Social and ethical perspectives of landslide risk mitigation measures

Bjørn Kalsnes and Bjørn Vidar Vangelsten, NGI
EGU, Vienna, 15 April 2015
CRED data period 2000-2015

Pakistan 2005
China 2008
Haiti 2010

Total killed

- Landslides
- Earthquake
- Flood
- Tsunami
- Windstorm

Pakistan 2005
China 2008
Haiti 2010

2004 + 2011
Myanmar 2008

13500

250000
500000
Risk Assessment - changing trend

“Hazardous events only become disasters when people’s lives and livelihoods are swept away”

**Trend:** from hazard-dominated analyses to more conceptually-correct approaches which recognize the importance of vulnerability
Landslide Sarno 1998

On May 5, 1998 Sarno and neighbouring villages in the Campania region were devastated by a series of landslides. 180 houses were destroyed, 450 severely damaged, and 161 people died in what was one of the biggest catastrophes of its kind in modern Italy.

The landslides had been caused by several days of torrential rainfalls, but were also blamed on agricultural, residential and industrial overexploitation and the lack of any substantial environmental programs.

The catastrophe prompted the Italian Ministry of the Environment to introduce a couple of legislative measures for environmental protection which have come to be known as legge Sarno.
Mitigation measures Sarno
Risk acceptance – need for mitigation measures
Mitigation measures landslides

Physical (structural) measures

Slope stabilisation, drainage, erosion protection, channelling, vegetation, ground improvement, barriers, elevated land, anchoring and retaining structures etc

Non-structural measures

Early warning systems, land-use planning, public awareness, emergency preparedness, enforcement of building codes and good construction practice, measures to pool and transfer the risks etc
<table>
<thead>
<tr>
<th>Classification</th>
<th>Component of risk addressed</th>
<th>Brief description</th>
<th>Notes and other terms used</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stabilization</td>
<td>Hazard (H)</td>
<td>engineering works to reduce the probability of occurrence of landsliding</td>
<td>Preventive, remedial, hard, soft, active stabilization</td>
</tr>
<tr>
<td>Control</td>
<td>Vulnerability (V)</td>
<td>engineering works to protect, reinforce, isolate the elements at risk from the influence of landsliding</td>
<td>Preventive, hard, soft, passive stabilization</td>
</tr>
<tr>
<td>Avoidance</td>
<td>Elements (E)</td>
<td>temporary and/or permanent reduction of exposure through: warning systems and emergency evacuation or safe sheltering, land-use planning and/or relocation of existing facilities</td>
<td>Direct temporary and/or permanent reduction of the number and/or value of elements at risk. Monitoring and warning or alarm systems and associated civil protection procedures, often described as reducing vulnerability, in actual fact operate through temporary, selective avoidance,</td>
</tr>
<tr>
<td>Tolerance</td>
<td>Elements (E)</td>
<td>Awareness, acceptance and/or sharing of risk</td>
<td>Indirect reduction of the number and/or value of elements at risk</td>
</tr>
</tbody>
</table>
Key (ethical) questions in the decision-making process

- Who benefits, who looses?

- What is the impact on the physical environment?

- What risk is acceptable?
Roles (Dolce and di Bucci, from Wyss and Peppoloni)

1. Scientists (evaluation of risk level, cost-benefits)
2. Political decision-makers (definition of acceptable risk level, identification of specific actions)
3. Technical decision-makers (adoption of the most suitable technical solutions, implementation)

Other actors: Professionals, mass media, citizens...
SafeLand Case study: Nocera Inferiore, Italy (ref. IIASA and UNISA / Scolobig et al, EGU 2012)

- Population: 47,021
- Landslide risk area (Monte Albino slope): ~4,000 residents
- Last landslide: 2005
Stakeholder processes for identifying “appropriate” risk mitigation strategies

**Goal:** To learn how to convert better scientific information about landslides into actual policies and practices that will prevent and mitigate risk.

- What are the options available?
- How expensive and effective are they?
- What factors cause people to decide to act to mitigate and prevent the risks?
- How can alternative mitigation and prevention options be ranked and communicated?
- What processes are necessary to gain consensus in a community and move towards effective action?
Main aim:

- Develop and test a risk communication and stakeholder led process for selecting risk mitigation measures that are considered most appropriate from the technical, economic, environmental and social perspectives.

- The intent is to inform the political process and to carry out a process for reaching a compromise among participants on mitigation measures.
## Risk mitigation options – Nocera Inferiore

<table>
<thead>
<tr>
<th>Group</th>
<th>Aim (social sc.)</th>
<th>Solution (geotechnical eng.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hierarchical</td>
<td>Protect lives and properties</td>
<td>No large, unaesthetic expensive structural measures. Mix of active and limited passive measures.</td>
</tr>
<tr>
<td>Egalitarian</td>
<td>Careful stewardship of the mountains</td>
<td>Preserve the fragile ecosystem. Mitigation with low environmental impact (forests). Monitoring.</td>
</tr>
<tr>
<td>Individualistic</td>
<td>Rational individual choice-Relocation</td>
<td>Based on cost-benefit analyses. Relocation an option.</td>
</tr>
</tbody>
</table>
The compromise proposal

Active control works
- over the open slopes
- along the rills

Passive control works
- storage basins, located at the mouth of the basins, to be designed for alluvial phenomena due to rainfall having a return period $T = 200$ years

Monitoring
Territorial survey
Conclusions

- Stakeholder involvement important for decision making.

- Risk acceptance a key component.

- Potential conflict between those who prefer structural measures and those who prefer organisational measures (environment protection).
Thanks for your attention!

bgk@ngi.no
bvv@ngi.no
www.ngi.no