Title
Program 3 : Community-Based Landslide Disaster Reduction in Developing Countries

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### Community - Based Landslide Disaster Reduction in Developing Countries

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<thead>
<tr>
<th>Proposer Information</th>
<th><strong>Dang Quang Khang</strong></th>
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<tbody>
<tr>
<td>PhD student of Civil and Earth Resources Engineering, Kyoto University, Japan</td>
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<td>Tel: 080-4010-1628</td>
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<th>Aims of Education/training</th>
<th>Knowledge, Actions</th>
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<tr>
<th>Target User</th>
<th>Type</th>
<th>Direct user</th>
<th>Trainee/Indirect User</th>
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<tr>
<td></td>
<td>Self learning, Education/training</td>
<td>School teachers, Community leaders, Students</td>
<td>Students (Elementray school, Junior high school, High school, College/University), Local regidents</td>
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<tr>
<th>Focus of this Information</th>
<th>Process Technology (PT)</th>
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<th>Hazards</th>
<th>Landslide</th>
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<th>Type of Education/training</th>
<th>Training Camp, Group discussion, Field trip, Self learning</th>
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<th>Media/Material</th>
<th>Presentation, Guideline</th>
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<tr>
<th>References</th>
<th>1. DRH 56 - Low-cost and adaptive technology to support a community-based landslide early warning system in developing countries</th>
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<tr>
<td></td>
<td>2. DRH 61 - rain-induced landslide susceptibility: a guidebook for communities &amp; non-experts</td>
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Step 1 - Basic Information about Landslides

**What is a Landslide?**
A landslide is the movement of a mass of rock, earth, or debris down a slope

An animated picture of landslide | Landslide that occurred at La Conchita, California, USA in 2005

**Basic Landslide Types**

An animated picture of landslide | A rockfall that occurred in Clear Creek Canyon, Colorado, USA 2005
<table>
<thead>
<tr>
<th>Type</th>
<th>Image</th>
<th>Description</th>
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<tbody>
<tr>
<td>Topple</td>
<td><img src="image" alt="Topple" /></td>
<td>Block toppling at Fort St. John, British Columbia, Canada</td>
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<tr>
<td>Rotational landslide</td>
<td><img src="image" alt="Rotational landslide" /></td>
<td>Rotational landslide in New Zealand (Michael J. Crozier, September 21, 2007)</td>
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<tr>
<td>Translational landslide</td>
<td><img src="image" alt="Translational landslide" /></td>
<td>A translational landslide in 2001 in British Columbia, Canada</td>
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<tr>
<td>Spread</td>
<td>Lateral spread in 1989 in Loma Prieta, California, USA (Steve Ellen, U.S. Geological Survey)</td>
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<td>Debris flow</td>
<td>Debris flow on the north coast of Venezuela in December 1999, killing 30,000 people</td>
<td></td>
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<td>Lahars (Volcanic debris flows)</td>
<td>A lahar in 1982 from Mount St. Helens, Washington, USA</td>
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<tr>
<td>Debris avalanche</td>
<td>A debris avalanche in the Philippines in February 2006</td>
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The 1993 Lemieux landslide – a rapid earthflow in sensitive marine clay near Ottawa, Canada

Slow earthflow (creep)

Creep in United Kingdom (Photograph by Ian Alexander)

Where do Landslides Occur?

Anywhere in the world:

+ On land and under water;
+ Bedrock or soils;
+ Cultivated land, barren slopes, and natural forests
+ Extremely dry areas and very humid areas
+ Steep slopes or gentle slopes (1–2 degrees)

Map of the global risk of landslides (Robert Adler and Yang Hong)

Example of lateral spreading, a type of ground failure often associated with earthquakes
What Causes Landslides?

- Natural occurrences:
  + Water: rainfall, snowmelt, changes in groundwater levels
  + Seismic activity: earthquakes
  + Volcanic activity

The Mameyes, Puerto Rico landslide in 1985, triggered by a tropical storm (Randall Jibson, U.S. Geological Survey)

Earthquake-induced landslide after the 2004 Niigata Prefecture Earthquake (Professor Kamai, Kyoto University, Japan)

- Human activities:
  + Populations expanding onto new land: Disturbing or changing drainage patterns, destabilizing slopes, and removing vegetation
  + Undercutting the bottom and loading the top of a slope
  + Irrigation, lawn watering, draining of reservoirs, leaking pipes, and improper excavating or grading on slopes.

Example of landslides due to human activities
Step 2 - Making a Landslide Hazard Map

- Start with community knowledge
- Conduct field investigation
- Produce a landslide hazard map

Step 3 - Low Cost Early Warning System (DRH 56)

- Proposer: Assoc. Dr. Teuku Faisal Fathani, Gadjah Mada University, INDONESIA

- Saved 35 families from a landslide that occurred in Kalitelaga village in Banjarnegera Regency on November 7, 2007

- These monitoring equipment are connected to a siren system in order to directly warn the local community.

- The local community in remote areas can easily operate and maintain the equipment based on their own capability.
Two types of simple extensometers and automatic rain gauge

- A handmade manual reading extensometer
- Automatic extensometer, where the relative movement between two points is mechanically enlarged by 5 times and recorded on a paper continually

- Both types of extensometers are connected to the siren system in order to directly warn the local community for taking necessary actions in dealing with landslide disaster.

A simple modified rain gauge was also developed with hourly rainfall intensity recorded on a paper continually.

- This rain gauge is also connected to the siren system to warn the community when the precipitation reaches a certain value.

- This system presents the results of real-time measurement by using automatic extensometer, tiltmeter, groundwater measurement, and tipping bucket rain gauge

- The monitoring equipment connected with a data logger and integrated in a fieldserver

- This sensing device provides real-time online data display system, which gathers the data from multiple sensors and shows them in a webserver.

- This unit also implements early warning that can be adjusted depending on the site condition.
### Step 4 - Implementation

- Task Force for Disaster Mitigation and Management of local community:
  - installation
  - operation
  - maintenance of the technical system

- All the equipment are run by a dry battery and/or solar energy

- Public education and evacuation drill
  - Training for operator
  - Evacuation drills involving primary school students
References

1. DRH 56 - Low-cost and adaptive technology to support a community-based landslide early warning system in developing countries

2. DRH 61 - Rain-induced landslide susceptibility: a guidebook for communities and non-experts