclones, earthquakes, floods, storms, landslides, tsunami, volcanic eruptions and droughts.

Although written records of natural hazards in the Solomon Islands extend back to the accounts of early European navigators in the 16th century, the record can be regarded as reasonably complete only for the 20th century; in some cases it is only since World War II that we can be certain that most events have been recorded.
SUMMARY OF RESULTS

Our Solomon Islands natural hazards database contains information about 209 events of which 27 occurred before 1900 A.D. Earthquakes and volcanic eruptions total 103 of the 182 20th century events while tropical cyclones occurrences number 37 for this century (Table 1). Slightly less than half the total number of events are known to have produced damage in some form, but only 20 of the 209 hazard impacts have resulted in human deaths. Half of these events were tropical cyclones, suggesting that cyclones more commonly result in deaths than do more frequent earthquakes and volcanic eruptions. As indicated in Table 2 a total of about 900 human deaths are known to have resulted from the natural hazards listed, but only 273 (30 per cent) of these deaths have occurred this century. The more important natural hazards are now considered individually.

VOLCANIC ERUPTIONS

While the database contains references to 53 eruptions, including 16th century eruptions of both Savo and Tinakula (Figure 1), only two eruptions, both in the 19th century, are known to have produced human deaths. Although the death tolls for these eruptions cannot be precise, it seems probable that the 1827 eruption of Tinakula in the Eastern Solomons killed more than 100 people. This eruption produced pyroclastic flows. In a bid to escape from the island, people attempted to launch their canoes, but due to the tsunami which accompanied the eruption, this was impossible. From the available accounts, it seems likely that the entire population of the island was killed either by pyroclastic flows or the tsunami (Grover, 1956).

In about 1847 the island volcano Savo, in the Western Solomons, erupted. This eruption also produced pyroclastic flows, vividly described in Solomons Pidgin as 'shoot-e-come, all same hot water' (Grover, 1956), leaving few survivors. The death toll, based on projected estimates of the island's population at the time, is believed to have been about 500, or about one quarter of the island's population. Attempts were made to evacuate the island, but as there were...
insufficient canoes many people died in the
endeavour. Women and children were club-
bed in the struggle to get onto the boats,
‘hands clinging in desperation to gunwales
were chopped off without mercy’ (Grover,
1956).

Although only two volcanic eruptions
are known to have killed people in the
Solomon Islands, other nineteenth century
eruptions may have resulted in fatalities.
While it is more than 140 years since any
such deaths occurred, volcanic eruptions
appear to have been responsible for about
66 per cent of the known deaths resulting
from the geophysical hazards listed in
Table 2.

TROPICAL CYCLONES

The tropical cyclone season in the Solomons
is generally considered to extend from
November to April; however, damaging
cyclones have occurred in May, and even
in early June. Our database contains records
of 45 tropical cyclones in the Solomon
Islands area. The first of these was recorded
in 1568, the second in 1788, and a total of
only eight cyclones are known to have
occurred before 1900. Only six cyclones
were reported in the first 50 years of this
century; until the late 1940s annual reports
stated that cyclones did not occur in the
Solomons as it was thought that the islands
were situated too close to the equator
(British Solomon Islands Protectorate, 1911;
Pacific Publications, 1950). The cyclones of
December 1951 and 8 January 1952 changed
that belief with a further 29 cyclones
reported up to 1990. From the total record,
66 per cent of the tropical cyclones are
known to have caused damage but only 11
(less than 25 per cent) have resulted in
fatalities. This record is likely to be a gross
underestimate, but for most tropical cyclones
the death tolls have been remarkably low.
Table 3 summarises the known deaths.

Of the total 154 deaths attributed to
tropical cyclones, 70 per cent resulted from

<table>
<thead>
<tr>
<th>Date</th>
<th>Name</th>
<th>No. of deaths</th>
<th>Area of deaths</th>
</tr>
</thead>
<tbody>
<tr>
<td>1788</td>
<td>Vanikolo</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>1937 Jan</td>
<td>6</td>
<td>Reef Is., Utupua</td>
<td></td>
</tr>
<tr>
<td>1966 Nov 14</td>
<td>2</td>
<td>Malaita,</td>
<td></td>
</tr>
<tr>
<td>1968 Dec</td>
<td>Becky</td>
<td>1</td>
<td>Guadalcanal</td>
</tr>
<tr>
<td>1970 Apr</td>
<td>1</td>
<td>Malaita</td>
<td></td>
</tr>
<tr>
<td>1971 Dec 6</td>
<td>Ursula</td>
<td>1</td>
<td>Santa Catalina</td>
</tr>
<tr>
<td>1972 Jan 11</td>
<td>Carlotta</td>
<td>1</td>
<td>Guadalcanal</td>
</tr>
<tr>
<td>1972 May 30</td>
<td>Ida</td>
<td>3</td>
<td>Guadalcanal</td>
</tr>
<tr>
<td>1979 Feb 17</td>
<td>Kerry</td>
<td>1</td>
<td>Bellona</td>
</tr>
<tr>
<td>1982 Apr 3</td>
<td>Bernie</td>
<td>1</td>
<td>?</td>
</tr>
<tr>
<td>1986 May 16</td>
<td>Namu</td>
<td>97</td>
<td>Guadalcanal</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Malaita</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Makira</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Santa Cruz</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>154</td>
<td></td>
</tr>
</tbody>
</table>

Cyclone Namu which struck the Solomons
on 16 May 1986. After being identified near
the island of Sikaiana (Figure 1), the cyclone
moved in a south westerly direction. The
intensity seemed to increase as it crossed
the islands and it is likely that there were
winds of 116 km/hr with wind gusts of
185 km/hr reported in some areas. It has
been suggested that the central pressure
was as low as 960 hectopascals. On the
Saffir-Simpson scale Namu was probably
2–2.5 (Britton, 1987), a moderate cyclone,
but damage was great because of the slow
and erratic path. While the death toll in this
cyclone is sometimes reported as about 150,
we have been able to positively identify only
111 fatalities. Of these, 97 (88 per cent)
occurred on Guadalcanal.

As Table 3 indicates, all other cyclones
this century are known to have killed only
23 people. No deaths are attributable to 19th
century cyclones. The 1788 cyclone in the
Eastern Solomon Islands led to the wreck
of two ships in La Perouse’s fleet. The ships
were blown onto the barrier reef to the
south of the island of Vanikolo where many of the crew drowned (Handbook of the BSIP, 1911).

While these estimates of deaths in tropical cyclones in the Solomon Islands are likely to be gross underestimates, it seems safe to conclude that most cyclones kill relatively few people. Because the record is so dominated by Cyclone Namu which severely affected Guadalcanal, the majority of deaths in tropical cyclones (about 66 per cent) have occurred on Guadalcanal.

EARTHQUAKES

Seismic activity in the Solomon Islands is generally due to the underthrusting of the Solomon Sea Plate beneath the northwestern islands of the Solomons which lie on the Pacific Plate, but the tectonic system is complex, and the distribution and intensity of earthquakes is varied. From Choiseul to Makira the tectonic trench is well developed and seismicity is high along the southern side of the island arc. The area between Makira and the Santa Cruz Islands is of lower seismicity (Cooper et al., 1986).

Earthquakes included in the databases are almost entirely confined to the 20th century with 59 of the 62 events recorded since 1900. In contrast to the record for tropical cyclones and volcanic activity where knowledge of events extends over several centuries, the earliest reported earthquake occurred in about 1870. Although damage has been recorded for half the earthquakes reported in this century, fatalities are known to have occurred in only four events (Table 4). More than half the fatalities occurred in the Richter magnitude 8.1 1931 earthquake with three aftershocks greater than 7.0. Most of these deaths occurred toward the eastern end of Makira. Another five deaths were recorded on Small Malaita; although damage was extensive on Malaita we have no knowledge of any fatalities on this island. The 1977 earthquake (Ms = 7.5) resulted in 32 fatalities on Guadalcanal.

Although widespread damage was reported on Santa Isabel this was much less severe than on Guadalcanal and no fatalities are known from areas other than southern, central and eastern Guadalcanal.

TABLE 4 Deaths in earthquakes

<table>
<thead>
<tr>
<th>Date</th>
<th>No. of fatalities</th>
<th>Areas most affected</th>
</tr>
</thead>
<tbody>
<tr>
<td>1926 Jan 25</td>
<td>5</td>
<td>Guadalcanal</td>
</tr>
<tr>
<td>1931 Oct 31</td>
<td>55</td>
<td>Makira, Small Malaita</td>
</tr>
<tr>
<td>1939 Apr 30</td>
<td>12</td>
<td>Guadalcanal</td>
</tr>
<tr>
<td>1939 Apr 30</td>
<td>2</td>
<td>Santa Isabel</td>
</tr>
<tr>
<td>1977 Apr 21</td>
<td>32</td>
<td>Guadalcanal</td>
</tr>
<tr>
<td>Total</td>
<td>106</td>
<td></td>
</tr>
</tbody>
</table>

TSUNAMI

Tsunami experienced in the Solomon Islands have at least three source areas — locally, elsewhere in the Solomon Sea (principal near Bougainville, Papua New Guinea), and other parts of the Pacific Rim. Most tsunami occurring in the Solomons region have been generated locally by submarine earthquakes. Deaths resulting from these tsunami have been included above under earthquakes but are considered further below. Of the 19 other tsunami in the database, 12 have produced damage but none are known to have produced fatalities.

STORMS AND FLOODS

Only a few storms and floods are included in the database as entities separate from tropical cyclones. Of the 21 storms and floods recorded, 19 occurred this century with all but one of these being reported post-1950. While damage, rarely serious, was reported from most of the events only two floods and two storms are known to have caused human fatalities. The total
known death toll from floods is only three, all on southern Guadalcanal in 1965 and 1973. These totals are likely to be serious underestimates as individual deaths probably occur quite commonly as villagers attempt to cross flooded streams.

On the other hand it is estimated that 20 people have perished in storms, 13 of these when three canoes were lost during a storm in December 1984 near Ontong Java. A fleet of six canoes left Ontong Java on 20 December for the 65 km journey north to the Tasman Islands. They were hit by a fierce local storm and reported missing on 23 December. An aircraft found one canoe 72 km south east of Ontong Java and directed it home. Two canoes made it to the Tasman Islands and three canoes were never found. The other deaths occurred in 1888 near Tikopia when a canoe was lost at sea.

OTHER HAZARDS

Other hazards reported in the Solomons region include landslides and droughts. No doubt tens of thousands of landslides have occurred in the Solomon Islands this century, with most of these associated with earthquakes, tropical cyclones and storms. Only three landslides in addition to those associated with these hazards are included in the database. While each of these landslides produced damage, no injuries or deaths were reported.

Only four droughts have been recorded in the database; undoubtedly there have been many more, particularly on the low islands. The most serious drought followed the 1951 and 1952 tropical cyclones which struck Tikopia. The drought, exacerbated by the food shortages produced by the cyclones, resulted in the deaths of 17 people, nearly all of them children, between March 1952 and March 1953.

DISCUSSION

The known deaths in natural hazards in the Solomon Islands were referenced to 146 polygons based largely on 1976 census districts. The locations of those deaths which occurred in the Western Solomons are shown on Figure 2, the most striking aspect of which is the absence of recorded natural hazard fatalities in the western islands of the Shortland and New Georgia groups, Santa Isabel and Choiseul. This is despite significant cyclone damage (Radford and Blong, in prep.) and more limited damage from earthquakes, tsunami, storms and floods in these islands.

Figure 2 also indicates an absence of fatalities in parts of southern Makira and parts of northern Malaita. Much of Santa Cruz (Eastern Solomons) and the more southerly Ontong Java atolls also experienced no fatalities. All of these areas are known to have experienced some damage from natural hazards. The absence of fatalities cannot, therefore, be taken as evidence of the absence of natural hazard impacts.

Of the 146 polygons into which the Solomon Islands were divided for this investigation, hazard-related fatalities have been reported in only 38 polygons, although six of these polygons have experienced deaths on two occasions. The polygons with the greatest number of deaths are those including the volcanic islands of Savo (1847 eruption — about 500 killed), and Tinakula (1827 eruption — about 100 killed), an area south of Honiara on Guadalcanal (Cyclone Namu in 1986 — 61 killed), and two polygons in eastern Makira (1931 earthquake — 25 killed in each). The other polygons where more than 10 deaths have occurred are in the Eastern Solomons and include Vanikolo (cyclone in 1788 — about 20 lost), and Tikopia (1888 storm — seven lost at sea and 1952 drought — 17 died).

This summary of the larger death tolls concentrated in relatively small areas indicates that nearly all types of natural hazards identified in the Solomons have produced significant casualties. It is the 1827
and 1847 volcanic eruptions, Cyclone Namu and the 1931 earthquake which have, however, produced the highest local death tolls (Figure 3).

For most of the fatalities which occurred before this century we have no firm information on the agent which caused the deaths. It seems likely, however, that most of those killed in volcanic eruptions (where our death tolls are merely best estimates) were killed by the pyroclastic flows which are believed to have been produced in these eruptions; in moderate-sized eruptions where substantial pyroclastic flows occur, the risk of death is almost a certainty unless evacuation takes place early in the eruption (Blong, 1984, p. 131). The remainder of deaths were due to drowning in the tsunami or being killed in the struggle to gain access to canoes.

A significant amount of information is nonetheless available on the agents that have produced fatalities, particularly during tropical cyclones and earthquakes. Of the total of 154 deaths in the entire tropical cyclone record, information about the agent is available for 94 fatalities of which 65 per cent were due to Cyclone Namu. Of this total, 61 died as a result of landslides and 25 drowned when boats were capsized or lost at sea. Five more were drowned in rivers and three were killed by falling trees. Similarly, of the 106 earthquake-related fatalities, 78 can be ascribed to specific agents. A total of 62 people died in tsunami generated by earthquakes, 15 were killed by landslides produced by ground shaking, and one was killed when a rock fell on her head.

Reassessment of the summary data in Table 2 is clearly worthwhile. Volcanic eruptions, presumably pyroclastic flows, remain
the single most important agent of death, but landslides occurring during cyclones (61 deaths) and tsunami as a result of earthquakes (62 deaths) can be considered as more important than other earthquake-associated hazards (44 remaining deaths), though still of lesser significance than tropical cyclone-associated hazards (93 remaining deaths).

Whilst these totals are only indicative, they suggest a conclusion of some importance. Typical mitigation responses intended to reduce death tolls in tropical cyclones include improved warning systems and increased wind resistance of dwellings or shelters. Similarly, attempts to reduce earthquake fatalities usually involve enhanced earthquake resistance of dwellings and other structures. The data presented above suggest that such attempts are likely to be less successful in the Solomons than elsewhere where landslides and tsunami contribute fewer human casualties to the tolls produced by tropical cyclones and earthquakes; this tentative conclusion does not, of course, deny the benefits to be gained from increased structural resistance and improved warning systems. Nonetheless, they do emphasise that real benefits might be achieved through appropriate education programs that focus on reducing the consequences for humans of landslide, tsunami, strong wind and ground shaking hazards.

FUTURE RISKS

In most studies of future risks it is reasonably safe to regard the past as the key to the future. In large part this is also correct for the Solomon Islands, but there are some grounds for caution.

The historic record is very short and probably complete for some hazards only for the post World War II period. If estimates of future deaths from natural hazards are based only on the post-war period, it seems clear that tropical cyclones and earthquakes are the most important hazards.
but when 19th century data are included the important contribution of volcanic eruptions in producing fatalities must be acknowledged.

A substantial proportion of the deaths have been produced by just a few events, including the 1827 Tinakula eruption, the 1847 Savo eruption, Cyclone Namu in 1986 and the 1931 and 1977 earthquakes. These five events together out of the 20 in the database, produced about 88 per cent of the known deaths. It is likely that such a pattern of dominance will continue but it is extremely difficult to make sensible estimates of frequency for these major events from such a short record.

Figure 4 illustrates a cumulative complementary distribution function for all natural hazard events in which deaths occurred in the Solomon Islands. The curve suggests, for example, on the basis of past records that an event producing 100 or more human deaths can be expected, on average, once in a hundred years. Similarly, an event producing 10 or more deaths can be expected, on average, once every 20 to 25 years. If the 20th century record only is used, recurrence intervals for specified magnitudes (number of deaths) decrease significantly — for 100 or more deaths, about 82 years; for 10 or more deaths, about 14 years. If the post World War II record only is considered, recurrence intervals decrease still further. These variations reflect not only the increased population of the Solomon Islands but also the increased completeness of the disaster record toward the present day. Clearly the frequencies of events of specified magnitudes depends strongly on the length of record considered.

Despite the dominance of the fatality record by a few events, it should not be imagined that Cyclone Namu, the 1931 earthquake or the 1847 eruption of Savo are the most severe records that can occur in the Solomons region. Cyclone Namu was only
a Category 2 or 3 on the Cyclone Severity Scale used by the Australian Bureau of Meteorology (the scale is virtually identical to the Saffir–Simpson scale), and a much more severe cyclone (Category 4 or 5) is possible, indeed likely. Similarly, while the 1931 earthquake with $M = 8.1$ is probably close to the upper magnitude that can be expected in the Solomons, it did not severely affect the most densely populated areas. Finally, the Savo eruption can be described as only a moderate eruption (Volcano Explosivity Index, VEI = 2), and much larger eruptions of volcanoes in the Solomons are possible.

In short, future risks should not be assessed solely on the basis of a relatively short record which probably includes only those events with consequences that can be expected to recur every 50 to 100 years or more frequently. Natural hazards which produce more deaths, but which occur less frequently on average, can be expected some time in the future. As implied above, the most deadly events are likely to be volcanic eruptions, earthquakes and tropical cyclones, but the possibility of large damaging tsunami should not be ignored.

This brief consideration of future risks assumes that the present and the past are the key to the future. While this is probably correct when a record spanning hundreds, or preferably thousands of years, is available for consideration, global warming trends suggest that the past probably provides an imperfect record on which to assess the consequences of future meteorological hazards. Table 2 suggests that only about 22 per cent of the known fatalities have been produced by meteorological hazards, but the dominance of the record by a few events indicates how readily this could change. Under global warming, the incidence, severity and consequences of tropical cyclones and floods may well be affected.

Unfortunately, global climate models which have been used to generate possible future climates are not yet powerful enough to represent adequately meteorological conditions as small as tropical cyclones. There is some evidence that increased sea surface temperatures will result in increased rainfalls possibly leading to more pronounced flooding under greenhouse conditions. Some preliminary results from models suggest that there will be little change in the areas of tropical cyclone genesis but this provides no inferences about tropical cyclone frequency, intensity or track direction (Ryan et al., 1991). Some studies suggest that raised sea surface temperatures will result in lowered central pressures and higher windspeeds in tropical cyclones (e.g. Emanuel, 1987) and larger storm surges (e.g. Murty, 1991), but these possible changes may be counteracted by other (indeterminate) influences.

It is not yet known whether such changes, postulated for the Australasian region are correct or likely under greenhouse conditions and it is not known whether they might apply unaltered in the Solomon Islands region. Furthermore, no attempts have been made to model the consequences of global warming on the incidence or severity of El Niño. This is of considerable importance because El Niño has profound effects on the incidence of both tropical cyclones and droughts in the Solomons region. It is not possible, therefore, to state the effects of global warming on the incidence or severity of natural hazards in the Solomon Islands. Future risks from natural hazards are largely indeterminate; despite this it is possible to be fairly confident that fatalities and other consequences of natural hazards will increase as a result of increased population and the drift toward towns.

**CONCLUSIONS**

1. Only 20 out of 209 natural hazard impacts have resulted in human fatalities.
2. While information about the agents
producing fatalities is incomplete, pyroclastic flows (about 600 deaths), tropical cyclones (93), landslides (76), tsunami (62), and earthquakes (62), appear to be the most important.

3. The importance of landslides and tsunami in producing fatalities during tropical cyclones and earthquakes suggests that warning systems and building code revisions may be less effective in reducing death tolls than in other environments.

4. Although only 22 per cent of known deaths have resulted from meteorological hazards, a single event could alter this proportion significantly.

5. Five events out of the 20 in the fatality data base produced 88 per cent of the deaths. Future death tolls are also likely to be dominated by a small number of events, though it is not possible to determine where tropical cyclones, volcanic eruptions, earthquakes or tsunami are likely to be the most hazardous.

6. While the expected number of deaths in a given period is dependent upon the length of record considered it is clear that a disaster which kills one hundred or more people in the Solomons can be expected more frequently than once in a hundred years.

7. Global climate models have not yet been refined sufficiently to allow predictions to be made about the consequences for the Solomon Islands of human-induced warming, especially in the absence of detailed consideration of changes in the incidence and severity of tropical cyclones and El Niño events.

Note

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Evacuation Mapping: The Utility of Guidelines

UTE T. DYMON AND NANCY L. WINTER

Maps provided to the public for preventive and protective evacuations should be an integral part of emergency plans. The map design criteria contained in the United States Federal Emergency Management Agency (FEMA) guidelines for nuclear power plants were examined and compared with the content and design of evacuation maps found in the public information publications of thirteen United States nuclear power plants. Results indicated that the graphic and descriptive content of these maps varied considerably. Four characteristics related chiefly to the FEMA guidelines capture some of the findings from this study: 1) failure to comply with Nuclear Regulatory Commission (NRC)/FEMA suggestions; 2) failure to comply with FEMA guidelines for map elements; 3) weaknesses present in the FEMA guidelines themselves; and 4) significant omissions in those guidelines.

As humans occupy more space on earth, the burden of mortality and property losses from natural and technological hazards also increases. Over the past decade, accidents and disasters in which people must evacuate have been reported in growing numbers. These evacuations can be grouped into actions that take place before an emergency (pre-impact evacuations) and those that take place after it (post-impact evacuations). Both vary in their duration and complexity. Maps are vital for coordination of preventive, protective and rescue evacuations. They need to be developed, produced and integrated into emergency plans in every community. In any disaster, evacuation is the most massive, costly and disruptive community response (Hans and Sell, 1974). Useful maps, therefore, have a very high payoff.

Quarantelli (1984) has provided a model of evacuation which outlines a more complex pattern than merely one abrupt flight from a physical threat. Rather, in evacuation, a series of complex individual and group interactions take place. The truth of this model complicates even further the thinking needed behind emergency planning. For purposes of this research, Quarantelli’s definition of evacuation was not fully applied. Only the most direct and simple first decisions in the earliest time period of an evacuation were considered. This same immediate response is the time frame of the assumptions upon which nuclear evacuation maps have been designed.

In the United States during the 1980s, emergency evacuations necessitated by technological accidents appeared much more frequently (Sorenson, Vogt and Mileti, 1987). It is increasingly clear that
the number of evacuations will continue to grow in the present decade, yet few communities are equipped with comprehensive evacuation maps. It is thus urgently necessary to study the role of evacuation maps in planning for technological emergencies and disasters.

BACKGROUND

One of the most extensive and expensive emergency planning efforts to include mapping has been conducted by the nuclear power industry. This initiative has evolved in response to perceptions of the overall safety of nuclear facilities. Since the nuclear power plant accidents at Three Mile Island (TMI) in 1979 and Chernobyl in 1986, politicians and citizens' groups have questioned the degree of preparedness and emergency planning for nuclear power plant accidents in the United States. Initially, nuclear installations were only required to prepare emergency plans for the plant site and for the population of an area 2-3 miles around the plant (NUREG-0396, 1978). New regulations, reflecting the lessons learned from the nuclear accident at TMI, were put into effect by the Nuclear Regulatory Commission (NRC) in 1980 (NUREG-0654). Under a memorandum of understanding with the NRC, the Federal Emergency Management Agency (FEMA) has gained the authority to regulate potential radiological emergencies and is responsible for assessing the quality of offsite emergency plans at nuclear power plants (GAO-RCED-87-122 Radiological Emergency Preparedness). Such plans have to be approved by both FEMA and the NRC before new plants can be licensed. Newly drawn-up evacuation maps must show exit paths from a 10 mile Emergency Planning Zone (EPZ) encompassing the plume exposure area around each nuclear plant. A 10-50 mile ingestion exposure zone must also be delineated, but no evacuation plans are required for this area.

Legal requirements

The main goal for planning and implementing these Emergency Planning Zones is to reduce human exposure to radiation by implementing protective actions which combine sheltering, evacuation and mitigation of the effects of inhaling airborne contaminants by the use of thyroid-blocking agents. Four other changes mandated by NRC and FEMA regulations require that: 1) the protective measures to be taken within each EPZ be specified; 2) the NRC concur in the development of state and local emergency plans if licensing of a reactor is to be approved or continued; 3) the emergency plans be reviewed annually by persons not directly responsible for their preparation or operation; and 4) at least annually, the general public within the plume exposure EPZ receive information about the probabilities that an accident will occur, its potential effects, the methods by which warnings will be communicated and other protective measures, such as evacuation maps.

More detailed FEMA guidelines (Planning Standard G, NUREG 0654 and FEMA REP-11 June, 1987) describe how this pre-emergency information will be presented in public information publications distributed by the nuclear licensee to residents who are at risk. Evacuation maps for use by the public are integrated into these public information materials.

Emergency communication network theory

A critical issue in emergency preparedness is how adequate information can be delivered to the population at risk so that individuals can act expeditiously in the case of an accident. Plans for emergency response must be disseminated throughout a complex network of people that spans many jurisdictions. This network forms the basis of both the communication structure
needed to produce effective evacuation maps (Dymon, 1988) and the social communication during an actual emergency. Cartographic models of communication need to be outlined for evacuation maps. For nuclear power plants, this communication structure should extend through a hierarchy of participants from the general public, through plant managers, to local, state and federal officials. More effective evacuation maps should result if communications between these parties are improved and input from the general public is included. The central goal of this process is the efficient communication of information in the form of maps so that timely decisions can be made during an emergency. Clearly, one cannot produce maps to meet each citizen’s personal expectations or needs. This would be a costly and unproductive task. One should aim instead to design an optimum map which helps the majority of its potential users to navigate their way out of the area (Clark, 1989).

Maps provided to the public are ideally an integral part of evacuation plans and have the potential to provide a great deal of geographic information of substantial importance. However, a review of the current literature revealed that theoretical research on evacuation maps is virtually non-existent. In terms of nuclear power plant evacuation in the United States, this lack of research may be attributed to three factors: 1) the complexity and controversial nature of government planning for nuclear power plant emergencies; 2) the evolutionary nature of the development of public information publications for nuclear power plant emergencies; and 3) the unique form in which maps are embedded in literature given to the public as required by FEMA guidelines.

MAPS AS A COMMUNICATION DEVICE

The use of maps for communication during an evacuation is a critical issue and must be considered in relation to map design in the comprehensive mapping process. Robinson (1952) argued that ‘function provides the basis for the design’, but Petchenik (1983) cautioned that increased attention must be given to choosing the data to be gathered: how a map will be used must be established with care. In general, cartographic research with real map users has rarely been conducted, partly because such study tends to be complex and partly because funding is not usually extended to include a system of feedback between the makers and users of maps. There are also many cultural, educational, and socio-economic factors which influence the ability of people to use maps effectively (Gould and White, 1986). These factors have inhibited map use research in general and emergency mapping research in particular. A review of previous research on the latter confirms that the issue of map use during emergency evacuation with regard to both natural and technological disasters has been neglected.

Map design criteria

The essence of evacuation is the rapid spatial movement of people, goods, and services. Maps are an appropriate medium with which to depict this. Under the time constraints of evacuation conditions, the public has no time to read lengthy text. A map therefore should give the evacuee a comprehensive picture in a quick glance. A well-designed map will provide ‘a clear and unambiguous visualization of the natural setting’ and will promote ‘development, refining and sharpening of this vision in the most straightforward, direct and easy manner’ (Delucia, 1979). In terms of enhanced communication during an emergency, Dent (1972) stated the obvious: a poorly designed map leaves the reader confused and disoriented both visually and intellectually. This means that precious time will be wasted until the reader succeeds in deciphering the map. Dent’s model of map
reading includes a response-output phase because he maintains that the main purpose of preparing maps is to affect behaviour.

Most crucial to map communication is the way in which the elements of a map are organized. Thus, specific design criteria must be developed for emergency mapping. In the study described here, the map design criteria contained in the FEMA guidelines were examined, analyzed and compared with the maps contained in the public information publications of a sample of nuclear power plants. This research was based on three bodies of pre-existing knowledge and expertise:

1) cartographic theories of map communication (Board, 1967; Kolacny, 1969; Muehrcke, 1972; Ratajski, 1973; Dymon, 1988);
2) sociological theory about evacuation decision making and behaviour (Drabek, 1986; Perry and Mushkatel, 1984; Dynes, 1982); and
3) risk communication theory and research on public opinion and the level of public participation in planning (Renn, 1981; Kasper, 1984).

METHODOLOGY

This regional study, funded by a University of Massachusetts Faculty Research Grant, focused upon nuclear emergency publications produced and distributed to the public by thirteen nuclear power stations in the USA. These included seven plants in New England, five in Pennsylvania, and the Davis–Besse plant in Ohio, a 10 per cent sample of existing United States nuclear power plants. Four reasons explain why evacuation maps from the nuclear power industry were used:

1) they are readily available;
2) they relate to only one type of industry, thus simplifying the research endeavor;
3) limited guidelines for their design already exist; and
4) contacts had already been established within the emergency management agencies of the northeastern United States.

The FEMA guidelines were examined to determine what requirements they contained for preparation and use of public information literature for nuclear plants. Joint action on the part of the NRC and FEMA had promulgated these guidelines. Individual State Emergency Preparedness Agencies oversee the final implementation of the FEMA recommendations. Thereafter, the states are responsible for assuring that the licensee follows the guidelines.

Copies of all publications were requested from the public information office at each of the nuclear power plant sites both in writing and through follow-up phone calls. In some cases, however, it took up to three months to receive these printed (and supposedly freely available) materials. Each licensee contacted provided information about the availability of the information materials that they give to the public.

The evacuation maps within these publications were then classified and analyzed with respect to conventional cartographic criteria, such as basic map features, appropriate areal, point and linear features and map hierarchy, and the contents of the publications were compared against the requirements and suggestions for public information materials contained in the FEMA guidelines. The latter recognize that evacuation planners cannot assume that all residents at risk possess the map reading skills needed to operate from an evacuation map. Hence, FEMA guidelines require all emergency information of a spatial nature to be presented in both graphic and prose form in order to accommodate those members of the general public who lack map reading skills. This necessitates a skillful integration of the emergency map into a body of written text which is often in the form of a list. To analyze the evacuation maps embedded in
these public information materials, this research had to cover both the maps themselves and the written materials that provided their context.

Choosing a decision model for actions by the public

Assumptions about how the public will make decisions during a nuclear emergency guide the design of evacuation maps. A series of questions reveals the decision process it is expected that a family or an individual will apply in making emergency decisions. As the model in Ziegler et al. (1981) points out, there are a significant number of interrelated questions the public answers in their decision process during a crisis. Apparently when FEMA and the nuclear licensees designed these maps, they assumed the public's evacuation decision model would cover only two questions.

— Where is my assigned relocation center?
— What route am I assigned to take to that center?

One of the issues illuminated through this research was whether such a simple set of assumptions covers the full range of decisions the individual needs to make during a nuclear emergency.

RESULTS

The map products analyzed varied considerably in terms of their graphic and descriptive effectiveness. One need which the nuclear industry clearly has attempted to meet is to provide these materials in an attractive form so that members of the public will keep them for reference in a handy place in the household and not throw them out. In five of the thirteen cases, the form of these materials has gradually evolved from brochures, which many people misplaced, to calendars, which are more often valued and which are quickly available for reference in the home. However, they would not be instantly available if people were out in their automobiles or otherwise away from home.

Another characteristic of the nuclear evacuation maps in the public information materials of the thirteen nuclear power plants studied was the tendency to try to reduce the perception of threat from the plants themselves. In the majority of cases, the location of the nuclear power plant was downplayed to the point where one had to search for it.

The FEMA guidelines give little specific information on basic cartographic principles to be followed in the design of evacuation maps. Although they caution that, in the design of public information materials, care must be taken in the choice of typeface, photographs, artwork, colors, and paper, no information is given on what the content of the map should be. Yet, map content is the critical component of any map, and especially in maps used in support of decision making during an emergency evacuation. Likewise, in terms of map design, the guidelines define only a bare minimum of requirements, such as the use of a compass rose and a legend.

In terms of the FEMA guidelines, this study revealed four particular problems with the design of emergency maps and their implementation in the literature given to the public:

1) failure of states to comply with NRC/ FEMA suggestions;
2) failure to comply with the FEMA guidelines for map elements;
3) weaknesses of the guidelines themselves; and
4) significant omissions from the FEMA guidelines.

Failure to comply with FEMA suggestions

NRC and FEMA both suggested that each state adjust the EPZs on its nuclear evacuation maps to conform to unique local
conditions of landforms, population, land use, etc. In the main, this suggestion was not followed. The majority of evacuation maps displayed a circular 10 mile EPZ indicating that these states had not adjusted their EPZs. Maps that showed an adjusted EPZ did not include information in their legends with which to locate the EPZ. Clearly, the majority of states involved had not made the effort to monitor the preparation of their maps.

Failure to comply with FEMA guidelines

Comparison of the FEMA guidelines with the public information publications drawn up for this set of nuclear power plants reveals discrepancies between the guidelines and the evacuation maps produced. In most cases, basic map elements, such as the compass rose or north arrow and map legend, are missing. In some publications, the required explanations of evacuation services and supplies provided by relocation and/or congregate care centers are missing. Added to these discrepancies are more serious weaknesses and omissions from the FEMA guidelines.

Weaknesses of the FEMA guidelines

In the descriptions found in the public information materials studied, staying-in-place or ‘sheltering’ is mentioned, but there is no meaningful explanation of the critical issue of the timing of accidental releases of radioactivity from a nuclear plant and of the desirability under certain conditions of just staying indoors. Lindell and Perry (1983) claim that ‘the vast majority of the public remains unaware that any attenuation of radiation exposure could be achieved by remaining indoors. Lacking any knowledge of effective alternatives, the public’s inclination would be, of course, to evacuate.’ This may expose people to a radioactive plume at a point in time when simply staying indoors would be infinitely safer. This vital information on the timing of sheltering vs. evacuation is not effectively presented in the sample of current nuclear emergency information materials already examined. Only one public information brochure mentions another significant issue, spontaneous or independent evacuation by members of the public.

What the FEMA guidelines omit

The FEMA guidelines recommend that the subject of radiation be explained in the public information materials distributed annually. Potentially the most serious element missing from these materials, and especially from the maps, is an explanation of radiation that gives practical information the public can actually use. Sources of radiation and ranges of radiation doses are defined in a very academic way. The descriptions read as though a piece of an encyclopedia were copied complete with all sorts of technical references. In most cases, the writing is intended to prove how safe the nuclear power plant is. No consequences are outlined nor practical connection made as to what bearing this radiation information has for the public during a nuclear power plant emergency. With the exception of one brochure, information about radioactive plumes and how they act is not covered. In terms of the licensee’s and FEMA’s views of the role of the public in evacuations, this reveals the lack of a well-founded decision model for potential actions by the public.

Short-Term Protective Action Guides on how to lessen human exposure to the consequences of excessive doses of radiation have been written by the United States Environmental Protection Agency (1985), and Moeller (1992) provides a table of countermeasures for public exposures following a nuclear accident. During a nuclear power plant emergency, radiation doses to the whole body and to the thyroid from a radioactive plume or from deposited
radioactive dust are of critical concern. The public information materials studied gave no information on the concrete actions to be taken upon exposure to a radioactive plume. Practical advice is not offered on how to avoid inhaling directly the outdoor air, how to avoid carrying radioactive dust and dirt indoors on shoes and how to quickly shed dusty outdoor clothing. Neither is the possible need for decontamination by showering explained as a method for removing radioactivity during an emergency. Yet, Moeller (1992) points out that the ground will probably be covered with significant amounts of radioactive materials.

When the FEMA guidelines were promulgated, no decision had been made as to whether it would be useful for authorities to stockpile and to provide during an emergency the agents which reduce the effects on the thyroid of exposure from inhaling radioiodides. Even though these pills have not been stockpiled, information could still be offered about the protection provided to the vulnerable human thyroid by ingesting potassium iodide. Also, critical map content would include identifying the locations where thyroid-blocking agents could be obtained during an emergency. Sites such as pharmacies, drugstores, hospitals, clinics, etc. thus should be shown on nuclear evacuation maps.

Other types of critical information for nuclear evacuation map content is excluded from the FEMA guidelines. For example, no reference is made of the location of hospitals. Some would insist that the local populace knows where hospitals are. This may not be true in all cases, however, and transients in an area on any given day will probably need this information to be shown on the maps. Others would argue that, where plutonium radiation was accidentally released, bone-building medicines such as calcium supplements might also need to be located.

Vital survival information, peculiar to a nuclear emergency, can be taught through a map. The maps could include facts about decontamination processes, the location of decontamination centers, the nature of thyroid-blocking agents, and where thyroid-blocking pills can be obtained. The assumption upon which FEMA built its guidelines is that evacuees will be centrally managed by instructions given out over the Emergency Broadcast System (EBS) and will be instructed by radio about survival during the nuclear emergency. In effect this represents a deliberate decision to rely upon emergency radio broadcasts for essential information. This restricts opportunities for the public to learn in advance facts about nuclear survival.

**Current assumptions and how they conflict with research findings**

Knowledge of how people respond to crises should form the basis for making effective radiological emergency evacuation maps. Theoretical and empirical studies of natural and technological emergencies (Moore et al., 1963; Drabek, 1969; Perry, 1979; Perry et al., 1981; Dynes, 1982; Perry and Mushkatel, 1984) show on aggregate that regularities in human behavior, especially habits, dictate that planning should be a process, rather than a product. Moreover, it should be based on what people are likely to do in an emergency, rather than trying to get them to follow a plan. It should be an educational activity, not merely a set of written instructions. It should be based on everyday routines. It should be predicated on sharing information, not restricting it. In this 'emergent human resources model' the local social system should shape the plans for emergency action, rather than a centralized control of new structures.

Sorenson and Vogt (1987) analyzed the contentions and issues in emergency planning after the nuclear accidents at TMI and Chernobyl and made a strong recommendation for the development of flexible plans based more solidly upon more local input.
Essentially, this would more equally balance the locus of planning in the production of emergency evacuation maps between the licensee's map maker and those who have better knowledge of local lore. The current emergency evacuation planning for nuclear power plants directed by FEMA and NRC is, however, based upon two key assumptions (Cutter, 1984). One, which would adjust EPZs to fit local geography, has not been fully implemented, and the other casts nuclear evacuation in a centralized 'command and control' structure which ignores evacuation planning recommendations made by academic researchers.

**Evacuation decisions by the individual**

The content included on the maps in the public information materials studied indicates that a number of serious issues are not encompassed in the evacuation decision model for individuals applied by FEMA and the nuclear licensee. Instructions are given to parents to evacuate directly to relocation centers without trying to pick up their children at public schools or state-licensed day care centers. A great number of parents do not have their children in state-licensed day care. Their children are being taken care of by people in private homes. This situation is not dealt with at all in the instructions for evacuation.

Many parents will need to leave their place of work to pick up younger children in day care before leaving for their relocation center. This is a critical issue for the ever-increasing number of working mothers in the United States. At its most basic then, the individual's decision process will cover the following four questions.

— Where is the danger located?
— Where is my family?
— How do I get away?
— Where do I go?

Further refinement suggests the following questions as the framework for individual decision making during a nuclear emergency.

— Where is the source(s) of danger located?
— How do we make sure our preschool children are safe?
— Should we get our preschoolers?
— What is the best response to this emergency at this time: to stay (sheltering-in-place) or to leave (evacuation)?
— What actions should be taken if we stay in place?
— Where do we want to evacuate to?
— What is the best route to take to our destination?
— Can this trip be made in one try?
— What barriers may we meet?
— What alternative routes are available?
— What places may we need to find at a later stage of the emergency (hospitals, decontamination centers, etc.)?

Decisions based on answers to these questions help frame the content needed on an evacuation map.

**Spatial behavior during spontaneous evacuations**

Recent research on nuclear power plant emergencies (Zeigler and Johnson, 1984) reveals there are several aspects of nuclear evacuation behavior that contrast with what has been learned about spatial behavior during natural disasters. When extreme natural events necessitate human evacuation of an area, the public resists evacuation until strong danger clues from the immediate environment are observed or warning messages that outline dire consequences convince people to leave. In contrast, studies of the TMI evacuation establish the existence of what Zeigler et al. (1981) have termed the 'evacuation shadow phenomenon', or spontaneous evacuation by more people from a wider area and in greater quantities than planned when an official advises that a limited number of individuals, such as pregnant women and
young children, should evacuate. Citizen behavior in natural disasters manifests delayed response in net contrast to nuclear emergencies which generate a much more prompt response in the form of mass evacuation. When the governor of Pennsylvania advised pregnant women and preschool children located within 5 miles of TMI to evacuate, an estimated one fourth of the population left (General Public Utilities, 1979). Estimates vary, but Zeigler and Johnson (1984) calculated that more than 40 times as many people evacuated as were advised to, and they left from a wide area covering six counties, not only from the five around the plant. A second divergence from evacuation behavior during natural disasters was the extreme distances journeyed to reach temporary housing; many moved more than 100 miles away. In contrast, those who evacuate in non-nuclear emergencies tend to move only as far as the outskirts of the danger zone.

The FEMA guidelines have not anticipated these two evacuation responses to a perceived nuclear threat nor incorporated them into emergency response plans and maps. At least two other forms of behavior common to evacuations of all types have also been ignored; most evacuees prefer to choose their own evacuation routes rather than use planned ones and to stay with relatives or friends rather than go to public shelters. These should be recognized as sociologically-confirmed spatial behaviors of common applicability. As neither evacuation plans nor maps are required for the 10–50 mile ingestion zone EPZ, except in the case of instructions to farmers and food producers and distributors, it is obvious that the findings on distances travelled by independent evacuees from the TMI evacuation (and confirmed common spatial behaviors during all types of evacuations) have not been strongly integrated into FEMA guidelines.

Risk information

Nuclear emergencies require a number of responses which were not incorporated into the rules for evacuation until TMI required a public evacuation advisory (Cutter, 1984; Helgeland, 1987). Nuclear emergencies are different from other crises because special equipment such as geiger counters or radiological monitoring badges are needed to even track or locate the threat. In historical emergencies, the public has usually been able to see flood waters, smell toxic gas clouds or see fumes. To locate plumes of radioactivity from a nuclear power plant emergency, sophisticated equipment is required. Novel medical and prevention procedures may be needed during a nuclear emergency as compared with other forms of evacuation. Decontamination and the acquisition of thyroid-blocking agents are two procedures which add new aspects to the planning for nuclear evacuation. Perhaps the most lethal situation to be handled during the most serious nuclear event, rated as a general offsite emergency, is how to keep the public from moving toward areas being covered by invisible, undetectable plumes of intense radioactivity. Lindell and Perry (1983) suggest that this problem may be exacerbated by the public’s idea that, after release, radioactivity blankets the surrounding area immediately. There seems to be no notion about radioactivity existing in a particle cloud or plume that can be blown by the wind. Yet, for any portion of the populace who choose to evacuate independently, it may be vitally necessary for them to understand about radioactive plumes and how wind directions, rains and other factors affect the movement of radioactive air. This information may be presented on a map.

CARTOGRAPHIC CRITERIA

The worth of the FEMA guidelines could be increased by adding specific cartographic
criteria for the design of more readable and more easily interpreted evacuation maps. Weaknesses in the cartographic design of the thirteen nuclear evacuation maps analyzed in this study provide indicators for additional map criteria which should be added to the FEMA guidelines. Basic map features, areal features, point features, linear features, inclusion of physical barriers and strength of the map hierarchy should all be considered in design of nuclear evacuation maps.

Basic map features were too academic or too vague on the nuclear maps studied. Map titles were poor. Though the FEMA guidelines require a compass rose or north arrow, 20 per cent of these maps had no direction indicator. Map legends are also required by FEMA. Over half had map legends, but they were very limited showing only line symbols for highways and boundaries. Areal map features also were either missing or promoted ambiguity. Nearly 25 per cent of the maps did not even show any EPZ. Point features on these maps also produced uncertainty with one map not even indicating the location of the nuclear plant at all while the rest of the maps had extremely small nuclear plant symbols or no name was associated with the symbol. A third of the maps contained no point symbols for the relocation centers and also no directions for getting there were marked on the map, yet these centers are the end points of the evacuation plan, the whole purpose for the maps. None of the nuclear evacuation maps studied showed schools, major employment centers, hospitals, police stations, firestations, decontamination centers, drugstores and medical supply sources. In terms of linear features, pre-planned evacuation routes were the main reason for producing these maps. However, a quarter of them did not indicate these vital routes. The importance of the location of physical barriers in planning for evacuation movements is obvious. Although rivers were shown on the majority of these maps, nearly half of them did not name the rivers. Only two maps showed bridges not only along the pre-planned evacuation routes, but also at other locations. No lakes, wetlands or mountains were shown on any maps.

A clear map hierarchy is the most important cartographic element needed. Here, hierarchy does not refer to the planning priorities of the government map maker, but to the immediate operative needs of the map user. On all maps, a hierarchical organization of the information is missing. This meant a quick glance would not allow the most important information to emerge immediately. Map users would have to take more time to study the map.

CONCLUSIONS AND RECOMMENDATIONS

There are clear indications of restricted expectations about the role of emergency maps, especially their educational potential, and lack of guidance on the cartographic principles to apply to produce more readable maps in these public information materials.

This study reveals one specific practical recommendation to enhance map availability for the user. Some tear-off version of the map could be added to the calendars or brochures now mailed to the public annually. This supplement could be placed in the glove compartment of a car, in a handbag, or on one's person.

The risk inherent in the nuclear evacuation situation is enormous and obvious. The lives and health of thousands, and in some cases millions, of residents around nuclear power plants are at stake. In a report to the NRC, Policy Research Associates (PRA, 1977) found that 85 per cent of the nuclear power plants in operation and those being planned for construction in the United States are located within 60 miles of an urban metropolitan area and, therefore, have the collective potential to affect directly more than half of the US population. Added
to this nuclear risk is the burgeoning accident rate in the chemical and transportation industries. Through emergency planning, population studies and mapping deal essentially with questions of life and death (Monmonier and Schnell, 1988). Both evacuations during non-nuclear technological disasters and worst case scenarios for nuclear power plant emergencies show that, both before and during the emergency, effective decision making will be crucial if exposure to harmful and potentially lethal hazards is to be minimized. Plans for mapping should, therefore, include all four phases of comprehensive emergency management: mitigation, preparedness, response and recovery (National Governors’ Association, 1979).

A key question is what ‘publics’ have been targeted by emergency planners. Research on TMI indicates that a certain percentage of the people want to manage their own evacuation (Zeigler and Johnson, 1984). Other populations need extensive direction and support in order to evacuate. The role of new social contracts and institutional reforms whereby ‘the public’ may confront the uncertainties of both nuclear and non-nuclear emergency evacuation by participating in the planning process, including the design and production of emergency maps, should be investigated thoroughly.

Evacuation maps should be the end product of a long line of emergency management and planning maps integrated beforehand resulting in production of a useful emergency evacuation tool for the public. Within the limits of the constraints and assumptions imposed by both regulations and the licensee, the communication process between the map users and the map makers will determine the effectiveness of cartographic information given in nuclear emergency information publications. The following groups might participate in emergency planning, and many others may be found in the communication process leading to the production of nuclear public information materials:
- the licensee;
- the consultant or resident graphics expert who designed the cartographic presentation;
- the FEMA officer responsible for liaison between the state and licensee;
- NRC;
- the state Emergency Preparedness Agency;
- the local fire departments within the 50 mile zone;
- the local Departments of Public Works;
- the local Police Departments;
- town and county officials;
- environmental and other citizen groups;
- visual media representatives (TV, newspapers);
- the Red Cross and other non-governmental relief agencies; and
- the general public.

Research is needed in order to ascertain what the actual communication links are in the nuclear map design and production processes. There is little information on how the map makers think that nuclear evacuation maps are to be used and whether the map users make the same assumptions. The decision model for the public’s responses is based on critical assumptions. Efficient and effective map communication may be achieved by incorporating the existing knowledge of the public’s spatial behavior and the public’s conceptions of local geography and map use into map design. The complex network of communications and coordination efforts which manifests itself before but especially during an emergency evacuation makes the design of effective emergency maps a crucial issue. A well-integrated set of emergency planning maps can be a vital ingredient in promoting cross-department, cross-agency and cross-jurisdictional coordination of emergency response efforts. Evacuation maps are a key piece of such a map set. They must be
shaped to represent the reality of potential actions by the public.

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Delaware.

Ute J. Dymon
Department of Geography
Kent State University
Kent
Ohio 44242
USA

Nancy L. Winter
Graduate School of Geography
Clark University
Worcester
MA 01610
USA
Economic Effects of Riverbank Erosion: Some Evidence from Bangladesh

MOAZZEM HOSSAIN

In this paper I investigate some of the economic effects of riverbank erosion in Bangladesh. The study was conducted in one village over the period 1979–89. Between these dates the village lost almost 20 per cent of its farmland to riverbank erosion. This resulted in a loss of more than 50 per cent of crop income (at 1989 prices). About 45 per cent of households were affected during the period. It appears, however, that there is little understanding among the relevant government agencies and non-governmental organisations of the severity of riverbank erosion in Bangladesh. This article aims to provide, therefore, some basic information on the various economic effects of this natural hazard.

Bangladesh is widely known as a land of natural hazards and disasters. Recent records show that, since Independence in 1971, Bangladesh has faced one form or another of natural hazard almost every year (Chowdhury, 1988). These hazards take the form of floods, droughts and cyclones. Due to the immediate impact of, and international media interest in, floods and cyclones, minor hazards have received less attention both from the government and outside agencies and observers. Riverbank erosion is one of these minor hazards. It is caused mainly by the shifting or diversion of river courses. Although to some degree caused by floods, it is a continuous and age old process, particularly within the immediate vicinity of the three main rivers of Bangladesh, Padma, Jamuna and Meghna, and their tributaries. It appears, however, that the damage it is causing has not yet been realised, either within Bangladesh or outside. In this article I attempt to demonstrate the economic effects of riverbank erosion in terms of economic hardship, crop losses and property losses, with evidence from an affected village.

First, a brief analysis is provided of two major dimensions of riverbank erosion in Bangladesh: the geographical and the economic. Second, a case study is presented of a village which has suffered riverbank erosion. Third, a detailed analysis of the economic costs to the villagers, in terms of property and crop losses, is presented. Fourth, the consequences of property loss and dispossession of farmland are examined in terms of the future food security of households. Finally, conclusions are presented, with suggestions for future action.
square miles (Zaman, 1991). The drainage of such a vast area with a huge volume of water is not without cost. Every year millions of people are affected by sudden shifts in the river courses which imperil standing crops, farmland and homestead land (Figure 1).

It is estimated that about 5 per cent of the total flood plain area of Bangladesh is directly affected by riverbank erosion. Although the area affected appears negligible in absolute terms, by Bangladeshi standards, where a meagre 1.2 acres is available to each farmer (Khan and Hossain, 1989),
The encroachment of any kind is a great set-back for the nation. Erosion is most intense between the months of August and September (Adnan, 1991), particularly as the flood waters rise and recede.

The damage caused by erosion is barely recorded nationally. Some studies, however, have investigated the resulting property losses and human suffering. Curry (1979) demonstrated that, out of almost 600 upazilas (sub-districts), people in at least 66 upazilas were vulnerable to riverbank erosion. It has been estimated that about 19 million of the rural population are at risk from bank erosion alone in the Padma—Jamuna flood plain region covering more than 7,755 square miles (Haque and Zaman, 1989). Haque (1983) demonstrated that, between 1973 and 1980, the land eroded within the flood plain area of Padma—Jamuna was 299,518 acres. On the other hand while erosion removes land, new and fertile land re-emerges from riverbanks over time (Haque and Zaman, 1989). It is not certain, however, that the victims of erosion are always allowed to claim the re-emerged land, which remains a source of perennial dispute among conflicting claimants from both banks of the river (Zaman, 1989).

THE CASE OF VILLAGE PACH BAROIL

The village chosen for this study was Pach Baroil within the district of Manikgoning on the bank of the river Kaligonga, which originates from the Jamuna. Pach Baroil is a medium-sized village of 168 households, located in the Jamuna—Padma flood plain. Its cultivated areas fall in one of the two deep-water rice zones of Bangladesh (Hobbs, Clay and Hoque, 1978; Brammer, 1977). The deep-water rice zones include those areas which are flooded, in most years, to a depth of more than one metre in the rainy season.

A complete survey of the village was conducted in 1980 and all households (164) enumerated (Hossain, 1983). A re-survey of the village was conducted in 1990, using five enumerators, to examine the economic changes taking place in the village within a longitudinal framework. The re-survey included 168 households. Thus, over the ten year period the village had expanded by only four households, all through partition.

The survey and the re-survey periods were for the crop years 1979 and 1989 respectively. The households were interviewed using two sets of questionnaires. One questionnaire was for farmers and the other for landless labourers. Data were collected on land use patterns, the land tenure structure of the village, crop types, crop production, sources of income and consumption.

In 1979, the total population of the village was 974 persons, of which 513 were male and 461 female (53 and 47 per cent respectively). By 1989, in contrast to the national trend, the village population had declined to 856 persons, of which 433 were male and 423 female (51 and 49 per cent respectively). At least four non-governmental organisations (NGOs) were operating in the village in 1989, whereas, in 1979, there was only one, Bangladesh Rural Advancement Committee (BRAC). This has contributed to a considerable flow of resources to the low income villagers between the two survey periods. The data suggest that the village lost almost 40 acres of farmland between the two surveys, due to the left bank erosion of the River Kalingonga (Table 1). Riverbank erosion has become a major set-back for village agriculture. (The village has surface-irrigation facilities with a well developed infrastructure comprising rural electrification, agricultural extension services and modern transport services.)

In order to ensure the direct comparison of households between the two survey periods, care was taken to ensure that the head of each household in the 1990 data set was:
TABLE 1
Land ownership pattern of different categories of farm household, 1979–89

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Big</td>
<td>65.40</td>
<td>38.40</td>
<td>31.56</td>
<td>23.37</td>
<td>10</td>
<td>5</td>
<td>6.10</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Medium</td>
<td>84.22</td>
<td>66.8</td>
<td>40.65</td>
<td>40.48</td>
<td>30</td>
<td>25</td>
<td>18.29</td>
<td>15</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Small</td>
<td>41.84</td>
<td>48.8</td>
<td>20.21</td>
<td>29.58</td>
<td>36</td>
<td>39</td>
<td>21.95</td>
<td>23</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Marginal</td>
<td>15.70</td>
<td>11.0</td>
<td>7.58</td>
<td>6.67</td>
<td>38</td>
<td>37</td>
<td>23.17</td>
<td>16</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Landless</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>50</td>
<td>72</td>
<td>30.49</td>
<td>43</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>207.20</td>
<td>165</td>
<td>100</td>
<td>100</td>
<td>164</td>
<td>158</td>
<td>100</td>
<td>100</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*In this and subsequent tables, farmer groups are identified as follows:

Big = Farmers owning more than 5 acres
Medium = Farmers owning more than 2 but less than 5 acres
Small = Farmers owning more than 0.67 but less than 2 acres
Marginal = Farmers owning less than 0.67 acres
Landless = Landless labourers owning no land

— the same person as in 1980;
— the spouse of the household head in 1980; or
— a direct descendant (son/daughter) or
the head of the household in 1980.

The majority of household heads belonged to the first category. Only two belonged to the second and 20 to the third, due to the death of former household heads between the two survey periods.

LOSS OF PROPERTY

Table 2 shows the number of households which lost farmland, homestead land or both between 1979 and 1989. About 45 per cent of households were affected in one way or another by riverbank erosion. Big and medium farmers were the most severely affected groups. Eighty per cent of big farmers and 56 per cent of medium farmers were affected but, out of the total households affected, almost 39 per cent belonged to the landless group and only 5 per cent belonged to the big farmer group.

Table 3 shows the amount of land lost in the village by farmer groups. The total area lost was more than 40 acres, of which big farmers lost 27 acres, medium farmers 17 acres and marginal farmers about 5 acres. Although some small farmers lost land by riverbank erosion, this group made net gains of farmland during the study period through household mobility.

TABLE 2
Households affected by riverbank erosion, 1979–89

<table>
<thead>
<tr>
<th>Farmer group</th>
<th>Number of households</th>
<th>Number of affected households</th>
<th>Percentage of households affected</th>
</tr>
</thead>
<tbody>
<tr>
<td>Big</td>
<td>5</td>
<td>4</td>
<td>80.00 (5.3)</td>
</tr>
<tr>
<td>Medium</td>
<td>25</td>
<td>14</td>
<td>56.00 (18.7)</td>
</tr>
<tr>
<td>Small</td>
<td>39</td>
<td>18</td>
<td>46.00 (24.0)</td>
</tr>
<tr>
<td>Marginal</td>
<td>27</td>
<td>10</td>
<td>37.00 (13.3)</td>
</tr>
<tr>
<td>Landless</td>
<td>72</td>
<td>29</td>
<td>40.00 (38.7)</td>
</tr>
<tr>
<td>Total</td>
<td>168</td>
<td>75</td>
<td>45.00 (100)</td>
</tr>
</tbody>
</table>

Note: Figures in brackets refer to the percentage of households out of total households affected.
Economic Effects of Riverbank Erosion

TABLE 3
Land lost by different categories of farm household, 1979–89

<table>
<thead>
<tr>
<th>Farmer group</th>
<th>Area (acres) 1979</th>
<th>Area lost/gained (acres)</th>
<th>Percentage of land lost</th>
<th>Value of land lost/gained in Taka</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Big</td>
<td>65.40</td>
<td>(-) 27.00</td>
<td>55</td>
<td>2,025,000</td>
</tr>
<tr>
<td>Medium</td>
<td>84.22</td>
<td>(-) 17.42</td>
<td>35</td>
<td>1,306,500</td>
</tr>
<tr>
<td>Small</td>
<td>41.84</td>
<td>(+) 6.96</td>
<td></td>
<td>522,000</td>
</tr>
<tr>
<td>Marginal</td>
<td>15.70</td>
<td>(-) 4.70</td>
<td></td>
<td>352,500</td>
</tr>
<tr>
<td>Total</td>
<td>207.20</td>
<td>42.16</td>
<td>100</td>
<td>3,162,000</td>
</tr>
</tbody>
</table>

Notes: 1. Land is valued in the village at 75,000 Taka per acre (US$ = 40 Taka)
2. (-) = net area lost through erosion
3. (+) = net area gained through purchase

LOSS OF CROPS

The main crops grown in the village are three varieties of rice (Aus, Aman and Boro), jute, pulses, oilseed and wheat. The winter (non-flood) crops are pulses, oilseed, wheat and Boro. Aus is grown either singly or as a joint crop with broadcast Aman. In the latter case it is difficult to allocate inputs, such as land preparation, to one crop or the other, so that estimates of the production costs and returns for these crops must be regarded as highly tentative.

Table 4 shows the proportion of land used by different farmer groups for each crop. Big and medium farmers had considerably larger Boro crops than other groups because this is a modern crop, requiring technological inputs to which they had better access because of their relatively strong economic position.

Table 5 shows the total return achieved per acre for each crop grown by different groups on the basis of the prices received. Approximate cost estimates per acre are also given. Tables 4 and 5 are the principal sources of information for estimating the crop losses caused by riverbank erosion since, to estimate net return per acre, it is necessary to know the land-use pattern and the costs and returns for each crop. Using this data it can be estimated that, between 1979 and 1989, the village lost a net crop income of 130,000 Taka (at current prices), big farmers being the worst affected.

TABLE 4
Percentage of land used for each crop by different categories of farm household, 1989

<table>
<thead>
<tr>
<th>Farmer group</th>
<th>Aus</th>
<th>Aman</th>
<th>Boro</th>
<th>Jute</th>
<th>Wheat</th>
<th>Pulses</th>
<th>Oilseed</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Big</td>
<td>21.4</td>
<td>23.8</td>
<td>23.8</td>
<td>4.8</td>
<td>4.8</td>
<td>11.9</td>
<td>9.5</td>
<td>100</td>
</tr>
<tr>
<td>Medium</td>
<td>22.2</td>
<td>22.2</td>
<td>22.2</td>
<td>11.1</td>
<td>11.1</td>
<td>5.6</td>
<td>5.6</td>
<td>100</td>
</tr>
<tr>
<td>Small</td>
<td>40.0</td>
<td>5.0</td>
<td>5.0</td>
<td>5.0</td>
<td>5.0</td>
<td>30.0</td>
<td>10.0</td>
<td>100</td>
</tr>
<tr>
<td>Marginal</td>
<td>30.3</td>
<td>33.7</td>
<td>7.5</td>
<td>17.0</td>
<td>15.7</td>
<td>10.1</td>
<td>2.0</td>
<td>100</td>
</tr>
</tbody>
</table>
TABLE 5
Gross return and estimated costs (per acre) for various crops, 1989

<table>
<thead>
<tr>
<th>Farmer group</th>
<th>Aus</th>
<th>Aman</th>
<th>Boro</th>
<th>Jute</th>
<th>Wheat</th>
<th>Pulses</th>
<th>Oilseed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Big</td>
<td>5055</td>
<td>3000</td>
<td>15000</td>
<td>5250</td>
<td>2250</td>
<td>4375</td>
<td>3750</td>
</tr>
<tr>
<td>Medium</td>
<td>2625</td>
<td>2250</td>
<td>15000</td>
<td>3000</td>
<td>2750</td>
<td>2500</td>
<td>2250</td>
</tr>
<tr>
<td>Small</td>
<td>3750</td>
<td>3250</td>
<td>15000</td>
<td>3000</td>
<td>2750</td>
<td>3437</td>
<td>3000</td>
</tr>
<tr>
<td>Marginal</td>
<td>3777</td>
<td>3500</td>
<td>15000</td>
<td>7500</td>
<td>3000</td>
<td>2750</td>
<td>3354</td>
</tr>
</tbody>
</table>

Notes: 1. All values expressed in Taka.
2. NE = Not estimated because costs negligible

Table 6 shows that about 75 per cent of lost crop income was borne by big farmers, 20 per cent by medium farmers and only 5 per cent by the marginal group. In other words, big farmers lost about 50 per cent of the total crop income earned by these three groups in 1989. About 40 per cent was lost by medium farmers and the rest by marginal farmers. Table 6 also shows that the proportion of loss in crop income to total crop income borne by the big farmers was about 70 per cent, whereas it was 26 per cent for the medium farmers and 38 per cent for marginal farmers. It is, of course, to be expected that big farmers would be more severely affected by riverbank erosion, since they owned more land in the first place.

TABLE 6
Percentage of crop income lost by different categories of farm household

<table>
<thead>
<tr>
<th>Farmer group</th>
<th>Percentage of farm households</th>
<th>Lost income (Taka)</th>
<th>Percentage share of lost income</th>
<th>Total crop income (Taka)</th>
<th>Percentage of crop income lost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Big</td>
<td>3</td>
<td>95700</td>
<td>74</td>
<td>136107</td>
<td>52.5 (70)</td>
</tr>
<tr>
<td>Medium</td>
<td>15</td>
<td>27084</td>
<td>21</td>
<td>103858</td>
<td>40.1 (26)</td>
</tr>
<tr>
<td>Small</td>
<td>23</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Marginal</td>
<td>16</td>
<td>7140</td>
<td>5</td>
<td>19063</td>
<td>7.4 (38)</td>
</tr>
<tr>
<td>Landless</td>
<td>43</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
<td>129924</td>
<td>100</td>
<td>259028</td>
<td>100.0 (50)</td>
</tr>
</tbody>
</table>

Note: Figures in brackets refer to lost crop income as a percentage of total crop income by individual group.
its entire agricultural income from this source. Crop income, as one of the sources of total income, contributes 21 per cent for big farmers, 15 per cent for medium farmers and 12 per cent for marginal farmers. It was surprising, however, to find that crops, as a source of total income, were a liability for small farmers.

By analyzing information on crop income losses from the preceding tables, it appears that the big farmers' real income dropped by almost 15 per cent, medium farmers' income dropped by 4 per cent and marginal farmers' income dropped by 5 per cent over the ten year period. This drop in income, of course, has a highly adverse effect on food consumption. Hunger and inadequacy in calorie intake, particularly among lower income groups, relate more to inadequacies of demand rather than of supply. Even after good harvests, when sufficient food is available locally, the poor simply do not have adequate purchasing power with which to meet their needs. While other factors are important, real income is the most significant determinant, in that it can be used as a general indicator and predictor of the food security status of individual households. In the study village, riverbank erosion has contributed further to the reduction of the income of households and as a result it contributes to the decline in their food security status.

CONCLUSIONS

Riverbank erosion is a major natural hazard in Bangladesh but the damage it causes to the nation has not yet been properly realised. The victims have received almost no attention from the relevant government agencies or NGOs working within the affected areas. The evidence presented here demonstrates the extent of the damage caused by riverbank erosion. The evidence has been presented in terms of property, crop and income losses in one village over the period 1979–89. During this period, the village lost almost 20 per cent of its cultivatable land to the adjacent river and this resulted in the loss of more than 50 per cent of crop income. Over 45 per cent of households in the village have been affected since 1979.

It appears that Bangladesh keeps very limited records on loss of farmland or standing crops due to riverbank erosion. There has, moreover, been almost no proper economic investigation conducted into this problem. As a minimum, the following action needs to be taken as a matter of urgency:

---

**TABLE 7**

Agricultural and non-agricultural income as a percentage of total income, 1979

<table>
<thead>
<tr>
<th>Farmer Group</th>
<th>Agricultural</th>
<th>Non-agricultural</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Crop Income</td>
<td>Wage Income</td>
</tr>
<tr>
<td>Big</td>
<td>21</td>
<td>—</td>
</tr>
<tr>
<td>Medium</td>
<td>15</td>
<td>—</td>
</tr>
<tr>
<td>Small</td>
<td>(−)1</td>
<td>23</td>
</tr>
<tr>
<td>Marginal</td>
<td>12</td>
<td>30</td>
</tr>
<tr>
<td>Landless</td>
<td>—</td>
<td>37</td>
</tr>
</tbody>
</table>

— identify all locations affected by riverbank erosion by large rivers and their tributaries;
— survey the villages in the immediate vicinity of the affected areas to identify potential victims;
— assess the kinds and nature of support these people will need; and
— list priority areas to support the resettlement of the victims.

References


Moazzem Hossain
Division of Asian and International Studies
Griffith University
Queensland 4111
Australia
Coping with Drought and Food Insecurity in Ethiopia

PATRICK WEBB

In this article I examine the impact of drought on farm households in Ethiopia and their response to crisis conditions. I ask whether every household in a community is equally affected by drought and what households do to mitigate the effects of drought and associated food insecurity. Information on production, income and food consumption is disaggregated by agroecological zone (highland and lowland), and by socioeconomic strata (relatively wealthy versus poor). Such detailed analysis permits an improved understanding of why the poor are much more vulnerable than the wealthy to drought and associated famines and why they need to be more effectively targeted by relief and development interventions. In a world of limited public resources for crisis intervention, such understanding is crucial to the design of improved policies and projects for reaching people most at risk.

It has been claimed that ‘drought and famine affect mostly poor peasants and landless labourers, not the wealthy and propertied sectors of society’, (Kebede and Jacob, 1988, p. 68; ICIHI, 1985; Devereux, 1988; Harrison, 1988; Herren, 1991). The assumption is made that wealthy households have the resources to mitigate the worst effects of drought and to survive, largely unscathed, through drought-related famines. Yet there are few studies confirming differential drought impact and household response according to wealth status (Swinton, 1990; Kennedy, 1992; Webb and Reardon, 1992). Cutler (1985, p. 94) has pointed out that ‘research into human response to drought should be an urgent undertaking. For Ethiopia, in particular, we need to know why some populations are more vulnerable than others’. Similarly, Campbell (1990, p. 144) argues that ‘while most studies have described the responses of particular societies to specific crises, they have not analyzed differences within and between groups in ability to cope’.

In this article I seek to fill some of these information gaps by examining the differential impact of drought on farm households in an environment in which everyone is poor in absolute terms. Drawing on detailed survey data from Ethiopia, I consider the effects of drought on richer and poorer households, as defined by their net annual income. The key questions are whether every household in a community is equally affected by drought and what households do to mitigate the effects of drought and associated food insecurity.

Given finite public resources for crisis intervention, answers to these questions are crucial to the effective design of future policies and projects for reaching people most at risk. Only with such a disaggregated
analysis can the key characteristics of household food insecurity be established, and improved targeting of relief interventions be achieved.

STUDY AREAS AND RESEARCH DESIGN

The research was organized by the International Food Policy Research Institute in collaboration with Ethiopia's former Ministry of Central Planning (now the Ministry of Planning and Economic Development) and with the International Livestock Centre for Africa. A survey of 550 households was conducted during 1989 and 1990, the first relatively good harvest year after five years of drought and extensive food deprivation. The households represented a stratified random sample drawn across seven villages: four in the semi-arid lowlands (below 1500 metres) and three in the more temperate, but still drought-prone, highlands. Multiple visits (up to 7 per household over a three-month period at each site) permitted the collection of data on production, assets, income sources, expenditure and consumption patterns, as well as information on experiences during the most recent famine.

No claims are made that the surveyed localities are statistically representative of the country as a whole. Many conditions were found to be the same, however, at all seven survey sites: proneness to climate-driven production fluctuations, a lack of employment opportunities, limited household asset base, isolation from major markets, low level of farm technology, constraints to improvements in human capital and poor health and sanitation environments. It is the way different households cope with these constraints that largely determines the degree of their food insecurity and vulnerability to famine.

Drought is only one element contributing to household food insecurity and vulnerability to famine. Chronic food insecurity in Ethiopia is the result of a complex interaction between supply, distribution and demand factors; no single element can be invoked to explain the causation and evolution of food crises. The focus here on drought, and its impact on productivity, does not imply a supply-side bias in the discussion of household vulnerability. The research aimed at understanding the underlying conditions that result in greater suffering for some regions and households than others when faced with destabilizing events. The disruptive role of armed conflict on relief and development efforts in the north cannot be over-emphasized but, while the long-term drain on human and economic resources associated with war was felt in the study regions, military action never played a direct part in the famine experiences of the sample households. Environmental and policy-related factors were of more immediate importance.

DROUGHT IMPACT ON PRODUCTION

Droughts are common in Ethiopia. Although there has been only a small decline in the overall rainfall trend during the past 25 years, fluctuations around the mean between years and between regions have been large. In 1984, for example, rainfall was 22 per cent below the long-term mean at a national level and most regions suffered. Such a shortfall is significant. A simple rainfall–crop output model based on 27 years of data indicates a relatively sturdy relationship between changes in total rainfall and changes in production: a 10 per cent decline in rainfall (below long-term average) results in a 4.4 per cent fall in national production. A 10 per cent decline in rainfall (below long-term average) results in a 4.4 per cent fall in national production, representing a reduction in food production of about 300,000 tons in that year (Webb, von Braun and Yohannes, 1992). Yet, in other years, droughts affect only parts of the country. The worst drought to hit Wollo since 1961 occurred in 1984. Sidamo had a record drought in 1980, while Gondar’s worst experience was in 1966 (Webb, von Braun and Yohannes, 1992).
It is not just the severity of an individual drought that matters in relation to food insecurity. While single year deficits are important, the cumulative effect of repeated droughts has more significance (Hay, 1988; de Waal, 1988). Household vulnerability increases through the progressive depletion of food stocks and capital assets as a result of repeated harvest failures. The worst of the recent famines represented the culmination of at least two years of poor rainfall. Figure 1 shows that in Wollo and Hararghe provinces the 1972–1974 famine was preceded by three consecutive years of below-average (and declining) rainfall. Similar, if shorter, drought sequences preceded the national food crises of 1979/80 and 1984/85.

At the survey locations, 75 per cent of respondents laid the blame for famine squarely on adverse climatic conditions (the other 25 per cent cited a mixture of declining soil fertility and increasingly difficult economic conditions). At the highland survey sites, the worst drought year (1984/85) caused annual rainfall to drop from an average of 1,250 mm to 740 mm, while at the lowland sites it fell from 613 mm to only 440 mm. Below-average rainfall in the previous three years had already depleted food, seed and capital reserves.

The droughts affected a farming system characterized by low productivity even in good years (Harbeson, 1990; Brune, 1990; Belete et al., 1991). Mean farm size is only 0.15 ha per capita at the survey sites and 0.12 at a national level (Webb, von Braun and Yohannes, 1992). Such small farms result from a high population concentration in the central and northern highlands, coupled with policy restrictions on farm size in force since the 1975 land reforms. Because of land redistribution in the 1970s, relatively wealthier households in the sample (the top third of households in the sample with average annual incomes of US$100 per

![Mean annual rainfall from 1961 to 1988 for Wollo and Hararghe regions](image)

FIGURE 1 Mean annual rainfall from 1961 to 1988 for Wollo and Hararghe regions
capita) did not farm substantially more land than relatively poorer households (the bottom third of sample households, with an annual income of only US$42 per capita). Former land-owning households in the sample (those that received rents from tenants before 1974), had access to roughly the same area as former tenant or landless households: 0.14 ha and 0.16 ha, respectively.

In other areas of the farm economy, however, wealthier households gain the advantage. Access to labor (animal and manual), capital and improved inputs was limited everywhere, but the wealthier had greater access than the poor. In the highlands, where thick vertisols (black volcanic soils) predominate, access to plough oxen is one of the prerequisites of a successful harvest. In 1989, fewer than 13 per cent of the sample households owned a pair of oxen (required to pull a traditional plough), while 79 per cent did not own any at all. Of those that did not own any oxen, 91 per cent were poorer households.

Similarly, few sample households had access to formal credit or improved inputs, such as seed and fertilizer. Those that did were generally wealthier. While none of the respondents had a formal bank account, for example, 17 per cent reported membership in a community-based savings society (Equb). This ranged from 12 per cent among the poorest households to 30 per cent among the relatively wealthier households. Likewise, only 8 per cent of survey households (all relatively wealthier households) ever obtained a loan from local Service Cooperatives for the purchase of fertilizer (normally procured through the Cooperative). As a result, only 1 per cent of sample households used any chemical fertilizer during the 1988/89 season.

These general production constraints (coupled with pricing, marketing and infrastructure constraints) result in very low productivity (Webb, von Braun and Yohannes, 1992). In 1988/89, a year of good rainfall, survey households obtained average yields of only 740 kg per hectare in the highland sites and 340 kg per hectare at the lowland sites. This translated into an average 111 kg of cereals per capita across sites. Yields fell lower still during the drought of the mid-1980s. Despite common 'risk aversion' measures (such as crop diversification, inter-cropping, staggered planting and selective weeding), cereal yields at the study sites dropped in 1985 to an average of only 181 kg per hectare, or 24 kg per capita.

What is more, there was differentiation between rich and poor. Wealthier households achieved drought-year yields three times higher than poor households — 300 kg versus 111 kg per hectare. As a result, drought-year output from wealthier households was also higher, reaching an average of 38 kg per capita, compared with only 9.5 kg per capita in poor households. Yet, while the relative difference between the income groups is high, drought-year cereal output in wealthier households was still extremely small in absolute terms. In 1985, the wealthier households produced only 38 kg of cereals per capita, only a third of the average of 112 kg per capital in 1988. Thus, although some smallholders were more successful than others in dealing with the adverse climatic conditions of the mid-1980s, almost all households faced major crop and livestock production shortfalls.

The differential impact of drought by wealth status also extended into livestock production. Extraordinary measures were taken by households trying to keep animals alive. At the lowland survey sites, 69 per cent of sample households fed roof thatch to their oxen and milch cows. Cactus stems and fruit were used by 24 per cent of households, and 5 per cent collected tree vines. In addition 35 per cent of pastoral respondents increased the watering frequency of their herd, and another 10 per cent increased the frequency of their transhuman cycles by staying for shorter periods at any one place.
Despite such extreme preservation measures, loss of production and animal mortality during famine years were high. In lowland Sidamo, average milk offtake per cow (Boran species) is estimated at 1 litre per day during a good year (Donaldson, 1986; Holden, 1989). In 1985, average offtake declined to 400 ml per cow per day (Donaldson, 1986). The milk offtake from camels (the property of wealthier households) was much higher during the drought than that of cattle, averaging almost 800 ml per day. This underlines the role of camel ownership (which is expensive) during years of drought.

In the highlands, milk yields from local cows held by sample households averaged 5 litres per day in 1989. However, while milk yields from cows in wealthier households was generally maintained at that level during the worst year of drought, output from cows owned by poorest households fell to only 1.2 litres per day (with many cows drying up altogether).

This was partly because wealthier households were able to concentrate more resources on good animals. Wealthier households emerged from the drought-affected 1980s with an average of 0.42 Tropical Livestock Units per capita, while the poorest households were left with only 0.17 units per capita. The wealthy achieved this through selective investment in key animals and acceptance of large losses among the surplus stock. Thus, while poor households experienced only a 23 per cent decline in herd size due to deaths and sales during the drought, the wealthy accepted a loss of 88 per cent of their pre-drought herd. With much larger herds to begin with, and more resources to invest in the maintenance of a core stock, wealthier households survived the crisis with more animals in hand than the poor.

HOUSEHOLD RESPONSE TO DROUGHT AND FOOD INSECURITY

Since droughts are neither uncommon nor unexpected in the resource-poor regions of Ethiopia, what strategies do households employ to enhance their food security and survivability? In this section I examine a number of response mechanisms widely reported among the sample households: the sale of assets, the search for non-farm income, loaning and sharing and the diversification and reduction of consumption. The focus is on response mechanisms, as opposed to coping mechanisms, and therefore does not include initiatives associated with pre-crisis risk minimization, such as crop and herd diversification, and broad-based income diversification (Campbell, 1990; Cekan, 1990; Shipton, 1990).

Asset Sales

As food and capital stores become depleted, the need for income for food purchases rises. One of the first strategies adopted by food-stressed households is to sell disposable assets. As would be expected, wealthier households had more assets to sell and what they sold tended to be of greater value. On average, 31 per cent of the poorer households sold livestock during the drought, compared with 54 per cent of wealthier households. The level of sales of farm and household assets were similar across both groups but income earned from asset sales by wealthier households was six times that earned by the poor: US$15 against US$2.5.

There were differences in the types of assets sold according to the intensity of the crisis. In the highlands, where the crisis was less severe, 51 per cent of respondents sold household goods but these mainly consisted of easily-replaced pots and blankets. In the more severely-hit lowlands, although fewer people (38 per cent) sold household assets because they had fewer to begin with, many households were reduced to selling their own clothing (coats, dresses, shoes) and essential cooking utensils (dishes, cups, jugs).
The sale of productive assets represents the later stages of hardship. Since private ownership of land is not common, land did not often change hands during the crisis but 28 per cent of sample households sold at least some farm equipment, and 56 per cent sold livestock. The majority of animals sold were male cattle, calves and small ruminants but draft oxen, cows and donkeys (the principal mode of transport and haulage) were also sold as conditions worsened. In 1984, few animals of any type represented 'distress sales' (defined as sales for the purpose of obtaining food) but in 1985, and again in 1987 and 1988, distress sales of the three most valued animals (oxen, cows and donkeys) rose steeply. The long-term implications of such asset-stripping are considerable. Fewer oxen (and ploughs) are available for the next farm season, income from animal products disappears, and sales of fuel products suffer because of transport constraints.

There appears to have been some degree of substitution between the sale of livestock, household and farm assets depending on availability. Where fewer livestock were sold, more household or personal assets were often sold, and vice versa. In the southern pastoral lands of Sidamo, for example, 90 per cent of the pastoral households in the sample sold livestock, while only 8 per cent sold household goods. Given that pastoralists own few household goods and many cattle this is not surprising. What is more, the sale of an animal is an event of high significance to pastoral clans. If a household was forced to sell livestock the clan tried to find a buyer within the clan so that animals rarely left the 'greater fold'. By contrast, in the densely-populated highlands of Wolayta (southern Shewa), 91 per cent of respondents sold household goods but only 55 per cent sold livestock, which fewer people own because of land pressure.

Disposable farm equipment took the form of ploughs, sickles, harvest sacks and rope. Few of the wealthiest households sold any of their productive farm assets but 48 per cent of the poorest sample households sold farm-related assets. This indicates that, in the absence of efficient capital markets, the poor had no means of protecting their assets and their productive efficiency. In 1989 the mean value of assets still owned by households after five or more years of crisis was only US$66 per capital, ranging from US$114 per capita among wealthier households to only US$52 in the poorest households. This underlines the relatively greater problem facing poorer households in attempting to re-establish post-drought production.

Non-Farm Income

Few households depend solely on crop production for survival. During a good rainfall year, such as 1989/90, wage labor, the sale of fuel products, the sale of craft-work and other activities unrelated to the home farm, account for an average of 69 per cent of total net income for wealthier households, and 36 per cent of income among the poorer households (Webb and Reardon, 1992). In other words, wealthier smallholders depend relatively less on agricultural production, and more on a diversified income portfolio.

Yet, as drought years succeed each other and reliance on domestic food production becomes more uncertain, the search for non-farm income grows — unfortunately at a time of falling demand for products and services. The collapse of demand for non-essential foods and fuel products during the crisis years of the mid-1980s sharply reduced the earning options for most households. In 1988/89, for example, (a good rainfall year), women in 21 per cent of the survey households earned a substantial income from the sale of processed food and drink. During
the years of drought and famine, however, less than 1 per cent of all households were engaged in such activities.

Instead, women were frequently forced to sell their last remaining asset of value (labor) alongside the men. In 1989, manual wage labor was a major source of income for men in 17 per cent of survey households and for women in only 3 per cent of households. During the worst famine year, however, the percentage of households in which both women and men were working as laborers rose to 25 per cent. This was true despite a 50 to 60 per cent fall in wages in the survey areas during the famine.

The only major difference between male and female laborers was that women worked close to home, while men migrated longer distances to find jobs with higher wages. It should also be pointed out that the loss of certain productive assets, such as pack animals, had a further negative impact on women’s ability to pursue non-farm income-earning activities. The loss of a donkey made it much harder for women to collect and transport to market firewood or manure bricks. Similarly, the sale of craft products, such as spun cotton and woven cloth, was compromised by transport constraints.

Social Support

In many instances, migratory searches for employment and income needed to be preceded or supported by drawing on social investment systems, such as family and community exchange and reciprocal obligation (Shipton, 1990). There is a large anthropological literature on the old, but still unresolved, debate about the nature and extent of sharing during times of stress (Turnbull, 1972; Dirks, 1980). The issue is whether communities, or even relatives, share what they have during famines. Evidence has been offered to support both sides of the argument (Pankhurst, 1984; Cekan, 1990).

The present findings are also mixed. Roughly one third of respondents at four of the survey sites supported their relatives at the worst time. The remainder reported that things were so bad that they could not help anyone but their own household. In southern Shewa, some relatives went out of their way to avoid seeing each other rather than confront the embarrassing issue of blood-ties. In the lowlands of eastern Shewa, where conditions were the worst of all the sites, a common response was that people felt a moral obligation to bury a neighbor if found dead, but that other forms of help were limited. One respondent replied, ‘there was no way of helping each other. It was a time of hating — even your own mother’.

The one exception was the pastoral site in Sidamo. Pastoral communities are often more mutually supportive than their agrarian counterparts (Laughlin, 1974; Webb, Bisrat and Coppock, 1991). Over 80 per cent of households supported not just other relatives, but anyone in the clan who needed assistance. Similarly, although access to water and grazing became very restricted during the drought, 90 per cent of respondents noted that there was no friction or conflict over resources. The few who did report clashes over grazing noted that this did not occur amongst the Borana or Gabbra, but with other ethnic groups such as the Guji who attempted to move into the Beke area during the drought. Those reporting friction over water said that this occurred mostly amongst the Borana because of strict controls imposed by the elders on access to ponds and traditional wells. Most disputes were over the allocation of clan water rights.7

Apart from pastoral reciprocity, which showed considerable stability, the diversity of responses at other survey sites suggests that social relationships change with the conditions around them. Cultural norms and the changing severity of local conditions both play a part. As Shipton
TABLE 1
Drought impact and household response by region and wealth status

<table>
<thead>
<tr>
<th>Region</th>
<th>Wealth Status</th>
<th>Percentage of households</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Highland</td>
<td>Lowland</td>
</tr>
<tr>
<td>Asset Sales</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Livestock</td>
<td>61</td>
<td>53</td>
</tr>
<tr>
<td>Household</td>
<td>51</td>
<td>38</td>
</tr>
<tr>
<td>Farm</td>
<td>28</td>
<td>20</td>
</tr>
<tr>
<td>Loans</td>
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<td></td>
</tr>
<tr>
<td>Food</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>Cash</td>
<td>35</td>
<td>34</td>
</tr>
<tr>
<td>Sharing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>'Family support'</td>
<td>29</td>
<td>41</td>
</tr>
<tr>
<td>Sharing food</td>
<td>25</td>
<td>36</td>
</tr>
<tr>
<td>Consumption Decline</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Famine foods</td>
<td>56</td>
<td>47</td>
</tr>
<tr>
<td>Reduced food</td>
<td>66</td>
<td>59</td>
</tr>
<tr>
<td>Reduced meals</td>
<td>17</td>
<td>40</td>
</tr>
<tr>
<td>(&lt;1 per day)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Early weaning</td>
<td>54</td>
<td>35</td>
</tr>
</tbody>
</table>


points out, 'hunger seems to separate the more from the less valued ties ... as sharing becomes more discriminant' (Shipton, 1990).

But what of ability to share? It has been argued that families in Ethiopia survive long periods of hardship because community support mechanisms enable the almost-desperate to borrow and share food with wealthier households (Rahmato, 1987; McCann, 1987). While the present data are too aggregated to identify the direction of food and income flows between different household types, Table 1 shows that roughly one third of the sample households shared more food and cash with relatives during crisis years than during 'normal' times. On the other hand, increased sharing of food shows up more among wealthier households (41 per cent), than among poorer households (23 per cent). Few respondents reported having shared freely with non-relatives. In other words, while sharing (and indeed increased sharing) of resources did take place, relatively more of the wealthier households were in a position to do so and they shared with blood-relatives rather than with destitute households outside of the family.

Credit and Loans
Where it was difficult to find access to shared resources, many households resorted to credit. Debts represent personal ties and personal ties represent security during crisis. Thus, if relatives could not (or would not) give food or cash in the form of a gift, they would often give a loan. Most households (87 per cent) took loans of food from nearby villages in the early stages of the crisis, which they later repaid with
interest. Almost half the loans reported were arranged between relatives. Another 41 per cent took the form of loans between friends, with only 11 per cent involving commercial money-lenders or merchants. Table 1 shows that slightly more wealthy households borrowed food and cash than did poorer households. They also made larger loans. This indicates that poor (in fact all) households lack access to the credit that is crucial to preserving resources during times of stress. Interest rates on loans ranged from 50 to 300 per cent, payable in cash or kind; where they were obtained from relatives rather than merchants, they usually carried no time limit for repayment.

Consumption Variation and Decline

Even during non-famine years calorie consumption in Ethiopia is extremely low. At a national level, average per capita figures commonly cited lie in the range of 1,500 to 1,750 calories per day (Harbeson, 1990). Among the sample households, daily calorie consumption in 1989/90 (a good harvest year) stood at an average of 1,850 per capita (Webb, von Braun and Yohannes, 1992), but the average conceals considerable variation. Per capita consumption in the poorest households stood at only 1,690 calories per day across all survey sites, with four of the sites falling below the 1,600 level. This compares with an average of 2,183 calories per capita for the wealthier households. Thus, wealthier households were consuming roughly 30 per cent more calories in 1989/90 than the poor.

Yet, by any nutritional standard, all of these figures are low. Many of the wealthier households consume fewer than 2,000 calories per capita per day. As a result, an average of 68 per cent of the sample households (across the entire sample) consumed less than 80 per cent of the recommended daily allowance of 2,300 calories per day. This compares unfavorably with recent surveys in The Gambia and Rwanda which found only 18 per cent and 41 per cent respectively of households calorie-deficient (von Braun and Pandya-Lorch, 1991). In other words, in a good year an average of no less than 42 per cent of households across the surveyed communities can be classified as malnourished.

The low base level of consumption inevitably restricts the options available for a consumption adjustment to food shortages. Nevertheless, three main consumption responses were adopted by the sample households: diets were diversified to incorporate food items not normally consumed, the quantity of food consumed per meal was reduced, and the number of meals per day was reduced.

Wealthier households changed their diet relatively less than the poorer households, but they did change them. On the one hand, the wealthy reduced their consumption of the most expensive grain (teff), substituting cheaper cereals such as maize and sorghum. On the other hand, many wealthier households were also forced to eat "famine foods". While certain forage foods are collected as a matter of course even during normal years, the range of items, and frequency of consumption, rose considerably among most households during the droughts and associated famines. Table 1 shows that at the upland sites, 56 per cent of households supplemented their diets with famine foods, such as roots, leaves and even grass and rats. In the lowlands, an average of 47 per cent of households consumed famine foods. Both men and women joined in the search for products to supplement an increasingly restricted diet.

Interestingly, 58 per cent of wealthier households increased their consumption of famine foods, compared with only 41 per cent of poorer households. This is because poorer households supplement a cereal or tuber-based diet with berries and fruits, even in years of good rainfall (Irvine, 1952; Wilding, 1985). Certain types of foraged food should therefore be distinguished from
'famine foods' (Fleuret, 1986). If such a distinction could be made, then foraging for specified foods could be identified as a 'coping mechanism', while the gathering of other 'famine foods' would more accurately represent desperation.

But some households eschew certain types of famine food as long as possible because of cultural norms. For example, the Afar and Arsi peoples of the Awash river basin refused to eat fish during the 1973/74 famine (Kloos, 1982). Similarly, in Sidamo, the Gabbra (as Moslems) are forbidden to eat the meat of animals that have died of hunger or disease. None of them admitted to eating such meat during the famine. On the other hand, 92 per cent of the Borana reported using this source of food in 1985/86. Although the Gabbra formerly drank blood as a regular part of their diet (as the Borana still do), a Gabbra council proclaimed 20 years ago that drinking blood was sacrilegious. Only 25 per cent of Gabbra households admitted increasing their consumption of blood during the famine, compared with 42 per cent of Borana households.

If Gabbra taboos did not break down during the crisis, this was not the case with followers of the Ethiopian Orthodox church, who constitute a majority of the sample households in Debre Berhan, Dinki and Gara Godo. Orthodox fasting rules, which dictate that meat and dairy products be avoided on 150 days of the year, were suspended by all sample households during the crisis (Dirks, 1980; Selinus, 1971). They have since been readopted.

The other two methods of dealing with food shortage (reduced consumption per meal and reduced numbers of meals) represent severe hardship and a lack of alternatives, rather than coping. Table 1 shows that an average of roughly 63 per cent of households reduced the amounts of food consumed per meal. More wealthy households did so because poor households had little margin within which to reduce quantities consumed.

Most households also cut back on the number of meals per day. In the highlands, only 17 per cent of households were reduced to eating less than one meal per day, compared with 40 per cent of lowland households. The most extreme case was recorded at the lowland site in eastern Shewa where 78 per cent of respondents had cut back to less than one meal per day during the 1984/85 famine. A dozen households reported going for up to four days without any food at all. At that time, several respondents report that they fought their neighbors over handfuls of roots found in the fields. By 1989, consumption had improved, such that 67 per cent of sample households were once again consuming 3 meals per day.

Often the reduction in meals was forced because of a lack of purchasing power. Some women noted that they relied on the daily sale of firewood in a market 20 km away. If they could find no buyer, they went hungry. Table 1 shows the proportion of households in which mothers were forced to wean their babies earlier than expected because their breasts had dried up. The highest proportion of such cases (84 per cent) was found in the highlands of southern Shewa. While the finding that breast-milk dries up during famine has been challenged (Rivers, 1988; Huffman, 1990), women in this sample confirmed that lactation can be severely compromised by prolonged reduction of calorie intake. That this issue was raised most often by women from wealthier households may indicate that they had intended to breast-feed their infants longer than poorer women (an hypothesis that remains to be tested).

CONCLUSIONS AND POLICY IMPLICATIONS

Three major conclusions emerge from this study of drought impact and household responses in Ethiopia. First, famine is inseparable from poverty. Even where everyone...
is poor in absolute terms, the depth of that poverty is important in determining how drought will affect individual households. While all households in the survey regions were affected by drought and associated food crises, their degree of food insecurity varied considerably according to income level, the degree of income diversification, and the value and disposability of the asset base. This finding has two important implications for the relief and rehabilitation of farm economies devastated by drought.

In the first place, it draws attention to the need for effective targeting of the poor by relief interventions. The differential impact of drought (and food crises) according to wealth status implies that it is the absolute poor who are hit first, and most seriously, by drought and other shocks to the local economy. If the poor are not successfully targeted with food, income and health transfer initiatives, the goal of stabilizing food and nutritional status among the most vulnerable will not be easy to achieve. In the second place, this finding underlines the importance of combating the root causes of household poverty as an essential part of any strategy aimed at preventing food crises. The poorest in Ethiopia are increasingly vulnerable to drought and associated food crises. Such households are unable to take full advantage of macroeconomic policy changes that encourage an immediate supply response. Thus, while overcoming economic imbalances remains a necessary step for tackling structural constraints to growth, it is in itself insufficient to reduce short-term famine vulnerability. There is a strong need to complement current economic liberalization policies with targeted measures designed to improve the purchasing power of 'at-risk' groups in vulnerable regions. This implies raising productive investment in the smallholder sector of drought-prone regions, not just in the surplus zones. Investment in Ethiopia’s surplus regions alone will not in itself remove food insecurity in the deficit regions.

The second conclusion to emerge from the study is that famines do not happen suddenly. Famines build on high levels of food insecurity that poorest households cannot withstand (and that governments are generally not prepared for). Food crises, therefore result from an accumulation of events that progressively erode the capacity of poor households to deal with short-term shocks to the local economy. Shocks often take the form of environmental extremes, but the conditions that promote household vulnerability to such extremes develop over long periods. The coping capacity of poor households in the drought-prone regions of Ethiopia has been substantially reduced in the 1980s. This suggests a limited scope for reliance on private solutions, depending on free access to markets as a means of rectifying past policy mismanagement. The current structural constraints to rural economic growth need to be removed through appropriate, cost-effective action in the public domain.

The third conclusion is that famines are preventable. The basic building blocks for rural growth, the data and logistical requirements for early warning, and the fundamentals of effective famine relief interventions are better understood now than they were at the start of the 1980s. What remains to be elaborated in Ethiopia, as in much of famine-prone Africa, is a comprehensive strategy for overcoming existing constraints to effective poverty reduction. Such a strategy should be based on a broad principle of rural growth, but narrowly focused on a key set of public policy priorities.

In the short term, these priorities should include the stabilization of food entitlements for the poor in drought-prone areas. Improved famine relief remains a priority. The long-term depletion of household stocks and resources has resulted in a situation in which single year droughts may now be sufficient to trigger food crises. Even the wealthiest households in the survey...
held few remaining assets, owned few livestock and were at very low consumption levels, even in a good harvest year, because they no longer had the reserves necessary to capitalize on improved rainfall when it came. The poor, meanwhile, were in a state of structural vulnerability from which it was difficult to emerge. The targeting of public interventions on the absolute poor is essential to prevent the future loss of human life, as well as economic assets.

In the longer term, the first policy emphasis should be on the promotion of agricultural growth through technological change and commercialization. Much could be gained from programs aimed at stabilizing production at higher levels. Research for improved drought-resistance in cereals, increased small-scale irrigation and programs of degradation control are critical for raising and stabilizing supply. But such a strategy could be inhibited by a narrow focus on staple food production. Concern with national food security driven by domestic self-sufficiency may be at odds with improved household food security based on higher real income from multiple sources. The sample households with a firmer economic base were those with a more diversified income. The removal of constraints to growth in food production, therefore, requires a broader strategy emphasizing agricultural growth through technological change and commercialization.

The adoption of improved technology (including inputs) is, of course, one of the keys to long-term food security, both through its potential to enhance agricultural productivity and through its related capacity to increase rural employment. Yet improved technology need not be restricted to staple food production, even where improved calorie consumption is desired, nor to the wealthy who have relatively better access to credit (von Braun, Webb and Puetz, 1989; Webb and von Braun, 1992). Growth in the staple food sector and the cash crop sector are not mutually exclusive. Both depend on a refocusing of investment on the smallholder as well as on appropriate market and price liberalization policies, infrastructure development and improved access to inputs and credit for the poor.

The second long term priority is employment creation through labor-intensive public works. This has taken on a new urgency for both rural and urban populations. In rural areas, the upgrading of rural infrastructure and the containment of natural resource degradation are essential development tasks that public authorities can realize through the offer of private employment. Through the income transferred, such labor-intensive works also play a vital role in supporting the purchasing power of the poor (von Braun et al., 1991). The need to support food security among the urban poor is also growing. Many international donors, (e.g., the World Bank, the International Labor Office and the World Food Program) and the new government of Ethiopia argue for a larger role for labor-intensive works in the 1990s. As with famine relief projects, however, the success of such works will depend on improved technical and participatory design, the complementing of food with non-food resources, better communication with participants about recruitment and remuneration criteria (including greater flexibility in modes of payment), improved and decentralized management and supervision, and the integration of implementation with sound monitoring and evaluation.

The third long term priority is improved health and sanitation services. Epidemic disease spreads rapidly during famine and accounts directly for the mortality of huge numbers of malnourished and unvaccinated people. Investment in an extensive network of rural clinics could help in minimizing deaths during famine by containing epidemics, as well as in improving the collation and analysis of child monitoring data.

The positive complementarities between
these priorities are promising and, if allowed to operate in a favorable macro-economic environment, would permit high returns to public investment. There is no single public intervention that can alone improve food security. Nor is there a universal, market-based solution just waiting to be tapped by vulnerable households. Many of the latter do not have the ability to take advantage of the potential for private initiatives. It is these households that must be targeted through appropriate public action. Programs such as wet feeding, food aid distribution, public works, asset distribution and technology transfer can operate simultaneously, so long as they are carefully coordinated to balance and complement each other rather than compete.

Of course, even well-designed and well-targeted projects cannot on their own resolve Ethiopia’s structural food insecurity. A consistent set of policies designed to support strategic national and donor interventions is required over the next decade (and beyond) to remove the long-standing obstacles to rural growth in Ethiopia. Lasting peace through improved popular participation, and sustained poverty reduction through rural economic growth are the best foundation stones for a future without famine. The design of such policies and programs will need to be grounded in a better understanding of the dynamics of the rural economy. Sound household information is still surprisingly scarce in Ethiopia. A widely-held (but mistaken) belief in the uniformity of rural conditions and of household strategies for coping with those conditions prevents appropriate attention being paid to the distributional consequences of policy and project interventions. As a result, the poorest of the poor, who are the most vulnerable to famine and therefore the first affected by it, are often overlooked.

Notes
This article benefitted greatly from comments made on an earlier draft by Joachim von Braun, Thomas Reardon and Julie Witcover. Thanks go to Yohannes Habtu, Luel Getachew and Raya Abagodu for their tireless assistance in the collection of these data, and to Yisheac Yohannes for their analysis. I am also immensely grateful to Anna Hugo-Webb for her selfless support.

1. See Webb, von Braun and Yohannes (1992), and Webb and Reardon (1992) for details of the research methodology and results.
2. The lowland survey villages were located in eastern Shewa, northern Arssi, Sidamo and central Gamo Gofa. The highland sites were in north-west Hararghe, northern Shewa and south-western Shewa. There lowland villages represented settled farm communities, one a pastoral community.
3. Based on data for nearest rainfall stations monitored by the National Meteorological Services Authority.
4. Three income groups ('rich', 'middle' and 'poor') were calculated, ex post facto, across all survey sites based on data on household income and expenditure for 1989/90. The three groups each comprise roughly one third of the total of 550 households.
5. Tropical Livestock Units are calculated as follows: Equines = 1.0, Camels = 1.0, Cattle = 0.83, Donkeys = 0.5, Small Ruminants = 0.2.
6. If a poor household owned 2 cows before the drought and lost 1 of them, that is a loss of 50 per cent of the pre-drought herd. If a rich household had 100 cows and lost 80 of them, that is an 80 per cent loss. But the rich household still has 20 cows, while the poor household has only 1 left.
7. For details of the complex political structures which govern water allocation from shared wells that are 600 years old, see Legesse (1973), Wilding (1985), and Cossins and Upton (1987).

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Patrick Webb
International Food Policy Research Institute
1200 Seventeenth Street, N.W.
Washington
D.C. 20036-3006
USA
Operational Value of Anthropometric Surveillance in Famine Early Warning and Relief: Wollo Region, Ethiopia, 1987–88

MARION KELLY

In this article I examine the operational implications of the findings reported in 'Entitlements, Coping Mechanisms and Indicators of Access to Food: Wollo Region, Ethiopia, 1987—88' (Kelly, 1992). The usefulness of anthropometric and other indicators for early warning and relief planning in Wollo is assessed by comparing the findings of Save the Children Fund’s nutritional surveillance programme with those of the Early Warning and Planning Service of the Ethiopian government’s Relief and Rehabilitation Commission. Case studies are used to illustrate the value of anthropometric and other indicators for targeting relief food and monitoring its effects. The costs of monitoring various indicators are then considered, and the cost of the Save the Children Fund programme is compared with that of other programmes. It is argued that in Wollo, anthropometric surveillance is a cost-effective means of improving early warning, planning, targeting and monitoring.

During 1987 and 1988, the Nutrition Field Worker/Nutritional Surveillance Programme (NFW/NSP) of the Save the Children Fund (SCF) carried out longitudinal and cross-sectional anthropometric surveys in nine of the twelve awrajas (districts) of Wollo Region, Ethiopia. In addition, NFW/NSP personnel monitored grain and livestock market indicators, and used questionnaires to collect information on crop yields, relief distribution, population movements and mortality (Kelly, 1992). The Early Warning and Planning Service of the Ethiopian government’s Relief and Rehabilitation Commission and the NFW/NSP were the Region’s only sources of systematically collected data on food security.

In Wollo, failure of the main rains in mid-1987 was followed by a period of acute food insecurity in 1988. A recent analysis of the anthropometric and socio-economic data collected by the NFW/NSP during 1987–88 led to two conclusions: first, the mean Weight for Length (WFL) of children under five was a valid indicator of access to food, which responded earlier than livestock market trends, migration or mortality; and second, the movements of different indicators were not strongly correlated with one another (Kelly, 1992). In this paper I consider the practical implications of these findings, including the question of whether the operational value of the anthropometric information gathered by the programme justified the expense involved in obtaining it.
EARLY WARNING AND PLANNING

In September 1987 it became clear that at least half of Wollo's main (meher) crop would be lost; in the months that followed, the NFW/NSP documented changes in the behaviour of various indicators of access to food. But the NFW/NSP was neither the only source of information on food security nor the main influence on decisions concerning relief intervention in the region. In order to assess the operational value of the anthropometric data collected by the NFW/NSP, it is necessary first to examine the other information that was available and to determine whether or not it was adequate for early warning and planning purposes.

Within the Ethiopian government, famine early warning is the responsibility of the Relief and Rehabilitation Commission's Early Warning and Planning Service (RRC/EWPS). In its bi-monthly reports, which are circulated to donors, NGOs and other agencies, RRC/EWPS presents information on rainfall, crop prospects, crop yields and market prices.

RRC/EWPS also quantifies requirements for relief assistance. Its estimates of relief food requirements are based mainly on qualitative assessments carried out every month by woreda (sub-district) committees made up of local administrators, agricultural agents and Farmers Association (FA) leaders. Around harvest time the committee estimates, for each FA in the woreda, the proportion of households in each of five categories:

- in need of assistance for twelve months (i.e., until next meher harvest);
- expected to need assistance for nine months;
- expected to need assistance for six months;
- expected to need assistance for three months; or
- not expected to need any assistance.

Grain stores and livestock wealth are taken into account in the classification process. Reports from the woreda committees are sent to RRC/EWPS in Addis Ababa, where they are considered in the light of other relevant information, including market prices and the preceding season's crop yields. Although RRC/EWPS does not do any systematic monitoring of population movements, sporadic reports of unusual migrations are also taken into account. Particularly alarming reports (e.g., of mass migration or starvation) may be investigated by an RRC/EWPS Disaster Area Assessment Team made up of specialist personnel. In general, RRC/EWPS treats the woreda committees' assessments with a measure of scepticism (Holt, 1990), so the final estimate of food aid needs is lower than would be obtained by simply pooling the committees' recommendations.

In November 1987, RRC/EWPS estimated Wollo's relief food requirements for the coming year at 204,167 mt (RRC, 1987). This estimate assumed there would be a normal spring (belg) harvest, which would cover about 15 per cent of annual consumption needs for the region as a whole. I have assumed that 100,000 mt (half of the amount requested) was earmarked for Wag, Lasta and Awssa, since these awrajas, which could not be covered by the NFW/NSP, were thought to be most seriously affected by the 1987 drought. 100,000 mt would have been enough to feed 75 per cent of the population of these three awrajas for 12 months, at 15 kg per person per month. The other half of the total tonnage requested would have been sufficient to feed about 20 per cent of the population of the nine NFW/NSP awrajas for a year. In these awrajas, meher production (estimated at 40 per cent of normal (Kelly, 1992)), together with the anticipated belg harvest, would cover about half the annual consumption requirement. An additional 100,000 mt in the form of relief food would have brought the total amount of food available in the NFW/NSP awrajas to about 70 per cent of consumption.
needs, leaving 30 per cent to be obtained from other sources.

In January 1988, RRC/EWPS revised its assistance requirement upward to a total of 276,725 mt. Assuming that 85 per cent of the people of Wag, Lasta and Awssa were now expected to need full rations for the entire year, the revised relief requirement for the NFW/NSP awrajas would be enough to cover 25 per cent of the coming year's consumption requirement.

The accuracy of these estimates can be gauged by comparing them with the amount of relief food actually provided, and assessing its effectiveness in mitigating the food insecurity experienced by the recipients. During 1988 the NFW/NSP awrajas actually received relief food equivalent to about 15 per cent of total consumption requirement, and the 1988 belg harvest proved disappointing (less than 50 per cent of normal, according to NFW/NSP questionnaire responses). Thus total food available (through farmers' own production plus relief distribution) would have covered about 55 per cent of total consumption needs, leaving the remainder to be made up through borrowing or purchases.

For a household with four members, each consuming 15 kg food per month, this leaves a deficit of 3.25 quintals (325 kg) for the year. One way of narrowing this gap would be to reduce consumption, and there is every reason to believe that people did exactly that (Kelly, 1992); however, the scope for compensating by means of dietary austerity measures is obviously limited. Even if no reduction in food intakes is assumed, a deficit of 3.25 quintals, at an average cost of 75 birr per quintal (the approximate cost of a basic mixed diet in early 1988), could be made up at a cost of around 250 birr. This amount could be raised by selling four to five sheep or goats at prevailing market prices, which would cause considerable hardship to the average household, but not leave it destitute.

Based as they are on awraja-level averages, these calculations are no more than a crude indication of the magnitude of the problem faced by people in the NFW/NSP awrajas. Many poorer-than-average households would, of course, have become destitute if relief had been distributed uniformly, but in general this was not the case: although the vast majority of the households in an FA received a ration whenever food was distributed in their FA, the number of distributions made to each FA varied according to the priority assigned it by the woreda committee. In other words, although the poorest households within an FA received no more than their better-off neighbours, the socioeconomic inequalities between households within an FA were not enormous, and the most food-insecure FAs tended to receive more than those with better access to food.

Had the NFW/NSP awrajas received even the amount of food aid recommended by RRC/EWPS in November 1987, the signs of stress that were detected would almost certainly have been less pronounced. In other words, grain price rises (caused by diminished supply and increased demand) would not have been as sharp, and anthropometric deficits (caused by voluntary reductions in food intake) would not have been as deep. Even if the amount of relief food requested in January 1988 had been provided and the belg harvest had been much better, the average household would still have been left with a deficit of nearly two quintals. Although it is impossible to say what would have happened to market prices and anthropometric status in these hypothetical circumstances, it seems highly unlikely that there would have been serious adverse side-effects, such as disincentives to producers through depression of food prices.

If the preservation of assets (including good nutritional status, which can be classed as a health asset) is accepted as a legitimate goal of relief, then even the amount of food aid requested by the RRC/EWPS in January...
1988 was not an overestimate. On the other hand, for purposes of simply preventing excess mortality, the original (November 1987) recommendation appears to have been roughly correct. Hence it seems that the information collected by the NFW/NSP was neither used nor needed for early warning and planning purposes as of late 1987/early 1988. However, this analysis has not yet touched on the vital link between early warning and response, wherein the question of credibility is of central importance. Donors feel that the RRC/EWPS habitually overestimates needs for assistance, and are often reluctant to accept its assessments (Cutler, 1985; Holt, 1990). Yet in late 1987 some of the NGOs operating in Ethiopia felt that the amount of aid requested by the RRC/EWPS for 1988 was too low (Sarah Atkinson, personal communication).

Lack of consensus on the validity of an assessment leaves a potential ‘escape hatch’ for decision-makers (Schaffer and Clay, 1984), who can delay taking action indefinitely while calling for more and better information. The NFW/NSP helped to narrow that escape hatch by providing independent confirmation of the severity of food insecurity. Essentially, the NFW/NSP’s information came from a source that was seen as having an objective point of view as well as a great deal of technical expertise. Hence, where the activities of the NFW/NSP and the RRC/EWPS overlapped, such as in the collection of market data, agreement between the two data sets helped to dispel doubts concerning the accuracy of the information supplied by RRC/EWPS. Moreover, by increasing the amount and variety of relevant information available, the NFW/NSP provided support for the RRC/EWPS’s interpretation of the present and likely future situation. After the first quarter of 1988, for example, when it became clear that children’s mean WFL was declining unusually early and unusually rapidly, the NFW/NSP’s anthropometric data could have been adduced to argue for a more vigorous relief response. Although it is impossible to say what would have happened in the absence of the NFW/NSP, the information it generated probably improved donor and NGO confidence in RRC/EWPS’s assessment and helped to ensure a timely response.

TARGETING AND MONITORING

The information collected by the NFW/NSP could also have been used to target assistance within the region and to monitor the effects of the aid provided. In practice, the allocation of relief food within Wollo during 1988 was determined jointly by RRC/EWPS and other implementing agencies, and was based mainly on the priorities established by the woreda committees. Information provided by the NFW/NSP was not a major factor in this process, although some felt that it should have been. In this section the usefulness of different NFW/NSP indicators for targeting food aid is explored by means of two case studies.

The first comes from Rayana Kobo awraja. RRC/EWPS said that Rayana Kobo, with over 90 per cent harvest failure, would need full rations during 1988, but the food aid actually distributed there amounted to only 35 per cent of the full ration level. Mean WFL, which had been ‘good’ in early 1987, declined in the middle of the year. But it levelled off in 1988, and remained well within the ‘satisfactory’ range throughout the year, despite the apparently poor availability of food. Grain prices remained at twice normal levels (higher than in any other NFW/NSP awraja) until the middle of 1988, and the number of livestock sold rose by 50 per cent. However, prices for livestock fell by only 7 per cent, and fewer than 5 people per 100 households left their villages in search of work or assistance.

Crop yields, grain prices and livestock sales show Rayana Kobo to have been more seriously affected than other NFW/NSP awrajas. It ranked somewhere in the middle, however, in terms of livestock prices.
and migration, and as one of the least affected in terms of anthropometric status.

Borena awraja provides a second case study. Although it normally produces a surplus of food, Borena suffered poor harvests (ranging from 30 to 45 per cent of ‘normal’) for four consecutive seasons beginning with meher in 1986. The amount of relief food distributed in Borena during 1988 was equivalent to 11 per cent of consumption requirements. During the period February—August 1988, grain prices rose to levels almost 60 per cent higher than those recorded in the same months of the previous year. Prices for livestock fell by 10 per cent during the same period, while the number of livestock sold during 1988 was somewhat lower than in 1987. Over the period October 1987—September 1988, an average of six people per 100 households left their villages. Mean WFL fell by more than 3 percentage points during 1988, reaching 90 per cent (the borderline between ‘satisfactory’ and ‘poor’) in mid-year.

Compared to the other NFW/NSP awrajas, Borena was a little above average in terms of 1987 meher crop production, and average with respect to grain price. However, migration, livestock prices and anthropometric status would put it among the worst affected.

The various indicators appear to behave inconsistently in both Rayana Kobo and Borena, but if local conditions are taken into account the discrepancies can be reconciled. The grain prices and livestock sales for Rayana Kobo are rather alarming, but to some extent they were probably influenced by traders coming from nearby Wag and Lasta awrajas, or from neighbouring Rayana Azebo awraja in Tigray Region. All of these awrajas were at least as seriously drought-affected as Rayana Kobo, and all of them suffered from civil conflict, which further jeopardised access to food. The relatively good anthropometric status of children in Rayana Kobo might reflect the availability of both locally-produced and donated supplementary foods, since cattle holdings (which help determine the availability of meat, milk and butter) are higher in Rayana Kobo than in any other NFW/NSP awraja, and Rayana Kobo received more relief food per capita during 1988 than any other NFW/NSP awraja.

Because of their proximity to the adjacent surplus-producing region of Gojjam, farmers in Borena have better access to paid work than others elsewhere in Wollo. This alone could explain the relatively high rate of migration from Borena (although sampling error makes it difficult to know whether it was really any higher than that of many other awrajas). The rather low mean WFL recorded in Borena suggests that although crop failure there was not as severe as it was elsewhere in 1987, this awraja’s needs for relief food in 1988 were not met in full, perhaps because the cumulative effects of several years of poor to indifferent production had been underestimated, and/or because coping capacity had been overestimated.

These case studies illustrate the ways in which local differences influence the behaviour of indicators, and help to explain why different indicators can appear to give contradictory messages. Paradoxically, despite the outward simplicity of production methods, food sources in Wollo are diverse, and they become even more varied when food security is threatened. The same is true of factors that affect demand for food, such as asset holdings and income sources. The ability of indicators to predict or summarise the behaviour of other indicators is limited (Kelly, 1992). The reasons for this are that each indicator reflects one or more different aspects of the overall food security picture, and that communities respond to food insecurity in different ways.

The case studies presented above suggest that the targeting of relief during 1988 was based too much on 1987 yield estimates and grain prices, without taking sufficient account of demand factors and other
aspects of coping capacity. It follows that targeting could have been improved by considering all available indicators, including anthropometric status. This is not just a matter of assigning a fixed weighting to each of several indicators and calculating an overall score, but of understanding the local differences that account for the apparent discrepancies.

COST

Ideally, a food security information network would make use of all potentially available indicators of food supply and access to food; in practice, however, resource constraints can make this difficult to justify. It is therefore worth examining the usefulness of different indicators in relation to the cost of monitoring them.

Arguably, the earliest indicators of food insecurity are crop yields and the price of grain. Of all the indicators considered here, grain prices are probably the easiest to use, for three reasons: accurate recording of grain prices does not require much education or training; personnel can be recruited locally so very little travel is involved; and it is relatively easy for the data analyst to distinguish trends from ‘noise’. The first and second features minimise the cost of data collection and the third facilitates detection of meaningful changes. By contrast, accurate estimation of crop yields is neither cheap nor easy, but since most countries attempt to quantify production at regional and district level for general planning purposes, monitoring of this indicator need not involve additional manpower or cost.

Although crop yield helps to predict change in grain price, neither is a good predictor of the behaviour of the other indicators that help to complete the food security picture (Kelly, 1992). Where grain prices are already being collected, the duties of the grain price recorder can fairly easily be extended to include the recording of livestock prices and livestock sales volumes. Anthropometric surveillance, on the other hand, is generally less easy to incorporate into existing systems of information collection, because it demands specialised skills and a considerable amount of field work. The same is true, however, of non-market socioeconomic data (e.g., migration rates, mortality rates, household food stocks) if reliable and representative results are to be obtained.

It is difficult to disaggregate the cost of the NFW/NSP into its anthropometric and non-anthropometric components, but to collect only the non-anthropometric data from the same sites would probably cost about half as much as it does to collect both kinds of data. Elimination of the anthropometric surveillance component would make it possible to reduce staff numbers considerably, but a disproportionate number of the staff who could be spared would be those with fewer skills, who cost less to employ in the first place. To continue collecting representative quantitative socioeconomic data, skilled interviewers would need to be retained; they would need to travel to survey sites, and to receive supervision and administrative support. In a place like Wollo, the regular collection of accurate, up-to-date and representative socioeconomic data would still be a skilled labour-intensive undertaking necessitating considerable expenditure.6

Having compared the costs of various individual components of the NFW/NSP, I now consider the costs of the NFW/NSP as a whole in relation to those of other programmes. In 1987–88, SCF spent about a third of a million dollars a year on the Wollo NFW/NSP, making it considerably more expensive than the average NGO development project. The cost of the NFW/NSP is also high in relation to the Ethiopian government’s budget for early warning, which is half a million dollars a year for the entire country.

Relative to the cost of relief operations, however, the NFW/NSP is actually quite cheap. The relief food originally requested
for Wollo in 1988 (i.e., just over 200,000 mt which clearly was not an inflated estimate) would have cost US$90 million, assuming an average cost of $450 per mt, including external and internal transport (Andrew Jowett, personal communication). This amount of food is not needed every year in Wollo, but it seems reasonable to assume that on average 50,000 mt are needed annually, at a total cost of $22.5 million. If these estimates are accurate, the cost of the entire NFW/NSP is equal to only 1.5 per cent of the average annual cost of providing relief, while the anthropometric surveillance component adds less than 1 per cent to the total bill for early warning and relief. Expenditure on anthropometric surveillance in Wollo can therefore be justified as long as the information it produces makes it possible to improve the cost-effectiveness of relief operations by even a few percent.

The benefits of the NFW/NSP per unit cost are, moreover, likely to increase with time. The longer the programme remains in operation, the more it will accumulate information, field experience, and insight into the dynamics of rural communities. The accumulation of field experience should lead to refinements in the organisation of the programme, which will reduce the cost of data collection. The interpretation of data should become easier and more accurate as data from good and bad years accumulate, and as understanding of the cultures and the economies of the region increases.

The main drawback of the NFW/NSP is not its cost, which is tiny in comparison to what is spent on relief operations, but the fact that, owing to civil conflict, the programme has rarely been able to cover Wag and Lasta, the awrajas where food insecurity is greatest. This barrier has recently been lifted, however, by political developments which have made these awrajas accessible.

CONCLUSION
I have shown elsewhere that for Wollo Region, anthropometric status is a valid and timely indicator of access to food, which has a potential role in famine early warning as well as in the planning, targeting and monitoring of relief operations (Kelly, 1992). The task of this paper has been to assess the practical utility of the anthropometric component of the NFW/NSP for all of these activities under the conditions prevailing in Wollo during 1987–88.

Toward the end of 1987, the Ethiopian government's RRC/EWPS predicted that a substantial proportion of people in Wollo would experience food insecurity during 1988. The amount of food aid needed to avert this threat was estimated from the qualitative reports of local communities. In these early warning and planning activities, RRC/EWPS used neither the anthropometric nor the socioeconomic data collected by the NFW/NSP. Nonetheless, the NFW/NSP probably helped elicit an international response by independently verifying some of the data collected by RRC/EWPS, and by providing additional information which supported RRC/EWPS's assessment. The additional information provided by the NFW/NSP could also have been used to improve the accuracy of relief targeting.

The practical value of anthropometric surveillance for targeting relief and monitoring its impact is apparent from case studies of two Wollo awrajas. These show that, owing to local differences, indicators often behave inconsistently and thus no single indicator can adequately summarise the complex conditions prevailing in vulnerable rural communities. In these circumstances, the accuracy of targeting can be maximised by using a variety of indicators, including anthropometric status, and by interpreting their behaviour in the fullest possible light.

The cost of the NFW/NSP is high in relation to those of many other NGO programmes and to the national RRC/EWPS budget for early warning, but quite low in relation to the cost of relief operations. Provided the information it produces enables
relief to assist vulnerable people more cost-effectively, expenditure on the NFW/NSP is worthwhile.

Notes

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1. Each woreda is made up of between a dozen and a hundred FAs. Each FA is made up of several hundred households whose main source of livelihood is farming.

2. In northern Shoa region, for example, at the end of 1987, the local committees' estimate of relief assistance requirements was about three times higher than RRC/EWPS's final figure for the area (Sarah Atkinson, personal communication).

3. Meher production (i.e., 0.4 × 0.85) + belg production (i.e., 0.15) = 0.49.

4. The extremes of wealth and poverty seen in certain other societies are not found in rural Ethiopia, where land is allocated according to family size and cannot be bought or sold.

5. RRC/EWPS (1990) uses the following classification scheme for mean WFL: good = at least 95 per cent of NCHS median value; satisfactory = 90–94 per cent; poor = 85–89 per cent; serious = less than 85 per cent.

6. There may, however, be some scope for reducing costs by avoiding duplication of data collection in the areas where RRC/EWPS and NFW/NSP overlap (i.e., production estimates and grain prices).

References


Marion Kelly
Joint Centre for Public Health Studies
University of Wales College of Medicine
Heath Park, Cardiff CF4 4XN
UK

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The Erzincan (Turkey) Earthquake, March 1992: Psychosocial Consequences and Search and Rescue Teams

JEAN PIERRE REVEL

At 19.23 local time, on Friday 13 March 1992, an earthquake measuring 6.8 on the Richter open scale rocked the city of Erzincan in eastern Turkey, an area notoriously prone to earthquakes because of the presence of two major fault lines, the North and East Anatolian Faults (Table 1 and Figure 1). The disaster came after major earthquakes in Iran (Gilan Province) in June 1990, with a death toll exceeding 32,000 and in Armenia in December 1988, with a death toll exceeding 18,000. Thirty earthquakes were reported in Turkey between 1965 and 1991, with a total death toll of 19,000. This puts Turkey fourth in the world for earthquake related mortality (Centre for Research and Disaster Epidemiology, 1991). In this report on the Erzincan earthquake, I focus on psychological stress factors and the role of search and rescue teams.

PSYCHOLOGICAL STRESS FACTORS

Rumour

The lack of reliable information led to the spread of all kinds of rumours, some of which decreased the stress experienced by the population but others of which increased their feelings of insecurity and fear. It was alleged by some, for example, that a recommendation made after the 1939 earthquake, that the city should be relocated, had been disregarded. Others claimed that the tremor was a ‘warning of Allah’ (Gulkan, 1992, p. 39). There were also rumours about the possibility of getting tents on the black market and from certain prominent persons. A member of the British ‘International Rescue Team’ reported having been told that his own team had only managed to rescue one victim alive — according to him, a complete inaccuracy.

Fear

Although small buildings, which included most private houses, suffered only mild to moderate damage, people spent most of their time outside. Even at night, with temperatures down to -20°C, they preferred to sleep outside. In the villages also, where there were no buildings over two stories and empty houses were still standing (although with cracked walls), people spent days and nights in the streets, in their gardens or in the yards of their farms. Since very few tents were distributed in the villages in the first few days after the earthquake, many people were living under plastic sheets, tarpaulins and other makeshift shelters, such as farm carts.

This behaviour was explained to us as a consequence of the magnitude of the aftershocks and we were frequently told that a tremor of even higher magnitude was
<table>
<thead>
<tr>
<th>Time</th>
<th>19.23 local time (17.23 UTC)</th>
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</thead>
<tbody>
<tr>
<td>Magnitude</td>
<td>6.8 on Richter Open Scale</td>
</tr>
<tr>
<td>Duration</td>
<td>30 seconds</td>
</tr>
<tr>
<td>Aftershocks</td>
<td>More than 30 reported, up to 5.8 on the Richter scale</td>
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<tr>
<td>Epicentre</td>
<td>40 km east of the city</td>
</tr>
<tr>
<td>Population before the earthquake</td>
<td></td>
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<tr>
<td>City:</td>
<td>92,000</td>
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<tr>
<td>Province:</td>
<td>300,000</td>
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<tr>
<td>Dead</td>
<td>541* (353 in the city)</td>
</tr>
<tr>
<td>Severely injured</td>
<td>680</td>
</tr>
<tr>
<td>Total injured</td>
<td>&gt;2,000</td>
</tr>
<tr>
<td>Animals killed</td>
<td>&gt;11,000</td>
</tr>
<tr>
<td>Severely damaged buildings</td>
<td>5,000 (± 20 per cent of the city)</td>
</tr>
</tbody>
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* Later revised to 653 by the Prime Minister, Mr S. Demirel (Agence France Presse, 8 June 1992).

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**FIGURE 1 Map of eastern Turkey**

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expected, which would destroy the buildings already affected. There was consequently a rush for tents and other shelters to withstand the intense cold and, later on, the rain and mud. Gulkan writes of doctors refusing to work in a health centre which had been set up in a building which had been declared safe (but which was close to the Social Insurance Hospital which had been destroyed) and of 'public officials who are afraid to go into their offices to get their personal belongings' (1992, p. 39).

**Feeling of being overwhelmed**

For the relief workers who reached the city two days after the earthquake, it was surprising to see that most of the search and rescue activity was in the hands of expatriate teams, who were surrounded by silent spectators as they worked. The teams arrived with their own equipment (and sometimes search dogs) and were fully trained for this task. They worked in difficult circumstances and required complete silence to take full advantage of their phonic devices. Contacts with the local population were limited, therefore, save for the drivers of the cranes which were lifting the heavy concrete blocks. The local people were searching for their belongings in collapsed apartment buildings, trying to clear their houses of what was needed in their temporary shelters or queueing outside ruined shops to buy basic foods, such as bread. Most family members had been evacuated and only the heads of families, mainly men, were seen roaming the streets, day and night.

**Lack of confidence in the future**

This feeling was expressed very early in the aftermath of the earthquake by villagers who told us they were willing to leave the area and establish themselves as far away as Ankara, Istanbul, or even Germany. The Governor of Erzincan reported that civil servants were coming to him asking for his signature on transfer request forms. Later on, it was reported that many people living in the city wanted to leave. This is more surprising, since they presumably had more assets and less reason to leave their homes, their jobs or their businesses than the civil servants. The reason given was that there were so many earthquakes in the area that it was not possible to lead a normal life. It must be stressed, however, that there was considerable emigration from the Province of Erzincan, even before the last earthquake. It is said that there are more people from the Province in Ankara than in the city of Erzincan itself. Although the Government has started to implement measures intended to stop the emigration, they have not so far been effective.

**Discussion**

In December 1939 a major tremor, measuring 7.9 on the Richter scale, flattened Erzincan, killing more than 32,000 and leaving 15,500 injured. On 18 November 1983 a tremor measuring 5.6 on the Richter scale caused damage to buildings but no deaths. It was followed by 'cosmetic' repairs to the affected building, but no structural changes. (It is particularly striking to see how few old monuments there are in Erzincan, given that its origin goes back well over 1000 years.)

Everybody living in the city, therefore, has either first hand experience of an earthquake or a relative or close friend with such experience. Some relief team members argued that the population showed a fatalism in its response to the earthquake which was the result of this 'community memory', and which was linked also to various cultural and religious factors. Since the behaviour in question is widely observed in people affected by disasters, however, this can, at best, be only part of the truth. In fact, the symptoms described above are those of post-traumatic depression.
(Giel, 1991), a condition that is amenable to treatment by trained practitioners or volunteers who have enough experience to recognise it. We were told during an official meeting that the psychological support of the victims and their relatives had been completely overlooked during the relief operation, as it frequently has been in other disasters. No epidemiological study of the psycho-social impact of the earthquake has yet been undertaken.

Such a study would be a new departure for Turkey and for many other countries prone to the same type of disaster. It would require long term commitment and careful monitoring but adequate management of these symptoms (with the dissemination of relevant information beforehand) could enhance the confidence of the local population in its capacity to deal with, and react adequately to, future events of this kind.

SEARCH AND RESCUE TEAMS

Search and Rescue Teams have been developed in recent years by a number of countries, either as NGOs or as part of a national structure, such as civil defence. The sophistication of their equipment and techniques has greatly increased over the past ten years; but their role continues to be controversial (League of Red Cross and Red Crescent Societies, 1991). They can be seen either as a very valuable contribution to the relief phase of a disaster or as a ‘show-off strategy’. In any case, they are not likely to disappear, even if their cost effectiveness has proved to be limited. They may even become a ‘growth area’ as various armed forces look for a new role following the end of the Cold War. For countries or international organisations which do not have such teams, the question is how best to make use of the teams which are made available in the immediate post impact phase of an earthquake.

Mobilisation of ex-patriot search and rescue teams

To be fully effective the team has to be operational on site within 24 hours of the disaster, the so-called ‘golden hours’. Time might be saved by signing agreements with the governments of earthquake prone countries which allow teams to be flown in as soon as the announcement of the earthquake is confirmed by geological institutes. This was the case for the Swiss Disaster Relief Team which arrived at the scene of the Erzincan earthquake less than 20 hours after the tremor. Despite the fact that Turkey is about 3 to 4 hours’ flight from the countries of Western Europe and that there is a military airfield (which was not affected by the earthquake) 6 km from the city, most of the teams arrived in Erzincan more than 24 hours after the end of the ‘golden hours’. This was because their departures were delayed by the lack of preliminary agreement with the Turkish authorities.

Relationship with local volunteer teams

In their rush to take action, search and rescue teams often remain isolated from the local community. There is clearly a need for better communication and more effective sharing of information between the teams and local volunteers, who should be trained in initial assessment and basic search and rescue activities (WHO, 1989). This would include instruction on how to estimate (or make a quick census of) the magnitude of the destruction and the number of casualties according to type of housing, time and duration of the tremor, etc. This information could be quickly processed in a disaster centre and dispatched to the capital city from where it could be disseminated abroad. Being first on the spot, local volunteers should also be trained to initiate and conduct first aid and life saving activities during the first few hours of the disaster.
This would complement the information collected during the initial assessment which would be passed on to the search and rescue teams when they arrive. Special training programmes could be set up within the framework of the Red Cross/Red Crescent Movement, and in collaboration with National Societies which already have experience in this field of activity. Finally, search and rescue teams should not only be consumers of information but should also provide information to local authorities. Together with shared experiences and techniques, this information could be used in training programmes for local volunteers.

Coordination with local organisations

This was noticeably weak during the first few days after the earthquake, a frequently mentioned problem being the lack of identified counterparts. Few meetings were arranged between the various officers in charge of search and rescue teams on the one hand and local personnel on the other. Special attention should be given to this point, since it may determine the success or failure of a relief operation. A proper system of information management should be set up immediately after the onset of the disaster. Initial information, including decisions so far taken, should be transmitted to all agencies/NGOs upon arrival.

Note

This paper is based on information gathered during various missions in Turkey and numerous meetings with people who were in the affected area during and after the Erzincan earthquake of March 1992. I want to express my special thanks to the staff of Kızılay (Turkish Red Crescent Society), the International Federation of Red Cross and Red Crescent Societies, and various Ministries, Departments, and Institutes from Turkey who contributed to my knowledge of the problems.

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Jean Pierre Revel
Relief Health Adviser, DPD International Federation of Red Cross and Red Crescent Societies
CH-1211 Geneva
Switzerland
Health Response to a Large and Rapid Influx of Albanian Refugees in Southern Italy, 1991

DONATO GRECO, SALVATORE SQUARCIONE, CINZIA GERMINARIO, SERGIO LO CAPUTO, NANCY BINKIN and MARCO PANATTA

Over a two-day period in March 1991, more than 23,000 Albanian refugees arrived without warning in the southern Italian port of Brindisi. A simple surveillance system was established within days of their arrival to monitor health problems that were expected to have a high frequency, were of concern to the Italian health care system because of potential spread to the local population, and were susceptible to therapeutic or preventive measures. The most commonly encountered health problems were pediculosis and scabies. Despite poor sanitary conditions, only one outbreak of gastrointestinal disease was reported. Obstetric events were common, and many resulted in adverse outcomes. Hospitalization rates were high, although in the early weeks of the emergency, many were unwarranted. This experience demonstrates the value of a simple, rapid surveillance system in prioritizing health problems and preventing rumors. In future, greater emphasis should be placed on outpatient management of simple medical problems.

Between 5 and 7 March 1991, more than 23,000 Albanian refugees arrived without warning in the Puglia region in Southern Italy. As the political situation deteriorated in Albania and food became increasingly scarce, a massive boat migration began to the Southern Italian coast, a brief, 70 km journey from the Albanian capital of Tirana.

Most mass migrations of refugees in recent decades have involved movements of populations from one developing country to another. In this case, however, the refugees migrated from a relatively undeveloped country to a much wealthier country with a well-developed health infrastructure. The situation presented unique opportunities, but at the same time unique problems, in the provision of appropriate care for the refugees. In this article, we report on the activities undertaken to set up a surveillance system for a large number of refugees coming from a country where little data were available on the health status of the population. We also present the health problems encountered most frequently in this group, and the reaction of the Italian health care system to this large influx of refugees. Finally, we discuss the lessons learned that may be useful in similar settings.

BACKGROUND

Albania is considered the poorest country
in Europe. The health status of its population is largely unknown since it is the only European country that does not report its surveillance data to the World Health Organization Regional Office (WHO, 1985). By contrast, Italy is currently the 6th richest country in the world, with a life expectancy of 74 years and an infant mortality rate of 9/1000 live births (Istituto Centrale di Statistica, 1988). It has a widely developed and well-staffed health network that provides health care free of cost to its residents (Gazzetta Ufficiale No. 360, 23 December, 1978, law 833. Istituzione del servizio sanitario nazionale).

Most of the refugees arrived in the port of Brindisi. Because they arrived with no advanced warning, no arrangements had been made to provide shelter, food, sanitation, and health services for the massive influx. Most arrived without food and with only minimal possessions, and the sanitary conditions on the boats were poor. Local authorities worked with officials from the Ministry of Civil Protection to provide emergency food and housing for the refugees. Over a three day period, all were moved from the wharves to temporary housing in schools in the town of Brindisi. Provision of food was organized by the Italian military, but sanitary facilities at the sites were inadequate. Within the following two weeks, the refugees were moved to campgrounds and tourist accommodations on the coast of Puglia and to other regions. In late spring, all were resettled throughout Italy, with the number of refugees allocated to each region proportional to the size of the region.

Shortly after the arrival of the refugees, the Minister of Civil Protection asked the Minister of Health to establish epidemiclogic surveillance for the refugee population. Rumors of epidemics were already circulating, and the sanitary conditions in the port were alarming. The Ministry of Health sent a team to Brindisi consisting of an epidemiologist from the Istituto Superiore de Sanità (ISS) in Rome and two epidemiologists appointed by the regional health authorities of the region of Puglia where Brindisi is located.

METHODS

The epidemiologists applied a surveillance model that had been successfully applied by the ISS staff in a number of previous health emergencies among large populations in Italy that had occurred as a result of natural disasters (Greco et al., 1981). Examinations were performed on all refugees at the time of admission to each of the camp sites, and information on diseases or conditions was reported to the surveillance system. Subsequently, surveillance data were collected on a daily basis from the sites where refugees were housed. In the first two weeks, a doctor was stationed at the larger sites, and the smaller sites were visited daily by a mobile medical team. By the third week, when the refugees were moved to more permanent quarters, a doctor or nurse was assigned to all sites with more than 100 refugees.

Patients requiring hospitalization in the early weeks following arrival primarily were sent to the 700-bed public hospital in Brindisi. Subsequently, they were hospitalized in the public hospital nearest the site to which they had been moved. All hospitals serving the refugee population were requested to provide data for the surveillance system.

Based on previous Italian experience and WHO recommendations (Greco et al., 1981; WHO/PAHO, 1980), a limited number of diseases or conditions were selected for surveillance. Criteria for selection were as follows:

- expected high frequency;
- posed a potential threat to the local population; and
- amenable to prevention or treatment.

The conditions chosen and the working
TABLE 1
Surveillance definitions

Daily population: Number of people who had slept at the site the previous night.
Acute gastroenteritis: At least three loose stools in the past 24 hours.
Fever: Measured temperature of 38° at least twice in the past 24 hours.
Persistent cough: At least four episodes of insistent cough at intervals of not less than one hour.
Pediculosis: Visible presence of head or body lice or infestation of clothing.
Scabies: Presence of at least two suspected scabetic lesions on various parts of the body located in intertrigenous zones and accompanied by itching.
Trauma: Signs of trauma with expected recovery period of 3 days.
Jaundice: Presence of scleral icterus or cutaneous jaundice with or without dark urine.
Conjunctivitis: Serous or purulent discharge from one or both eyes.

definitions used are shown in Table 1. A simple data collection form was developed for recording the daily surveillance data at each site. Data were also collected on the number of individuals present at the site in the previous 24 hours.

Each day, data were transmitted by fax or by telephone to the epidemiology coordinating center in Brindisi. The data were entered into a personal computer, and a daily bulletin was issued by 4 pm that afternoon. This bulletin was distributed by fax to the units participating in the surveillance system, to appropriate authorities at the local and national levels, and to the public information services. A special team of epidemiologists were available to investigate suspected epidemic foci, for public health consultation, and to carry out surveys on the hepatitis, the human immunodeficiency virus, and the vaccine status of the population.

RESULTS

Characteristics of the Refugee Population

The distribution of the refugees by region, sex, and age is shown in Table 2. The total number of refugees was 23,889. Most (87.2

TABLE 2
Distribution by sex, age and region of final destination in Italy, Albanian Refugees, Puglia, March 1991

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Number</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sex</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>18,039</td>
<td>75.6</td>
</tr>
<tr>
<td>Female</td>
<td>2,782</td>
<td>11.6</td>
</tr>
<tr>
<td>Unknown</td>
<td>3,068</td>
<td>12.8</td>
</tr>
<tr>
<td><strong>Age in years</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0–10</td>
<td>740</td>
<td>3.1</td>
</tr>
<tr>
<td>11–17</td>
<td>2,328</td>
<td>9.7</td>
</tr>
<tr>
<td>≥ 18</td>
<td>20,821</td>
<td>87.2</td>
</tr>
<tr>
<td><strong>Destination</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Piedmont</td>
<td>1,704</td>
<td>7.1</td>
</tr>
<tr>
<td>Lombardy</td>
<td>527</td>
<td>2.2</td>
</tr>
<tr>
<td>Trentino</td>
<td>421</td>
<td>1.8</td>
</tr>
<tr>
<td>Friuli-Venezia-Giulia</td>
<td>1,212</td>
<td>5.1</td>
</tr>
<tr>
<td>Liguria</td>
<td>951</td>
<td>4.0</td>
</tr>
<tr>
<td>Emilia-Romagna</td>
<td>181</td>
<td>0.8</td>
</tr>
<tr>
<td>Marches</td>
<td>95</td>
<td>0.4</td>
</tr>
<tr>
<td>Tuscany</td>
<td>127</td>
<td>0.5</td>
</tr>
<tr>
<td>Molise</td>
<td>42</td>
<td>0.2</td>
</tr>
<tr>
<td>Campania</td>
<td>1,159</td>
<td>4.8</td>
</tr>
<tr>
<td>Puglia</td>
<td>13,150</td>
<td>55.0</td>
</tr>
<tr>
<td>Basilicata</td>
<td>2,308</td>
<td>9.7</td>
</tr>
<tr>
<td>Sicily</td>
<td>1,517</td>
<td>6.3</td>
</tr>
<tr>
<td>Other</td>
<td>495</td>
<td>2.1</td>
</tr>
</tbody>
</table>
per cent) of the refugees were ≥ 18 years of age, and the male:female ratio was 6.5:1.

Operation of the Surveillance System

Table 3 shows the number of reporting sites and estimated populations of the sites participating in the surveillance system over the 8 weeks during which surveillance was carried out. In the initial days following their arrival, most of the refugees were housed in schools, which were considered as a single site. The number of sites increased in the second week as the refugees were moved to other accommodation.

At its peak, the surveillance system covered approximately 67 per cent of the total refugee population. The number of individuals observed decreased by the seventh week, when the third phase of the emergency began and many of the Albanians housed in large camps were sent to more stable residences not included in the surveillance system. Over the entire observation period, however, the surveillance system covered an estimated 64 per cent of the refugee population.

Not all centers reported on a daily basis. When a center failed to report, the individual responsible was contacted by telephone. This did not always produce results, however, and the number of reporting centers decreased over time.

Surveillance System Findings

A total of 3373 visits for new diseases or conditions were reported during the two month observation period. Because some refugees were seen for more than one problem, the disease rates in the population cannot be directly calculated. However, the ratio of visits per refugee, as calculated by dividing the sum of total visits by the sum of the number of refugees under observation each week, was approximately 1:4 in the two month period.

Table 4 presents the total and weekly rates per 1000 refugees of each of the diseases and conditions included in the surveillance system. Overall rates, as well as the rates for most of the diseases and conditions, were highest during the first week, in part because all refugees were examined and because these figures include incident as well as prevalent cases. The two most common health problems over the observation period were pediculosis and scabies, with rates of 55 per 1000 for pediculosis and 36 per 1000 for scabies. Fever was seen in 11.4 per 1000, persistent cough in 10.0 per 1000, and gastroenteritis in 9.6 per 1000.

### Table 3

Number of reporting sites and estimated population under surveillance by week, Albanian refugees, Puglia, 1991

<table>
<thead>
<tr>
<th>Week beginning:</th>
<th>Number of sites reporting</th>
<th>Population under observation</th>
<th>Mean population per site</th>
</tr>
</thead>
<tbody>
<tr>
<td>March 6</td>
<td>3</td>
<td>7,803</td>
<td>2,601</td>
</tr>
<tr>
<td>March 14</td>
<td>27</td>
<td>16,740</td>
<td>620</td>
</tr>
<tr>
<td>March 22</td>
<td>63</td>
<td>14,773</td>
<td>234</td>
</tr>
<tr>
<td>March 30</td>
<td>116</td>
<td>19,672</td>
<td>170</td>
</tr>
<tr>
<td>April 7</td>
<td>131</td>
<td>15,593</td>
<td>119</td>
</tr>
<tr>
<td>April 15</td>
<td>112</td>
<td>18,744</td>
<td>167</td>
</tr>
<tr>
<td>April 23</td>
<td>105</td>
<td>11,725</td>
<td>112</td>
</tr>
<tr>
<td>May 1</td>
<td>89</td>
<td>12,431</td>
<td>140</td>
</tr>
</tbody>
</table>
TABLE 4
Incidence rates per 1000 by week for diseases or conditions reportable to the surveillance system, Albanian refugees, Puglia, 1991

<table>
<thead>
<tr>
<th>Disease/condition</th>
<th>Mar 6</th>
<th>Mar 14</th>
<th>Mar 22</th>
<th>Week beginning:</th>
<th>Mar 30</th>
<th>Apr 7</th>
<th>Apr 15</th>
<th>Apr 23</th>
<th>May 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conjunctivitis</td>
<td>2.7</td>
<td>1.2</td>
<td>0.0</td>
<td>0.2</td>
<td>0.0</td>
<td>0.3</td>
<td>0.3</td>
<td>0.0</td>
<td></td>
</tr>
<tr>
<td>Fever</td>
<td>4.5</td>
<td>3.2</td>
<td>1.0</td>
<td>1.4</td>
<td>0.8</td>
<td>0.6</td>
<td>0.6</td>
<td>0.5</td>
<td></td>
</tr>
<tr>
<td>Gastroenteritis</td>
<td>1.8</td>
<td>3.2</td>
<td>0.4</td>
<td>0.9</td>
<td>0.6</td>
<td>0.1</td>
<td>1.7</td>
<td>1.7</td>
<td></td>
</tr>
<tr>
<td>Pediculosis</td>
<td>65.2</td>
<td>10.3</td>
<td>3.9</td>
<td>2.5</td>
<td>0.4</td>
<td>0.1</td>
<td>0.1</td>
<td>1.1</td>
<td></td>
</tr>
<tr>
<td>Scabies</td>
<td>16.7</td>
<td>9.1</td>
<td>5.2</td>
<td>4.5</td>
<td>1.4</td>
<td>1.4</td>
<td>1.1</td>
<td>1.5</td>
<td></td>
</tr>
<tr>
<td>Cough</td>
<td>3.6</td>
<td>5.0</td>
<td>0.1</td>
<td>0.9</td>
<td>0.1</td>
<td>0.3</td>
<td>0.3</td>
<td>0.2</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>53.3</td>
<td>19.3</td>
<td>11.8</td>
<td>8.5</td>
<td>12.1</td>
<td>5.2</td>
<td>12.8</td>
<td>14.2</td>
<td></td>
</tr>
<tr>
<td>Overall</td>
<td>147.8</td>
<td>51.3</td>
<td>22.4</td>
<td>18.8</td>
<td>15.5</td>
<td>8.1</td>
<td>16.9</td>
<td>19.2</td>
<td></td>
</tr>
</tbody>
</table>

TABLE 5
Number of cases by week and overall incidence rates per 1000 for other diseases or conditions, Albanian refugees, Puglia, 1991

<table>
<thead>
<tr>
<th>Other Diseases/conditions</th>
<th>Mar 6</th>
<th>Mar 14</th>
<th>Mar 22</th>
<th>Mar 30</th>
<th>Apr 7</th>
<th>Apr 15</th>
<th>Apr 23</th>
<th>May 1</th>
<th>Total</th>
<th>Rate*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tuberculosis</td>
<td>1</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>5</td>
<td>0.34</td>
</tr>
<tr>
<td>Hepatitis</td>
<td>2</td>
<td>0</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>13</td>
<td>0.89</td>
</tr>
<tr>
<td>Typhoid fever</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>5</td>
<td>0.34</td>
</tr>
<tr>
<td>Parasitoses</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>12</td>
<td>6</td>
<td>2</td>
<td>6</td>
<td>1</td>
<td>28</td>
<td>1.91</td>
</tr>
<tr>
<td>Other communic. dis.</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>5</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>101</td>
<td>115</td>
<td>7.83</td>
</tr>
<tr>
<td>Pneumonia</td>
<td>0</td>
<td>0</td>
<td>25</td>
<td>5</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>31</td>
<td>2.11</td>
</tr>
<tr>
<td>URI</td>
<td>8</td>
<td>79</td>
<td>0</td>
<td>9</td>
<td>41</td>
<td>9</td>
<td>4</td>
<td>3</td>
<td>153</td>
<td>10.42</td>
</tr>
<tr>
<td>Syphilis</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>7</td>
<td>0.48</td>
</tr>
<tr>
<td>Other STD</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>—</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>3</td>
<td>0.20</td>
</tr>
<tr>
<td>Abortions</td>
<td>0</td>
<td>1</td>
<td>5</td>
<td>2</td>
<td>4</td>
<td>4</td>
<td>1</td>
<td>5</td>
<td>22</td>
<td>1.50</td>
</tr>
<tr>
<td>Deliveries</td>
<td>0</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>5</td>
<td>3</td>
<td>4</td>
<td>6</td>
<td>21</td>
<td>1.43</td>
</tr>
<tr>
<td>Dermatitis</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>37</td>
<td>0</td>
<td>8</td>
<td>1</td>
<td>0</td>
<td>49</td>
<td>3.34</td>
</tr>
<tr>
<td>Abdominal colic</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>15</td>
<td>28</td>
<td>5</td>
<td>4</td>
<td>5</td>
<td>59</td>
<td>4.02</td>
</tr>
<tr>
<td>Other general med.</td>
<td>1</td>
<td>0</td>
<td>31</td>
<td>3</td>
<td>7</td>
<td>4</td>
<td>0</td>
<td>5</td>
<td>51</td>
<td>3.47</td>
</tr>
<tr>
<td>Trauma</td>
<td>56</td>
<td>17</td>
<td>14</td>
<td>16</td>
<td>3</td>
<td>22</td>
<td>8</td>
<td>8</td>
<td>144</td>
<td>9.81</td>
</tr>
<tr>
<td>Other</td>
<td>347</td>
<td>215</td>
<td>174</td>
<td>57</td>
<td>20</td>
<td>34</td>
<td>23</td>
<td>39</td>
<td>883</td>
<td>61.90</td>
</tr>
</tbody>
</table>

**TOTAL**                  | 417   | 323    | 259    | 167    | 122   | 98     | 52     | 175   | 1615  | 109.98 |

* per 1000

A total of 1615 cases (109/1000) of miscellaneous diseases and conditions occurred over the observation period (Table 5). The most common of these conditions were respiratory problems and trauma, both with rates of 10/1000, followed by abdominal colic. Dermatoses occurred in 5/1000, though the incidence of these peaked after a visit by a team of dermatologists, thereby suggesting that there was an underreporting
of cases through the surveillance system.

Tuberculosis, hepatitis, and typhoid fever, all of which presumably had been contracted in Albania, were also seen among the refugee population. If these cases are indicative of the current disease incidence in Albania, the incidence or prevalence rates of these diseases are high: 0.34/1000 for tuberculosis, 0.89/1000 for hepatitis, and 0.34/1000 for typhoid fever.

Sexually transmitted diseases were present but relatively rare. Two cases of condylomatosis were diagnosed, as were 6 cases of other sexually transmitted diseases. Date of onset of the symptoms was not recorded, and it is therefore not known whether these diseases were acquired in the camps.

A total of 22 spontaneous abortions or miscarriages and 21 births occurred among the 2,782 refugee women, yielding a total of 1.5 obstetric events per 100 women in the 8 week period.

The mix of diseases and conditions shifted over time, as can be seen in Figure 1. The predominant diseases and conditions in the first two weeks were pediculosis and scabies. Their incidence declined sharply thereafter, and the illnesses seen were those commonly observed in non-refugee populations which became more prominent. An outbreak of 100 cases of food poisoning characterized by abdominal pain and diarrhoea occurred during the eighth week of observation.

### Hospitalization Data

In the initial weeks following the arrival of refugees, many patients with even mild diseases or conditions were hospitalized. The percentage of cases reported to the surveillance system who were hospitalized by week are shown in Table 6. In the first week, pediculosis (88 cases) and scabies (10 cases) accounted for almost a third of the 309 hospitalizations. Although the disease specific rates of hospitalization changed over time, the ratio of hospitalizations to surveillance cases remained relatively constant at about 1 in 4. The average duration of hospital stay was 8.3 days.
**TABLE 6**

Number of days of hospitalization, Albanian refugees, Puglia, 1991

<table>
<thead>
<tr>
<th>Week beginning:</th>
<th>Admissions</th>
<th>Discharges</th>
<th>Days of hospitalization</th>
</tr>
</thead>
<tbody>
<tr>
<td>March 6</td>
<td>309</td>
<td>121</td>
<td>1,162</td>
</tr>
<tr>
<td>March 14</td>
<td>136</td>
<td>196</td>
<td>742</td>
</tr>
<tr>
<td>March 22</td>
<td>115</td>
<td>108</td>
<td>791</td>
</tr>
<tr>
<td>March 30</td>
<td>90</td>
<td>68</td>
<td>945</td>
</tr>
<tr>
<td>April 7</td>
<td>117</td>
<td>108</td>
<td>1,008</td>
</tr>
<tr>
<td>April 15</td>
<td>65</td>
<td>57</td>
<td>1,064</td>
</tr>
<tr>
<td>April 23</td>
<td>48</td>
<td>42</td>
<td>1,106</td>
</tr>
<tr>
<td>May 1</td>
<td>68</td>
<td>77</td>
<td>1,043</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>948</strong></td>
<td><strong>777</strong></td>
<td><strong>7,861</strong></td>
</tr>
</tbody>
</table>

Mean duration of hospitalization: 8.3 days

**DISCUSSION**

The surveillance system that was established shortly after the arrival of the refugees was useful in assessing the health problems of a population whose previous health status was largely a mystery. These data were helpful in avoiding unnecessary interventions and directing appropriate expenditure of human and financial resources; they were also useful in reassuring the local population. Considerable fear had been voiced about the potential for large-scale epidemics, particularly in view of the abysmal levels of sanitation and crowding in the boats and subsequently in the wharves before refugees were moved to more acceptable quarters. In fact, the only disease or conditions documented on a large scale were pediculosis and scabies.

A strength of the surveillance system was its simplicity. The diseases chosen were those with an expected high frequency that posed a potential threat for the local population and were amenable to prevention or treatment. The simplified list of diagnoses undoubtedly contributed to the high compliance with reporting, although the ‘other conditions’ category remained large and it was difficult to obtain an accurate picture at the time, of diseases or conditions not specifically included on the forms.

A second strength of the system was the rapid feedback, which was made possible by daily transmission of data from each site via fax or telephone and entry of the data into a microcomputer that subsequently generated automatically a daily report. These reports were disseminated to decision makers as well as those supplying the data within 24 hours of the close of each reporting period. Data for decision making was thus extremely timely, and those providing the data were aware of the importance and usefulness of their efforts.

Although the existing national health care system was rapidly mobilized to provide health care for the refugees, a possible weakness of the refugee efforts was the focus on curative health care. No nutritional evaluation of the population was undertaken on a systematic basis. No overt malnutrition and vitamin deficiencies were detected despite anecdotal reports of serious food shortages in Albania. Furthermore, although polio vaccination was carried out, no attempts were made initially to assess vaccination status, relying on reports of Albanian doctors that vaccination with locally produced vaccines was routine. The refugee population for the
most part was not from isolated areas and was predominantly adult, but the potential for major problems with vaccine-preventable diseases was nonetheless present. A serosurvey performed on a sample of 400 refugees demonstrated that 19 per cent were HBsAg-positive, including 17 per cent of the 84 children <10 years of age who were tested (Lo Caputo).

As seen in the vast majority of refugee situations, the health problems of the refugees consisted predominantly of diseases and conditions that might have been predicted given the circumstances. The most common problems were the human parasitoses. Reportedly, many Albanians have only one set of clothing, and bathing is relatively infrequent because of the lack of soap and water. It is likely that some of the refugees carried lice in their hair and clothing from Albania and infected other refugees during the voyage or shortly after arrival. This problem was successfully managed by mass treatment and improved hygiene, although in future situations, mass treatment upon arrival may avert further spread among the population.

The high incidence of obstetric events in the female population was unexpected. Contraceptive services are virtually non-existent in Albania, and the high rate of obstetric events may have been related to the age structure of the population seeking refuge in Italy or the desire to deliver in Italy, where the child would automatically be an Italian citizen. The reason behind the adverse pregnancy outcomes, including spontaneous abortions or miscarriages, is not known, although it might have been related to stress, acute food deprivation, or dehydration during the voyage. These findings suggest that pregnant women should be carefully evaluated and targeted for health intervention and followup.

The rate of hospitalizations was high. Many of the refugees had health problems that had previously not been adequately evaluated or treated, but in part the high rate was due to unfamiliarity of the health personnel with the refugee population and conditions likely to be seen in refugees and the difficulty of providing adequate outpatient care in the initial settlement of the refugees. Because hospitalization is expensive and may be an inefficient use of available resources, it may be useful in the future to have initial health evaluations of the refugees performed by those with previous experience in refugee health or who have received training in refugee health problems. It may also be helpful to prioritize the establishment of adequate outpatient treatment facilities shortly after the arrival of the refugees.

In summary, a number of lessons were learned from this experience that have proved valuable in contingency planning for other refugee emergencies. A simple surveillance system was established which proved useful in responding to rumors concerning epidemics and for making public health decisions. In the future, efforts should be directed to establishing adequate outpatient facilities which can handle the majority of refugee health problems, and greater emphasis should be placed on prevention activities.

Note

We wish to thank the local health and hospital authorities in the Puglia Region and the many physicians and nurses who contributed to the surveillance system.

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Donato Greco, Sergio Lo Caputo, Nancy Binkin and Marco Panatta
Laboratorio di Epidemiologia e Biostatistica
Istituto Superiore de Sanità
viale Regina Elena 299
Rome 00161
Italy

Salvatore Squarcione
Public Health Directorate
Ministry of Health
Rome
Italy

Cinzia Germinario
Institute of Hygiene
University of Bari
Bari
Italy
A Computer Assisted Exercise in Classifying Nutritional Status: A New Tool for Learning

S.B.J. MACFARLANE, C.R. McCONNELL and W.B. RUSSELL

Despite the increased interest in and development of qualitative data collection techniques for rapid appraisal of health and nutrition problems, there is a continued need for the type of information generated from nutrition surveys (Scrimshaw & Hurtado, 1987). These surveys, commonly carried out amongst refugee or displaced populations, are designed to provide reliable estimates of the prevalence and type of malnutrition in the sampled community or camp. This information can then be used to advocate for more resources, plan interventions and assess the effectiveness of existing programmes.

Nutritional assessment includes taking measurements (anthropometry), deriving indices from measurements and classifying individuals or communities according to the severity of malnutrition. The results obtained from such assessment then need to be interpreted and used to determine an appropriate response. It is sometimes assumed that nutritional assessment can be done by inexperienced staff with little or no training. In practice, effective nutritional assessment requires good organisation, accurate measurement and correct classification. The first is quickly learned in the face of a large number of crying children and the second is best learned 'on the job' under careful supervision. There has rightly been considerable attention paid to measurement techniques and training of field staff often focuses on this. The last skill — determining the extent and severity of malnutrition in a child or community — has received less attention and can best be acquired away from the children themselves. This article presents a computer based exercise which can help health workers to gain this skill.

Computers provide a useful means of simulating reality for training purposes and now that they are so widely available, particularly in training institutions, it is important to maximise their use. Computer assisted learning is becoming increasingly popular, particularly when used alongside other more traditional forms of learning. The advantage of computer assisted learning is that users can learn at their own pace, usually in an attractive, interactive and imaginative environment. Its potential for distance learning has not been properly explored. There is no doubt that there are advantages in distributing and updating computer disks — particularly in countries where there are shortages of paper.

The Liverpool Epidemiology Programme was set up at the Liverpool School of Tropical Medicine with funding from the Overseas Development Administration to explore alternative ways of providing training in basic epidemiological techniques. An aspect of the work is to develop a series of computer modules using hypertext
software which can be used for individual or group work. One example is the Meningitis Hypertext Case Study which handles the methodology required to investigate an outbreak of meningitis (Cuevas et al, 1992).

This article describes a case study which was developed as an extension to a module on nutritional surveillance and can be used for individual learning or for group work.

The objective of the exercise is to provide users with the opportunity to practice and evaluate different methods of converting and classifying anthropometric measurements into nutritional indices. It is a classroom tool to be used prior to, or immediately after, the first training session in the field.

ASSESSMENT OF NUTRITIONAL STATUS

Anthropometric measurements

Weight and height are the recommended measurements for assessing nutritional status (WHO, 1986a). Sometimes mid-upper arm circumference (MUAC) is used as a proxy for weight. The emphasis of this exercise, however, is on the use and interpretation of weight and height measurements. A young child between the ages of six months and five years is usually weighed using suspended 25 kg hanging scales. Height (or length in young children who cannot stand) is measured using a calibrated height or length board (Young, 1992).

Deriving indices from measurements

A weight measurement itself is of no intrinsic interest unless there is some way of comparing it with the range of values which would be expected for children of the same height or age. Nutritional indices are formed by relating the child's measurements to the values of a reference population.

The choice of the reference population opens a debate which is beyond the scope of this paper. It is common, however, to use the American NCHS reference population when no local reference exists and/or when it will be necessary to make international comparisons (US Dept of Health, 1977). It is argued that the use of a common reference permits valid comparison not only within but also between communities (ACC/SCN, 1990).

As an index of wasting or thinness, the weight of the child is related to the reference population median weight for a child of the same height. This is known as the weight for height index. As an index of underweight, the weight of the child is related to the median weight for a child of the same age. This is known as the weight for age index. It is less useful than the weight for height index in societies where children are generally shorter (and therefore lighter) than the reference population. As an index of stunting, the height of the child is related to the median height of a child of the same age. This is known as the height for age index. There are two methods of expressing these indices.

The child's weight can be expressed as a percentage of the reference median for a child of the same height. This is referred to as the percentage of the median for weight for height. Similar calculations lead to percentages of the median for weight for age and height for age (Young, 1992). The child's weight can also be expressed in terms of the number of standard deviations it is away from the reference median for a child of the same height. This is referred to as the standard deviation score of weight for height. It requires knowledge of the reference standard deviation as well as the median. It is now considered to be more useful than the percentage of the median and the latest reference tables provide both standard deviations and medians (WHO, 1983). Standard deviation scores can also be calculated for weight for age and height for age.
The two methods give approximately equivalent results. In the reference population, a standard deviation score of -2 is roughly equivalent to 80 per cent of the median for weight for height and weight for age and to 90 per cent of the median for height for age. These are the usual cut-off points. In practice there is a tendency to classify a slightly higher proportion as malnourished when using the standard deviation score cut-off for weight for height, for example, than the percentage of the median cut-off. There are various ways of calculating these indices and thereby classifying each child. The choice depends on the situation, the available time and resources, and the skill of the staff.

METHODS OF CLASSIFYING EACH CHILD

Using a reference table

The reference figures are often available in tabular form. Oxfam distributes a table with values of the reference median weights and of percentages of the medians for a range of heights. Once weight and height have been measured, a child can quickly be classified as wasted by referring to the weight values in the table. Tables using standard deviation scores are also available. If printed tables are not accessible the appropriate reference population values can be copied down and given to the health workers at the start of the weighing session. This method is easy and quick to use and gives the health worker an immediate assessment of the individual child.

Sometimes weight for height charts are pinned on the wall of the health centre (Nabarro & McNab, 1980). The child is weighed and stood against the column for its weight. The child’s height indicates the weight for height category in which it falls — actually making it a height for weight chart. The procedure is equivalent to using reference tables except that the height measurement may not actually be recorded.

Using a graph

Children can also be classified by referring to a graph showing the relevant cut-off points for the different indices. The road to health chart, commonly used in growth monitoring, can be used to classify according to weight for age (WHO, 1986b). Weight for height charts are based on the same principle. If printed charts are not available they can be drawn up by plotting the relevant reference values for weight against height on a piece of squared paper (Figure 1).

Each child’s value is plotted on the graph and the classification noted on the record sheet. This method is slower than simply referring to a reference table but has the added advantage that at the end of the measuring session the distribution of the values for the sample is clearly shown on the graph. The health worker has an immediate impression of the extent of the problem in the whole sample. Health workers who use and understand road to health charts should not find this method difficult. There are, however, more possibilities for error in plotting each point since, unlike the road to health chart, there is no continuity between the points, the points belonging instead to different children.

Using a calculator

Another method which is often recommended is to calculate the exact values of the percentage of reference median for each child using a calculator. For this reason Oxfam distribute a number of basic calculators with their mini survey kits (Young, 1992). If the median values for the reference population are available then it is simple to calculate each child’s percentage of the median. It is more difficult to calculate standard deviation scores because the calculation requires the median and the standard deviation of the reference population.
There is more scope for error in the calculation. The advantage of calculating exact values is that it is possible to manipulate them at the end of the day, for example to calculate means of the index for the total number measured. It also helps to know how many of the children are actually on the borderlines of the classifications.

A special slide rule has been developed which will calculate centiles and percents of the median once the weight, height, sex and age of the child have been entered (Cole et al, 1981). This is based on the British reference population (Tanner et al, 1966) and, although there are only small differences from the NCHS population, it is seldom used in this context outside Britain.

**Using a computer**

Now that computers, and particularly portables, are more widely available it is realistic to assume that the classification could be done using one. Several simple packages are available for entering, classifying and analysing nutritional data, such as Epi Info, EPINUT and ANTHRO (Dean et al, 1990; Coulombier et al, 1991; Sullivan & Gorstein, 1990). All these programs have specially prepared data entry screens. As the measurements for each child are entered they are simultaneously converted into the various indices using the NCHS reference population. The data and results are stored in a file for printing and subsequent analysis.

The advantage of computer analysis is that all the indices can be obtained simultaneously. One disadvantage with using a computer package is that the interpretation of the data becomes retrospective and passive. It is often difficult to enter the data...
as each child is measured and it may well be easier to analyse the whole sample at the end of the day. Unless there is some form of hand analysis in the field the health workers taking the measurements do not gain any impression of the situation.

Once all the children have been measured and those at risk have been identified it is important to consider the range of nutritional status in the community sampled. This can be done by hand or using one of the computer software packages mentioned above.

METHODS OF CLASSIFYING COMMUNITIES

Tables

It is good practice to look at the distribution of the values of the indices calculated and to find the number falling into all possible categories of the index. This will give an impression of the range of the problems in the sample. Simple tables can be quickly drawn up after completing the measurements and staff can determine the number of children who would be included for supplementary feeding, for example, using different cut-off points.

Diagrams

There are several useful diagrams for displaying the results and these can be made easier by computer graphics. EPINUT, for example, produces three diagrams as an automatic part of the analysis. The most useful is the cumulative graph (Figure 2) which allows comparisons to be made between indices and/or between communities on the same graph. A cumulative graph can also be used to determine the malnutrition rates if different cut-off points are used.

Rates

Most governments and donors want malnutrition rates to be expressed in the simplest possible manner. Once a cut-off has been agreed they are usually satisfied with a rate for wasting and a rate for stunting for the population and for defined subgroups although background information should be available on request. Such rates must always be quoted with their corresponding 95 per cent confidence intervals to give an impression of the sampling error involved. The larger the sample the smaller the confidence interval. The calculation takes into account the sample size and the sampling methodology used (Young, 1992).

FORMAT OF THE EXERCISE

Use of hypertext

The exercise has been set up using the hypertext software Linkway (IBM, 1990). This type of software allows the user to follow a chosen route through a number of computer screens using a mouse. It is extremely simple to use requiring no previous knowledge of computers. The screens may contain text and/or graphics with a number of notes which will 'pop-up' on the click of the mouse. Users may take their own time to read the screens and then click their choice for the next screen. It is also possible to control the time period during which a screen may be observed. Linkway is a relatively cheap package which is available for IBM compatible computers. The run time versions of the programs written in Linkway are free. This exercise has been written for the basic configuration of a 20 megabyte hard disc microcomputer with a Microsoft compatible mouse, EGA graphics and colour monitor.

After an initial introduction, the program takes the user through the alternative methods of classifying nutritional status. A series of instructions about how to do the exercise is followed by a number of screens of children and their measurements (Figure 3). The children are represented diagrammatically in the first
version due to the limitations of EGA graphics. In a second version photographs of real children will be shown but this will only be available for computers with MCGA graphics and sufficiently large and fast access hard disks.

The name, identification number, age, and sex are given for each child and a weight scale and a length or height scale are shown. The user is expected to read off and record the respective weight and height/length as judged from the scale. The user is asked to classify the child using any of the above methods and then to continue to the next screen. When all the screens have been studied the user has the option to run through each screen again — this time clicking on another button which gives some answers and comments (Figure 3).

There follow some further questions...
about the nutritional status of the individuals and community. The user is taken through screens showing appropriate tables and diagrams, with rates of wasting and stunting calculated together with their confidence intervals. The exercise ends with a summary of the situation and a list of the lessons which should have been learned.

The data

The data used in this exercise are measurements of real children with very common problems. There are 290 children in the data set although the user only observes the first 20 children. The cumulative graph given in Figure 2 represents the nutritional status of all 290 children. Some of the children are wasted, while others are stunted or both wasted and stunted. Some of the indices are so unlikely that the user is led to suspect that one of the measurements may be wrong, particularly the age.

Instructions

The exercise can be used by an individual or by a group of up to six people. The first task is to draw up a suitable form on which to record the data for each child. The single user can then choose the method of classification which s/he prefers to practice. Since it would be cumbersome to enter Epi Info after every screen, it is recommended that the single user runs through the data once by hand and then enters the recorded data into Epi Info when all the screens have been seen. This is realistic of the real life situation when the data are often checked and analysed in the evenings. When there is a group of participants it is recommended that each person in the group tries a different
classification method. Ideally, participants would then take turns trying out each of the methods.

EXPERIENCE AND EVALUATION

The players

The exercise was developed for a group of about 30 participants attending a one week course on refugee community health care (International Health Exchange, 1991). It was played by hand the first time with children being represented by slips of paper. These were passed round a group of 6 people each of whom had been allocated a particular method of classification. It proved successful and popular and the experience led to the development of this computer based exercise. The hypertext version was played in 1992 by another group on the same course. There were 31 participants with backgrounds ranging through the fire brigade, teaching, administration, general practice, paediatrics, midwifery, health visiting and social work. Just over half had previous overseas experience but all wanted to prepare themselves for working with refugees.

The timescale

The three hour session started with a brief introduction to malnutrition and methods of assessing nutritional status in children. The participants were then shown a video on conducting a nutrition survey in a refugee camp (Etat D’Urgence, 1990). The video was stopped at regular intervals to discuss some of the issues raised and in particular the methods of measuring and classifying nutritional status.

After a short coffee break participants were divided into five groups in different rooms. Each group had access to two computers — one for the hypertext program and the other for classifying the children using Epi Info. A facilitator was available to each group.

Problems

The main problems arose because of lack of time and, to a lesser extent, prior computer experience. The value of the exercise comes from trying out all the different classification methods (graph, chart etc) and discussing what has been learnt about them. At least 2 hours should be allocated for the exercise — during which time all participants are encouraged to rotate round — with at least half an hour discussion at the end of the exercise. An individual user would need less time to go through the exercise and use all the methods. For those participants who had no previous experience of using a computer the data entry into Epi Info was slower than anticipated. Although this caused some frustration amongst group members using alternative methods who were ‘ready’ for the next child, it did help to emphasise that computers are not always the quickest method.

Evaluation

Participants were asked to complete an evaluation of the exercise and to give their informal comments on ways in which it might be improved. Only four of the sixteen respondents had calculated the indices before, by any method. The feedback was generally positive, most finding the exercise enjoyable and informative, but nearly everyone wanted more time. The advantages and disadvantages of the different methods of classification had been identified and discussed amongst the groups — particularly the relative advantages of speed, accuracy and visual presentation. Several participants had gained an understanding of the relationships between the different indices and the importance of comparing like with like — a fact that is often overlooked by people writing survey reports about the prevalence of malnutrition.
DISCUSSION

In many programmes, particularly those addressing the needs of refugees and displaced people, there is a need for skilled personnel who are capable of assessing and classifying nutritional status so that appropriate decisions can be made about appropriate interventions. This exercise enables staff to learn how to classify nutritional status away from the stresses of the assessment session.

The major skills learned during the exercise include the calculation of indices from measurements, the method of classifying both individuals and groups of children, and ways of presenting the information obtained. The major lessons learned are the need to check questionable measurements when indices are out of the expected range, that different indices give different rates of malnutrition, the advantages and disadvantages of different methods of classification and the importance of distinguishing acute and chronic malnutrition for decision making about interventions. Above all the exercise aims to redress the balance from measurement to assessment and therefore towards interpretation. The emphasis is on the assessment of each child and of the community rather than on the mechanism of measurement.

The exercise is a useful learning tool for anyone likely to be involved in survey work. It can be used in a classroom setting or individually as a form of distance learning. Individual users may require additional explanation which is why the exercise has been designed to complement a more detailed computer based learning module explaining the epidemiological methods required for nutritional surveillance.

Copies of the exercise are available from the Liverpool Epidemiology Programme for a nominal charge to cover the cost of materials and postage. It is distributed with a reading list and an evaluation sheet.

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International Health Exchange (1991) Refugee Community Health Care Course, 1–5 July 1991. Run by International Health Exchange, Save the Children Fund and Oxfam at the Liverpool School of Tropical Medicine, UK.


Liverpool School of Tropical Medicine
Pembroke Place
Liverpool L3 5QA
UK
There is no question that, for the first time in history, humanity has altered the chemical composition of the atmosphere. Carbon dioxide, largely the product of fossil fuel burning, has increased from about 270 parts per million at the beginning of the industrial revolution to about 355 ppm in 1992. Not since 130,000 years ago, between two major ice ages, has the earth seen such levels of carbon dioxide. Then it was naturally produced as the result of little understood biochemical and physical phenomena that spanned thousands of years in the earth’s evolution. It is predicted that in 40 years the concentration of carbon dioxide could reach 600 ppm. No such levels have occurred in the past as far as we can tell from paleo-climate records.

It is commonly predicted that, as a result of such chemical changes in the atmosphere, the global mean temperature of the earth will increase 1.5°C to 4°C. These predictions are fraught with uncertainties. Nevertheless, many, if not most, scientists believe that our knowledge is sufficient to warrant serious concern. The evidence of changes in the past 100 years is tenuous — about 0.5°C global mean temperature increase, accelerated retreat of glaciers, thinning of ocean ice, etc. — but sufficiently consistent to encourage study and possibly action to prevent further changes in atmospheric composition.

The big uncertainties and concerns, though, lie not on mean temperature predictions, but on related effects. How much will oceans rise, mostly due to thermal expansion, flooding the already marginal lands like Bangladesh? Will hurricanes, fed by ocean temperatures, increase in magnitude and frequency? Are droughts going to be more frequent? How will agricultural production change? Who will suffer and who will benefit? What demographic and political changes will follow? In other words, what natural hazards will become disasters with major socio-political implications at the regional and national level?

The potential for man-induced climate change and other global environmental issues have captured the attention of everybody, from the child in the local elementary school to the heads of state that attended the United Nations Conference on Environment and Development. But the linkage between global and regional environmental damage and natural disasters is too commonly glossed over. Ironically, this great movement for global environmental protection is occurring during The International Decade for Natural Disaster Reduction (IDNDR). The commonalities of these two international efforts must be emphasized and the synergism between those involved encouraged. It was with these two goals in mind that the Center of Global Change Science of the Massachusetts Institute of Technology hosted the The World at Risk Symposium. The meeting was sponsored by the U.S. National Science Foundation, Engineering Directorate, Natural Hazards and Man-Made Hazard Mitigation Program. About 200 engineers and scientists dealt with issues of predicting hazards impacted by climate change; discussed impacts on various industries and sectors; outlined strategies of prevention and/or adaptation to such hazards; and debated appropriate responses of society, professions and nations.

As commonly is the case, any collection of selected papers will necessarily fail in capturing, in its entirety, the nuances, exchanges and excitement of the meeting. Nevertheless, the Proceedings of this Conference, soon to be published by the American Institute of Physics, include a good portion of the formal presentations.

The material is introduced with articles by James P. Bruce, Chair of the U.N. Scientific and Technical Committee for the International Decade for Natural Disaster Reduction, and by
J.C. Dooge, Chairman of the Organizing Committee for the Second World Climate Conference, President-elect of the International Council of Scientific Unions, and advisor to the Secretary General of the U.N. on the proposal for IDNDR. Bruce discusses the paradigm of environmentally sustainable development and argues that it is necessary to view efforts in natural disaster reduction in a similar way. National disaster preparedness must be part of any successful development strategy. IDNDR is the framework for international cooperation to achieve that goal. Dooge explores the common scientific, institutional and social grounds of climate change and natural disasters. He argues for new partnerships between scientists and engineers and between the scientific-technical community and other groups including international governmental organizations, national governments, private business and the public at large.

The next series of articles deals with the possible Impacts of Climate Change on Natural Phenomena. Kerry Emanuel estimates the changes in frequency and intensity of tropical cyclones that may result from man-induced climate change. He concludes that significant increase in the destructive potential of hurricanes is possible. Richard Peterson and Thomas F. Warner discuss potential data sets that may be used to detect any changes in tropical cyclone behavior as a result of ocean warming. Sea level rise and its potential impact is discussed in articles by Andrew R. Solow and William K. Nuttle. Solow provides a critical review of evidence of sea level rise. Nuttle deviates from the traditional warnings of coastal inundation and argues that sea level rise poses a serious threat to the land hydrology. Twenty centimeters of sea level rise could double the mean surface runoff and reduce the groundwater discharge by half in a small watershed in Cape Cod, Massachusetts. Articles by Steven J. Evans and John J. Clague and by Mauri J. Pelto focus on the observed significant glacier ice loss around the world. Loss of glacier ice induces instabilities that result in avalanches and floods commonly resulting in disasters of very large magnitude. Evans and Clague catalog and discuss these impacts very well. Pelto argues that glaciers act as reservoirs of water, damping periods of high flow and providing weather during otherwise dry times. The retreat of glaciers increases flood risk and endangers water supply during late summer periods.

Lightning kills a very large number of individuals annually as well as significantly disrupts many key activities of modern day society. Colin Price and David Rind show results indicating that doubling CO₂ concentrations in the atmosphere may lead to a 32 per cent increase in lightning activity. This combined with the amazing possibility that present-day 100-year drought may become a common two-year drought by the year 2060 in parts of the U.S., could result in increased forest fires, among other impacts. Earle Williams and Stan Heckman use the relationship between lightning and temperature in a suggestive way to detect climate change. It is argued that the Schumann resonance, a global electromagnetic phenomenon driven by global lightning activity will respond quickly and uniformly to temperature changes. This could provide a means for detection of global temperature changes with local observations.

Ercan Kahya and John A. Dracup highlight the interdependence of climate processes over large global scales. They study the relationship between streamflows in southern California and El Niño/Southern Oscillation signals in the equatorial Pacific. Ignacio Rodriguez-Iturbe also dwells on interdependence, this time between surface hydrologic processes and the atmosphere. He couches the behavior of droughts and soil moisture on the nonlinear feedbacks between the atmosphere and the continental land masses. Eric Wood, Dennis Lettenmaier and James P. Hughes outline a possible procedure to assess the impact of climate change on extreme floods. The technique is designed to properly transfer information from the large scale of global climate models to the sub-grid, regional, scale. Richard Peterson and James Gregory look at records from Lubbock, Texas, to understand the relationship between weather, climate and blowing dust. In the last paper of this section, J.S. Levine, W.R. Cofer, D.R. Cahoon, E.L. Winsted and B.J. Stocks illustrate the magnitude of human initiated biomass burning and argue that this may be the source of as much as 40 per cent of the global annual production of CO₂ and similarly a large proportion of other greenhouse gases.

Predictions of the potential impact of greenhouse gases on climate change are generally
based on models. These models are approximations to reality and in many ways flawed. Ultimately model results must be verified with appropriate global scale information. The next section Modeling and Measurements concentrates on models and their limitations, particularly the issue of parameterization of processes that occur at scales smaller than the common model resolutions. Furthermore, several papers discuss the problem of measuring key phenomena at global scales. Peter H. Stone puts global circulation models in perspective. He explains how they operate and identifies some of their known flaws. Jochem Marotzke makes a strong argument for the need to integrate models of oceans and atmospheric circulation. Presently this link is at best weak and, without it, predictions of climate change are seriously compromised. The next three papers deal with the representation of processes that occur at scales smaller than the common grid size of a Global Circulation Model. This is the problem of sub-grid parameterization. Roni Avissar suggests a prognostic equation for mesoscale kinetic energy to relate subgrid-scale landscape heterogeneity to subgrid-scale convective clouds. Dara Entekhabi and Peter S. Eagleson focus on the interaction of subgrid scale soil hydrology and the atmosphere. They outline the influence of landsurface processes on climate and describe ways of modeling those processes within the context of GCM's. E.A.B. Eltahir and R.L. Bras accent the land surface–atmosphere interactions by estimating the level of moisture recirculation at mesoscales over the Amazon basin. About 25 per cent of all rain that falls within the Amazon basin is contributed by evaporation within the basin. W.F. Krajewski, and Robert J. Nicholls, Karen C. Dennis, Claudio R. Volonte and Stephen P. Leatherman discuss the large scale measurement of precipitation and sea level rise, respectively. Tad McGeer advocates the use of small, remote controlled aircraft, to obtain global scale environmental data.

The next section is on Industry, Climate Change and Natural Disasters. G.A. Berz opens by stating that the international insurance industry has been confronted with a drastic increase in the scope and frequency of great natural disasters. Although this increase cannot be attributed to any climate change, the prospects of some of the predictions coming true are sobering. He warns about national and international insurance industries running into capacity problems. David C. White provides a thorough view of the relationship between the electric industry and climate change, particularly the production of greenhouse gases. He concludes that the only feasible strategy to reduce CO₂ emissions is to increase the efficiency with which energy is used and to shift the energy systems towards electric energy that is produced by more efficient generating systems using lower carbon-based fuels and eventually to noncarbon-based energy sources. Paul Waggoner calls for adaptation as a valid and reasonable strategy for the agricultural industry. Historically, changing technology and flexible strategies by farmers have overcome threats of similar nature. Waggoner bets that they will again succeed in facing this new challenge. James MacKenzie and Allen Perry offer two views of climate change from the perspective of the transportation industry, particularly the automobile. MacKenzie argues that growth in motor vehicle use will overwhelm gains in fuel efficiency, hence not reversing the trend of increasing greenhouse gas production. He believes that ultimately electric and hydrogen vehicles, charged by non-fossil electric sources, are the only long-term technical options that can reverse the increasing trends of greenhouse gas production and air pollution. This position contrasts with White's opinion that this non-fossil technology for vehicles is not on the cards. Finally Ahsan Kareem outlines the impact of climate induced natural hazards, such as extreme winds, storm surges, hurricanes and erosion, on the construction industry. The industry has to be concerned about new construction as well as about retrofitting the infrastructure that supports us.

Whether an extreme geophysical event becomes a disaster depends largely on how society responds to the menace. The next three papers deal with Societal Responses to Global Change and Natural Hazards. Joanne Nigg identifies several factors that affect the way societies respond to hazards: societal resources, realistic expectations, vulnerability, and past experience. Climate change induced natural hazards add an element of uncertainty not necessarily present in other societal experiences. The question is how well society responds to possible future disaster events, due to a changing, but still not characterized, physical environment. Mark Meo,
Thomas E. James and Robert E. Deyle chronicle the contrasting experiences of Florida, Massachusetts, and North Carolina in handling coastal erosion. Successful policies involve institutions and mechanisms that facilitate the communication between key decision makers and the scientific/technical community. Douglas C. Ling calls for an international consortium involving governments, academia, industry, and businesses as a way to effectively respond to natural and manmade disasters. He calls his concept Fire Station Earth.

Research is an integral element of any approach to the dual issues of climate change and natural hazards. Several countries presented their research initiatives, particularly within the framework of the International Decade for Natural Disaster Reduction, under the heading National Research Activities. Three of these contributions are included in the proceedings. Joseph Bordogna (Assistant Director for Engineering, U.S. National Science Foundation) and J. Eleonora Sabadell (Program Director, Natural and Man-Made Hazards Mitigation, U.S. N.S.F.) outline the initiatives of the Engineering Directorate of the U.S. National Science Foundation. Lucio Ubertini, Director of the Research Institute for Hydrogeological Protection in Central Italy details his country’s activities in response to IDNDR, while Sabadell discusses U.S. activities.

The Symposium ended with a panel discussion of how governments, at the agency and policy-making levels, are responding to the new challenges and questions posed by the prospect of climate change and associated natural hazards. The discussion centred around the positions of developed and developing countries. It was evident that although objectives of sound environmental management are prevalent, the approach and concerns differ significantly. The papers by Dallas L. Peck, Director of the U.S. Geological Survey and former Chairman of the Committee on Earth and Environmental Sciences, and that of C. Caponi and A. Rosales, from the Ministry of Environment and Natural Resources of Venezuela, present both positions. Peck emphasizes the need for increased knowledge in order to base policy on sound scientific foundations. Caponi and Rosales struggle with the sometimes conflicting needs of development and environmental protection. They wonder who is going to pay for the alternative and presumably more expensive, strategies for sustainable development. Peter Thatcher, Senior Advisor to the Secretary General of the U.N. Conference on Environment and Development, and Senior Counselor at the World Resources Institute, moderated the panel. He ends the proceedings by putting in perspective the north—south debate evident in the previous two statements. He correctly points out that 'Both the North and the South are preoccupied with immediate problems (even the rich feel poor) and find it convenient to hide behind uncertainty’ and calls for more attention to the legitimate questions related to the costs of reducing climate risk and committing our economies to providing goods and services on a sustainable basis.

Although considerable uncertainties about the nature, and even the magnitude, of human-induced climate change exist, the consequences are potentially too large to ignore. Vice-President Al Gore, in his recent book Earth in the Balance, refers to global environmental changes as strategic threats to civilization. Many of these threats are related to potentially devastating natural hazards. All too often natural hazards and society’s ability to deal with them are ignored in the debate on global environmental change and sustainable development. A society cannot develop if it cannot appropriately respond to nature’s unavoidable extremes. Hopefully the Symposium and Proceedings of The World at Risk: Natural Hazards and Climate Change will help raise the consciousness of engineers, scientists and policy makers to these issues.

Rafael L. Bras
Department of Civil and Environmental Engineering
Massachusetts Institute of Technology
Cambridge
Massachusetts 02139
USA

Second Asian—Pacific Conference on Disaster Medicine, Chiba City, Japan, 10—13 September 1992

The Second Asian—Pacific Conference on Disaster Medicine, organised by the Japan Association for Acute Medicine and the Japan International Cooperation Agency, brought together over 600
participants representing over twenty countries, principally in Asia and the western Pacific. The First Asian—Pacific Conference on Disaster Medicine was held in Osaka, Japan, in 1988. The purpose of the conference was to present issues of relevance to improving medical preparedness and response to natural and technological disasters, particularly those affecting the Asian—Pacific region, and to provide recommendations for international cooperation in disaster prevention, mitigation and response. The conference will evolve into a continuing forum, held every four years, with the Third Asian—Pacific Conference on Disaster Medicine planned to take place in Indonesia in 1996.

Papers were presented both in plenary sessions and in smaller topical symposia. Topics included (1) country disaster preparedness reports from several Pacific, Asian and Latin American countries; (2) activities of international organizations in disaster situations, including presentations by the World Health Organization, the Department of Humanitarian Affairs/United Nations Disaster Relief Organization (DHA/UNDRO), the Pan American Health Organization, the International Committee of the Red Cross (ICRC) and Médecins sans Frontières (MSF); (3) lessons learnt from past natural and technological disasters for improving future medical responses; (4) disaster epidemiology; (5) clinical disaster medicine topics, such as triage, burn and trauma care, anaesthesia and resuscitation; (6) refugees and displaced persons; (7) Japan's international medical cooperation for disaster relief; (8) coordination of civil and military sectors in foreign disaster relief operations with a focus on the future role of the Japan Self-Defence Forces; and (9) methods for providing effective technology transfer for the purpose of reducing deaths and injuries through pre-planning for natural disasters and/or post-disaster response. The proceedings of the conference will be published during 1993.

In addition to the plenary sessions and symposia, the conference provided a valuable opportunity to meet representatives of emergency preparedness and relief agencies from many different countries in the Asian—Pacific region as well as from Russia and Latin America, representatives from international relief organizations, such as the ICRC, MSF, DHA/UNDRO and UNICEF and regional disaster preparedness institutions such as the Asian Disaster Preparedness Center in Bangkok and UNDRO's South Pacific Disaster Preparedness Program Office in Fiji.

In a draft resolution, the 'Chiba Resolution on Disaster Medicine', the conference recommended that

a permanent scientific and operational Asian—Pacific Institute be established, preferably in the host country [i.e., Japan], for research, study, dissemination and coordination of action in favour of protecting and maintaining health in all aspects of disasters.

Several other potential projects for cooperation between countries were suggested in the symposia sessions in the areas of improving preparedness and coordination for disasters occurring in Pacific-rim countries.

The Asian—Pacific region has a rapidly growing population and the fastest growing economies in the world. Not surprisingly, many economists and political scientists feel the 21st Century should be called the ‘Pacific Century’. This region is also the most disaster-prone part of the world, with hundreds of millions of people at risk from the catastrophic effects of both natural and technological hazards. It was a privilege to have the opportunity to discuss and exchange ideas on ways of further improving the capability of the world, and especially the Asian—Pacific region, for disaster medicine.

Eric Noji
Disaster Assessment and Epidemiology
Section
Centers for Disease Control
Atlanta
GA 30341-3724
USA

Jean Drèze and Amartya Sen have brought together twenty-six essays on hunger, famine and poverty from across the developing world, originating in a World Institute for Development Economics Research conference in 1986. The essays are of varying quality and, given the four to five year delay in publication, of varying contemporary relevance. The three volumes are, among other things, supporting evidence to Drèze and Sen’s earlier work, Hunger and Public Action, the findings of which I have summarized in an earlier review in this Journal (Beck, 1991).

Two of the authors, Barbara Harriss on the intra-family distribution of hunger in South Asia, and Drèze on famine prevention in India and Africa, have achieved high levels of scholarship on which other scholars could fruitfully build. But, unfortunately, most of the essays in The Political Economy of Hunger (PEH) are economic surveys that lack the clarity and insight of Hunger and Public Action.

It is not possible in this review to do justice to each of the contributions individually. Instead I will concentrate on two themes that are important throughout the three volumes: their conceptual approach and its relation to political economy; and the relations between hunger and policy making.

Conceptual approach and political economy

Most of the contributions fit within a narrow economic paradigm in which the investigation of hunger or poverty are reduced to two stages — identifying the poor, and then formulating policies to meet their perceived needs. As the author of one of the essays, on under-nutrition in Sub-Saharan Africa, puts it (Svedberg, III, p. 156), ‘... one needs to know who the people at risk are; otherwise it will be impossible to reach them with targeted policies or to see to it that they are compensated if they suffer from side-effects of general policies’. Here is the traditional (and one might also say outdated) approach to the alleviation of hunger that most of the essays in the volumes espouse. Much attention is given throughout to the numbers in poverty and what their characteristics might be. This approach lacks vision, in particular the vision to move away from a fascination with calculation and statistical analysis towards research that involves poor people and poor communities themselves in policy making and analysis.

The economic approach of the authors takes at best an ambiguous view of the possibilities of agency by the poor. If the main aim of development is to identify the poor and make policy, what place do the poor themselves have in this process? This problem arises partly from the use by many of the authors of the entitlement concept. Entitlement theory was developed by Sen, partly as a means of moving the analysis of poverty and hunger away from a focus on commodities and food availability and towards the idea of the individual as an economic actor. But the view taken of the poor, hungry individual in entitlement theory remains ambiguous. In the original hypothesis1 Sen states,

The entitlement approach to starvation and famines concentrates on the ability of people to command food through the legal means available in the society, including the use of production possibilities, trade opportunities vis-à-vis the state, and other methods of acquiring food. A person starves either because he does not have the ability to command enough food, or because he does not use this ability to avoid starvation. The entitlement approach concentrates on the former, ignoring the latter possibility. (1982, p. 45)

The causes of starvation are related directly here to the inability of the individual to command enough food. This is a welcome shift away from the notion that individuals have no social role, and that the main cause of famine is inadequate food supply. But surely a more accurate hypothesis in famine situations or in situations of hunger would concentrate equally on the way in which individuals or groups are denied access
to food, by the state, by the local elite, or even by other members of the household. And a more holistic conceptualisation of the poor person would focus on other abilities rather than simply that of command over food. This Sen has attempted in the concept of capabilities, but this concept, as argued in my earlier review, also remains restrictive, focussing on mortality, morbidity and illiteracy, that is the lack of capability of the poor. It is also ironic, given that most of the authors in PEH express a strong affection for entitlement theory, that Drèze and Sen, in their companion volume, state that 'The focus on entitlements, which is concerned with the command over commodities, has to be seen as only instrumentally important, and the concentration has to be, ultimately, on basic human capabilities' (1989, p. 13). Entitlements and capabilities, however, fall within the same economic tradition, one that denies agency to the poor outside their inability to achieve certain economic indicators or targets.

Since theory and method generally interlock and given the narrow economic framework within which most of the authors operate and the paternalistic view they take of the poor, it is not surprising that the policy options on offer are standard 'top-down' ones. The main recommendation in the volumes — that protection of 'entitlements' through state support for employment, health and education can help the poor — is made forcefully and with the use of several case studies, and is a welcome antidote to those who suggest that the market can achieve all. But anyone reasonably familiar with development literature (and even those not familiar with it) would not be surprised to learn that the more money they earn and can use, the better off the poor are likely to be. It is only in the essays by Drèze and Harriss that the demands the poor might make on the state are considered, and even in these two essays this is done in a perfunctory manner. The enterprise of targeting employment at the poor could usefully be supplemented by an investigation of how poor people gain employment, how they bargain for wages, and how they create formal and informal unions to support their demands. But such an investigation would require a belief in poor people as real social actors rather than consumers of policy or 'economic man'.

How far can these essays be considered as political economy? Several are political economy with the politics left out. The contributions by Svendberg, Dasgupta and Ray, and Osmani are, for example, basically discussions of nutrition, nutritional controversies, and adaptation to undernourishment. One is reminded by such analysis of the character of Stein in Conrad’s novel Lord Jim, who spends his time in the study of his immaculate mansion with his rare butterfly collection, occasionally stepping outside to contemplate events in the world around him. Other essays, such as those by Desai or Ravallion, are largely about econometric modelling. Good as these essays may be within their particular paradigm (which I cannot judge), they have little place in a series on political economy. Even Kumar’s case study of the Ethiopian famines of 1973—1985, which are ripe for political analysis, largely ignores the political nature of the famine (on which, see Jansson, 1987 and Kent, 1987), presenting instead an anodyne analysis of entitlements during the famine (which incidentally shows that even on its own terms entitlement theory may not be a very good mechanism for explaining some famines). The lack of political analysis is not incidental. It too stems from the affection many of the authors show for entitlement theory. When one is concentrating on the inability of the individual to command food, it is difficult to bring in the state, interest groups, and exploitation as well. On the other hand, the essays by Ram on the role of political pluralism and the press in fending off famine and hunger, and Sobhan on the politics of hunger, lean much more towards political economy, and do so because they are not seriously involved in discussion of entitlements (despite Sobhan’s nod or two in its direction).

This lack of a political economy approach is also evident in the failure of PEH to consider the role of transnational corporations and their relation to hunger. I counted three references to such corporations (less than to ‘basal metabolism rate’). Does the fact that four large developed country corporations control the movement of 90 per cent of the world’s traded food have no relevance to hunger?

Policy making and hunger

These volumes give much food for thought as to the relation between academic research, policy
making and hunger. This is partly because, at a combined price of £115, they cost more than an agricultural labourer is likely to earn in a year in many parts of the developing world. This in itself is an unfortunate enough circumstance, but will these volumes make any difference to hunger? Are they in the best format for influencing policy makers? Who, apart from academics, will read them, and what use will they make of them?

This takes one into an area that appears to be little understood. The development research 'community' does not appear to have a good sense of how research findings and academic discourse is translated into policy making. If books and articles on hunger have little effect (a conclusion at which it is not possible to arrive as yet), then why are academics researching into hunger? The view that, in the long term, the understanding of poverty and hunger may help to relieve them, may just be the academic equivalent of 'trickle down' theory. If academic enquiry is not having sufficient impact, is there a better way for academics to spend the considerable time, effort and money that goes on producing volumes such as those under review (and the many other volumes consistently produced on hunger and poverty)? To paraphrase Susan George, a useful future enterprise might be to study development policy makers to find out what drives them and how academic research feeds into this.

The view taken by the editors of PEH would appear to be that policy is made rationally, carried out rationally by politicians, and that reasoned argument and scholarship can affect this. In his essay on famine prevention in Africa, for example, Drèze questions the assumptions of agencies such as the World Food Programme that delivery of food, rather than protection of 'entitlements', is the only possible anti-famine strategy. The case for exclusive reliance on the latter strategy rests implicitly on the combination of two assumptions: (1) that no effective entitlement protection is possible without a commensurate and simultaneous increase in food availability, and (2) that no reliable channel for increasing food availability exists other than the famine relief system itself. These assumptions appear to be highly questionable on both analytical and empirical grounds. (II, p. 161)

Drèze's assumption here is that because agencies such as the World Food Programme do not understand famine better, they respond to it in the wrong way. I find this a simplistic relation between knowledge and policy making. The problem, from a political economy viewpoint, also involves geo-politics, subsidies to farmers in developed country nations, lobbying by large food corporations, pressures on developed country nations to dispose of food supplies, and the need to provide visible aid. It remains one of the basic flaws of PEH, and entitlement theory, that they do not address such questions of political economy.

I can only conclude that there is a need to examine more carefully the relation between academic research and policy making and to determine which elements of academic research (if any) are successful in influencing policy. A similar conclusion is reached by Idachaba, who asks

What is required to understand the policy options facing African agriculture is a demand side approach which seeks to explain why policy makers do what they do. Who are the main policy participants as formulators and implementers? How do they relate to the various interest groups and the recurring class of 'unintended' beneficiaries? ... These questions take us far into theory of pressure groups, self-interest, altruism, and coalition, an area we cannot develop in this chapter. (III, p. 231)

Two recent innovative volumes by Mosley, Harrigan and Toye (1991), which look at how the policy makers make policy in the World Bank, are a move in this direction. It may no longer be possible to rely on the traditional approach — publishing articles or books in the expectation or hope that they will have some influence and relying on the development 'two-step': identifying the poor and targeting policy at them.

A more holistic investigation of hunger would look not at the incapacity of the poor to
achieve food entitlements but the ways in which food is consistently denied to the poor, how the poor set out to deal with hunger and poverty themselves, and how these attempts might be supported. With this in mind I refer the reader to two recent thoughtful books, Lewis (1991) and Rahmato (1991).

Notes

1. This passage is also quoted by Ravi Kanbur, in support of his arguments on global food balances in Volume 1 of PEH.

2. Only one of the four case studies in Sen’s Poverty and Famines (on the Great Bengal Famine) considers the role of the state in detail. Harriss’s essay on the intra-family distribution of hunger deals with denial of food within the household, but does not discuss entitlement theory.

References


Tony Beck
University of British Columbia


The Ariaal are poised between cattle-owning Samburu and their close allies, camel-owning Rendille, having combined these two economies (together with small stock) to produce a hybrid society that is bilingual and has characteristics of both: their camel settlements are quasi-Rendille in character, their cattle settlements are Samburu, and many elders straddle the two with families in each. This work is concerned with those Ariaal who were derived from Samburu towards the end of the nineteenth century. It does not consider those who came originally from Rendille and provided the initial expertise, culture and language associated with their camel keeping. It is a useful and well written summary of work undertaken in the area, including that of the author, and would be a useful text for those taking A level Geography with a liberal display of maps, bar-charts, tables and photographs. The thrust of the analysis concerns the economic adaptation of the Ariaal in comparison with the Rendille and the effects of missionary and developmental initiatives in the area.

The chapters on these initiatives make sombre reading and provide an important view of the effects of outside interference that tend to be glossed over in formal reports by those actually involved. The Catholic missions especially are singled out for their impact on the Rendille. Having attracted impoverished families to settle close to the mission centres where they would be easier to convert, the missions created a situation of permanent dependency as small towns grew up in these areas. Up to 45% of the Rendille have been separated from their traditional economy in this way, whereas the Ariaal have hardly been affected. The author argues that it is the combination of stock among the Ariaal — of cattle added to their camels, sheep and goats — that has proved the more viable mix in a situation of almost permanent drought in the area. Recent Rendille attempts at cattle keeping have not been successful and this has rendered their more exclusive dependence on camels more vulnerable. Rather as the role of the Rendille in introducing Samburu originally to camels in Ariaal is not considered in this work, so there is no consideration of the extent to which perhaps the partial failure of Rendille in cattle-keeping was their more recent attempt to adopt cattle independently of Samburu help and expertise.

On the developmental side, various initiatives since 1976 under the umbrella of the
Integrated Project in Arid Lands (IPAL) have extended to Ariaal with a less devastating impact before being abandoned in 1986. The project developed further urban concentrations in the better watered parts of the Ariaal area with new initiatives in agriculture and marketing livestock, but made no permanent contribution towards pastoralism. Developers failed to resolve the problems of famine in the area owing to the distance they maintained from the pastoralists themselves, underestimating the importance of the indigenous culture and the extent of their adaptation to stock-keeping in this marginal area.

As the author shows, the problems of the Ariaal are shared by pastoralists in Northern Kenya more generally, and he attempts to unravel the root causes of the problem in an area that is at the butt-end of capitalist development, agriculturalist intrusion, population movements and population growth. There is however an unresolved blindspot in the analysis. The author reacts against Malthusian interpretations, arguing that the solution lies in redistributing available resources and allowing pastoralists to manage their own affairs in their own traditional lands. Yet the devastating population growth throughout Kenya, including the pastoralist area, is elsewhere acknowledged. In this work, the Ariaal are allowed the opportunity to speak for themselves, and their final word is a request among other things for medicine for infants and health education for children. The work ends here without considering the moral dilemma that this poses for the reader. Given that we in the West have medicines and insights into promoting health, can we refuse to share these? And yet, it is precisely in sharing them that we contribute towards population growth. The towns that have grown up around the missions and those depending on famine relief, which figure so prominently in this text, include a sector of the population who almost certainly would not have survived but for this help. In dismissing the Malthusian argument, the author glosses over the ethical implications.

Paul Spencer
School of Oriental and African Studies
University of London


As the risk of global war appears to recede, it is entirely predictable that countries with a low perceived threat from geophysical hazards will struggle to adapt their civil defence arrangements to meet the needs of peacetime emergencies. But the British experience, well summarised in these proceedings of a small international conference held in September 1989, persistently highlights the increasingly serious mis-match which exists between the level of national preparedness and the disaster potential, especially that arising from rapid-onset, 'techno-social' hazards.

The twenty-four contributors to this volume are drawn from a wide variety of backgrounds but they unite in criticising the low priority given to peacetime disasters by government and the resulting lack of a coordinated national policy. Although local services, and self-help initiatives, are vital in the immediate aftermath of all disasters, the main impetus for effective emergency planning must be 'top-down'. In Britain, the refusal of the central government to impose statutory duties on local authorities to prepare peacetime emergency plans and the inability to allocate overall responsibility for disaster policy to any single Ministry fails to provide an adequate context for hazard management. As a result, the country continues to muddle through with a reliance on improvisation and personal heroism during the disaster in combination with retrospective enquiries, public or otherwise, which do comparatively little to anticipate future events, after the disaster. On such a crowded group of islands, with a culture based on complex legal controls and a well-developed tradition of commercial secrecy in industry, it is perhaps surprising that the existing disaster toll, which claimed well over 1,000 lives in Britain during the 1980s, has not been higher. The bulk of the book, sandwiched between introductory and concluding chapters, is divided into three sections entitled Emergency Planning and Management in Britain; Explanatory Perspectives; and Hazard and Emergency Management Concepts for the Future. Apart from isolated contributions, the treatment concentrates on strategic issues and is well judged between the
broad, overly theoretical view and the technical detail of specific emergency training or operational procedures. It provides a clear critique of current emergency planning provision in Britain, illuminated by some parallel accounts of arrangements overseas, and argues a powerful case for a more enlightened, integrated approach to hazards in the future. The editors have done a good job in minimising overlap between the papers and in drawing together the differing threads in each major section. This is a book which deserves to be read by all the players on the emergency planning stage.

Keith Smith
University of Stirling


This exactly titled book is a thorough, perceptive and pellucid description and analysis of the Ethiopian resettlement programme; it stands well with the earlier Manchester University Press volumes on resettlement in Israel and Zambia. Resettlement brought misery and death to thousands of already destitute industrious peasants. This book is as close a representation of the experiences and responses of the victims and the survivors as we are ever likely to get. It is made very clear that the suffering would have been much worse but for the 'continuities' of peasant endurance and initiative, which formed 'the underlying text' beneath the turmoil of a brutally enforced but flawed vision of social change. My own recollections of those few fiery advocates of resettlement whom I met are that they were, at best, simple minded, and at worst, deranged by power lust.

The strength of Pankhurst's analysis derives from fourteen months of close field observation, between January 1987 and June 1988, in a settlement given the name Village Three. We are shown how the settlers, sunk in the depths of sickness, destitution and anomie, climb back to such a point of civility that an official could make the accusation: 'Village Three has become a place of merriment, ignoring the Constitution.' The ascent was eased because, despite all the revolutionary rhetoric, the new hierarchies were based on the old Ethiopian ones: 'knowledge of writing, or fighting, and relationships with State representatives'. That is, the new structures were the old familiar ones in fancy dress, so the settlers soon learned to manipulate them. The new leaders even assumed prerevolutionary privileges and demanded deference and that their plots be dug for them by the poor. The settlers avoided and evaded official regimentation whenever they could; they were grateful for the food but resisted the exhortations. From the start they engaged in petty market trade; relaxed and gossiped in improvised bars; sold what they could to get salt and pepper to give a little spice to their diet; bought snuff and 'chat' for their comfort, and coffee. Coffee is the source of sociability and is 'a metaphor for social relations, and a vehicle for spiritual blessings' to Christians, Moslems and Traditionalists alike. Once they had got together the prerequisites for sociability the settlers started to recreate a social life, in forms that were comfortable and comforting, and they did so despite the obstacles officials tried to put in their way, even as they themselves became incorporated in that social life.

The first step was to restore the natural rhythms of life which, during resettlement, had been 'in a sense reversed: death came before birth'. During the journeys and in the Shelters the dead just had to be dumped. So dignity had to be restored to death and the dead by proper mourning and religious observances, even though the erection of mosques and churches was forbidden. It followed then, as one percipient elder put it: 'since we are living together we must agree so that we can become relatives'. Becoming relatives required the restoration of marriage, which in turn 'requires the help of team mates'; and from marriage derive kinship and affinity which, in their turn, provide the bases for good neighbourliness, hospitality and domestic morality. Marriage soon became 'arguably the most important social relationship in the village'. Unions which had just happened from immediate need or convenience, but without social recognition, were converted into marriages; women who had been 'married for nothing' pressed for a bride dress as 'clothing a wife stood for marriage'. The state attempted to intervene by setting up a Marriage and Divorce Committee, but it was only really
heeded when the wishes of the state and the people coincided. The neighbourhood elders soon got the upper hand.

Pankhurst revisited Village Three in 1991. Life was still hard and the tractors had mostly stopped working, so access to plough oxen was a key resource again. But collectivisation was just a nasty memory and no one was compelled to stay in the village. There was some hope, and the settlers who had stayed had transformed themselves into villagers.

To provide a voice for those who cannot speak out for themselves continues to be an imperative, if subsidiary, responsibility of a social anthropologist. Alula Pankhurst is especially qualified to recount the experiences of Ethiopian peasants: he is a well trained observer; had a 'feel' for Ethiopia and the sufferings of its peoples; and, most importantly, can converse in Oromo and Amharic which are the two most widely spoken languages in Ethiopia; indeed he speaks and writes the latter as a native.

He is also an Ethiopian patriot and patriotism is not always a pure light. It seems to me that in his section 'The use of force' he has let his sympathies blind him a little. He asks why it was the Mengistu regime ever got itself stuck with an indefensible programme, 'when the country was economically bankrupt and while famine was taking its devastating toll of people and resources'? His answer is that resettlement became 'a symbol of hope and proof of action' in 'the context of humiliation and frustration at dependence on foreign aid'. That may have been true enough from the viewpoint of a proud Shoan official, but not so if you were a forced settler or someone who lived where the settlers were dumped. Indeed, many resettlement officials were so revolted by their tasks that they joined the flood of refugees fleeing the country. This same blind spot, as I see it, causes Pankhurst to underemphasise the consequences of conscription and the liberation struggles (or civil wars) that were bleeding Eritrea, Tigre and many of the Oromo lands. It is also, I presume, why he berates those outsiders who, correctly in my view, opposed resettlement and even accuses Survival International, the ally of the voiceless oppressed throughout the world, of 'taking on board' the campaign against resettlement, led by Médecins sans Frontières with 'the support of a number of French intellectuals', and of using 'emotive imagery' in its publications. But surely human misery is emotive, and certainly being a refugee is.

P.T.W. Baxter
University of Manchester


Predictably and necessarily there is now a plethora of new books dealing with South Africa's transition to a post-apartheid state and society. Here, Panos have added to their already impressive list of more popular publications on development and environmental issues a well conceived and edited volume written by concerned and involved southern Africans who have first-hand experience of their subject matter. 'Environment' is interpreted broadly, so as to provide coverage of associated socio-political, energy, health and legal issues.

Altogether there are 18 chapters plus a short conclusion, grouped into five sections dealing with Challenges and Constraints, the Rural Environment, the Urban Environment, Environmental Law, and Southern Africa respectively. The initial chapters emphasise the historical and broader contemporary context, outlining how the environment has been neglected, and often directly exploited beyond its recoverability, in the cause of apartheid. Of course, the process did not commence with the advent of the National Party in 1948, but has long roots dating back to the nineteenth century. It becomes clear that, although South Africa's experience is unique in obvious respects, similar problems occur elsewhere and that the wider questions of unsustainable development are global in scope. It is also good to have a substantive section examine other parts of southern Africa, given the interrelationships of economy, society and environment which exist in the region.

In rural areas, the authors make clear how the problems of environmental degradation are not by any means confined to the 'homelands', as many people in South Africa are fond of believing. Certainly, the effects of inadequate or inappropriate planning, poor land and livestock
management, overcrowding as a direct result of forced removals, and other facets of under-development have given rise to incredible hardship and problems. However, (white) commercial farming has also been predicated on unsustainable practices and heavy use of inorganic fertilisers and pesticides. Some prerequisites for a more sustainable agriculture are set out.

Some of the most poignant sections highlight how asbestos mining, the reprocessing of toxic chemicals and heavy metals by Thor Chemicals, and other industrial processes, have been allowed to proceed for decades without due regard for workers’ health or the environment. In the words of Zacharia Matime Mabiletja, a resident of Mafefe, a former asbestos mine in the northeastern Transvaal,

I feel grief when I think of the suffering and the loss of life. My overwhelming worry is that I spent half my life on or near the asbestos dumps or inside an asbestos-plastered hut. We know all too well that asbestos fibres are silent and do not warn us of their danger once they are in our lungs ... So the dust is everywhere. I for one slept in it, played with it, studied in it. We wonder now — after so much dust in so many people’s lives — how many of us will live to see our fourth decade. Here I am today. I think about all the wealth gathered and gone, leaving behind death for some and disease for others.

Fortunately, however, all is not gloom. The authors have sought to balance the severity of the problems with case studies of progress towards more sustainable and democratic futures. NGOs and community groups have been in the forefront of several important initiatives which have overcome powerful vested interests and official hostility. Such examples include the pathbreaking agreement to allow the local people to remain in the newly proclaimed Richtersveld National Park, to share in its management and to continue their pastoralism on a controlled basis; the new consultative arrangements about water release from the Jozini Dam to avoid destroying peasant crops below; and urban squatter or locality movements seeking to exercise greater control over their own lives and areas. Quite rightly, the authors stress the complexity and interrelatedness of many problems, most important of which is the necessity of tackling poverty if environmental degradation is to be ameliorated and the quality of life for the majority to be improved.

The style is clear and matter of fact, providing an easy read through pages filled with the horror and structural violence wreaked on the majority of South Africans and their environment by the apartheid system. Hard facts and overall situations are interspersed with case studies and personal testimony, driving home the way in which large scale processes affect individual lives. The text is also supplemented by appropriate photographs, maps and a few boxes. Physical production is good, with very few typographical or other errors (although one, Namib River instead of Desert, p. 179, is conspicuous). One curious anomaly is the book’s subtitle identifying the contents as dealing with South Africa alone, when one of the five sections covers the wider southern African region.

Although this is not intended as an academic book, there will be much of interest here — not least case material and recent data — for specialists as well as a general audience. It deserves to be widely read and should appear on student reading lists. I, for one, will be using it for my courses on Development Studies and contemporary Southern Africa.

David Simon
Royal Holloway College, University of London
EDITOR: Alan Holland, Department of Philosophy, Lancaster University, Lancaster LA1 4YG, UK.

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