Combining different knowledges: community-based climate change adaptation in small island developing states

2

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Introduction

Throughout history, indigenous peoples around the world have successfully adjusted to social and environmental changes. However climate change is undermining many existing livelihoods based on natural resources and challenging the relevance of indigenous knowledge on which those livelihoods are based. Similarly, current scientific knowledge about climate change and weather patterns is limited, and can rarely provide all that is needed for dealing with change. The challenge is to find ways of combining indigenous and scientific knowledge to help in successful adaptation at community level.

This paper describes a community-based framework for combining different types of knowledge to address climate change. It builds on earlier work by Mercer to develop and pilot a framework for addressing disaster risk reduction in Small Island Developing States (SIDS).[1] The 52 SIDS face similar sustainability challenges, including exceptional vulnerability to climate change.

The framework also draws on an assessment of climate change impacts, vulnerability, and adaptation across SIDS prepared by Kelman, West, and colleagues under the Many Strong Voices (MSV) programme.[2] The MSV assessment work indicates that many SIDS communities have extensive indigenous knowledge and traditional skills that have helped them to deal with

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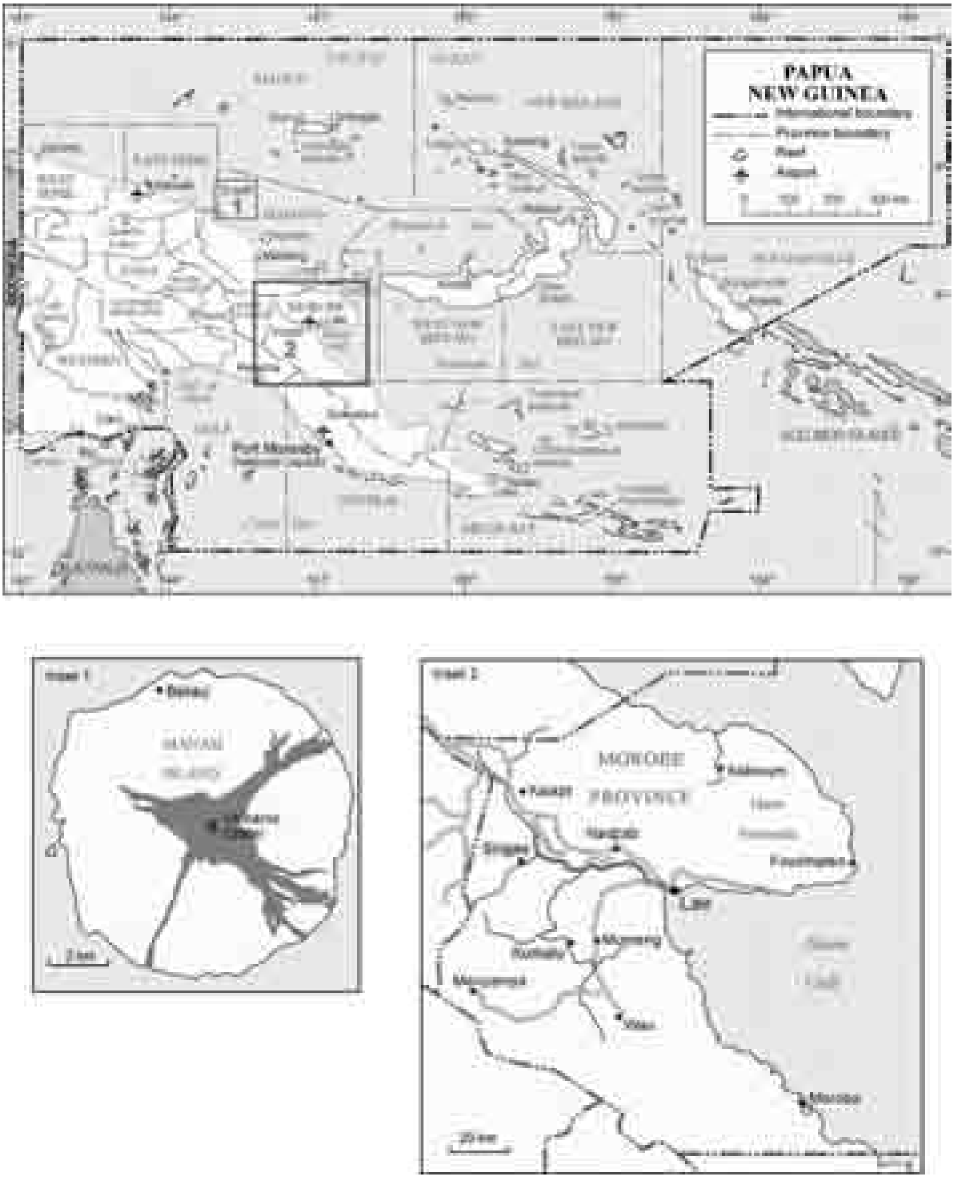
[1] The United Nations International Strategy for Disaster Reduction defines disaster risk reduction as 'systematic efforts to analyse and manage the causal factors of disasters, including through reduced exposure to hazards, lessened vulnerability of people and property, wise management of land and the environment, and improved preparedness for adverse events'. See Kelman and Gaillard (2008) for one discussion about similarities, differences, and linkages between disaster risk reduction and climate change.

[2] The programme is supported by a consortium of donors including the Government of Norway and is led by UNEP/GRID-Arendal and the Center for International Climate and Environmental Research – Oslo (CICERO), for whom two of the authors work. MSV seeks to catalyse local action about climate change through capacity building, research, education, and outreach. See www.manystrongvoices.org for more details.

Figure 1: Map of PNG illustrating village locations



Source: based on http://un.org/Depts/Cartographic/map/profile/papua.pdf

change for centuries (CICERO and UNEP/GRID-Arendal, 2008). That assessment provided the baseline for applying the disaster risk reduction work directly to climate change as reported in this paper.

We begin this paper by describing the framework developed for addressing disaster risk reduction (DRR), highlighting some of the participatory approaches used. We then show how the framework could be adapted to address climate change.

DRR framework scope and method

The framework was originally developed with indigenous communities in Papua New Guinea (PNG), one of the 52 SIDS. Subsistence agriculture is the main livelihood for the majority of PNG's population, which is 87% rural (PNG National Statistical Office, 2003). More than 400 crop species are grown for food across the country – mainly on land passed down through families for generations – reflecting the country's enormous environmental variations (Department of Lands and Physical Planning, 2005). Indigenous knowledge and indigenous practices are being undermined by a combination of 'modernisation', national pressures including urbanisation, and global changes including climate change.

Mercer carried out fieldwork in PNG in 2006-2007 in three rural villages, Singas, Kumalu, and Baliau (Figure 1). Respectively, these communities are affected by floods, floods and landslides, and an erupting volcano. The villages were selected based principally on their previously expressed interest in participating in disaster risk reduction activities after community members had approached PNG authorities for assistance. Throughout the work, rapport and trust were built by participating in community tasks, including gardening, cooking, playing with children, and going to market to buy and sell goods.

In each village, with the community members' agreement, the fieldwork method used was 'guided discovery' in which an external facilitator helps community members draw on past experiences and local knowledge to seek new relationships, connections, and ideas that assist them to take action. Guided discovery was supplemented with other participatory techniques, including mapping exercises, timelines, and matrix rankings (see Mercer *et al.*, 2008, 2009a, b). In each context, these exercises must be selected in consultation with the population, especially regarding literacy levels.

As part of the guided discovery, communities developed a process framework (Figure 2). This helped guide community members through an in-depth exploration of factors contributing to their disaster vulnerability and the use of indigenous and external scientific knowledge to reduce that vulnerability. Four steps were used (Mercer *et al.* 2009a, b), as described below.

Step one: collecting background information

Mercer collected background information through participatory group work (Figures 3 and 4), identifying general community information, interests, and goals. Each group session, and in the other steps too, was attended by community representatives selected themselves and covering a variety of ages within the ethnically homogenous villages. Genders were generally segregated and then brought together to present to each other (Figure 4), because in PNG men usually dominate discussions whereas this work sought input from both genders.

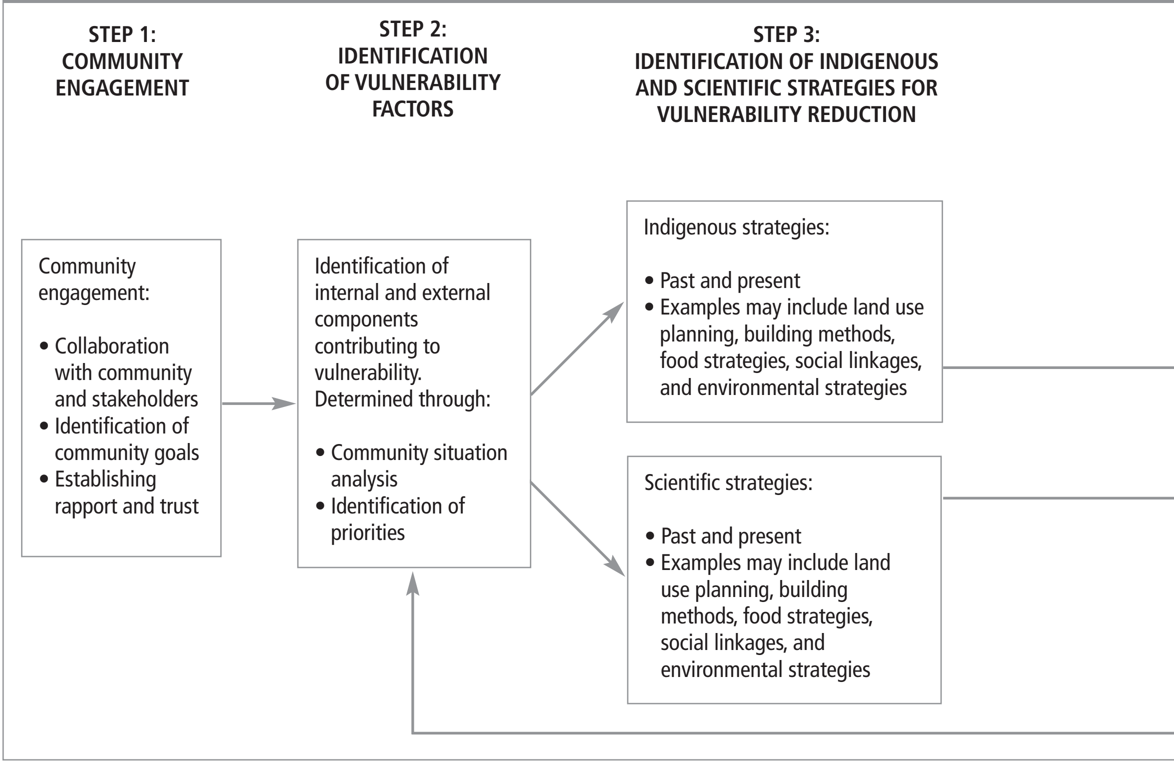
The results from the group sessions were presented to the entire community at a community meeting to confirm or revise information. Examples of the information gleaned were village history, hazard and event timelines, maps, and environmental and social trends, with examples given in Figure 5.

Step two: identifying underlying vulnerability factors

With this baseline, communities identified underlying vulnerability factors, both external and internal. External factors are those beyond a community's control, such as storms and volcanic eruptions. Internal factors can be controlled by the community to a large extent, such as changing crops or cropping patterns.

Although climate change was not this work's focus, climate change was mentioned as an external factor in all three villages. That is, through guided discovery, the villagers – not outsiders – determined that climate change was an important issue that should be addressed. This conclusion was reached during discussions about the

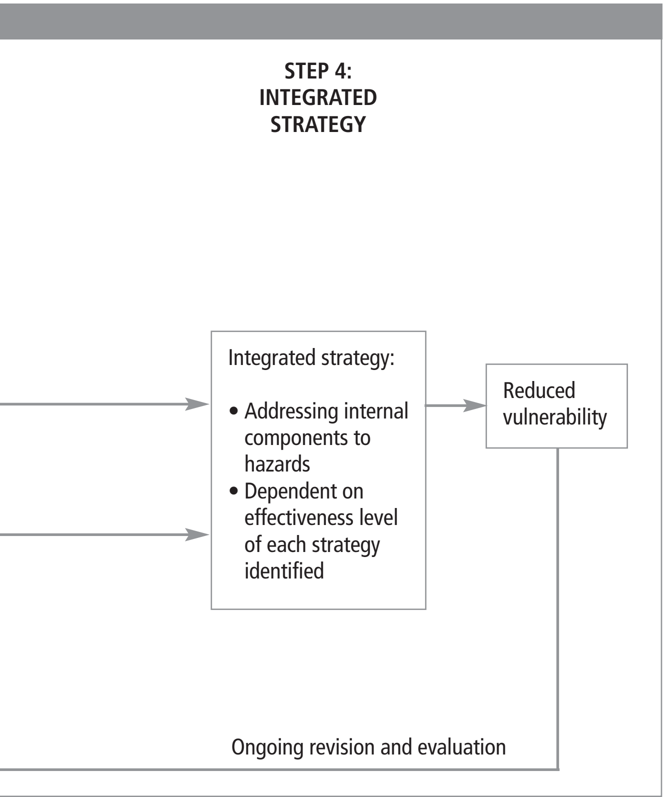
Figure 2: The original process framework developed and used in PNG



Source: Mercer *et al.* (2009b) with some text adjusted.

Photo: Jessica Mercer

Figure 3: An intense focus group discussion in Kumalu church where participants were discussing the impact of landslides and flooding upon Kumalu village.



natural resources that sustain their livelihoods. Villagers in all three locations discussed weather patterns, raised the issue of recently changing weather patterns, and connected those experiences to climate change. Whilst climate change was identified by the villagers as an external factor, it was not discussed in depth. Rather, the disaster risk reduction framework outlined here focused on the consequences of climate change internally and how these consequences could be addressed. The process highlighted the need to revise the framework to consider climate change, as this paper does.

Step three: identifying strategies for vulnerability reduction

Community members separated into groups to identify past and present indigenous and scientific strategies used to cope with the internal vulnerability factors identified. The distinction between 'external' science and 'internal' indigenous, traditional, or local knowledge(s) is not always straightforward.

Photo: Jessica Mercer

Figure 4: Men and women in Singas discussing maps drawn of the village and associated hazards.

Differences frequently highlighted are the different methods used to investigate and interpret the surrounding world along with science's attempts to separate knowledge from context compared to indigenous knowledge being deeply rooted in particular contexts. Community members themselves distinguished between the categories through identifying the knowledge, strategies, and resources available to them and through determining the source of each. Once strategies for vulnerability reduction were identified, community members scored the effectiveness of each strategy in reducing vulnerability.

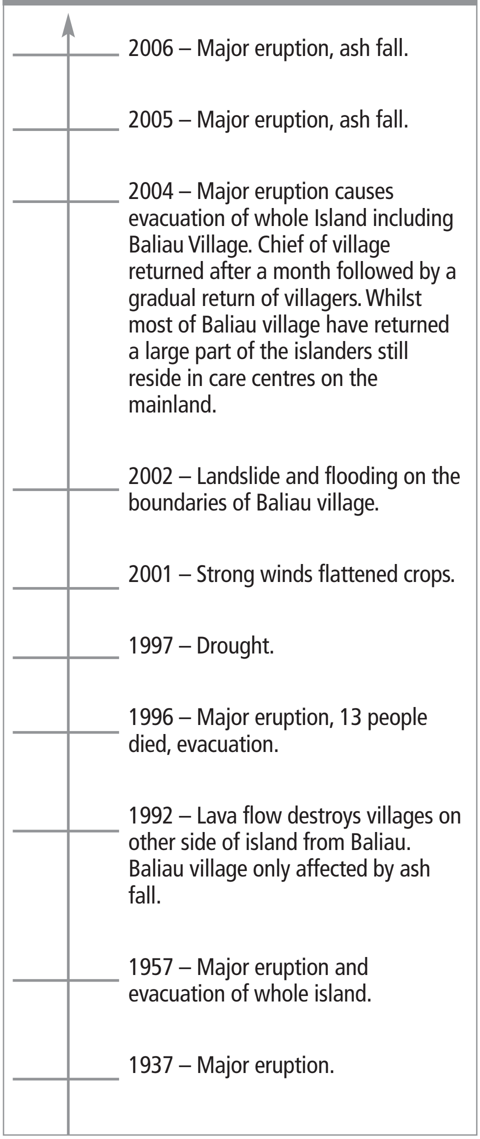
Step four: prioritising vulnerability reduction strategies

Community members prioritised possible vulnerability reduction strategies, based on the scoring. The scores were seen as a guide rather than as being absolute. On occasion, the scoring results led to qualitative discussion that further revised the scoring to reflect community members' views. Thus, the process was iterative and factored in intangible, qualitative views rather than rigidly adhering to numbers – an important principle within the framework. Identifying and prioritising the most effective strategies represented the integrated approach for reducing vulnerability by combining indigenous and scientific knowledge (Figures 5, 6 and 7).

Feedback from community members indicated that this approach enabled them to identify strategies that they felt were achievable using existing resources. The process also enabled them to identify varying stages and forms of vulnerability through time and how their own decisions, such as changing land use practices and building materials, could have contributed.

Guided discovery through the framework therefore focuses on the principle of encouraging awareness and responsibility within the communities to address their own vulnerabilities by themselves, especially the internal factors, but within the context of external factors. However, whilst applying and using the framework has been described for disaster risk reduction, follow-up work has yet to be completed for evaluating outcomes and for measuring over the long-term any discernible reductions in vulnerability.

Figure 5: Example of field results from implementing the framework for disaster risk reduction. Hazard timeline developed by Baliau community members, highlighting several climate- and non-climate-related events.



(Mercer *et al.*, 2009ab).

Figure 6: Example of field results from implementing the framework for disaster risk reduction. Cause-effect vulnerability tree developed by Singas community members outlining what they considered to be 'internal' and 'external' vulnerability factors.

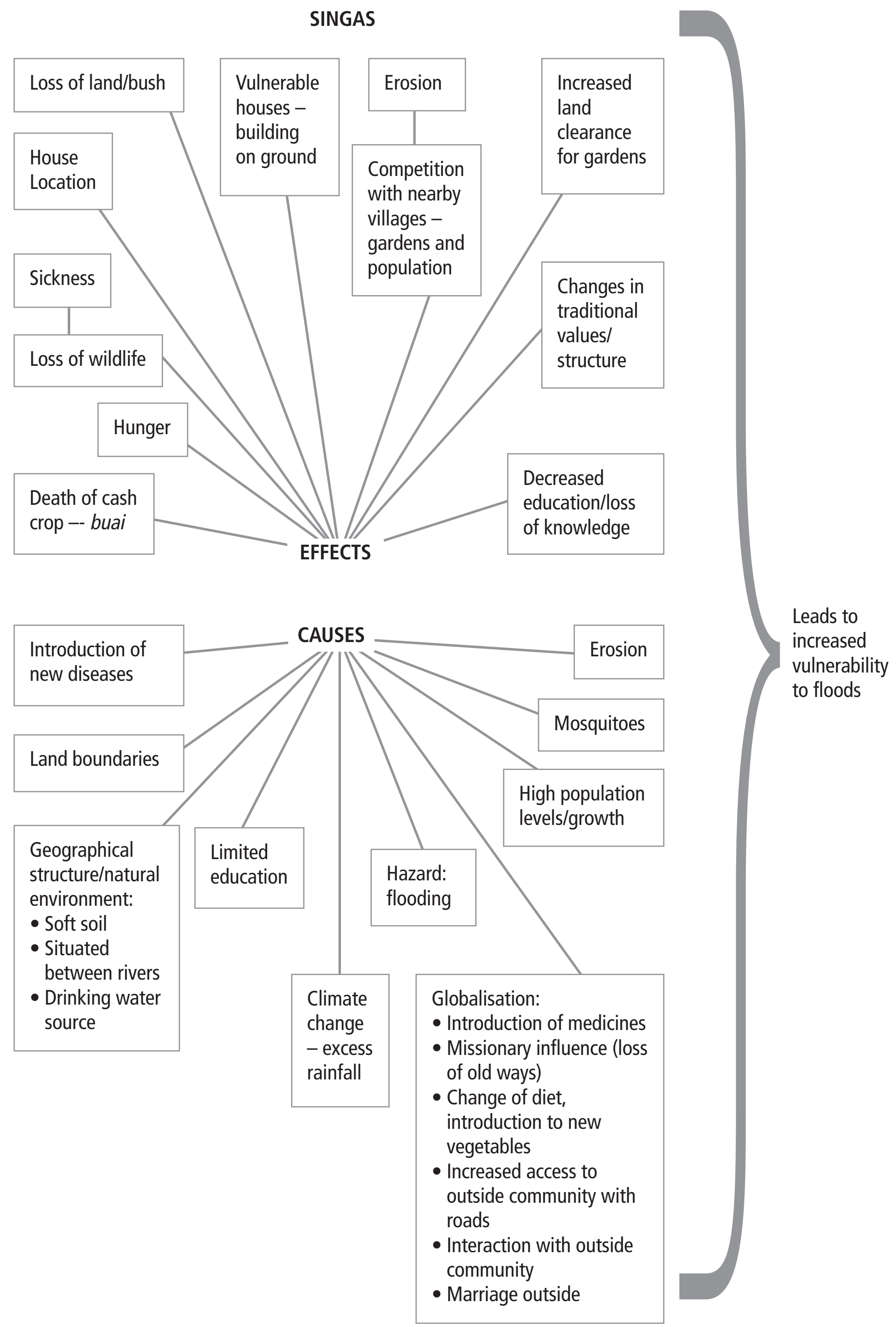


Figure 7: Example of field results from implementing the framework for disaster risk reduction. Example of a pairwise ranking grid completed by Kumalu community members to prioritise pre-identified vulnerability factors.

SIGNS	÷	Δ	○	⊗	⬚	⊛	✱	□	☽	⇧	■	Z
÷	N/A	Δ	÷	⊗	⬚	⊛	✱	□	☽	÷	■	Z
Δ	Δ	N/A	Δ	Δ	⬚	Δ	Δ	□	☽	Δ	Δ	Δ
○	÷	Δ	N/A	○	⬚	○	✱	□	☽	○	■	Z
⊗	⊗	Δ	○	N/A	⬚	⊛	✱	□	☽	⊗	■	Z
⬚	⬚	⬚	⬚	⬚	N/A	⬚	✱	□	☽	⬚	⬚	⬚
⊛	⊛	Δ	○	⊛	⬚	N/A	✱	□	☽	⇧	■	Z
✱	✱	Δ	✱	✱	✱	✱	N/A	□	✱	✱	✱	✱
□	□	□	□	□	□	□	□	N/A	□	□	□	□
☽	☽	☽	☽	☽	☽	☽	✱	□	N/A	⇧	■	Z
⇧	÷	Δ	○	⊗	⬚	⇧	✱	□	⇧	N/A	■	⇧
■	■	Δ	■	■	⬚	■	✱	□	■	■	N/A	■
Z	Z	Δ	Z	Z	⬚	Z	✱	□	Z	⇧	■	N/A
TOTAL	4	16	6	4	16	4	18	22	12	6	14	10

Key:

÷	Limited knowledge
Δ	Construction of houses in dangerous places
○	Lack of diversification of income sources
⊗	Minimal outside support
⬚	Land clearance (loss of bush/trees)
⊛	No community planning
✱	Land loss (gardens and coffee due to hazards)
□	Vulnerable housing
☽	Hunger
⇧	Changes in farming practices (coffee, vegetables etc.)
■	Garden accessibility
Z	Market access

Priority list order

1	Vulnerable housing
2	Land loss
3	Land clearance
4	Construction of houses in dangerous places
5	Garden accessibility
6	Hunger
7	Market access
8	Changes in farming practices
9	Lack of diversification of income sources
10	No community planning
11	Lack of knowledge
12	Minimal outside support

Notes:
•After discussion, people from Kumalu decided that 'limited knowledge' was more important than previously identified and so the priority list order was changed to move 'limited knowledge' to number 5.
•N/A (meaning 'not applicable') is used throughout the centre of a grid to avoid two of the same factors being compared against each other.

Using the framework to address climate change

The framework for disaster risk reduction targeted mainly floods, storms, landslides, and volcanic eruptions that the communities had previously experienced. Climate change is likely to alter the timing, severity, and frequency of some environmental hazards along with affecting weather seasonality. Consequently, the framework provides a useful entry point for discussing how and why communities could be vulnerable to, and could deal with, longer-term climate change. The framework has not yet been applied in the field for only climate change.

Figure 8 shows how the framework could be revised to address climate change. It incorporates knowledge gained from the MSV assessment (CICERO and UNEP/GRID-Arendal, 2008) of climate change impacts, vulnerability, and adaptation on SIDS.

Step one

Step one of the process remains unchanged, as it is important for determining communities' own priorities and concerns. In our experience, climate change is a priority for SIDS communities. SIDS communities are reporting climate change challenges.[3] They are actively seeking and supporting endeavours to address climate change, as shown by MSV. However, this may not be the case for communities elsewhere. If communities do not consider climate change to be a concern yet scientific evidence suggests otherwise – an unlikely occurrence for SIDS – then practitioners involved in using the framework will need to decide ethically and practically the appropriateness of trying to introduce, or force, climate change onto the community.

Step two

In step two, a global situation analysis is carried out, with global climate change causes and trends linked to local impacts and vulnerabilities. External scientific information indicating historical and potential future consequences of climate variability and change – for instance, satellite observations and downscaled climate projections for short- and long-term scenarios – could be presented and discussed to connect to internal vulnerability factors. For example, land use changes increased flood damage in both Singas and Kumalu as an internal vulnerability factor and that can be redressed locally in each place. Any changes must be done in the context of uncertainty in how flood characteristics will change due to climate change. The global situation analysis would identify both components and describe how they are linked. Suggested strategies for understanding the complete situation analysis range from fully accepting responsibility, to specific internal vulnerabilities, through to wider advocacy, education, and awareness-raising strategies regarding climate change causes and impacts, both in the community and beyond the community.

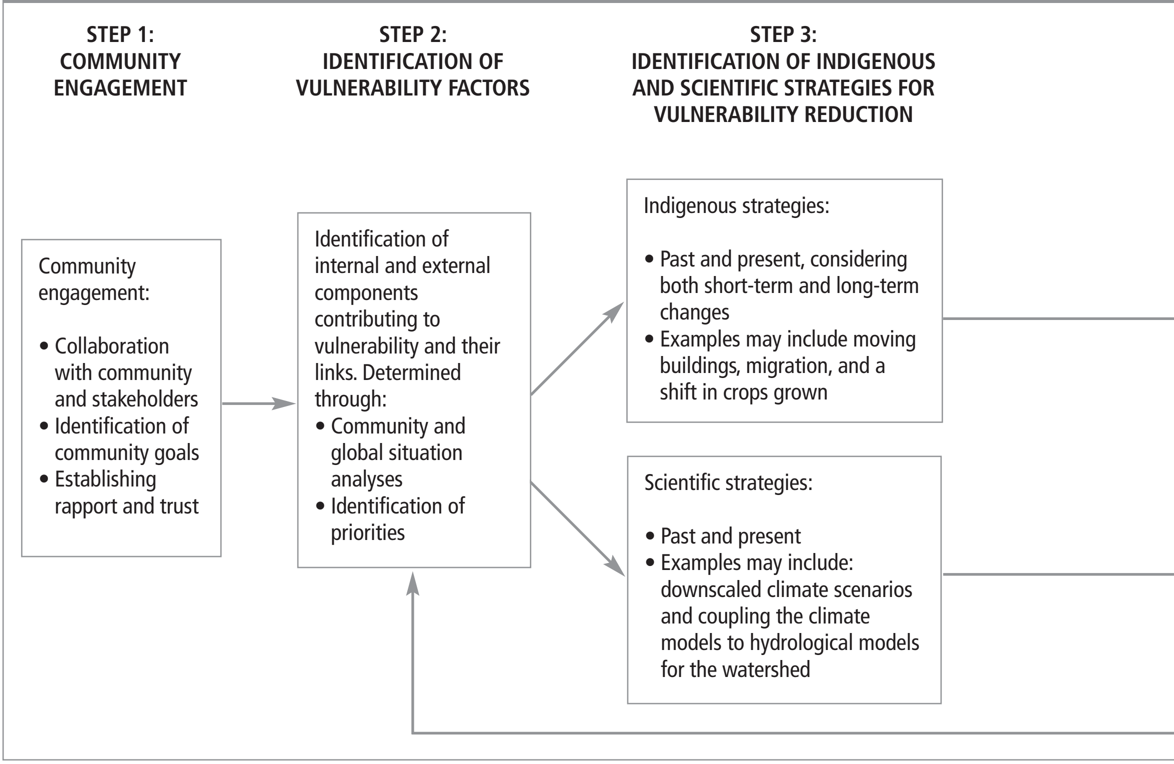
Rather than separating internal and external factors as mutually exclusive categories, climate change reveals overlaps, as shown above for Singas and Kumalu. Including climate change suggests that contingency and flexibility, rather than fixed strategies or rigid goals, should be considered for flood risk reduction.

Step three

When identifying indigenous strategies for reducing vulnerability to both environmental hazards and climate change, the focus should be on determining how people have responded to longer-term changes in the past. Examples of past responses that might be applicable under current local realities, as well as under projected future changes, can be found within building construction methods: building homes on stilts to avoid flooding as undertaken in Singas and the construc-

[3] See e.g. www.climatefrontlines.org

Figure 8: The revised process framework, for introducing and addressing climate change



Source: Mercer *et al.* (2009b) with some text adjusted.

tion of steeply sloped roofs to avoid fire risk from volcanic ash and to ensure runoff during heavy rainfall as in Baliau.

One part of identifying scientific strategies should be requesting data that the community decides might be useful for long-term planning. Examples are downscaled climate scenarios or regularly updated remote sensed observations. This information could enable communities to prepare in advance, through for example identifying appropriate crops to plant given the expected conditions, identifying appropriate areas for gardens, and adjusting the agricultural growth cycle accordingly.

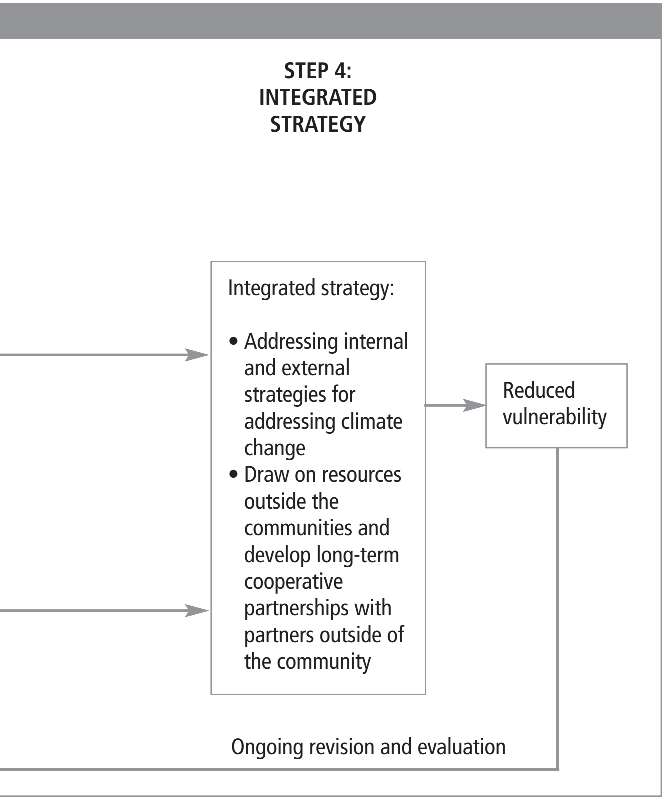
Step four

Strategies should include measures for addressing climate change, especially beyond already experienced environmental hazards. One example is the potential for invasive species that could change the pest or disease profile of local agricultural systems. Partners outside the community may be needed to incorporate external scientific knowledge about climatology and ecology.

As another example of a potential strategy, MSV provides cases of indigenous SIDS peoples gaining capacity for dealing with climate change in international fora, such as the Conference of Parties (COP) negotiations. Additionally, PNG is not currently on the United Nations' list of Least Developed Countries (LDCs), but it could nonetheless be useful to consider pursuing a National Adaptation Programme of Action for climate change, as completed by other SIDS that are LDCs, or to undertake a similar process such as the Government of St. Lucia (2003) has done.[4]

As such, the community could identify

[4] See: http://unfccc.int/national_reports/napa/items/2719.php



strategies for addressing climate change that go beyond the local level. The framework explicitly permits different levels of action that may be needed (e.g. local, district, national, international) while permitting and identifying links amongst those different levels.

Main lessons

The lesson to highlight from this work is the framework's ability to relate local and global topics, especially by combining community knowledge and experiences with external scientific information and approaches. Two main points are detailed here for emphasis when applying the framework for climate change, based on experience with the disaster risk reduction framework (Mercer *et al.*, 2009a, b).

First, by identifying community goals and priorities, and by connecting these to local and global situation analyses, climate change adaptation and disaster risk reduction are supported simultaneously. The focus is on the community's needs, not on climate change or disaster risk reduction as the starting point. For example, all three villages in PNG identified increased vegetation burning as being a land use change that might exacerbate floods and erosion. The framework helps to consider how land use has changed, affecting community vulnerability, over past decades. By considering indigenous and non-indigenous strategies that improve land use and that reduce burning, flood and erosion vulnerability is reduced, irrespective of climate change affecting those hazards. The communities identified land use challenges and improvements, automatically supporting climate change adaptation and disaster risk reduction simultaneously.

The second point, emphasised in MSV, is that climate change and disaster risk reduction should be integrated within wider development contexts. The three PNG villages exemplify development challenges faced by many SIDS communities, irrespective of climate change. Meanwhile, through MSV, SIDS peoples express a need for climate change research, policy, and action that acknowledges wider development contexts.

One possible idea to explore with caution for the PNG villages, based on the experience there, could be reversing land use changes to reduce flood and erosion risk by expanding the crop profile. Crops could include local species with multiple uses, covering combinations of erosion prevention, building materials, edibility, and livestock fodder. The potential could be explored for growing small amounts of crops for selling and trading alongside food crops. That could supplement income while maintaining sufficient diversity in case of shifts in external markets and/or environmental conditions.

If such livelihood adjustments were deemed to be appropriate, and if they were accompanied by locally sensitive support from external partners, the changes could potentially bring livelihood benefits while reducing vulnerability. Indigenous knowledge would be needed regarding appropriate cropping patterns and land use. Non-indigenous local knowledge could assist in identifying suitable crops that might not have been grown before in the community. External scientific knowledge might help in identifying potential climate scenarios.

Caution is essential before implementation in order to fully analyse the potential positive and negative consequences. The uncertainties in future climate and market analyses must be weighed carefully against analysis of who may win and lose, in the short-term and long-term, when livelihood and land use systems are adjusted. For instance, the introduction of cash cropping for coffee in Kumalu in 1954 was identified by the community as leading to later vulnerability.

This example highlights the challenges of ensuring that climate change concerns are addressed without causing or exacerbating other problems. MSV highlights SIDS community concerns that climate change is only one of many major topics to be considered, with others being livelihoods and disaster risk reduction. The framework enables communities to find solutions for adjusting and expanding livelihoods to tackle many challenges simultaneously.

Conclusion

The revised framework has the potential to demonstrate the usefulness of combining disaster risk reduction and climate change (see also Kelman and Gaillard, 2008). Key commonalities between the original and revised frameworks are:

- the four-step structure;
- community members identifying factors that should be addressed to reduce vulnerability; and
- the strategies combining indigenous and external scientific knowledge.

Key differences are highlighted by Figures 2 and 8.

An important strength of the framework is recognising indigenous and external scientific knowledge as resources upon which to build successful local strategies for vulnerability reduction. The 'guided discovery' method adheres to principles within both disaster risk reduction and climate change endeavours, providing step-by-step guidelines for working with a community to move away from solely top-down approaches. In describing the framework and suggesting its application, though, this paper does not analyse the new framework's implementation or evaluation.

The main expected outcome of implementing the revised framework is reduced community vulnerability through considering disaster risk reduction and climate change simultaneously. Both entail explicitly recognising and acting on immediate and long-term challenges. A second outcome is establishing long-term cooperative partnerships between communities and collaborators outside the community at regional, national, and international levels. Those partnerships would be for exchanging and applying local and scientific knowledge and expertise to design vulnerability reduction strategies that are locally contextual without neglecting wider contexts.

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