Progress, Future Challenges and Sustainability Issues in Geohazard Research

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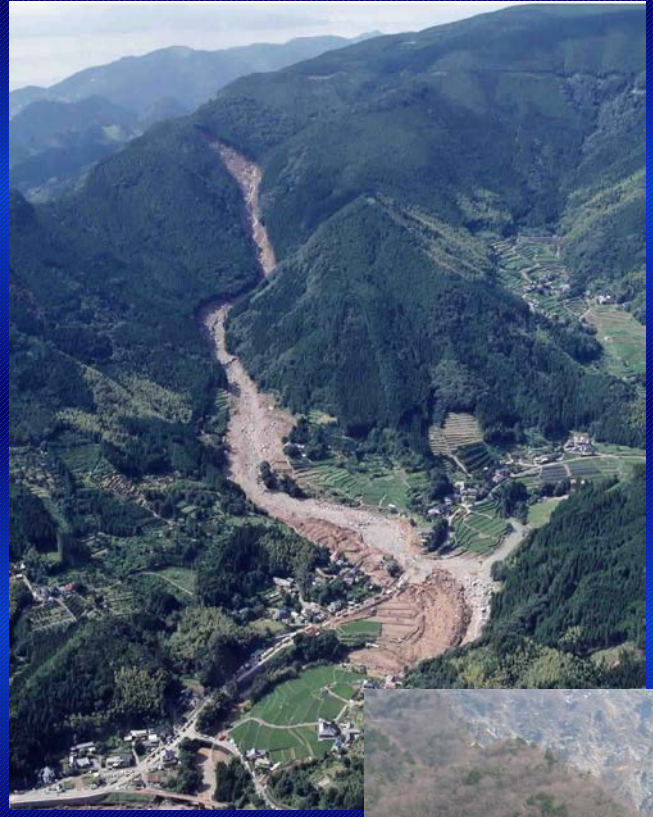
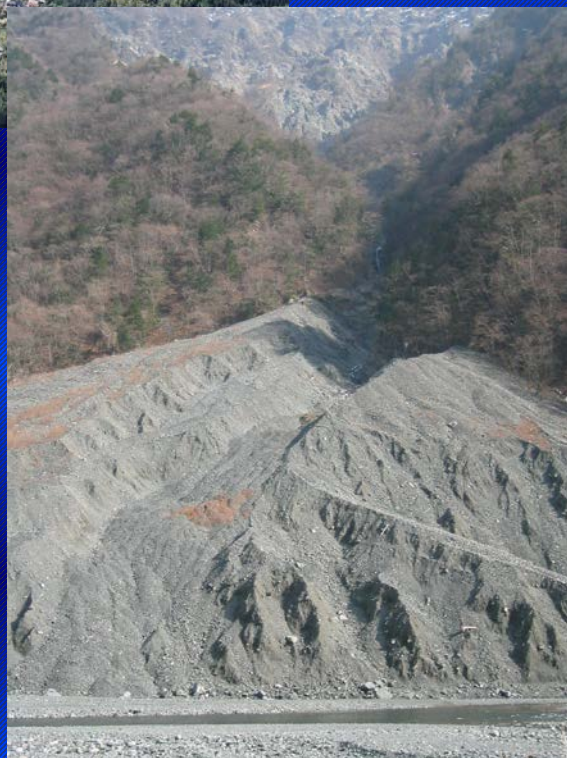
Second Global Summit of Research Institutes for Disaster Risk Reduction: Development of a Research Road Map for the Next Decade

Presentation Theme

- Briefly outline some of the progress in geohazard research
- Examine future challenges in this field
- And best determine "how to tackle these challenges" within the context of sustainability

As such, both a broad-based and long-term focus is required





A few key points:

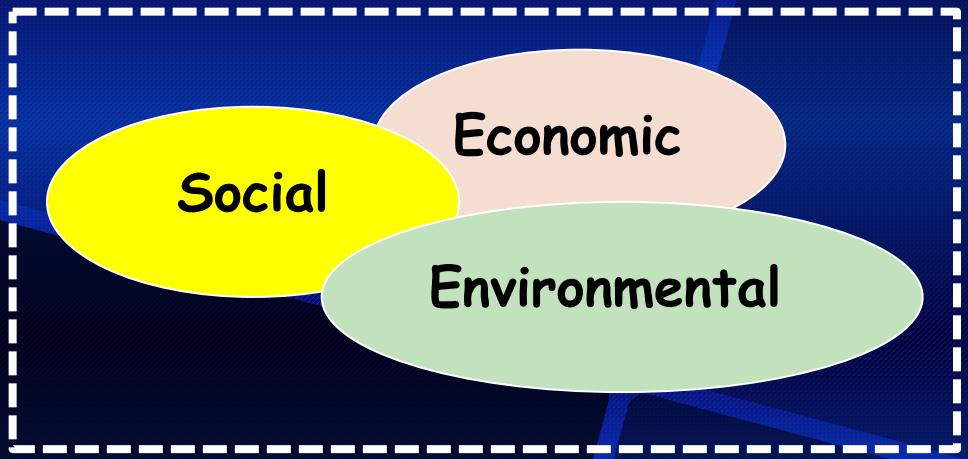
- To move research forward we to expand our perspective of geohazard research and related management issues and not look at these as isolated occurrences
- We need to embrace the concept of interacting ecosystem components within a sustainability framework to assess geohazards at broader spatial and longer time scales
  - Oftentimes, numerous natural and anthropogenic 'stressors' act together to affect geohazards
  - Such complex system interactions can lead to loss of resilience in ecosystems when 'tipping points' reached
  - System interactions can also result in 'cascading' disasters
- As such, the cumulative effects of both natural processes and anthropogenic stressors need to be assessed in many cases to fully examine the causes and effects of geohazards

Strong Japanese tradition in basic geohazards research and numerical simulations of landslides/sediment disasters

- Landslide studies in flumes, centrifuges, etc. under controlled conditions
- Sediment transport studies in flumes
- Detailed field monitoring of pore pressure & suction response, and sediment transport
- Geomorphic hollow development
- Weathering mechanisms related to geohazards
- Earthquake initiated landslides
- Modeling landslide dynamics

Building upon this solid background, here are some examples of future challenges in geohazard research within the context of sustainability

Concept of Sustainability

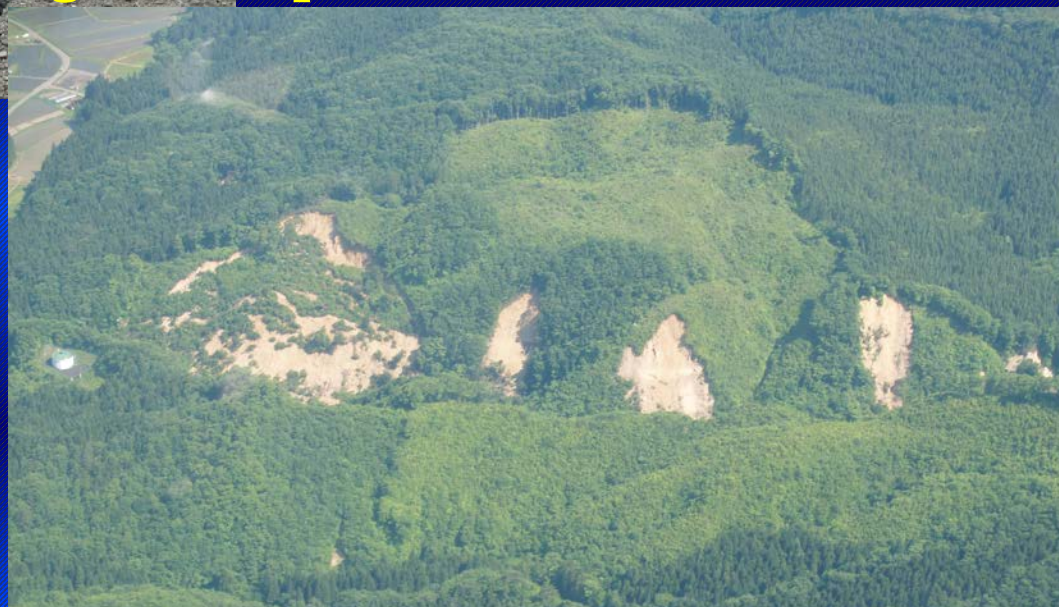


Spatial scale challenges in geohazards

2008 Iwate-Miyagi Earthquake

Extracting lessons from individual deep-seated landslides and …

expanding inferences to larger scales in diverse geomorphic, geologic & land use settings



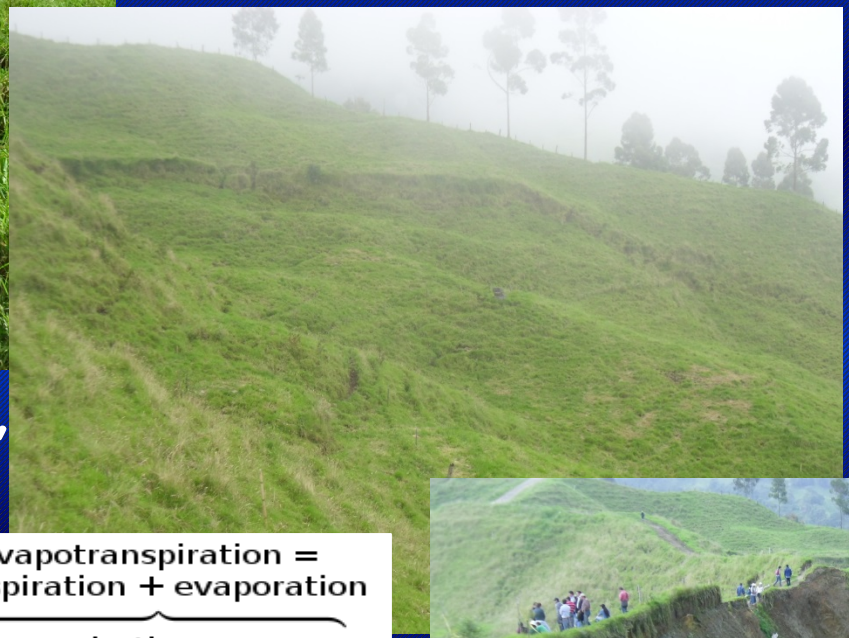
Spatial-temporal challenges associated with landslides affected by anthropogenic activities

expanding this to address more complex land management interactions and topographic considerations

Using information from land use effects at individual sites and …

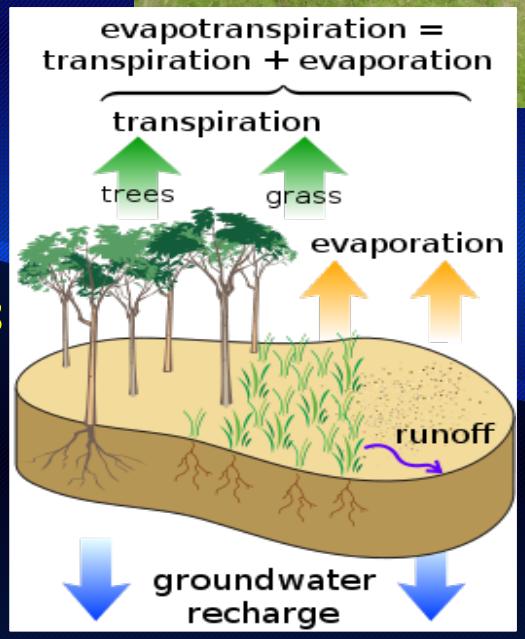
Complex interactions - Connections between soil creep and…

Incipient landslides, and…



Large scale landslides

- Feedback between creep and deep landslides
- Deep soils/regoliths
- ET effects
- Rooting strength changes
- Grazing terraces



near Manizales, Colombia

Example of Cascading Geo-disasters

March 2011 Great East Japan Earthquake

Cumulative cascade of disasters:

M = 9.0 earthquake

Fires

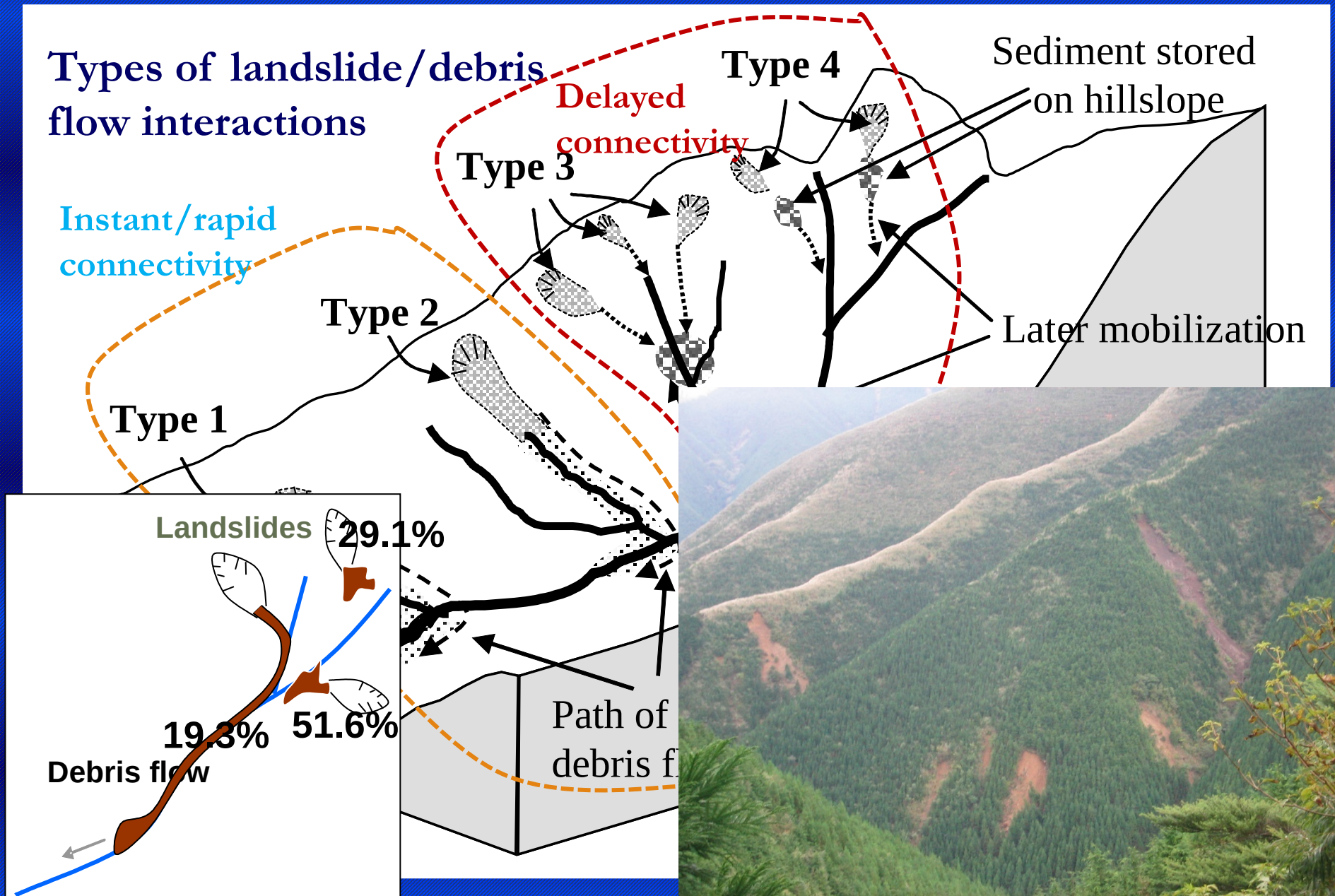
Tsunami with run-up heights > 30 m

Landslides/ debris flows

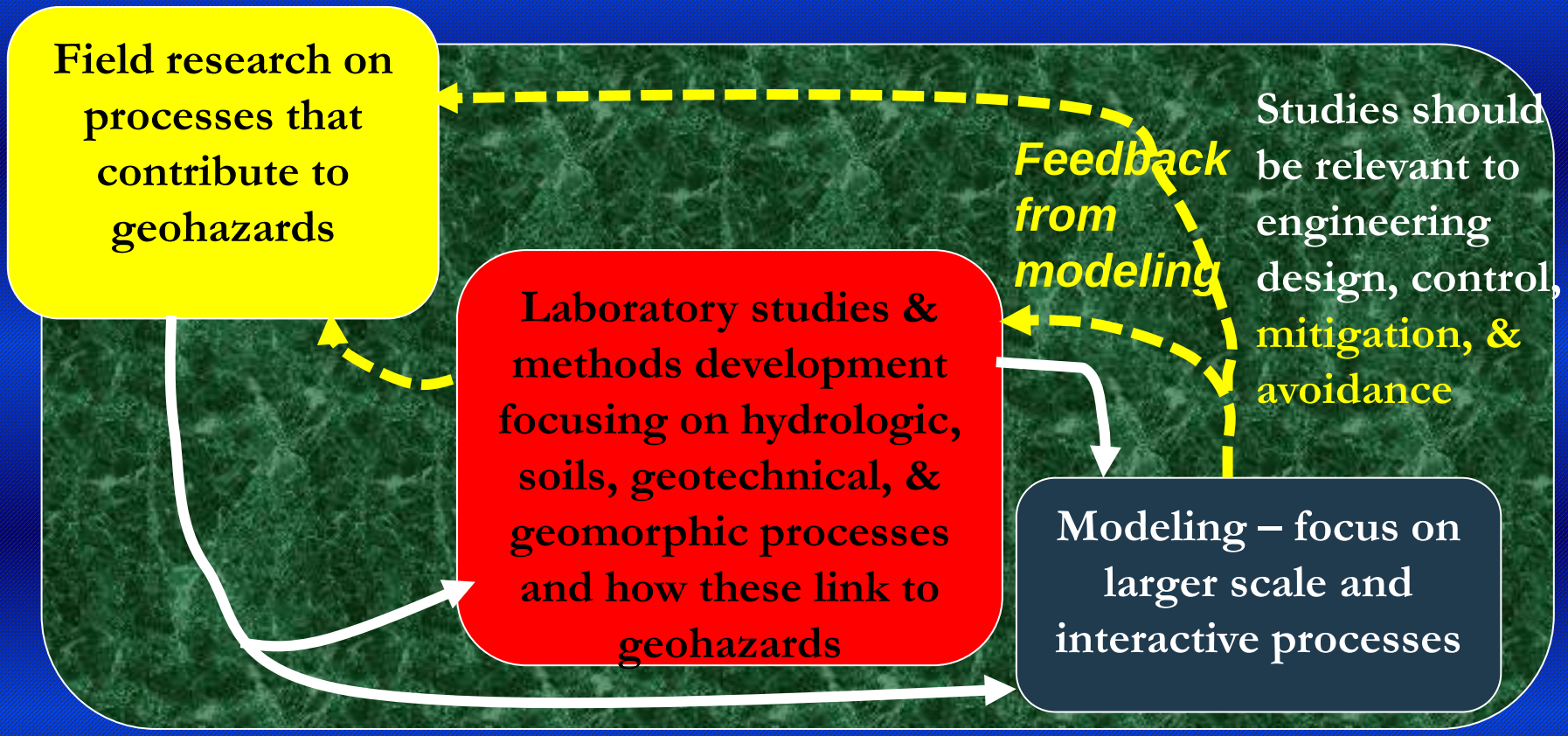
Radioactive releases from power plants

Direct & indirect consequences

Connectivity of hillslope landslides to in-channel debris flows



An important research approach that we need to embrace



And finally, this integrated environmental research needs to be viewed within the broader sustainability context, where economics and societal issues are considered

Some concluding thoughts

- There is now a need to build on previous process-based geohazard research and extend this to larger spatial and longer temporal scales, which will necessitate assessment of more complex land management scenarios
- Need to embrace 'systems-based' approaches to solve the complex environmental problems that are facing us
- Research priority needs to be given to the most pressing issues; concepts of sustainability and risk provide a basis for prioritizing
- Better knowledge of the hillslope to channel continuum is needed related to landslides and debris flows
- Linking the best hydrologic, geomorphic and geotechnical process information into models is important – and models should not be too complex for 'end users'