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Maximising Multi-Stakeholder Participation in Government and Community Volcanic Hazard Management Programs; A Case Study from Savo, Solomon Islands

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Abstract. Participatory rural appraisal (PRA) methods and philosophies were trialed in a volcanic risk management planning and awareness activity for Savo Island, a historically highly destructive volcano in the Solomon Islands. Through a combination of methods we tried to combine the roles of facilitators and educators, and to involve the input of all stakeholders (from community to national government) in the process of volcanic risk management. The PRA approach was an ideal way to address the fundamental differences in outlook, education, needs, and roles of individuals and groups involved or affected. It was also an important catalyst to Savo island- or community-based planning initiatives, which are arguably the most important step toward the preparedness of the 2500 inhabitants of the island for any future destructive volcanic activity. We adapted almost every tenet of the PRA philosophy through inexperience, self-perceived importance and desire to combine both scientific and traditional views for Savo volcanic risk management planning. Nevertheless, what emerged from our experiences was an idea of how fundamentally well suited many PRA approaches are to initiating dialogue within diverse stakeholder groups, and deriving combined scientific/geologic and local/community risk assessments and mitigation action plans. The main challenge remaining includes increasing the involvement or voice of less powerful community members (women, youth, non-landowners) in risk management decision-making in such male-dominated hierarchical societies.

Key words: Volcanic hazards, volcanic risk, community education, participatory rural appraisal, PRA, Savo, Solomon Islands

1. Introduction

In spite of the obvious beautiful tropical fertility of Savo Island, which supports a population of 2500 subsistence agriculturalists, there exists a high risk of future life-threatening volcanic activity. The volcano is visible as the emergent upper-

third of an andesitic/dacitic cone rising 1500 m from Iron Bottom Sound. At least three volcanic eruptions have occurred in recorded history on the island, each was several years in duration and caused extensive loss of life (Petterson et al., 2003). According to local legends (Toba, 1993: Petterson et al., 2003), one of these eruptions caused either 7000 or 1007 deaths (depending on translation), leaving the island as a dusty lifeless remnant.

Despite this violent past, people have persisted and survived on Savo, a fact emphasised by the existence of characteristic local customs and tribal organization structure and by their language (Savosavo), distinct from any in the Solomon Islands and other parts of Melanesia, including in its grammar (Amherst and Thomson, 1901; Grimes, 1996; RDD, 2001). Oral history accounts (Guppy, 1887; Amherst and Thomson, 1901; Grover, 1958; Toba, 1993) imply repopulation of the island after each catastrophe by Savo people who had fled to neighbouring islands, especially Guadalcanal.

The threat of volcanism is constantly reinforced on the inhabitants of Savo through the widespread distribution of highly active geothermal areas (Petterson et al., 2003). In recent years, the expansion of many of these geothermal areas and appearance of new hot springs and fumaroles has led to heightened local concern. Pressures from local citizens led the MP for Savo to ask parliament to declare Savo a permanent volcanic disaster area in mid 1999. Although this motion could not be supported within the framework of present legislation in the Solomon Islands, external assistance was sought to address this issue. The Australian International Decade for Natural Disaster Reduction (IDNDR) Secretariat and the South Pacific Applied Geoscience Commission (SOPAC) commissioned a workshop-based activity in late 1999 to investigate strategies to manage volcanic risk from Savo.

Like any natural hazard management issue, a broad range of perceptions, political agendas, development priorities, education, awareness levels and degrees of motivation need to be addressed in an effort to move mitigation strategies forward in a consensual manner. We faced such diversity in the group of stakeholders concerned with managing volcanic risk on Savo, including local scientists, national and provincial government members, planners, emergency service personnel, NGOs, community leaders and local villagers. An additional challenge related to violent civil unrest gripping parts of the country (Ware, 2001; Turnbull, 2002), which are rooted in: political immaturity at national and provincial scales; ethnic politics; and a typically Pacific highly-developed land-ownership psychology.

To address this diversity and political climate as well as to build consensus and teamwork we applied a series of Participatory Rural Appraisal (PRA) sourced techniques (Chambers, 1994a; 1997; Bar-On and Prinsen, 2002). Within a relatively short period of time (6 days) we facilitated (and constantly adapted) a program of exercises for participants in two environments, familiar to each of the two main groups (administration/NGOs versus Savo community). We report here on the methods developed and used toward building partnership in volcanic risk

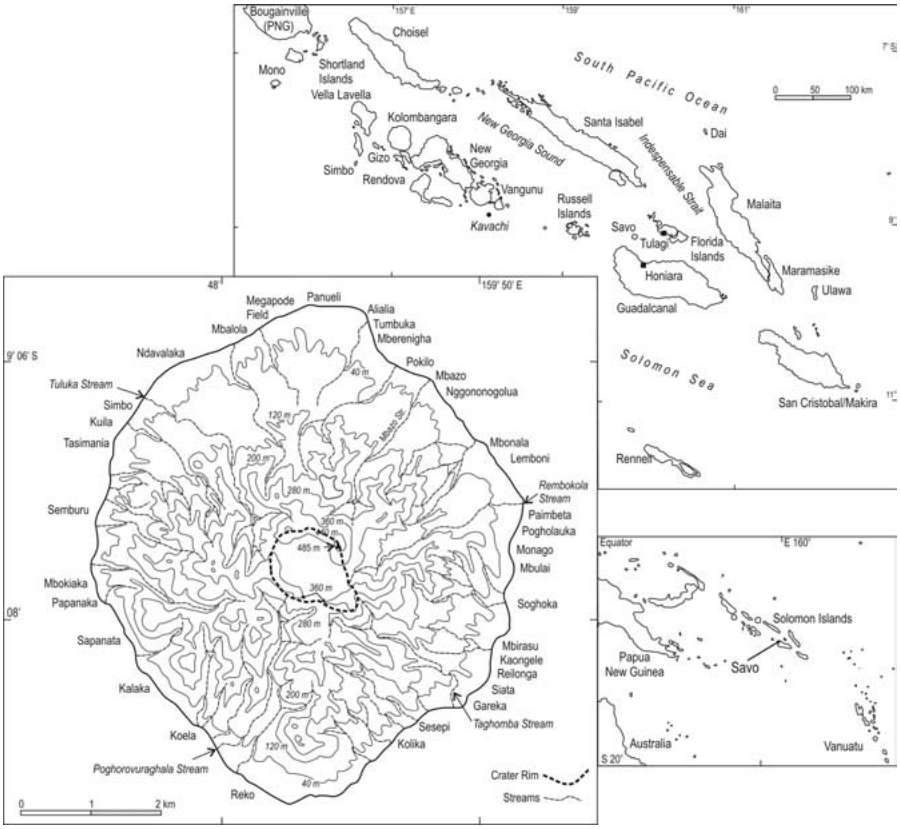

Figure 1. Map of the topography and major villages/settlements around Savo Island (lower left frame) within the Solomon Islands (upper right frame). Position of Solomon Islands in the SW Pacific Ocean shown in lower right frame.

management on Savo and on the resulting lessons learnt from the application of PRA methods in the risk management arena.

2. Savo Geological Background and Scientific Perceptions of Volcanic Hazard

Savo is a slightly elliptical 6 km-diameter island, rising to 485 m and located 35 km northwest of the Solomon Islands capital, Honiara (Figure 1). The island is the surface expression of a volcano with a total height of c. 1500 m and a 9 km basal diameter, part of the present island-arc volcanic chain relating to subduction of the Australian Plate along the New-Britain-San Cristobal Trench system (Crook and Taylor, 1994).

A crater (1.5 by 1 km diameter) dominates the central summit area of Savo, with major drainage valleys radiating from it. The drainage valleys initially form narrow deep channels in the hilly interior and feed out onto broad fans of unconsolidated

volcanic and fluvial deposits. These fans, which form the main areas of flat land on the island, consist of breccia-like volcaniclastic deposits emplaced during small pyroclastic flows (hot, very rapid, dense, ground hugging clouds of gas and rock particles) and lahars (warm or cold, rapidly flowing mixtures of water and rock debris) during Savo eruptions of the last c. 500 years (Petterson et al., 2003). In the south-southwest sector of the island, older hills cored by volcanic domes form a more irregular landscape, disrupting the radial stream pattern in this area.

Hydrothermal areas containing small geysers, hot springs and fumaroles are concentrated in the central crater area and southwestern sectors of the island. Apart from these areas, the remainder of the island is cloaked in dense rainforest vegetation and near the coast local food crops and coconut plantations.

Mendaña, the first European to visit the Solomon Islands, witnessed eruptions of Savo in 1568 (Amherst and Thomson, 1901). Later, Guppy (1887) and Grover (1958) recorded local oral accounts of eruptions in 1840s–1850s. Geologic investigations suggest that in addition to these two events, another eruption occurred sometime between 1630 and 1670 (Petterson et al., 2003). From a combination of oral history and geological data (Petterson et al., 2003) typical eruption processes were as follows:

1. An awakening phase, during which steam explosions occurred from hydrothermal areas near the crater along with the generation of landslides and volcanic mud flows (lahars) from collapse of hydrothermally altered, weak rocks of the central island area.
2. Main eruptive phases, of which there were several, include growth and explosions from lava domes in or near the crater. Large explosions generated from the crater area produced volcanic ash and steam columns that rose vertically, before collapsing to form pyroclastic flows down the volcano flanks. These phases were accompanied by ash fall on neighbouring islands (especially Guadalcanal) and lahars in the main drainage paths.
3. Intervals between and following the main eruptive phases involved periods of quiet along with production of lesser steam explosions and lava dome growth, along with rainfall and eruption induced lahars.

Reports of both the c. 1568 and 1840s–1850s eruptive periods indicate that activity occurred over several years, although the main events during the 1840–1850s were relatively brief (1–2 days at most).

Based on initial surveys of the geologic history and assumptions of continuity, Petterson et al. (1997) prepared a preliminary geologic hazard map, outlining areas at relative degrees of volcanic risk (Figure 2). The main features of this map include the principal drainage channels and their related fans as the sites of greatest hazard, primarily from pyroclastic flows and lahars. *These very same areas support the most productive soils and agriculture, the gentlest island terrain and the highest population densities.*

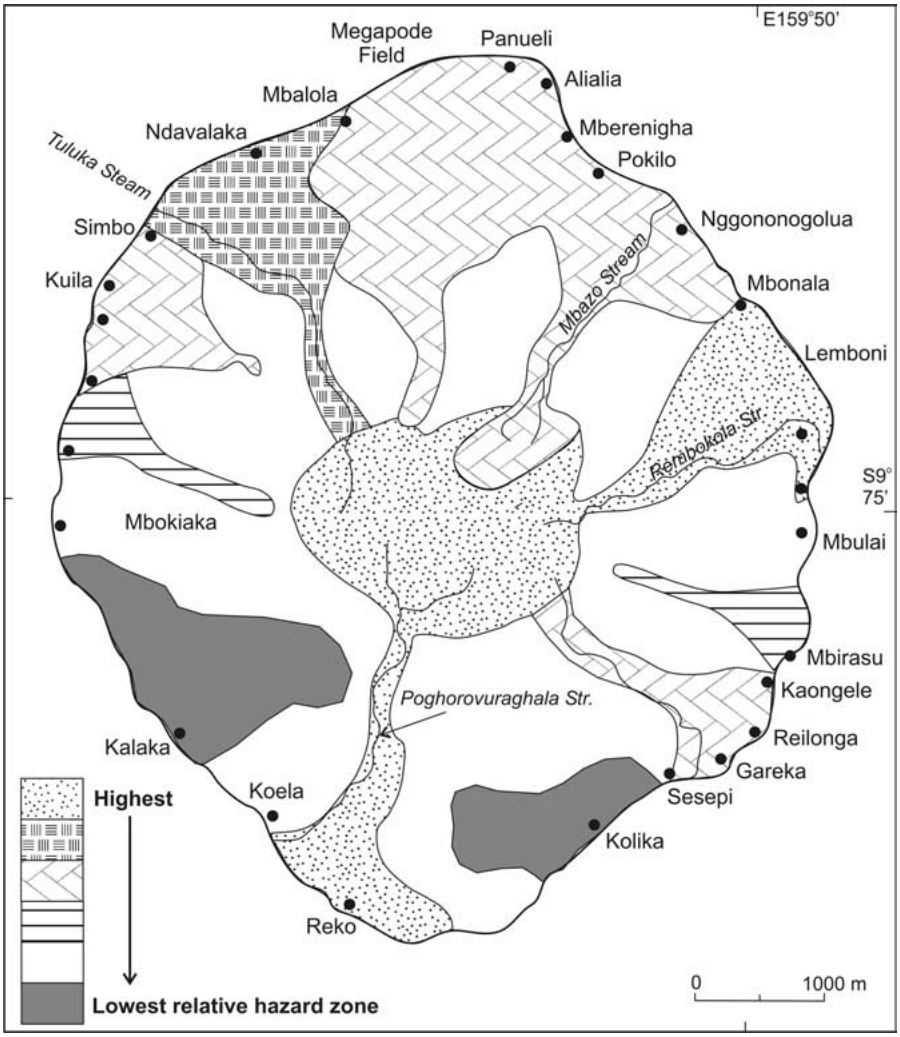

Figure 2. Preliminary scientific assessment of relative levels of volcanic hazard on Savo based on geologic mapping information.

3. Population, Administration and Social Factors

Savo Island is home to c. 2549 people (1999 Census, Census Office, Honiara), broken down to 1146 in the northern half of the island (61% female) and 1403 in the south (50% female); the lack of men in the north is due to their migration to urban centres for employment (RDD, 2001). Based on province-wide data from Central Province, age distributions are as follows: 1–14, 41.3%; 15–34, 35.2%; 35–65, 19.7%; 65+, 3.9%; with an overall growth rate of 2.0%. Population density on Savo is relatively high for the Solomon Islands, and people live within ca. 50 villages and settlements, all along the coast (Figure 1). Population and food and income

generating activities are hence concentrated on the fans of young volcaniclastic deposits, or areas of highest scientifically perceived hazard.

Savo is administered as part of Central Province, from headquarters in Tulagi (Florida Islands), with a substation on Savo in Mbonala (Figure 1). Two members of the currently 9-member provincial assembly are elected from Savo. Delivery of provincial services is hindered by logistic (communications, transport) and finance issues (RDD, 2001), along with internal political rivalries.

The Melanesian population of Savo retains traditional dance, song and story telling, along with traditional healing, sorcery, totems and taboos (RDD, 2001). The culture involves respect for "Bigmen" (men who through inheritance, deeds, strength, wealth or intelligence gain prominence) and these Bigmen or chiefs play an important role in settling disputes, maintaining relations within tribes, overseeing justice and enforcing cultural traditional practices. The democratically based chief administrative system involves a hierarchy of chief status, including paramount chiefs that consult with landowner chiefs. This system runs in parallel to the democratically elected state political system. While the chief system is entirely male dominated, females can become public servants, members of parliament and ministers. In addition to Bigmen, elders are also highly regarded within communities, while children and youth are obliged to remain quiet when elders or Bigmen speak. The language of Savosavo is only spoken by those on Savo, but Savo people can usually also speak the language of the Florida Islands and use pidgin to communicate to those from elsewhere. In traditional society, women have little chance for voice in public debates or decisions; youth are also marginalised in decision-making processes.

Alongside traditional beliefs, the dominant religion is Christianity, with the Church of Melanesia typically playing a strong role in conflict resolution as well as promoting the role of women in decision-making processes through recent church activities. A recent boom in various religious factions in the Solomon Islands has led to complex inter-faction relationships. Strategies need to be developed to engage these stakeholders in a positive manner.

Education on Savo and Central Province is hindered by a lack of trained teachers, an increasing school-age population and a high dropout rate (RDD, 2001). Central Province has the lowest literacy rate of the Solomon Islands (c. 52%, measured as those who have attended at least 4 years of school). Overall c. 59% of males and 56.5% of females attend school. Educational services have been very badly affected by recent ethnic tensions and at present only a vestige of the nationwide educational structure is operational.

The main health issues on Savo include respiratory infections, malaria, and diarrhoea, resulting from poor water supplies, sanitation facilities and health infrastructure. Savo has two Health Aid Posts and one Rural Health centre, with four health staff providing basic services and referrals. Water supplies are generally gravity-fed, rain-tank, or wells with or without pumps.

The main economic activities on Savo include the collection and sale of megapod eggs (a megapod is a large turkey-like bird that incubates its eggs in warm tropical and volcanic sands in north Savo), coconut plantations, fishing and slash-and-burn agriculture to exploit the fertile volcanic soils for subsistence. Coconuts are generally near the coast, while inland plantations include sweet potato, cassava, taro, yam, banana and occasionally rice. Other food sources include pigs and chickens, along with marine products. Land is held almost exclusively in customary ownership, passed down in a matrilineal system. Land ownership can include offshore regions such as reefs, lagoons and fishing grounds. Since most of this land is not documented, land disputes are common.

A tractor road was built around the island, but due to coastal and stream erosion it is passable now only in areas of south Savo. There are no regular boat services, with local outboard motor canoes being the main method of transport off island. The only communication facility on the island (when operating) is a radio-telephone located at Panueli (Figure 1).

4. Workshop Objectives

The stated objectives of the hazard workshop conducted were developed in conjunction with the Natural Disaster Management Office (NDMO) of Solomon Islands, and the Member of Parliament for Savo, the Hon. Sir Alan Kamekeza (the Prime Minister of the Solomon Islands as at September 2003). These were later added to and amended by the workshop participants to create the following objectives:

1. To raise awareness and understanding of volcanic hazards and their impacts on Savo volcano and development in the region at a management and service-provider level.
2. To develop approaches for reducing the vulnerability of the population and its livelihood, including designing elements of an island-level operational support plan, monitoring and early warning system, and community education/awareness program.
3. To demystify and explain the derivation of geologic hazard assessments and demonstrate the methods by which scientific volcanic hazard maps are prepared.
4. To trial and demonstrate participatory approaches for community awareness and planning for volcanic hazards.
5. To examine issues and local perceptions of possible short or long-term resettlement of Savo Islanders in the event of renewed activity.

The last of these objectives was highly politically charged, since disputes regarding resettlement of people on Guadalcanal (particularly from Malaita) are one of the main causes of the violent civil unrest and collapse of government and law and order in the Solomon Islands (Ware, 2001; Turnbull, 2002).

5. Participants

The main part of the workshop focussed on a core group of 34 participants, who later themselves became facilitators to community workshops on Savo involving several hundred other people. The core group comprised:

- Six Savo Bigmen, Paramount Chiefs or Chiefs,
- The two Savo members of the Central Province Assembly
- Two further Savo-based observers (including a teacher)
- Three planners and administrators from the Central Province headquarters at Tulagi.
- Four planning officers from national government departments.
- Two emergency services officers (police and marine rescue).
- Two NDMO officers
- One health/water quality officer.
- One Solomon Islands Red Cross Society representative.
- One Church of Melanesia representative.
- Ten Solomon Islands geology/seismology officers.

Ideally we had hoped for representatives from Women's Affairs and Health Ministries, along with further representation of other NGO groups operating in the Solomon Islands. However the composition of the focus group was decided upon by the NDMO based on availability of government staff and Savo representatives were nominated by the MP for Savo. No women were included in the focus workshop group.

6. Strategy and Methods

6.1. OVERALL STRATEGY

The overall workshop organization was constantly adapted to face short-term changes in resource availability, transport and priorities emerging from the workshop on a daily and even hourly basis. The strategy involved the following elements:

1. An initial intensive three days of exercise and briefing sessions with the core group in Honiara. This was to enable the Savo-based (community representatives) and Honiara-based (government and NGO representatives) participants to come together to an understanding of the hazard issues and in partnership to design appropriate hazard management steps required for mitigation. The Honiara environment favoured the government participants to allow them to explain the limitations of the government to solve the issue.
2. A following three days living on Savo Island, carrying out further exercise activities with both the core group and local community groups. In this part of the workshop the environment favoured the Savo-based part of the core group, allowing them to explain the relevant local issues and constraints to mitigation measures. This also allowed the Honiara-based participants to see

the volcano and the island first hand. Two main themes were pursued on Savo, familiarisation with geologic/scientific views and introduction to approaches in community participation.

One of the issues we could not overcome was the lack of female representation in our Honiara focus group, due primarily to a strong cultural tendency for males to be involved in decision-making and administration. On the third day of the workshop a female Community Education Officer (A. Planitz) joined the outside facilitation team, which was otherwise also male-dominated. The Savo portion of the workshop was the only chance to involve women and the value of their involvement we aimed to demonstrate to the focus group via gender-split exercises during village visits.

6.2. METHODS EMPLOYED

Due to the large differences in education levels, roles, political agendas and status/power within the workshop focus group, Participatory Rural Appraisal (PRA) methods (Chambers, 1992; 1994a, b, c; 1997) were considered to be the best 'leveller', that is to enable all participants to have a say. These techniques, now also know as Participatory Learning and Action (Chambers, 2002) are based in activist social development practices, particularly in areas of agricultural education in Africa and Southeast Asia. One of a range of participatory approaches (Rietbergen-McCracken and Narayan, 1998) PRA concentrates on ways in which marginalised groups can be given a say, and how dominance or power structures can be reversed, at least during PRA activities. Despite recent criticisms of their theoretical background (Kapoor, 2002), we considered these methods a good starting point.

The main principles of PRA-style approaches focus on modifying the attitudes, behaviours and mindsets of development practitioners (Chambers, 1994a; Wetmore and Theron, 1998; Bar-On and Prinsen, 1999) and include:

- 'Handing over the stick' or, listening instead of lecturing, encouraging development practitioners to learn from local people rather than the other way around. This involves using local language.
- 'Relaxing, not rushing', to offset first-impression biases and to seek out the voice of poor people and women.
- 'Optimising tradeoffs', by settling for an optimal quantity or quality of relevant information in relation to the costs of obtaining more.
- 'Triangulation or verification' of information using a range of methods.
- 'Seeking diversity' or variations in opinion, rather than looking for averages.
- 'Facilitation' of activities and letting local people run them alone.
- 'Self criticism' to recognise and correct error or dominating behaviour.
- 'Flexibility' to continuously modify goals as participants better realise their needs.
- 'Focus on strengths' and how these can be further built on rather than dwelling on weaknesses.

– 'Visualisation' and moving from verbal to visual, written to diagrammatic modes of communication to enable a common understanding and input from all. Also using language in an appropriate way to "paint a picture" in a similar way to the traditional storytelling culture.
– Other 'emphasis shifts' from individual to group, from measuring to comparing and from extracting information to empowering local analysts.

The classic orientation of PRA is to place value on local knowledge as opposed to western knowledge (Chambers, 1994b), but sometimes this may result in neglect or disparagement of non-local knowledge (Kapoor, 2002), and a loss of opportunity for education (van Kotze, 1998). Since, in addition to local perspectives, we considered scientific knowledge relating to Savo as well as volcanic risk management experiences gained in other countries to be valuable, we tried to tread the path between pure PRA mouth-closed 'facilitation' and education. The least we tried was to convey an understanding of how geologists derive hazard assessments for Savo. Local knowledge and scientific input were separated in any one exercise or activity, to avoid cases of interjection and confrontations of opinions between scientific and local world views.

Of the huge range of PRA approaches and methods available we selected those that were successful from personal experiences in similar community or government workshops in Fiji (Cronin and Kaloumaira, 2000) and Samoa (Cronin et al., 2000).

A. Activities based in Honiara *(English/pidgin sessions)*

1. Story telling – oral traditions/legends (kastom stories) are the main historical records in the non-written Melanesian culture (Bascom, 1965).
2. Mapping - resources/vulnerable elements, infrastructure development plans, perceptions of hazards.
3. Listing – vulnerable elements, hazard agencies, risk management strategies.
4. Ranking – hazard agencies, vulnerabilities, risk management strategies.
5. Action plans/statements, local (Savo) and national perspectives.
6. Structured group interviews.
7. Socialising – breaking down barriers and encouraging maximum participation.

An additional participatory activity, stemming from the hazard-management arena, was that of desk-top emergency scenario exercises.

Activity workgroups of 6–8 members were constantly changed, to allow common groups (e.g. Savo-based, planners, geologists, administrators/emergency services) to work together sometimes as entities, and at other times within mixed-background teams. Group organization was left up to its members, with the usual situation being that one member took control of chairing the group discussion, another of recording/drawing, and a third presenting the results/diagrams/lists/rankings to a reassembled plenary session. The presentations of results stimulated much discussion from other groups, with any particular group representative being supported by his group during debates arising.

Education-oriented multimedia activities, where local geologists presented results of their studies carried out on Savo, were interspersed with the PRA-style exercises. Presentations on volcanic hazard types and impacts utilised slides, discussions and the UNESCO videos "Understanding volcanic hazards" and "Assessing volcanic risk", plus British Geological Survey video footage of eruptions from Montserrat volcano (a similar style of volcano to Savo) with explanations given in Pidgin.

B. Activities based on Savo (Pidgin/English for the core-group sessions and Pidgin and Savosavo for the villages) included:

1. Transect walks and diagramming, coast (village) to crater-rim. This was carried out in the usual PRA sense with an additional focus on geological observations made along each transect and how these could be used to infer relative degrees of volcanic hazard. This was also used to elicit local kastom knowledge and stories for specific geographical areas.
2. Turning participants into exercise facilitators in village visits.
3. Village story telling.
4. Village mapping, resources/vulnerable elements, hazard perceptions, refuge area perceptions.
5. Thematic village discussion groups: refuge areas, responses in past disasters, resettlement issues, traditional monitoring and volcano observation, internal decision making structures, outside assistance issues.
6. Summary discussion groups (with core participants), action plans and priorities.

The first day on Savo was devoted to the transect exercise, and involved only the core workshop group and interested dwellers of the Reko village area (south Savo, Figure 1). The core group were then split into three subgroups, which travelled to different parts of the island (Reko, Kaongele, and Ndavalaka; Figure 1), each led by the Bigmen/chief core group members.

Since the village activities on Savo were the only occasion during which women and youth groups could be involved in the process, specific women's, elders and men's groups were set up at each of the three target areas.

7. Results

7.1. HONIARA

Story telling sessions from the Savo-based contingent and the presentation of research on local legends by a geologist from Savo, provided both an idea of the types of hazards and impacts experienced in past Savo eruptions and also practical insights into eruption precursors:

– infilling of the crater with water;
– earthquakes and tremors, increasing in frequency until the volcano came to life;

– landslides in and around the crater area;
– vegetation die-off around the crater.

Such precursory events, held in cultural memory can be used to form the basis of local low-cost monitoring methods. According to legends, the areas where people took refuge during the eruptions were Mbulai, Reko (probably Koela) and Panueli.

Resource element mapping, listing, and ranking of hazard susceptibility, vulnerability and value were carried out without difficulty by Savo-based (Table I) and non-Savo-based groups (Table II). Interestingly, the sophistication of the analysis was much higher for the Savo-based group, rather than the better-educated professional-dominated non-Savo groups. The latter group were surprised and concerned to conclude that Honiara, by far the largest population and economic centre of the nation, could be cut-off from air and sea transport through prolonged activity at Savo.

Further exercises concluded in listing the highest priority strategies to mitigate volcanic risks on and off Savo (Table III). The Savo group strategies emphasised local initiatives that would enable emergencies to be dealt with (and controlled) at a local level in the first instance, whereas the outsider groups considered more top-down regulatory style strategies. High priorities expressed by the Savo group included both requests for external resources, particularly outboard motor-powered canoes on the island and also for actions like points 2 and 3 in Table III, which involved little or no external resources. For all actions, including education and awareness programs, the Savo group requested on-island control and implementation, with back-up professional and educational support from Honiara.

In addition to the traditional monitoring methods as described above, a Solomon Island Seismology officer described how the volcano could be monitored by seismographs to provide early warning. He described how a past attempt at this had been thwarted by vandalism, landowner issues and technical problems. Group discussion session (mixed participants) results were combined to generate an action plan for an appropriate monitoring system on the island (Table IV). The main features of this plan were low cost, low technology and high local involvement, all factors thought to improve chances of successful implementation.

Further group listing exercises were used to develop an action plan for public awareness activities. Again the consensus was that Savo-based structures and low-cost methods should be used, with the formation of a Savo Disaster Committee to coordinate information delivery through church groups, schools and chiefs/bigmen. However, to start and maintain this, government or other funding was requested, along with assistance in developing materials by the NDMO and geology/seismology. A program of sustaining capability and physical resources was also considered essential.

Emergency management planning was discussed in three ways. Firstly, through the recounting of responses to a local past volcanic eruption “scare” at Simbo Island (Figure 1), secondly, through outlines of overseas volcanic operation support or contingency plans, and thirdly, by presentation and discussion of the national

Table I. Vulnerability of resources on Savo Island to renewed volcanic activity as summarised from mapping, listing and ranking exercises of Savo-based representatives of the core workshop group

Element	Sub element	Location	Value[1]	Type of hazard[2]	Ease of repair[1]	Alternative	Protection of element
Population	Human life	All around island but mostly along coastal	H	Pf, Ts, Fall + gas	L	–	Evacuate
	Houses	Plains and stream	H	Pf, Fall	L	None	None
	Villages	Flood plains	H	Pf, Fall	L	None	None
Medical	Clinic	Panueli	H	Pf, Ts, Fall	L	Aid posts	Relocate
	First aid post	Koela, Kaongele, Spanata	H	Pf, Ts, Fall	M	Other posts	Relocate
Water	Wells	All villages	H	Pf, Fall	M	Tanks	Relocate
	Streams	3 sites	H	Pf, Fall	L	Tanks	None
	Piped water	6 districts	H	Pf	M	Tanks	None
	Water Tank	All villages	H	Pf, Fall	M		Cover/seal
Transport	Canoe	All villages	H	Ts, Pf	M	–	None
	Old road	Surrounding island	H	Ts, Pf	M		None
Communication	HF Radio	3 sites	H	Fall	–	Telephones	Relocate
	Telekom	Not yet in service	H	Pf, blasts	–	HF Radios	–
Education	CHS	Paimbeta	H	Pf, Ts, Fall	L	None	Relocate
	P. School	Kalaka, Ndavalaka, Pokilo, Monago, Koela, Panueli	H	Pf, Ts, Fall	L	None	Relocate
Investments	Shops	All districts	M	Pf, Ts, Fall	M	None	Relocate
	Copra buying point	Lemboni	H	Pf, Ts, Fall	L	None	Relocate
	T/Resort	Ndavalaka	M	Pf, Ts, Fall	L	None	Relocate
Churches	Anglican blds	5 Districts	H	Pf, Ts, Fall	L	None	Relocate
	Catholic blds	6 Districts	H	Pf, Ts, Fall	L	None	Relocate
	SDA blds	?	H	Pf, Ts, Fall	L	None	Relocate
	SSEC blds	Mbazo	H	Pf, Ts, Fall	L	None	Relocate
	COC	?	H	Pf, Ts, Fall	L	None	Relocate
Cultural sites	Tambu sites	Selected sites	H	Pf, Ts, Fall	L	Irreparable	None
	Graves	Selected sites	H	Pf, Ts, Fall	L	Irreparable	None
Other elements	Megapode field	Nth Savo	H	Pf, Ts, Fall, gas	L	None	Relocate?
	Marine life	Nearshore	M	Pf	?	–	–
Agriculture	Subsistence gardens	All over island, in many high areas as well, plus poultry and piggeries	H	Pf, Ts, Fall, gas	M	Other locations	Replant
	Coconut plantations	Lemboni (Mbonala), plus smaller ones, other subsistence resources	H	Pf, Ts, Fall, gas	M	Other locations	Replant
	Soil resource	Over all island	H	Pf, Fall	M?	Other locations	Rehabilitate, remove ash
Planned developments	High school	Paimbeta	H	Pf, Ts, Fall	L	Other locations	Relocate?
	Telekom comms. tower	Island Summit	H	Pf, blasts	–	HF radios	–
	Copra buying point	?	M	Pf, Ts, Fall	L	–	–
	Wharf construction	Mbonala?	H	Pf, Ts, Fall	L	Other locations	Relocate?

[1] H = high; M = medium; L = low; ? = not sure.

[2] Volcanic hazard processes denominated as Pf = pyroclastic flows and lahars; Ts = tsunami; Fall = volcanic ash falls; gas = volcanic gases; blasts = near vent volcanic explosions.

Table II. Vulnerability of resources in the area surrounding Savo to renewed volcanic activity as summarised from mapping, listing and ranking exercises of the core workshop group

Resources/vulnerable elements	Hazard types	Areas at risk and specific issues
1. *Essential public infrastructures* Roads, schools, hospital (along the Honiara Coast), Point Cruz wharf (tsunami), Henderson Airport, business district in Honiara 2. *Population* Honiara, West Guadalcanal, Russell Islands, Florida Islands, Santa Isabel. 3. *Agricultural developments* Fertile land – Guadalcanal, NW part, prawn farm, plantation, coconut, cocoa Russell, fisheries, palm oil, coconut, cocoa Santa Isabel – small scale farming, Nickel mining (under development) Florida Islands – plantations 4. *Tourism* Tambea Resort (Guadalcanal), Florida Islands resorts, Vulelua Resort (Guadalcanal) 5. *Communications* Telephone, radio-phone, VHF radio 6. *Natural resources* Forestry, Fisheries	1. Tsunamis 2. Ashfalls 3. Floating debris	West Guadalcanal Honiara Isolation of Honiara including communications, international/domestic airport and sea port and economy. Closest alternative airport, Munda, New Georgia, Western Province. Closest alternative port at Noro, Western Province. These alternative facilities are not maintained to cope with higher usage and are far away from the economic centre of Honiara. Hence they should be upgraded and alternative sites closer to Honiara be located and developed. Russell Islands Florida Islands Santa Isabel Western Province

Table III. Risk mitigation priorities concluded through work-group exercises

Savo-group strategies	Surrounding area strategies
1. Having an evacuation plan in place for Savo. This could involve having canoes on the island ready for evacuation, or an organised Honiara response using patrol boats and other craft. Evacuation plans should include contingencies for staying on the island because under some conditions going onto the sea may be more dangerous 2. Develop community support plans to ensure safety of all members 3. Public awareness and education, including a knowledge of the hazards and what to do before and during an eruption 4. Since most of the vulnerable elements are located along the coast, protection measures could include building sea walls, or mangrove plantings along the coast 5. Move valuable infrastructure elements and villages inland, and to safer areas away from the main valleys 6. Install alternative communications, HF radio, VHF radio, telephone	1. Land use planning – including the development of appropriate government policies and legislation 2. Research and monitoring – other volcanoes as well as Savo 3. Standard building, infrastructure specifications – houses, public buildings, and commercial buildings, to build resistance against ash falls and earthquakes 4. Develop a National Evacuation Plan – to ensure procedures are in place to evacuate, temporarily accommodate and repatriate people from hazardous areas 5. Develop long-term plans and policies for implementing and maintaining appropriate training and plans for local and provincial authorities. This will enable one sector of the country to help another should there be a volcanic or other disaster. 6. Once plans are developed, test and practice them with drill exercises locally or regionally 7. Develop alternative airport and port facilities that are closer to Honiara

disaster management structure and national disaster plan. The Simbo example outlined the main challenges facing local emergency management being issues of problem-ownership, control, communication and trust between village, provincial and national agencies.

In an effort to develop the rudiments of a volcanic emergency plan for Savo, a table-top eruption scenario was run with three work-groups. Each group comprised representation from Savo, Province, NGO and government participants. Each group was faced with a simplistic scenario involving four stages of threat: 1. initial signs of activity, 2. confirmed threat or forecast of eruption, 3. minor eruptions – local effects, 4. climactic eruptions, island-wide impacts. The duration of each of these phases, as well as the time before the onset of 1., was varied for each group to examine issues of ordering and prioritising of tasks. Each of the three groups derived a different set of emergency management steps in the context of the local environment. Through group presentations, consensus could be achieved for ordering and prioritising of actions during an 'ideal' eruption (Table V).

Table IV. Savo volcano monitoring action plan derived through work-group exercises

Priority/staged Implementation	Activities required	How it should be carried out	By whom
1. *Low technology/cost*	• Vegetation mapping • Fumarole mapping • Hot spring temperatures • Geochemical monitoring	• Appointment of "official" local observers (honorarium or payment required) • Much hands-on training by geology/seismology staff • Public awareness campaign to support activities • Geochemical monitoring through government technical officer visits (2-3 month intervals)	Managed by a Savo Disaster Committee (to be formed) Local observers Government technical officers
2. *Observation or Extension officer stationed on Savo*	• Coordinate island wide monitoring activities • Collate and report on results • Implement public awareness activities	• Secondment of a Honiara-based technical officer or, • Nomination (by Savo Disaster Committee) and training of a local person (to be paid by government sources)	A government technical officer, preferably of Savo lineage
3. *Seismic network installation*	• Obtaining equipment • Installation, maintenance, analysis and reporting from a 3-station (vertical component) seismic network (or at least on unit) • Public awareness activities	• Equipment request through bilateral or other donor aid • Equipment siting and planning with Savo Disaster Committee • Patience and deliberation before beginning with system setup • Installation, maintenance, analysis and training by local Solomon Geologists • Security and low-level maintenance by local observers (honorarium required) • Appointment of an extension officer or "middle man" between Savo Disaster Committee and government • Public awareness activities by Savo Disaster Committee, Geology/seismology and NDMO	Managed by a Savo Disaster Committee and the Department of Geology/seismology Government technical officers Local observers Donors and outside experts NDMO

Table V. Summary of some of the tasks and responsibilities required in emergency response to an eruption on Savo, combined from the results of three workgroups with different eruption scenario exercises

Eruption Status	Tasks	Organisational Structure[1]	For whom	Responsible agencies
0	Educational awareness	NDC (initiating)	Schools	Geology/Seismology
(pre-eruption,	– Media	PDC	Communities	NDMO
no activity)	– Drills	Area Admin Officer	– Savo	Media
	– Community awareness	Island Committee	– nearby islands	Education Dept.
		Churches, Schools		Savo Disaster Committee
	including videos, evacuation plans and maps	Community		Extension Officers
				Chiefs, church leaders, school teachers
	Form a Savo Disaster Committee		Savo communities	Chiefs, church leaders, school teachers
	Hazard Mapping			Geology/Seismology
	Collect scientific data			
	Operational plan preparation			NDC, NDMO, PDC,
	Identify and task authorities with aspects of the plan			Geology/Seismology
				Other authorities
	Monitoring	Geology (initiating)	Geology	Geology/Seismology
	Install monitoring equipment	Local observers	Scientific experts	Savo Residents

Table V. Continued

Eruption Status	Tasks	Organisational Structure[1]	For whom	Responsible agencies
	Local monitoring – Fumarole temperatures – Changes to vegetation – Cracks in ground – Establish monitoring procedures and system		NDMO Communities	
	Establish village signals for evacuation (drum signal?)	Savo Disaster Committee	Savo communities	Savo Disaster Committee
1 (possible initial signs of activity)	Increase awareness activities Evacuation drill	Chiefs/community leaders to the community	Communities	NDC, NDMO, PDC, Savo Disaster Committee, Chiefs, Police
	Enhanced monitoring	Geology, Expert scientists, local observers		Seismology Experts Local observers
	Establish technician post on Savo	Geology division		Geology Division
	Obtain overseas science advice/assistance if needed	Geology division		Geology Division
	Install communications on island, radio, HF and VHF, Sirens	NDC, Police		NDC, Police, PDC, Savo Disaster Committee
2 (definite threat of activity)	Awareness reinforcement	Chiefs (personally) to the community	Community geology	Chiefs Individuals

Table V. Continued

Eruption Status	Tasks	Organisational Structure[1]	For whom	Responsible agencies
	Monitoring intensification	Geology/seismology		NDC, Geology/Seismology
	Dispatch an expert to Savo			Volcanologist
	Inform all ministries and media	NDC		NDC
	Standby all transport required for a possible evacuation	NDC		NDC, PDC, Police, Marine Department
3 (Small eruptions begin)	Immediate evacuation operation Stages: A. Most dangerous zones B. Rest of island? Secure evacuated areas Coordinate evacuation Arrange humanitarian assistance Investigate property protection or removal	Local state of emergency (minister), NDC, Savo Disaster Committee, community	Community	NDC, Savo Disaster Committee, emergency response unit Police Marine Department Donors Red Cross
	Monitoring (from a safe area)	Geology/seismology		Seismology Volcanologist
4 (large eruption in progress)	Evacuate all remaining on Savo	NDC, PDC, Savo Disaster Committee		NDC, PDC, Savo Disaster Committee and others
	Monitoring (from a safe area)	NDC, Geology		NDC, Geology

[1] Abbreviations include: NDC = National Disaster Council; PDC = Province Disaster Council; NDMO = National Disaster Management Office.

The main conflict issues arising during the emergency management sessions were those of responsibility and control. There was a three-way power struggle for potential operations control for Savo emergencies, the Savo participants wanted local control (through the formation of a Savo Disaster Committee comprising local chiefs/bigmen) for as long as possible, the Central Province participants wanted to exert overall control, and national participants felt that since the Province administration was distant from Savo and not as well resourced, the National Disaster Council (NDC) or a Central Control Group of the NDC should assume immediate control, bypassing the Province Disaster Council (PDC). The compromise reached after a discussion was that control should progress from SDC through PDC and onto NDC as the situation became beyond the capacity of each group to manage. It was clear, however, that this compromise was superficial and that despite the existence of a national disaster management plan, formal organisational structures are not in place to guide how such emergency management issues are faced. It was also clear that whatever final solution was agreed, a large amount of local participation was a mission-critical element.

The issue of where evacuees from Savo might travel to (off-island) was not mentioned, despite this being an issue of great concern for the Savo delegation (as voiced outside of activities or open sessions). Due to the prevailing violence and tension in Honiara/Guadalcanal, this historic refuge of Savo people was not considered a good option at the present time.

7.2. SAVO

7.2.1. *Transect Exercise*

The core participants were transported by boat from Ndavalaka to Reko and along with interested dwellers of Reko village, led up the Poghorovuraghala valley (Figure 1) by the Solomon's geology/seismology officers. This valley is typical of the higher risk parts of the island, having been a pathway for pyroclastic flows in the last three eruptions, and additionally for lahars in 1953 and 1998 (Petterson et al., 2003). Throughout the day participants were asked to point out features along the route (e.g., culturally sacred *tambu* sites, wood, food crops, fruit trees, betel nut, hunting areas, medicinal plants, water sources, hot springs, landslide/unstable areas, megapode burrows). Geological deposits were also described and explained on the way up the valley, including demonstrations of how hot spring water temperatures could be measured and other signs of hydrothermal activity that could be locally monitored. The late afternoon and evening was spent in group exercises that involved drawing up and discussing transect diagrams of the day's observations.

The most important realisation from this exercise was that although the upper Poghorovuraghala valley was narrow and deep (presumably able to constrain pyroclastic flows, lahars or floods), it became shallower and broader nearer the coast, where large flat areas surrounded the channel. The transect groups all recognised this feature, along with the fact that most of the population, food crops, water wells

and livestock were on these flat areas near to the stream channel. In addition, from the boat it was noticed that some areas away from the stream channels had large steep hills (old volcanic domes) that protected them from the crater, e.g., Koela and Kalaka, and seemed like good refuge areas. Through these exercises a basic mapping and ranking scheme of relative volcanic risk on the island was developed, with main valleys and coastal plains being highest risk, mid-slope areas medium, and the coastal areas protected by hills, lowest. This map had the strong advantage of wide stakeholder understanding and ownership.

7.2.2. *Village Exercises*

Three teams each spent a day within villages at Ndavalaka (where the whole group was based), Reko (where the transect activity began) and Kaongele (east Savo, Figure 1). At each village, the village and neighbouring areas had been pre-warned of the meetings and very large groups had assembled (95, 150 and 250 people, representing ca. 20% of the resident population of Savo). Following welcoming addresses (including a short address from the non-Solomon facilitators), exercises (as described above) were carried out in several localities around the villages, facilitation was carried out by core workshop group members, following briefings in the morning. The core participants had already experienced many of these exercises, hence briefings (one-on-one or in small subgroups) concentrated on both the main exercise aims and tips on how to stand back and let the group take control.

Each village work group had around 10 members, although the membership of some groups was fluid, with a core of 6–10 active and a large group of supporters sitting in the vicinity, contributing verbally and moving in and out of the centre of activity. This latter type of group structure generally characterised women's groups, with those sitting in outer reaches often taking turns to look after small children. As in the Honiara sessions, each group was invited to present their findings to all assembled.

Traditional knowledge views were very specific in aspects of past volcanism, including phenomena preceding eruptions, what types of volcanic processes and impacts occurred, and how people survived (Table VI). Individual group presentations of related themes elicited further discussion from listeners and additions to listings. Most traditional knowledge was held by the elderly men in the community, who recalled what their grandparents had told them, although elderly women also knew many of the stories. Many lamented that this knowledge transfer is not a strong as it once was, with the younger generation being influenced by outside ideas.

Women considered that their roles during an emergency would be to prepare food and supplies for an evacuation and to look after children. Women generally identified that decisions were made by the chiefs/bigmen or their husbands/fathers and that they would have little influence in these. Some women stated that they were worried on behalf of their children and that they felt some information was kept from them if decisions were made only by the chiefs/bigmen.

Table VI. Summary of traditional knowledge and local perceptions from village discussion, listing and mapping exercises concerning different aspects of volcanic risk management

Location (area of other reps.)	Volcanism causes	Warning signs	Safe areas	Dangerous areas	What to do
Reko (Kolika-Kalaka)	Evil Forces The devil dancing	• The island gets smaller (coastal erosion of the flat fan areas), an eruption comes when the island is the size of 'old Savo', when the coastline is near the old hills. • Vegetation around the crater dies • Wells dry up • Continuous ground shaking, sea becomes rough	Mbonala/Kalak a between May–Nov and Rekola between Nov–April (depending on the prevailing wind directions)	Poghorovuraghala valley, from floods, like that in 1953 and 1998	• Father is responsible for family movement • Chief to inform all of safest area • Chief advise people when to move • Evacuate children and women first
Kaongele (Mbazo-Sesepi)		• Coastal erosion occurs between eruptions, happening at present at an alarming rate • Hydrothermal area changes, a new fumarole field has developed recently	Locations where large hills protected from the crater, such as Mbulai village area	Rembokola, Mbazo, Taghomba, and Kolika valleys, from *Gaulesua biti* (cold volcano, flows that you sink into = lahars), and *Garaparasua biti* (hot volcano, gases/flows that burn = pyroclastic flows)	
Ndavalaka (Papanaka-Tumbuka)		• Once the sea reaches the bottom of the hills near the coast (through coastal erosion) the next eruption occurs. • Changes in hot springs, noted that hot ground areas used to be confined to the crater, now there are more and more areas with such activity, including new steam areas beginning recently	From last eruption, Panueli (for north villages), Kuila (for south villages)	Submarine volcano (gases) offshore of Alialia, now moved to offshore of Megapode field Main stream valleys	An Anglican Bishop has placed his walking stick in the main crater to stop the volcano erupting again

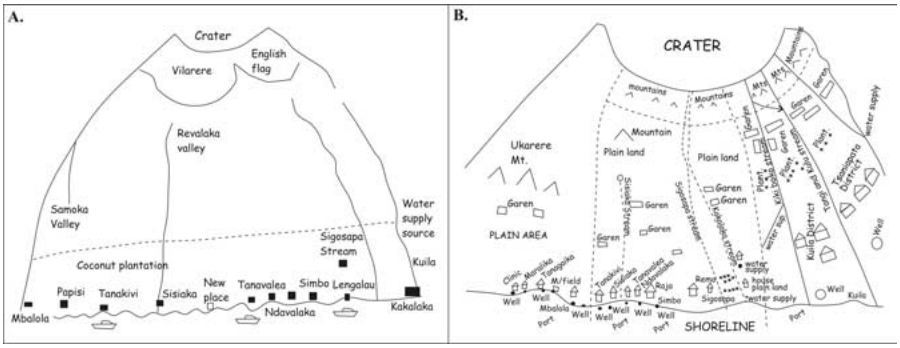

Figure 3. Tracings from photographed maps constructed during village exercises on Savo. A. Men's group map from Ndavalaka area (W-Savo), showing main villages, landings, and areas of hazard (marked streams, craters and areas above dotted horizontal line). B. Women's group map from Ndavalaka area (W. Savo), showing details of gardens and water supplies above villages, landing areas, landscape elements, and areas of hazard (marked stream valleys, and areas above dotted line on mountains).

Mapping exercises were used to verify traditional views and to reconcile them with the present day geography and demography. Maps were constructed following an order of: main geographic features, villages/dwellings, resources, dangerous areas, safe areas, and other important features. It was notable in all cases that women's maps contained a much greater level of detail concerning location of resources, including wood, water and food sources. Women clearly showed a more detailed knowledge of inland areas, whereas the men's geographical knowledge was confined mostly to the coastal fringe (Figure 3). Women's and men's groups independently identified the same areas of high relative danger or hazard as well as safe refuge areas.

Following presentation of mapping results, a simplified version of the scientifically derived hazard map (Figure 2) was presented for the area and discussed. Within this forum a composite map was sketched that included elements from both sources. In almost every case, the two maps of relative hazard were very similar, with almost 100% agreement over the areas of lowest and highest hazard. In this way an overall compromise hazard map was constructed for Savo, concentrating particularly the highest areas of hazard and the 'safest areas' with lowest relative hazard (Figure 4.)

Discussion groups focussing on local preferences of potential temporary or long-term refuge areas in the event of strong future eruptions were all concerned about avoiding areas of ethnic tensions and unrest on Guadalcanal. All village groups suggested areas on Santa Isabel and the Russell Islands. Risk mitigation priorities from the village work group exercises (Table VII) focussed primarily on requests for outside assistance, although the Ndavalaka group were more enthusiastic about developing locally based initiatives.

Table VII. Summary of volcanic risk mitigation priorities derived from village work group discussions

Reko group	Kaonggele group	Ndavalaka group
Internal • Encourage the revival of oral tradition transfer to the younger generation	*Internal*	*Internal* • Investigate legends surrounding the Toga'vitu eruption event and what it could mean for future volcanism • Formation of a Savo Disaster Committee to assist in coordination of awareness monitoring and emergency response to volcanism • Development of a local communication/signal system
External • Government to establish a volcano monitoring system • Government to plan for evacuation assistance and resettlement assistance	*External* • Government to plan for evacuation • Government to provide education materials and program for community volcanic hazard awareness • Government to establish a monitoring system	*External* • Government to organise land for resettlement in the event of major activity • Education department to introduce volcanic hazard information to school curricula • Government to establish a public awareness campaign, targeting safe areas, evacuation routes • Government to establish a special rescue team trained to help evacuation during an eruption • Government to supply every household with a pamphlet on volcanic hazards, what to do during an eruption and a map of safe and dangerous areas (in Pidgin and Savosavo) • Government to provide motor canoes for all villages to enable rapid evacuation

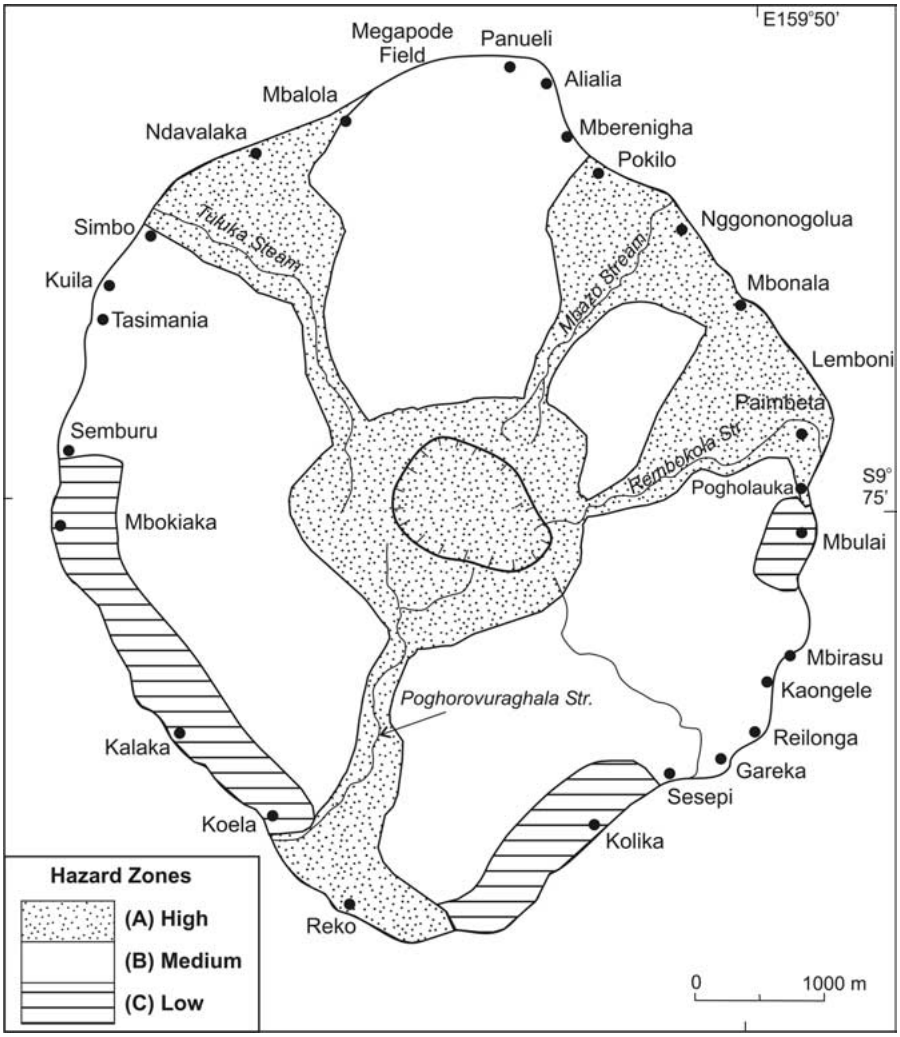

Figure 4. Summary volcanic hazards map for Savo derived through combination of scientific information, traditional views and current local community hazard perspectives expressed through village mapping exercises and discussions.

Wrap up discussion sessions with the core participants were used to determine an overall action plan combining ideas from the Honiara and Savo village-visit parts of the program, in addition to those arising from informal evening discussions between core participants and people on Savo.

8. Discussion

8.1. SAVO VOLCANIC RISK MITIGATION ISSUES

It is clear that volcanic risk mitigation for Savo presents a number of difficulties, common to many developing nations. This is particularly acute in the case of the Solomon Islands and other small island states who are amongst the least-developed and least urbanised of the world's nation states. Public radio is the only means of communicating messages rapidly from Honiara (or Tulagi) to Savo, and perhaps more importantly, there is no possibility at present for Savo people to call for outside help rapidly. Fortunately, historical and legend records from Savo's past eruptions indicate that a period of warning is expected before dangerous phases of activity begin. This warning period provides a chance for local organization plans to be put into place.

On-island institutions (such as a Savo Disaster Committee) are probably the most effective means of:

- Promoting Savo volcanic hazard concerns to province and national authorities.
- Providing a rapid contact point to disseminate information around the island.
- Coordinating local awareness activities that are not intrusive on culture or existing social organization structure.
- Coordinating locally based low-technology volcano observation.
- Facilitating permissions and security for monitoring equipment that may be deployed in the future.
- Promoting revival of traditional storytelling regarding past disaster management practices
- Coordinating local emergency management responses (Given the island size, members of a Savo Disaster Committee can rapidly meet and quickly spread messages around the island, by motor boat or runners).
- Promoting a high degree of local stakeholder ownership and participation across a range of hazard-mitigation related activities.

The Savo participants outlined their desire to control their own disaster management affairs and by the end of the workshop they had independently drafted their own action plan and list of recommendations to the government and province agencies. Within this plan, they stated that while their desire for self-coordination or control of risk management activities was strong, they required training and continued sustainable levels of support to take on this role with confidence.We agree strongly with these messages. A successful assistance related project develops truly sustainable local solutions for local problems. This can be achieved by embedding or creating a critical mass of local expertise and capability along with physical resources, which are sustainable in the medium-long term. Such a capability can address a range of key issues related to volcanic hazard mitigation, achieve a degree of community participation, and develop a strong ethos of self-help. In reality this may involve a degree of appropriate external support in sympathy with evolving local cultural values. The most important goals are simply to form a within island

communications network that can be rapidly activated, along with a central representative body to consider information from island-wide sources and discuss the best responses.

Off island measures should follow the recommendations listed in the action planning exercises. Organisational plans between Province and National level need to be coordinated with one another. For the controversial issue of organising refuge areas, the province council, with closer contact to neighbouring islands, is in the best position to facilitate dialogue.

8.2. METHODOLOGY: WHAT WORKED AND WHAT WE DID WRONG

The basic premise of PRA-style ranking and comparing versus counting (Chambers, 1992) fits naturally to the task of categorising and rating degrees of geological (in this case volcanic) hazard. Hazard mapping is an exercise of relativity, whether undertaken as a scientific exercise or a participatory one. In the same way, resource mapping and relative 'value' ratings are also easily converted into vulnerability analyses and risk assessments. Hence through the basic exercises used, many of the ways in which geologists come to conclusions of volcanic risk could be demonstrated. In this way trust can be built at the same time in both locally based analysis and outside information and knowledge.

The Honiara sessions began relatively formally, "icebreaking" took more than a day, and out of session conversations were limited to lunch, other breaks and immediately before and after sessions. By contrast, on Savo we were all living in temporary accommodation in the same village, hence informal interaction among participants and between participants and outside facilitators was greatly increased, mutual trust and friendships developed and many discussions went late into the night. The advantage of running the Honiara sessions first was that the core group could come to agreement on important issues, including understanding the origin of many 'outside' scientific ideas. This built the foundations for the group being able to facilitate discussion and exercise sessions on Savo. In hindsight we perhaps should have based the entire activity on Savo, having closed sessions with a core group to begin with; an option for future consideration. Despite the lack of multimedia facilities available, the ice-breaking could have been more rapidly achieved, and much more informal contact and mingling time be afforded 'on the beach' or in the village.

One criticism levelled at traditional PRA-style approaches is that learning opportunities are missed when facilitators spend too much time in the background, not behaving as educators (von Kotze, 1998). To strike an equitable balance between facilitation and education is not easy, and we erred in the first few days on the side of the educator, or in harsh terms (Chambers, 1997), the outsider dictating to the insider. In some ways the distinction between insider and outsider is highly restrictive, and a wider view of a community (Maturana and Varela, 1987) includes all those engaging in discussions to work toward a common goal, in this case Savo

volcanic hazard management. On the other hand, scientific knowledge is widely used or regarded as a source of power (Nelkin, 1985) and some argue that it is too rationally based to be relevant to a local context (Russell and Ison, 1993). In this case, we could demonstrate that our logical approach mirrored the lines of reasoning from both the core-workshop group exercises and the village-based exercise. Nevertheless, the role of outside 'experts' within community problem-solving is probably better managed by experts acting as normal participants, rather than facilitators, with no more or less say than the others in the group. It could also be argued that the Honiara-based sessions had a number of positive elements which included setting up a credibility profile for the "outsiders" in terms of their technical knowledge and experience and a demonstrated willingness to communicate effectively and respect local knowledge in a genuine open and consensual spirit.

One of the key tenants of the PRA approach is not to rush (Chambers, 1992). Due to a full program with the core workshop participants, we ran out of time and broke this rule in respect of the time taken with village visits on Savo. However, given that the issue addressed was of high local interest and that people were made aware of the visits well in advance, the attendance and levels of participation were high. In most cases all sectors of the communities were well represented, including around 50% female composition of assembled groups. The standard of information collected during a stay of several days in many of the villages would no doubt have been better, especially in obtaining a wider perspective of diverse opinions. In addition, conducting the village visits without the encumbrance of the white members of the party, may also have helped reach the lesser-ranked community members; the Europeans were automatically treated with 'bigman' status.

The initial reason for using PRA methods was to provide a leveller and build a teamwork philosophy in solving Savo volcanic risk management problems. However, despite agreements reached in exercises and on paper, large differences in opinions remained, with gulfs of distrust remaining between the three poles of national, provincial and Savo-based groups. Kapoor (2002) considers that much so-called 'consensus building' in PRA exercises is simply due to an erasure or depression of differences, rather than acceptable give-and-take. While this may describe the bleakest outlook of the situation at the end of the Savo workshop, the PRA activities nevertheless provided an excellent dialogue-building tool, and formed at least a basis upon which ongoing joint activities between the three groups can work toward a better future understanding. At the very least a range of justified viewpoints was crystallised and documented, which forms the basis of future revised methodologies.

As described above, Savo and Solomon Islands culture is highly hierarchical and male dominated. A common criticism of PRA approaches is that they are not well accepted by hierarchical organizations or cultures (Bevan, 2000), and are even supportive of a status quo that can be highly inequitable for women (Maguire, 1987; Cornwall, 2000). That well-off or powerful and older men tend to dominate the participatory process (Percy, 1999), sidelining other groups, was borne out in

our exercise. Firstly, there was the male-only composition of the core workshop group, and secondly, the more powerful members of the group tended to exercise the power of veto, both within the discussions and, by inference, outside the workshop.

While PRA methods are not automatically gender sensitive (Gujit, 1994), in the Savo village activities, both women's and men's groups participated equally. This was partly due to the availability of women to take part in activities, an oft-cited barrier to women in participation (Otsyina and Rosenberg, 1999; Cornwall, 2000). However, participation in the activities does not automatically mean that the women's views are treated with equal weight. Apart from a few exceptional older women, other women spoke only during the presentations of their group exercise results or maps. Bigmen and other older males dominated storytelling and most other verbal contributions.

Like many participatory activities, expectations are raised (Humble, 1998), in our case particularly with the Savo community and women's roles in later risk management decision making. Just providing the under-represented with a voice at the time of the exercises and activities does not change the way in which the society operates, nor will it improve the ability of women to participate in disaster management decision-making processes. However, at least through our activities these groups are informed and can in their own way make preparations.

On a similar note, enthusiasm built for taking action through participatory exercises requires rapid and sustained follow-up, otherwise the gains are short-lived (Webber and Ison, 1995). In our case, follow-up from external assistance has not been forthcoming, and apart from initial planning activities, no internal follow-up has occurred. The breakdown of law and order in 1999–2000, a coup in 2000, and the near bankruptcy of the nation since then (Ware, 2001; Turnbull, 2002) has led to poor delivery of government services in non-essential areas and a stop to many overseas development aid programs. Priorities in government, NGO and community sectors have been understandably focused on the immediate conflict-related issues.

9. Conclusions

While some extreme views within the PRA movement involve the insulting of academics rather than working with them, as described in Bevan (2000), we have demonstrated that it is possible to incorporate academic knowledge with local and traditional views for volcanic hazard assessment and management. The perspective change (or paradigm shift) for us involved accepting alternative world views or explanations of natural phenomena alongside our own scientific world view, something that academics are apparently not good at (Webber and Ison, 1995). This was possible because we were addressing a common problem. For example, while it is important that scientists understand and name the processes that generate pyroclastic flows on Savo, it is also important that traditional beliefs associated

with events such as *Garaparasua biti* (see Table VI); can also be valid. In this case the common ground is that both perspectives agree that these processes are hot, fast, and kill everyone in their path. Hence we could concentrate on neutral issues, such as the locations of the paths and areas affected by these flows (Figure 4), and how best to organise the population response to avoid them in advance.

In the spirit of self-criticism and self-change promoted by the PRA philosophy, we perceive a range of successes and failures in our application of the PRA approach. Nevertheless, we tried and recognised the value of these methods and perspective changes, albeit under the constraints of our own fixed aims of improving risk management awareness and planning for Savo volcano. From the lessons we learned during this activity in the Solomon Islands, we feel that there is potential for improved risk management education in similar developing nations by involving perspectives of both outsiders and insiders. We recommend that the following options be considered in developing our personal experience of community based participation exercises, particularly in the case of hazard awareness and mitigation:

- A series of workshops are held over a period of months or years.
- Workshops are aimed at focussing on natural milestones, which occur as local communities evolve their own strategies to take up and implement hazard awareness programs. Each workshop should reinforce education methodology, encourage local initiatives and build self confidence and a sense of purpose and vision.
- Workshops should target all appropriate stakeholders and aim for maximum inclusion.
- Each workshop should be of long enough duration to accommodate stakeholder aspirations, development and feedback.
- Each workshop builds on the positive local participation of the previous workshop to engender community belief and process credibility.
- The overall longer term vision must be consensually owned and driven. In our case the "vision" is to develop sustainable community awareness, expertise and capability in relation to hazard awareness and mitigation. This would involve sustainable linkages nationally and perhaps internationally. It would also involve the implementation of longer-term policies dealing with volcanic hazard observation and mitigation.
- Continual review and reappraisal of the process.

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