Community based landslide risk reduction: evidence and challenges

Prof. Malcolm G Anderson
1. Global emerging risks

2. Science base

3. Community base

4. Evidence base
Global landslide risk

Image courtesy NASA

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Four common assertions

- ‘risk mitigation pays’
  - but too few Cost Benefit Analyses to confirm this (Twigg 2004)

- ‘economic losses due to risk are increasing’
  - but normalised data shows no trend (Pielke et al. 2008)

- ‘providing the public with information on hazards encourages preparation’
  - an unfounded assumption (Paton 2003)

- ‘future context is today’s world, with modest variations’
  - scenario modelling suggests otherwise (Mahmoud et al. 2009)
Disaster related losses

Global risks

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...but normalisation tells us...

...that what matters is

\textbf{what we build,}

\textbf{where we build}

and \textbf{how we build}

\cite{Pielke et al 2008}
A framework of emerging risks

<table>
<thead>
<tr>
<th>Drivers increasing landslide risk in developing countries</th>
<th>Potential emerging risks</th>
<th>Scarcity of implementation standards</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lack of regulation and zonation methodologies - not at the scale of the triggering process (Coburn and Maynard, 2009)</td>
<td>Evidence of mitigation impact is rarely substantive. (Benson and Twigg, 2004)</td>
<td>Communication gap between science and practice (Malamud and Petley, 2009)</td>
</tr>
<tr>
<td>On-ground-delivery of mitigation very limited (Wamsler, 2007)</td>
<td>Cost benefit analysis requires detailed survey work that is rarely undertaken (Holcombe et al, 2011)</td>
<td>Monitor implementation process. (NASA, 2011)</td>
</tr>
<tr>
<td>Reductionist risk modelling and uncertainty (Kunreuther and Useem, 2009)</td>
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</table>

(Source: Anderson et al, 2012)
“Over the last three decades policy statements by all major agencies have included risk reduction as a pre-condition and an integrated aspect of sustainable development...” UN

“...but when it comes to practical implementation, very little has been done, even when money is available”
The need to act on urban landslides

Not uncommon for one expert to say that there is little to be concerned about...

...whilst another expert will say the same risk is of major significance

(Kunreuther)
“We're still to some extent sleepwalking our way into disasters for the future which we know are going to happen,

…and not enough is being done to mitigate the damage”

(Holmes, Under-Secretary-General for Humanitarian Affairs, UNEP. 2009).
## What is unique about MoSSaiC?

<table>
<thead>
<tr>
<th>Uses existing within-country capacity to reduce urban landslide hazard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Identifies hazard drivers to justify interventions</td>
</tr>
<tr>
<td>Community residents engaged throughout</td>
</tr>
<tr>
<td>Delivers landslide hazard reduction on the ground</td>
</tr>
<tr>
<td>Stresses importance of site supervision</td>
</tr>
<tr>
<td>Encourages behavioural change</td>
</tr>
<tr>
<td>Promotes evidence-base for landslide hazard reduction</td>
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</table>
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How do we reduce landslide risk?

Reduce the exposure to landslides
avoid the landslide hazard

Reduce the landslide hazard (likelihood)
good slope management practices, engineering measures

Reduce the vulnerability
communicating the risk, community warning, response and recovery plans...
Urban slope management issues

Science

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What is causing the landslides?
How effective are local practices?

Retaining wall hydrology simulation

1 in 10 year 4 hour storm
10 minute output timesteps

Analysis and animation by:
James Blake, Malcolm Anderson & J-P. Renaud
School of Geographical Sciences, University of Bristol

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What is the impact of water supply?

Metered water supply but no drainage + High density (>70%) unplanned housing

- But, roof guttering + proper surface drainage reduce the level of soil saturation to ...
  - 14 days per month
  - 1 day per month

Days per month soil is saturated

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Can the hazard be reduced?
1. Global emerging risks

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Start with community knowledge
Community slope feature mapping

...with residents and government teams
produces a landslide hazard map
New drains capture surface water
Agree plans with community

and with the government and local engineers
Community contractors build drains...
...that capture surface water
Landslide risk reduction scales

Funding agency
- Government
- Social Fund
- Community
- Household

Community-based

Drainage area
- Hillside
- Terrain type
- Country
- Region

TOP-DOWN
Policies and funding
GIS-based mapping

'People' / Organisational scale
Advocacy
Practice

Multiple projects

TOP-BOTTOM

....Physical process / Spatial scale

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Does it work / does it pay?
### Evidence it works

<table>
<thead>
<tr>
<th>Community (number of households)</th>
<th>Pre-MoSSaiC intervention rainfall impact on slope stability</th>
<th>Post-MoSSaiC intervention rainfall impact (Year and major triggering rainfall event)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Community 1 55</td>
<td>Major slides at low rainfall rates</td>
<td>2006 1 in 4 year, 24 hour event</td>
</tr>
<tr>
<td></td>
<td>None reported - Landslide in adjoining area</td>
<td>2007 Hurricane Dean 1 in 5 year, 24 hour event</td>
</tr>
<tr>
<td></td>
<td>None reported</td>
<td>2008 1 in 100 year, 15 day event</td>
</tr>
<tr>
<td></td>
<td>None reported - Reactivation of landslide in adjoining area</td>
<td>2010 Hurricane Tomas &gt;1 in 500 year, 24 hour event?</td>
</tr>
<tr>
<td>Community 2 428</td>
<td>Major slide and evacuation of 100 homes in adjoining area</td>
<td>2006 1 in 4 year, 24 hour event</td>
</tr>
<tr>
<td></td>
<td>None reported</td>
<td>2007 Hurricane Dean 1 in 5 year, 24 hour event</td>
</tr>
<tr>
<td></td>
<td>Minor slide within community</td>
<td>2008 1 in 100 year, 15 day event</td>
</tr>
<tr>
<td></td>
<td>Minor slide within community</td>
<td>2010 Hurricane Tomas &gt;1 in 500 year, 24 hour event?</td>
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<tr>
<td>Community 3 428</td>
<td>Major slide</td>
<td>2006 1 in 4 year, 24 hour event</td>
</tr>
<tr>
<td></td>
<td>None reported</td>
<td>2007 Hurricane Dean 1 in 5 year, 24 hour event</td>
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<tr>
<td></td>
<td>None reported</td>
<td>2010 Hurricane Tomas &gt;1 in 500 year, 24 hour event?</td>
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<tr>
<td>Community 4 371</td>
<td>Modest slides affecting properties</td>
<td>2006 1 in 4 year, 24 hour event</td>
</tr>
<tr>
<td></td>
<td>None reported</td>
<td>2007 Hurricane Dean 1 in 5 year, 24 hour event</td>
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<td>Community 5 20</td>
<td>Retaining wall failures and significant slides</td>
<td>2006 1 in 4 year, 24 hour event</td>
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<td>None reported</td>
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<td>None reported</td>
<td>2008 1 in 100 year, 15 day event</td>
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<td>None reported</td>
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<td>Community 6 60</td>
<td>Major previous slide with several lost houses. Subsequent minor landslides.</td>
<td>2006 1 in 4 year, 24 hour event</td>
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<td>None reported</td>
<td>2007 Hurricane Dean 1 in 5 year, 24 hour event</td>
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Evidence it pays

Benefit cost ratio of ~2.7:1
Next steps

Undertake future scenario modelling

Acquire data on landslide mitigation relevance at the regional level

Develop a delivery mechanism

Source: Mahmoud et al

Source: Holcombe et al
Contact:
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Prof. Malcolm G Anderson

Contact: mossaic@emailplus.org

COMMUNITY-BASED LANDSLIDE RISK REDUCTION
Managing Disasters in Small Steps

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Landslide risk reduction scales

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<tr>
<td>Community</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Household</td>
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Community

- Community-based
- Multiple projects

Drainage area
Hillside
Terrain type
Country
Region

Physical process / Spatial scale

..."People" / Organisational scale

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