LANDSLIP – Landslide Multi-Hazard Risk Assessment, Preparedness and Early Warming in South Asia: Integrating Meteorology, Landscape and Society

Report of Social Dynamics Scoping Visit to Nilgiris, 9th-12th January 2016

Researchers present:

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Stakeholders visited:

Chief Engineer Govindaraj, Nilgiris Mountain Railway
Dharmalingan Venugopal, Save Nilgiris Campaign
Assistant Geologist Mariamma and Draughtsman Punyan, Department of Geology and Mining, Coimbatore and the Nilgiris
Secretary General Ullas Menon and others, UPASI (United Planters' Association of Southern India)
Joseph Franklin, Disaster Management Resource and Research Centre
Dr Manivannan and Dr Kamon, Indian Institute for Soil and Water Conservation
Mr Kulandairaju, Asst Divisional Engineer, Nilgiris District Highways Department
Assistant Engineer Kamalakkannan, Hill Area Development Programme
Keystone Foundation

SUMMARY OF KEY FINDINGS:

Causes of Landslides

There is a general perception that the principal cause of landslides is redevelopment. This is taking place through a proliferation of resorts and second homes, many of which are built on unstable land with poor foundations. The last major landslide – in 2009 – was caused by a development under construction with poor foundations, which affected draining. Roads are also blamed for landslides, either through new development or increased traffic adding further loading to slopes. Landslides have also been attributed to slope stabilisation by the highways authority. This occurs either after a landslide or to protect a settlement (it is unclear how this is decided), and can affect draining.

The area has two monsoons – the SW monsoon which is regular but not intense, and the NE monsoon which is irregular and often heavy. Landslides are most common in October/November, where soil has become saturated during the SW monsoon. If rainfall is heavy for four days, landslides often occur on the 4th.

50% of the region is scheduled forest. However planting of Eucalyptus during the 1950s weakened slopes as this has poor soil stabilisation. Tea plantations act to stabilise slopes, but shifts to vegetable crops due to price fluctuations in price of tea can increase landslide risk. Vegetable growing is banned on slopes >9%, but this legislation is often ignored.

Institutional Mapping

There are many institutions with varying degrees of responsibility around landslides at different levels from national to municipality, and there is often crossover in responsibility.

For example, the (district- and state-level) Department of Geology and Mining undertake both pre- and post-landslide assessments, as do GSI. There is apparently some friction between these organisations.

Dpt. Geology and Mining are also responsible for undertaking geotechnical assessments of new developments with a footprint of >1,500 ft^2, although apparently many of their assessments are ignored, rules are subverted, and in some cases they are pressured to pass developments that would result in increased landslide risk.

Other organisations involved in landslide mitigation include the Department of Highways, the Department of Forestry and Nilgiris Mountain Railway. These all have their own remits, and coordination between each organisation is often poor. Coordination of activities is undertaken by the Disaster Management Officer within the District Collector's office, or by the District Collector himself. This person seems to be the most powerful person in the region, although we did not meet him. The railway is very minor operation and runs only once a day for tourists at an economic loss, so roads take priority in landslide reconstruction.

Vulnerability of Local Population

Local populations are a mixture of tribal, resettled Sri Lankan Tamils and outsiders. The tribal groups are generally not highly vulnerable to landslides. Four tribal groups live in the forests or on lower slopes. The largest group, Bhadagars, are relatively wealthy and owned tea plantations. Many of this group are now moving out of the region and selling their land for development. The most vulnerable group are the landless Tamils who work on the plantations and live in informal settlements on marginal land.

Existing Early Warning

A teacher called Joseph Franklin operates a one-man NGO called the Disaster Management Resource and Research Centre (DMRRC). HIs early warning system consists of automatic rain gauges installed in 10 villages that are attached to software and hardware that he built himself, based on Prankash's PhD work. He has also installed 25 loudspeakers that are to emit early warning from the District Collector. A Supreme Court Order has stated that these should be removed, but they are still operational although they have never been used. The District Collector funds Franklin from various sources, and his early warnings are passed to the District Collector. Some organisations we spoke to were aware of his early warnings but it is unclear how the District Collector disseminates them. It is also unclear how reliable they are. We will have to be sensitive when dealing with Franklin and his system.

Sources of Landslide Information

The following organisations have information on historical landslides:

- Nilgiri Mountain Railway have records of all landslides affected them from 1955, which they will share with us.
- The Department of Geology and Mining have records of larger landslides. We will have to get permission at the state level.
- Department of Agricultural Engineering have landslide records, although we did not speak to them.
- Revenue Department may have records of economic loss (again we did not contact them).
- Dharmalingan Venugopal (Save Nilgiris Campaign) has some newspaper records etc of larger landslides.

- Joseph Franklin has undertaken a lot of his own work on vulnerability, which he will share with us. It is not clear at the moment what quality this is.
- Keystone Foundation have vulnerability baseline assessments for health, but not disasters.

KEY POINTS OF DISCUSSION WITH STAKEHOLDERS:

Nilgiris Mountain Railway:

- Narrow-gauge railway that is now only used for tourists. Section of track most susceptible to landslides is Coimbatore to Ooty, which only runs one return train per day.
- Landslips regular during the monsoon (June/July, but mostly October/November) with railway regularly closed for 2-3 days per year. Last major landslide that closed the railway for 6 months was 2009. Previous large event 1993.
- Clearance after landslides by 13 gangs of >7 people who work sections of the track. Earth-moving vehicles are brought in on contract if required.
- Weather forecasts provided by IMD to zonal railway headquarters in Chennai
- Keep a record of landslides from 1955

Save Nilgiris Campaign:

- One-person campaign by retired banker who also set up John Sullivan Memorial Museum. Set up in 1985. Wide remit of campaign, including DRR.
- Mr Venugopal is fairly knowledgeable of the local area and considers it his mission to bring risk knowledge from GSI to the people. Ran a workshop called International Climate Champions for students from around the world in 2010. Very well connected and works at policy level, and probably good contact for social science research.
- Highlighted important land-use changes in Nilgiris: Eucalyptus (poor soil retention) planted for clothing from 1950s; tea from 1980s; tourism after Kashmir troubles.
- Department of Forestry has been very strong from 1980s, and land-use in the forest regions is exceptionally heavily regulated. Estimated that Nilgiris is 50% forested.
- 30% of land is held by scheduled tribes.
- Hill Area Conservation Act was set up in 1980s, but this is now threatened due to movement into the area by tourists and second homes. These often build on steep slopes. Venugopal stated that ‘land sale is a bigger threat than landslides’.
- His view is that ‘direct action is the only response’, and you cannot simply appeal to the public or administrators. He believes that early warning needs to combine with land-use planning. Land use management needs to be brought to government attention.
- There is a potentially politically sensitive issue with regards to property prices, as early warning will affect prices.
- He also believed that the local Department of Geology and Mining often undermined the decisions of GSI

Department of Geology and Mining:

- District division of a state- level (Tamil Nadu) administrative body. Following functions:

1. Study all landslides
2. Give permission for mining activities (only 'minor minerals')
3. Provide geotechnical permission for all developments with a footprint greater than 1,500 ft^2.

- When a landslide occurs they alert the District Collector's Office. The first organisation to speak to the local people after a landslide would be the Revenue Division Office, i.e. the *Talook*-level of the Revenue Department. They will work with the local Panchayat in disaster management. They will also inspect landslides on the railway, and will give a report to the State department.
- If an early warning system was developed this is what they would continue to do, i.e. all decision-making is made by the District Collector's Office.
- Responsibilities of the Department of Geology and Mining is shared with GSI. There is lots of overlap, but GSI do not work in detail at the local level and they are not interested in small landslides. Also, GSI are not rapid response.
- Geology and Mining at the State level is only 30-40 years old. Prior to 1985 all responsibilities came under GSI.
- For this reason records of landslides are better after 1985.
- Geology and Mining is now a State Subject, which means State and Centre are both involved, but State takes priority (alternative would be Central Subject).
- Only 10% of developments in Ooty District have geotechnical review, and some larger tourism resorts are given clearance. Avoidance of the review is common.
- Other laws are also avoided, such as a High Court Order banning heavy plant in the mountains, which is ignored when it comes to road construction and permission is given by the District Collector.
- Stated that interest in landslides is diminishing as rainfall is diminishing (last three monsoons have been weak).

UPASI

- NGO who represent tea, coffee, cardamom and spice planters in three states in Southern India (Karnataka, Tamil Nadu, Kerala). Officers are selected by members. Involved in research on plant science, involving about 30 planters. 80% of planters represented in the group. Works closely with the Commerce Department. Umbrella group, although state bodies exist in all three states.
- Did not seem very interested in early warning themselves, although felt that it would be useful for highways.
- Impact of landslides is more of a problem for plantation villages like Kheti, rather than the plantations themselves.
- Plantations help to stabilise the soil, as tea has 10 foot deep roots. [Unclear what the level of risk is during the 4-year tea growth period, although they said not much regrowth is happening at any time]
- All plantations have their own rain gauges. They also have 30-40 years of landslide records.
- Perception again that monsoon is decreasing in intensity so landslides are less of a problem.

- Stated that institutionally, road is prioritised over the railway. Department of Revenue have overall control over landslide response. The Disaster Management Committee answer to the District Collector.

Joseph Franklin

- One-person NGO engaged in disaster management. Used to work for Disaster Management Committee and Revenue Department, until he became disenfranchised and worked on his own. Felt that continuity in community disaster training was poor, and there was a culture of retrospective demands for relief. Government monitoring is weak, although it was better under a previous collected named Acchya Patni. Now runs DMRRC (www.dmrrcindia.in)
- He has worked as a consultant for the District Collector in Coimbatore and at the state level. He has also hired his own consultants.
- He has developed an early warning system in 25 locations, which are loudspeakers accessed by a specific radio frequency that can broadcast warnings from the District Collector's Office. Apparently these have never been used. The Supreme Court ordered that these be removed, but apparently many are still operational.
- Has also developed a model based on Prankash's PhD work that creates an automatic alert when rainfall goes above a certain threshold. He designed an automatic system involving rain gauges and software based on Prankash's model that he has installed in 10 villages. These give warnings to the District Collector's Office. It is unclear how the warning are then circulated, but other organisations claimed to have heard of them. Note that the rain gauges have not been validated by the IMD, so he lists them as being for research only.
- Received 25.5 lakhs rupees from HADP for the above, funded through the State Planning Committee.
- Claims the predictions are 80-90% successful, although the Highways Department later said around 50%. He claims to have successfully predicted a flood in 2015.
- Held a landslide stakeholder workshop in 2015.
- He also says he has worked with other PhD students on landslides.
- He has many links with local institutions including people who have received training through his organisation. Stated that the local power is held by the Collector and by the Panchayats. However, the Collector himself does not have a lot of information and can be difficult to contact.
- When he was a Disaster Management Officer he ran Hazard Vulnerability Assessments from secondary data on 106 vulnerable locations based on GSI hazard maps derived in the 19890s. Also some micro-level studies using primary data. This was around two years ago.
- He stated that other vulnerability data may be held by the Integrated Child Development Scheme, alongside information held by the government.
- He considered floods to be a major issue associated with landslides. Highways are a particular issue.
- Note that landslides are only deemed to be such if government says so, otherwise considered landslips etc.

Indian Institute of Soil and Water Conservation

- Research organisation under the Indian Consulate of Agricultural Research. They work directly with farmers regarding water conservation, and the state regarding landslides. They are currently proposing a project to DST on physical landslide vulnerability.
- They operate 8 of their own rain gauges to determine the link between rainfall and landslides.
- Stated that landslides often occurred in the NE monsoon when rain is high intensity but rare, if ground had become saturated during SW monsoon where rain is frequent but not heavy. There is a 2m deep clay layer. Landslides particularly prevalent when rainfall takes place for 4 consecutive days. If rainfall is above 160mm on the fourth day, landslides are likely.
- Felt that the main causes of landslides are landuse. This includes poor draining in tea plantations, although this is now less of a problem. Landslides also occur where draining becomes blocked. Tea itself stabilises the soil due to deep roots, although price fluctuations can cause farmers to move to vegetable crops, which can cause landslides. It is not permitted for vegetables to be grown on slopes >9%, but this is ignored. Tea plantations have been known to wash away.
- IISWC have developed use of Jute geotextiles to hold together soil during replanting together with deep-rooted grasses. Developed with National Jute Board and National Soil Institute, together with Common Fund for Commodities in the Netherlands.
- Poorly-built houses also increase risk, due to improper site selection. Houses are built in depressions as it is easier to build but this can block drainage. This is what happened in 2009 landslide. Previously tribal housing was only built in ridges, so low risk.
- Vertical cuts in roadside also increase risk. IISWC made a recommendation to the highways department that vertical cutting is banned and 60° slopes are used with grasses
- Provided a list of local stakeholders for landslides: Department of Police (can stop transport), Department of Fire and Civil Protection, Local Municipalities and Panchayats, Department of Highways, Department of Water Resources, Department of Agricultural Development.
- Coordination of all of these stakeholders is undertaken by the District Collector's Office.
- Department of Geology and Mining are pressured to pass developments in high-risk areas.
- Stated that the Department of Agricultural Engineering will have landslide records.

Highways Authority

- Two operations in the aftermath of landslides:
    1. Temporary restoration (used 65,000 sandbags in 2009)
    2. Permanent restoration
- Immediately after a landslide they will mobilise a gang of their own people, and subcontract JCBs if required. First priority is always to clear traffic.

- We spoke to people who represented both the National and State Highways, although they both worked in Coimbatore. Coimbatore to Ooty road is managed by State Highways but funded by National Highways. They explained the jurisdiction of highways:
    - National Highways (funded from centre)
    - State Highways (funded by state)
    - Major District Roads (funded by state)
    - Rural Roads (funded by municipality)
    - Municipal Road (funded by municipality).
- The official report on the landslide would be put together at the district office in Coimbatore.
- Felt that Coonoor was the main landslide area in the Nilgiris.
- In 1993 2 busses and several houses were destroyed.
- They have records of small and large landslides in Coimbatore, but we would need permission from the State Highways Engineer in Chennai to consult them.
- They say that early warning would be useful, but that he already knows where the landslides will be.
- Stabilisation works occur generally after landslides. Anticipatory stabilisation occurs in areas of development if funds were available. They claimed an individual could not ask for stabilisation above their property, but a group of properties could (this was contested by other interviewees).

Hill Area Development Programme

- Funding body for general development initiatives
- Previous funded by 90% central government, 10% state
- Recent changes mean they are no longer HADP but part of a wider SADP with a number of other districts. They now receive all of their funding from state
- Previously funded Franklin's early warning systems. 25.5 lakhs allocated to the District Collector's office and then to Franklin for 3 years (unclear if this amount is yearly or over the whole period). Now they no longer fund his work and if it is to continue the District Collector will need to find funds from elsewhere.
- Stated that the Department of Agricultural Engineering is the main organisation for handling landslides. HADP allocated 90 lakhs per year to the Department of Agricultural Engineering for landslides. This amount is allocated because it is unknown exactly when landslides will occur.
- They also gave money to local Panchayats for mitigation.
- Main problem of landslides is perceived to be infrastructure collapse.
- Stated that an early warning system would only be useful if it reached the common people. People would have to be made ready for an evacuation. This would occur through the District Collector's office.
- Stated they have no records of economic losses, but Revenue Department will have this if it exists.

Keystone

- NGO working on water resources, information planning and ecodevelopment. Began with work on indigenous honey-collecting practices and have no expanded to a large

organisation including NGO work, education, a private company and a brand management division. Forest conservation is central to their work. They have a team of around 100 and run an international undergraduate exchange programme with Cornell, with whom they have a link. They are also involved in work around the Green Climate Fund.

- Explained that tea workers are Tamils who were settled in the region from Sri Lanka. They live in informal settlements that are growing in size, and are probably the most vulnerable to landslides. They rely on plantation work and many of them are landless.
- Indigenous people live in old dwellings in the forest that are more resilient to landslides, or in the forests
- Landslide risk is now increasing due to development of roads and resorts. Also second homes. Two months ago a High Court order was put in to prevent development on agricultural land which might have a benefit for landslide risk, but this is often ignored
- The main landside corridor is the Ooty-Coonoor road.
- Slope stabilisation is put on the roads, but this affects drainage patterns. The road becomes inundated during the monsoon due to concrete beside the road from slope stabilisation.
- Eucalypus trees also increase risk as these do not hold the soil.
- The local Bhadagar indigenous people, who make up 200,000 of the 850,000 population of the district, are relatively wealthy as they owned tea plantations, but they now face pressure to sell their plantations for development.
- With regard to institutions, they stated that the District Collector himself coordinates the multiple stakeholders. Off-season there is one person in the Disaster Management cell, but during landslide season they mobilise a big team of people from within the office.
- They have baseline vulnerability-health assessments and WASH assessments, but no disaster vulnerability assessments.
- They are also engaged in forest restoration. However, much existing disaster work is retrospective.
- They have options for communication through a community radio station that they operate, and a local newspaper for indigenous groups. They also have their own newsletter, which they broadcast in three languages.

Other information (taxi drivers etc)

- General feeling that development is the key cause of landslides. Farming is becoming more expensive due to fluctuations in tea price and land is expensive. Tree-felling is banned.
- Five indigenous groups in the region. Budegas most numerous and wealthy. Also Todas, who are a scheduled tribe, Irulas in forest, and two more on the lower slopes.