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Environment and Urbanization 1997 9: 251

DOI: 10.1177/095624789700900102

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Reducing risk as a tool for urban improvement: the Caqueta ravine, Lima, Peru

David Sanderson

SUMMARY: *This paper presents a description of the Caqueta district in Lima and describes the methodology and research methods used. It presents the key findings of the project and concludes with a brief discussion of mitigation as a tool for urban development. The paper seeks to reinforce the key point of the project: that adherence to “top down” interventions can ignore community level initiatives and the positive inputs of other actors; also that risk reduction can be used as a tool in uniting key actors to focus on protecting livelihoods, as well as lives, in the promotion of sustainable urban development.*

This paper results from a recently completed project entitled “Reducing Risk In Vulnerable Communities, Lima, Peru. Phase One: Caqueta Pilot Project”. The principle aim of the project was to identify and subsequently develop, with the participation of key “stakeholders”, sustainable risk reduction measures for Caqueta, a particularly low-income area of Lima, Peru, vulnerable to landslides, earthquakes and fire.

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The project described here included a two-week risk evaluation and a three-day Workshop “Caqueta, A Place to Live Without Risk”. The project was a joint collaboration between the Oxford Centre for Disaster

I. CAQUETA AND THE CAQUETA RAVINE

THE CAQUETA DISTRICT is located near to the commercial centre of Lima on the intersection of Avenida Pan Americana Norte and Avenida Caqueta. Caqueta grew dramatically during Peru's economic stagnation of 1985-90 with the rapid growth of informal markets providing cheap food and goods for the city. Street traders, or *ambulantes*, sprang up in almost every street as low priced foods attracted visitors from all over Lima. Today, the area is characterized by congestion: a surfeit of street traders crowd most main streets and public spaces, producing large amounts of garbage which the irregular garbage removal services do not cope with. Caqueta accommodates an estimated residential population of about 15,500 living in just over 3,000 formal and informal dwellings. Shelter ranges from unconsolidated “illegal” wooden shacks found within the densest of markets to tenured adobe constructed houses and four to five-storey concrete frame/brick infill and rendered houses.

The city of Lima is vulnerable to natural hazards: earthquakes,

Studies (OCDS) and the Peruvian NGO Instituto Para la Democracia Local (IPADEL). It was funded by the European Commission Humanitarian Office (ECHO). Phase Two of the project is now underway; the British Embassy in Lima has funded the renovation of the two precarious pedestrianized bridges crossing the ravine; ECHO is funding a programme of risk awareness-raising to be led by the local fire services, and the British Overseas Development Administration (ODA) has agreed funding in principle for the transport of a fire-fighting vehicle to Peru.

floods and landslides. Lima ranks as the second highest area⁽¹⁾ of seismic activity in Peru. The last major earthquake occurred in Lima in 1974; a recurrence is predicted in the next 10-15 years. Lima is also vulnerable due to its poor soil conditions, being built on a desert strip made up of boulders, gravel and sand. Possibly the most dramatic combination of natural hazard with urban vulnerability in Lima occurs, however, in the Caqueta ravine: a 30-foot deep cut through Caqueta caused by the Rimac river which transects the city. Poorly enforced building and planning codes, high densities and rapid urbanization (due to its proximity to commercial locations) combine with frequent landslides, caused by the widening ravine, to increase the vulnerability of the ravine squatter housing perched on the ravine edge. As a result, shelter damage and collapse is frequent, with losses of investments and sometimes lives. In the event of an earthquake losses would be high.



The Caqueta ravine; view from the bridge. As the ravine widens buildings continue to collapse into the river below.

1. Earthquake risk in Lima is summarized in the paper by Jorge E. Alva Hurtado, Professor of Civil Engineering, CISMID and published in Tucker, B.E. et al. (1994), "Seismic safety of the Lima metropolitan area", *Issues on Urban Earthquake Risk*,

Because of its dramatic conditions the ravine has a high profile within Lima. Several initiatives at governmental level have been discussed for solving the problem. These include the following:

- Covering the ravine. During the period of President Belaunde's administration in the mid-1980s, a project was developed to

Kluwer Academic Publishers: The Netherlands, pages 251-264.

2. The project is based on research carried out in January 1995 by IPADEL and OCDS staff as part of a two-week workshop "Rebuilding communities in Caqueta", carried out by The Faculty of Architecture at Lima's Engineering University with Oxford Brookes University and Massachusetts Institute of Technology, USA.

cover the ravine with a lightweight structure on which industrial enterprises would operate. The plan also included relocation of the ravine dwellers to improve the area. The initiative did not come to fruition.

- Relocation to Ventanilla. During discussions (as part of this project) with the chief advisor to the head of Civil Defence, or *Defensa Civil*, the government authority responsible for disaster management, he expressed his view that all of the area neighbouring the ravine should be relocated to Ventanilla, a government owned relocation area far from Caqueta in the north cone of Lima. The ravine area would be zoned as parkland: all buildings and infrastructure would be removed and the area replanted.
- Creation of the Rimac River Authority. Legislation currently with Parliament for debate proposes the creation of a rivers authority for the Rimac River. Such an authority would provide one body of power responsible for the Rimac including the ravine and those dwelling in it.
- In addition, previous research⁽²⁾ uncovered three master plans for Lima developed by central planning authorities and NGOs, describing how, as part of the city's restructuring, Caqueta and the ravine would be formalized and upgraded.

None of these initiatives has yet been put in place. Discussions with local communities, experts and political bodies have revealed that the reasons for this include:

- Reliance on large-scale technical solutions. Solutions to date, such as concreting the ravine banks, would be technically complex and hugely expensive.
- Lack of coordination at a political level. The Rimac ravine transects several municipal districts: a coordinated strategy would be very hard to achieve because of different interests, points of view, etc.
- Lack of political will. Forced relocation on a large scale is unsurprisingly very unpopular amongst local communities, especially to Ventanilla which is far from sources of work.
- A desire to solve all problems in one macro-level initiative. The top-down approach of a single solution has proved impossible to date. A cocktail of small-scale initiatives with differing time frames might prove more realistic.
- Limited resources. Large-scale relocation (including new housing) and urban improvement (demolition of vulnerable housing and reuse) is very costly.
- Lack of community consultation. Communities themselves are aware of the problems but chose to live in vulnerable

3. Action planning is described in Hamdi, Nabeel (1992), *Housing Without Houses*, Van Nostrand Reinhold:New York; also Hamdi, Nabeel and Reinhard Geothert (1988), *Making Microplans*, IT Publications:London.

4. The crunch model, or pressure and release model, is used in the United Nations DMTP manual *Vulnerability and Risk Assessment* by Coburn, Spence and Pomonis; see also recent publications including Davis, Wisner, Blakie and Cannon (1994), Routledge.

5. An explanation of capacities and vulnerabilities can be found in the chapter "A framework for analyzing capacities and vulnerabilities" in Anderson, Mary and Peter Woodrow (1989), *Rising from the Ashes; Development Strategies in Times of Disaster*, Westview Press:Boulder, Colorado and UNESCO Press:Paris, France, pages 9-25.

areas in order to be close to work. The research found that many families had moved to dwellings on the edge and would sell on their properties.

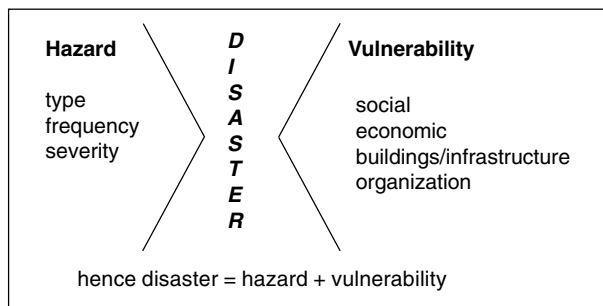
II. REDUCING RISK IN THE RAVINE: PROJECT METHODOLOGY

IT IS PARTLY because of the lack of action - "the macro-level approach" - that action planning⁽³⁾, or action oriented research, was used within the methodology of this project. Action planning adheres to the rapid gathering of information for use in the formulation of immediate projects where, crucially, results can be seen. Such projects may be small or large-scale, or may lead onto larger initiatives, but the point is that the research stage is the short period of a project and is oriented towards **doing**; it is the implementation that is the key part of action planning. Whilst the results of action planning may sometimes be criticized as incomplete or imperfect, nevertheless findings are being made, statements produced and action - real, tangible results - being implemented.

The project also relied methodologically on two other beliefs: the pressure and release, or "crunch" model and the need to "increase capacities and reduce vulnerabilities".

a. The Crunch Model⁽⁴⁾

The crunch model, widely used in disaster management, states that risk is the product of vulnerability meeting hazard. Vulnerabilities may be social, economic, cultural, organizational or political, whilst natural hazards include earthquakes, floods, landslides, volcanoes and fire. The following diagram illustrates the relationship between hazard and vulnerability and allows for the identification of the components of these two elements.



b. Capacities and Vulnerabilities⁽⁵⁾

The crunch model serves to articulate vulnerabilities (negative aspects causing disaster) but traditionally does not include capacities - positive aspects of a given situation which may, when mobilized, serve to reduce risk by reducing vulnerability. Reducing the risk to natural hazards can be described in terms of

reducing vulnerability and **increasing capacity**. At first sight, such a statement appears simplistic yet, within the complexities of risk reduction, with the minefield of political, economic and social factors dictated by interest groups each with individual agendas, agreement on the lowest common denominator for reducing risk provides the framework for movement forward. The definition also forces a recognition of what is **good** in a given situation not only on what is bad. Capacity is a positive statement recognizing existing measures and mechanisms already employed for reducing risk.

III. ACTIVITIES

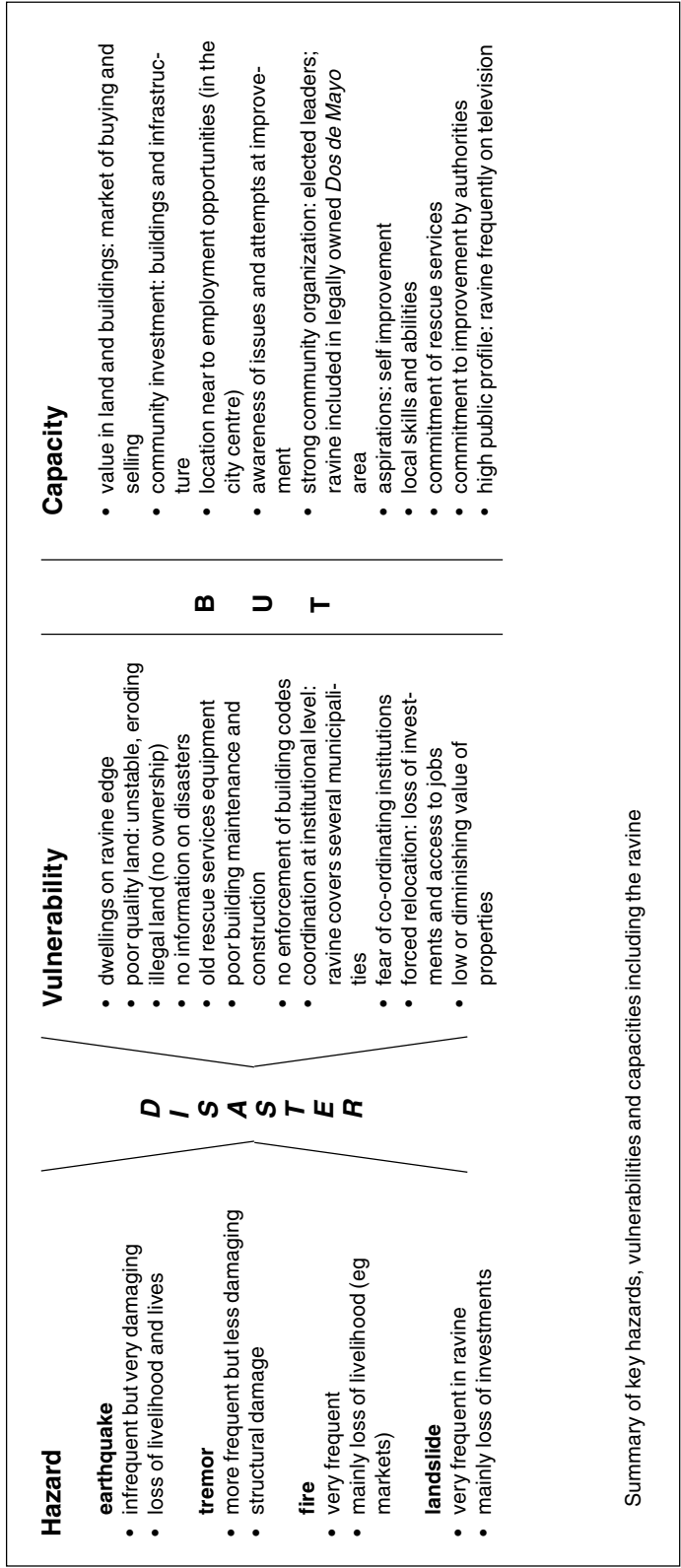
THE PROJECT COMPRISED two components: a risk evaluation of Caqueta's commercial and residential areas, and the Workshop "*Caqueta, Lugar Para Vivir Sin Riesgos*" ("Caqueta, Place To Live Without Risk").

a. Risk Evaluation

The purpose of the risk evaluation was to gather current data on hazard, vulnerability and capacity to be used as the basis for the formulation of "action plans" for risk reduction. Data was gathered not only on the ravine area but also on the informal markets and on a consolidated squatter area in Caqueta. The evaluation was used also to build relations with key actors at community, NGO and municipality level and, importantly, provided credibility for the project amongst authorities. Findings were recorded in a resource document which served as the basis of information for the workshop. During the risk evaluation, four research tools were used:

- Collection and review of existing research. Technical information was gathered from previous work including that undertaken by Intermediate Technology Peru and Lima's engineering university regarding earthquake in Lima, soil conditions in the ravine, etc.
- Observation. The purpose of the observation teams was to build up hazard maps of Caqueta relating to buildings and infrastructure. Data collected related to approximate building age, state of condition, number of floors and construction materials, and was presented as a series of risk maps.
- Questionnaires at household and organizational level. Two sets of questionnaires were used to gather information. These related to **organizational capacity** (size of organization, activities, breakdown of members by age and sex, frequency of meeting) - organization is a key strength in Peruvian society - and **households** (number, age and sex of household members, income earning activities and approximate monthly incomes relating to family members). In addition **life stories** were gathered.

Box 1: Summary of Key Hazards, Vulnerabilities and Capacities including the Ravine



Summary of key hazards, vulnerabilities and capacities including the ravine

- PRA meetings. A series of meetings took place with market and housing association representatives to gather data using PRA methods. Exercises were carried out mostly with association committees which included both men and women. In other areas, meetings were held in houses where community members, including children and teenagers, came and went. Activities included **community mapping** of the location of particularly memorable hazards, **time line development** of when hazards occurred, **development of disasters matrices** recording views on disaster causes and possible solutions, and **risk perception** including the ranking of hazards. Finally, findings were discussed during which participants shared their own visions of how risk could be reduced.

b. Risk Evaluation Findings

The following chart shows some of the data gathered within the ravine area - one of the three areas in Caqueta studies on risk evaluation. The findings include a summary of hazard, vulnerability and capacity, and PRA findings. PRA was undertaken with residents of Association Dos de Mayo, whose borders extend to the ravine edge. One street along the ravine edge was also chosen for a more detailed survey of building condition, residents and their incomes.

Historical Profile. Community representatives were asked about particularly memorable natural disasters. Residents stated that buildings fall into the ravine "all the time"; the fire services reported having to pull up people, in particular children, from the ravine on a weekly basis.

DATE EVENT

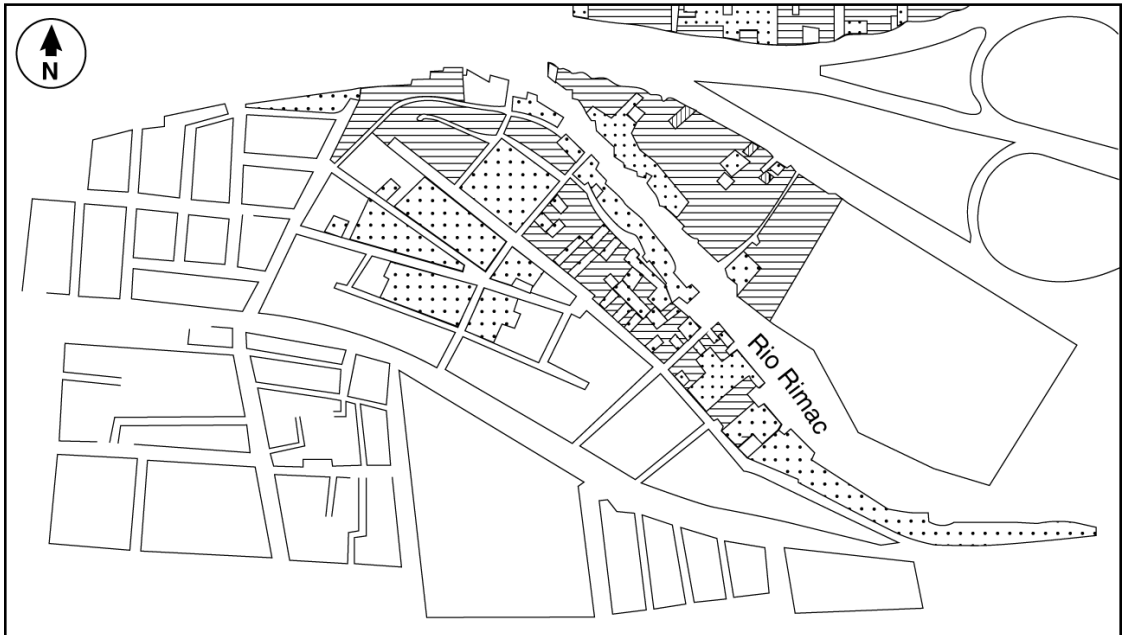
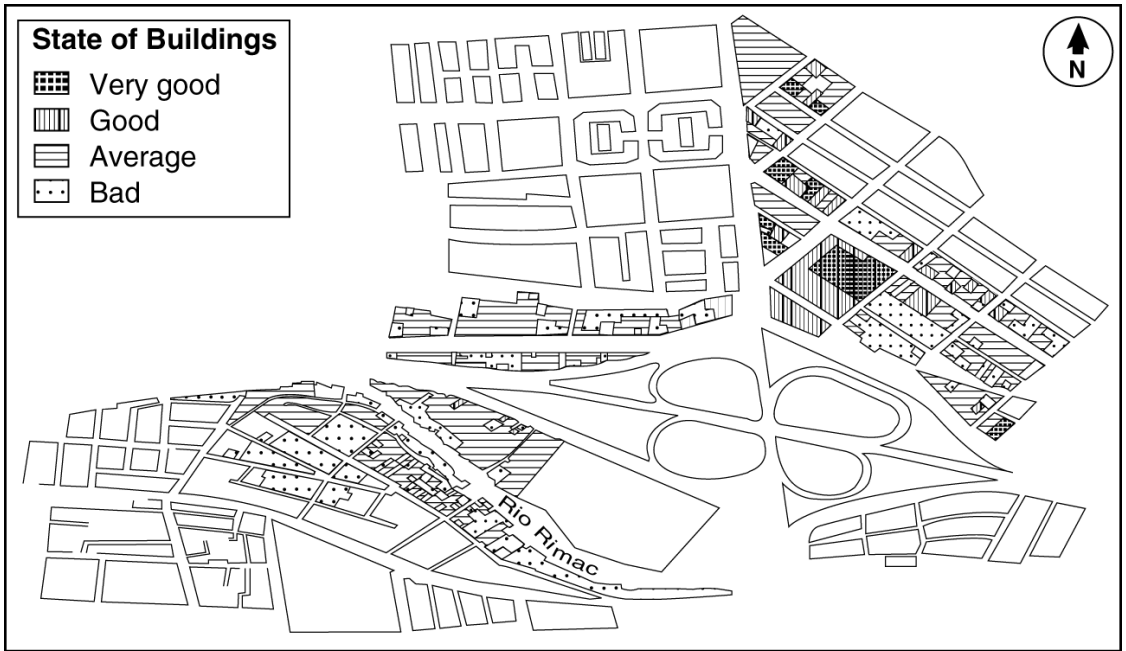
1968	Tremor and landslide; houses and families affected
1972	Law passed to move local chemical-producing factory to Ventanilla
1978	Landslide; houses lost and families affected
1983	Landslide; collapse of <i>coliseo</i> (stadium)
1984	Landslide; collapse of wall

Community Perceptions. Representatives were asked to identify the key problems and possible solutions - see box 2.

Household Surveys found that households on the ravine edge had access to regular incomes. Residents had been on the edge for between two and 50 years. Despite the dwellings being officially illegal (building is prohibited within 25 metres of the ravine edge), all had bought their properties and most anticipate selling them on. Hence, despite the clear risk associated with living on the edge of the ravine, property retains an exchange value. Families continue to buy and sell as well as consolidate their properties. In addition, there appears to be a high diversity of employment ranging from *ambulantes*, cleaners and formal traders to teachers and taxi drivers.

Findings from the risk evaluation for all three areas were ex-

Caqueta risk maps



Caqueta risk maps indicating top: the state of condition of buildings in Caqueta district and bottom: in the ravine area. Maps were also produced relating to age of buildings, height and materials of construction.

Box 2: Key Problems and Solutions

DANGERS	PROBLEMS	"SOLUTIONS"
Landslide of houses into the ravine	Ravine is very steep. Broken sewage pipes leak into the soil. Erosion of river undercuts ravine	Raise the height of the river. Construction of a covering over ravine
Bridge is in danger of collapse	Foundations are exposed	Repair and replace wood with concrete walkway
Pollution of river Rimac	Dumping of garbage and sewage	
Pollution of air by local factories	Health of community especially eye, nose and ear problems	Relocation of factory away from residential zone

trapolated into five "statements of belief" which formed the basis of the workshop. These are:

- **Effective mitigation measures include participation in decision making at all levels.** A key vulnerability lies in the lack of trust between different key actors: municipality, NGOs, *Defensa Civil*, community groups. Each appears to perceive the other as having a different agenda from their own. Communication is often limited to directives, ultimatums or resistance.
- **Perception of acceptable risk (however extreme) is outweighed by livelihood considerations.** The ravine edge dwellers are well aware of the risks they face. Their presence, however, is due to the proximity of the ravine to the city centre where income-earning is possible and because of the lack of affordable shelter.
- **A key capacity is people: aspirations for betterment, skills and abilities.** The existence of strong community organization, upgrading and maintenance of shelters is testimony of the ability of individuals and communities to cope with such extreme conditions. All too often this vital capacity is overlooked, especially by governmental authorities who can remain oblivious to the capabilities of communities.
- **Macro-scale solutions may ignore micro-scale community capacity.** Government authority "solutions" lie exclusively with macro-scale initiatives: forced relocation of entire communities - measures which are gaining political and economic support - would be titanic. Whilst aiming at such large one-off gestures, smaller, mitigating activities are being ignored

which may not offer ultimate solutions but which would reduce risk.

- **Even the most vulnerable areas have economic value.** A key capacity find was the existence of a property market on the ravine edge, even amongst some of the most vulnerable dwellings. Several of those interviewed had lived in their houses for several years. Many saw their dwellings as “stepping stones”, where families would live for a few years before moving on to better housing.

IV. “CAQUETA; A PLACE TO LIVE WITHOUT RISK” WORKSHOP

THE FINDINGS FROM the risk evaluation, and crucially the relationships built up between key actors, formed the basis for the three-day workshop “Caqueta; A Place To Live Without Risk” held three months after the evaluation. At the workshop, working groups comprised of members from each of the stakeholder groups identified key vulnerabilities and capacities, and possible initiatives aimed at reducing the risk of natural disaster (notably landslides, fire and earthquakes). More than 30 representatives attended the workshop, drawn from the local municipalities, congress, traders and residents associations, local NGOs, the fire services and international NGOs.

The workshop consisted of the presentation of key problems and the development of realistic, affordable initiatives. By the end of the workshop, several initiatives had been developed for risk reduction in Caqueta. These included training for fire awareness, ravine improvement through lobbying and information interchange, NGO awareness-raising of disaster management, community level environmental improvement and bridge upgrading in the ravine area.

Posters were used to advertise the workshop. The poster showed how the ravine area could be with greenery, infrastructure and key organizations represented in the area including *Defensa Civil*, municipalities and fire services offices.

V. TOWARDS REDUCING VULNERABILITY AND INCREASING CAPACITY

THERE IS NO affordable, all-embracing solution to reducing vulnerability in the ravine - an unfortunate fact for the urban planners and architects with whom we met who were still trying to “masterplan” their way out of the problem. However, whilst little is done (due to lack of resources, political will and the exclusion of key actors in decision-making) other interventions to **mitigate** risk - however small and imperfect - are possible. As a result of the workshop, groups are more in touch (especially between communities and the municipality); also, the profile of risk awareness and the need to reduce vulnerability has been

highlighted. Workshop participants from the ravine dwellers' association also talked about organizing their own risk awareness meetings.

Further interventions regarding ravine improvement through lobbying and community organization are planned for phase II of the project. Of the initiatives developed at the workshop, three have so far received support. These are:

- Reducing fire risk in markets and on the ravine edge through training the fire services to promote risk reduction measures amongst market and resident associations. This will include the identification and training of a "risk awareness officer" within each of the participating associations.
- Bridge improvement across the ravine, a high profile problem area where children, in particular, fall through gaps in the wire mesh made for dumping rubbish. Momentum for the bridge upgrading was gained when, shortly after the workshop, a child fell into the ravine from one of the bridges and was killed. Press attention led to funds being secured from the British Embassy for the proposal.
- Supplying improved equipment to the fire services to enhance emergency response combined with the long-term formation of a community risk reduction centre within the existing fire station including a training area and a permanent exhibition on risk awareness.

Some of the potentially most sustainable outcomes, however, required no funding; rather a change in values and perceptions by key actors. A key impact of the project has been the encouragement of a shift in thinking in considering the benefits of adopting pro-active measures to reduce risk, i.e. that actions regarding risk need not only be reactive. Such thinking is being developed within the fire services and within the participating community groups.

Another potential area is the development of mitigation as a tool for urban development, i.e. measures which **reduce vulnerability** and **increase capacity**. IPADEL staff remarked on the ready understanding of the project's purpose by market traders, community associations, municipalities and NGOs and on their willingness to participate. The obvious need for risk reduction served as a unifying cause, bringing together in agreement, **for the first time**, all the various actors - this was a particularly exciting, and unanticipated, occurrence. It is possibly in this way that promoting mitigation as an approach to reducing risk to a clearly defined issue can play a key role in sustainable urban development.

