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LANDSLIDE HAZARD AND RISK ASSESSMENT, AND MANAGEMENT AND MITIGATION FOR THE SCOTTISH TRUNK ROAD NETWORK

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LANDSLIDE HAZARD AND RISK ASSESSMENT, AND MANAGEMENT AND MITIGATION – SCOTLAND

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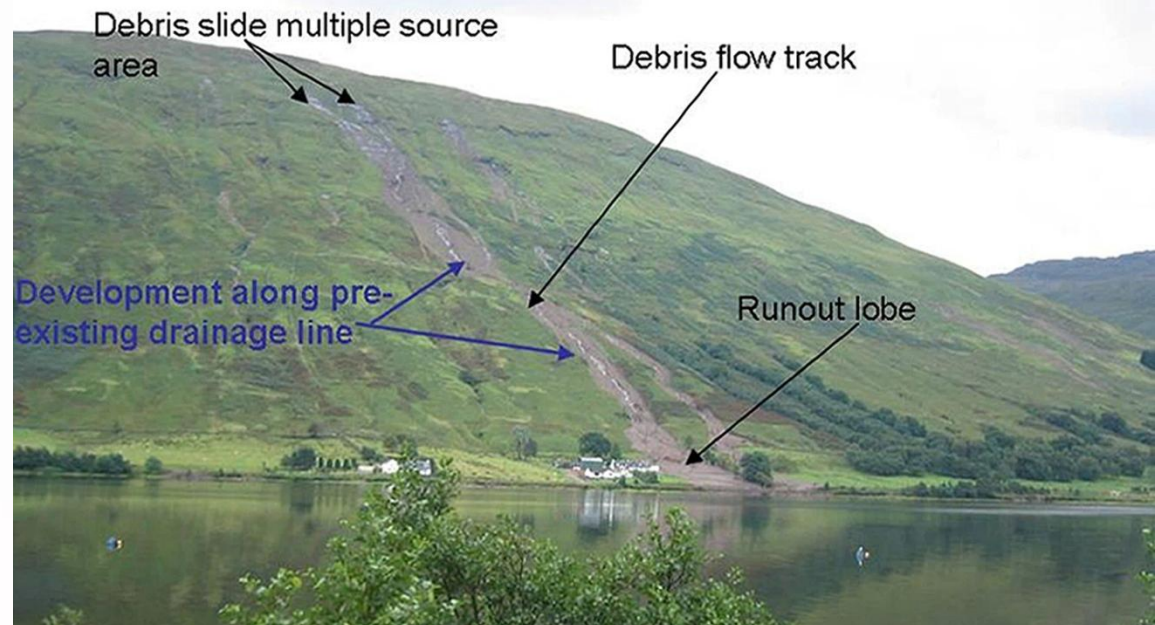
- Events
- Hazard Assessment
- Hazard Ranking
- Management & Mitigation
- Summary



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Events – August 2004

- Rainfall up to 300% monthly average
- One storm event
 - Up to 85mm
 - 48mm in 20 min
 - Peak 147mm/hr



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A9 N of Dunkeld,
11 August 2004



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A9 N of Dunkeld,
11 August 2004

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A85 Glen Ogle,
18 August 2004



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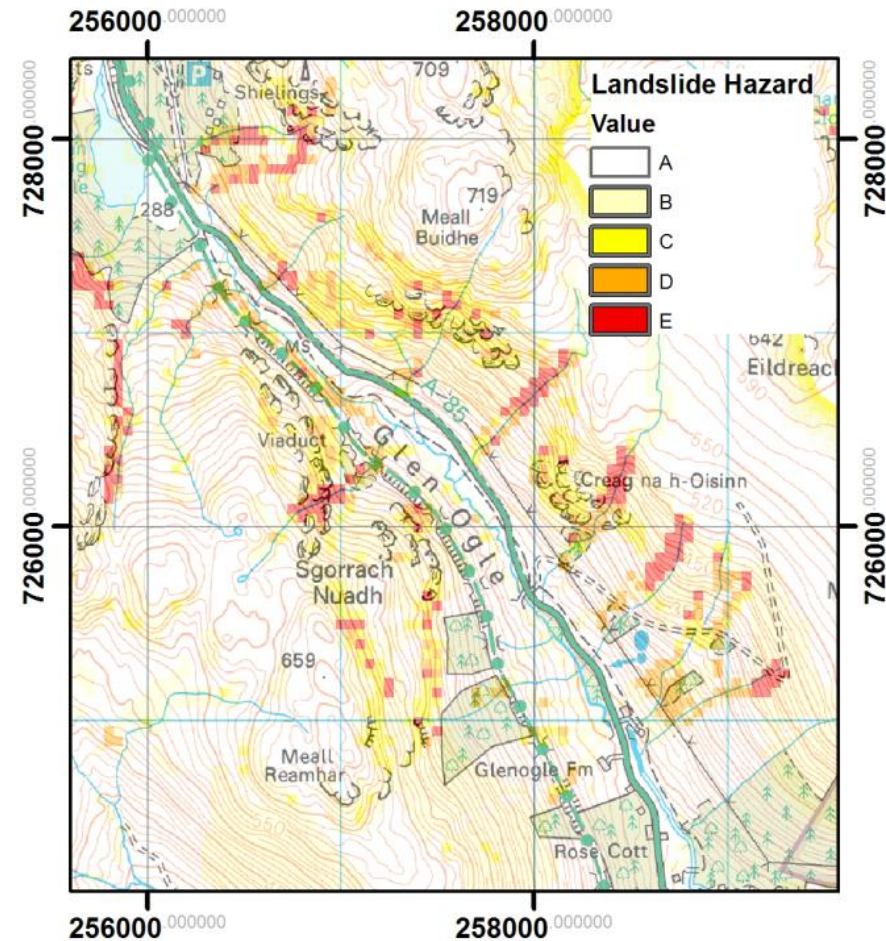
A85 Glen Ogle,
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Hazard Assessment - Susceptibility

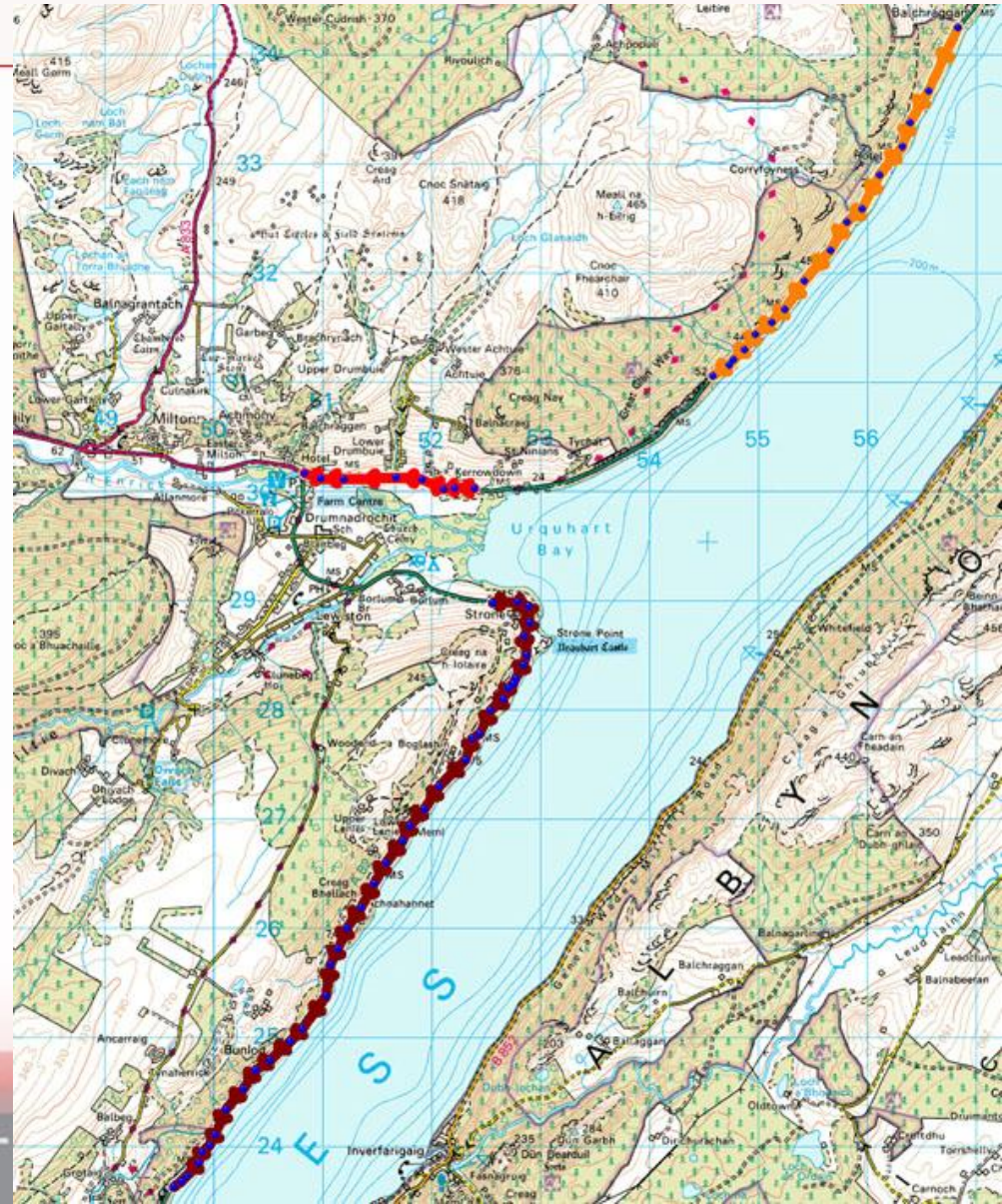
- Collaborative approach
- Susceptibility assessment
- GIS-based
- Needs to be interpreted
 - For Hazard
 - At road level
 - 2.5D to 1D (linear asset)



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Hazard Assessment – Hazard

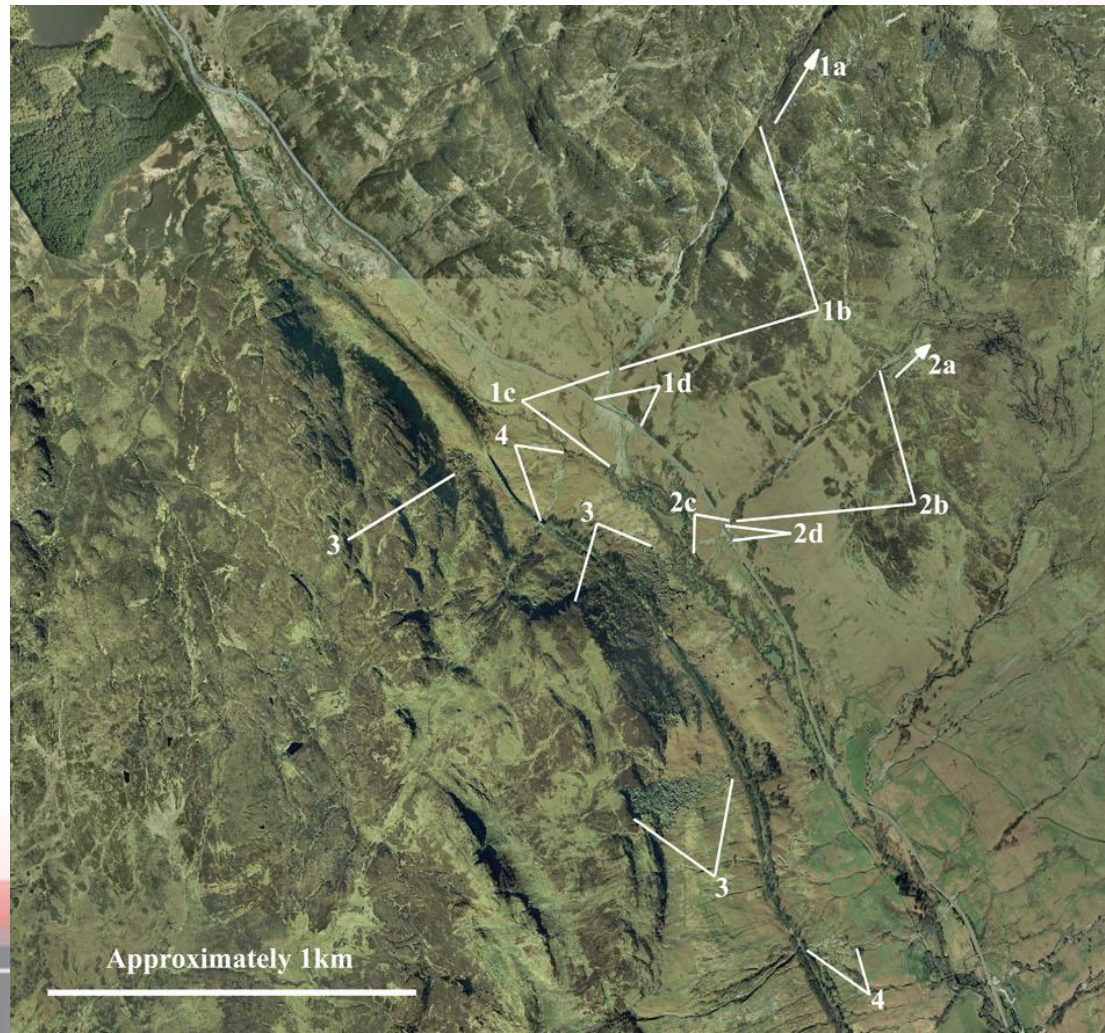
- Extensive interpretation
- Coarse sift
 - Highlight areas of interest
- Highly detailed
 - Prioritisation
- Desk study



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Hazard Assessment – Ground truthing

- Field based
- Draws in HR PA
- Validate desk study work
- Add detail



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Hazard Ranking / Risk

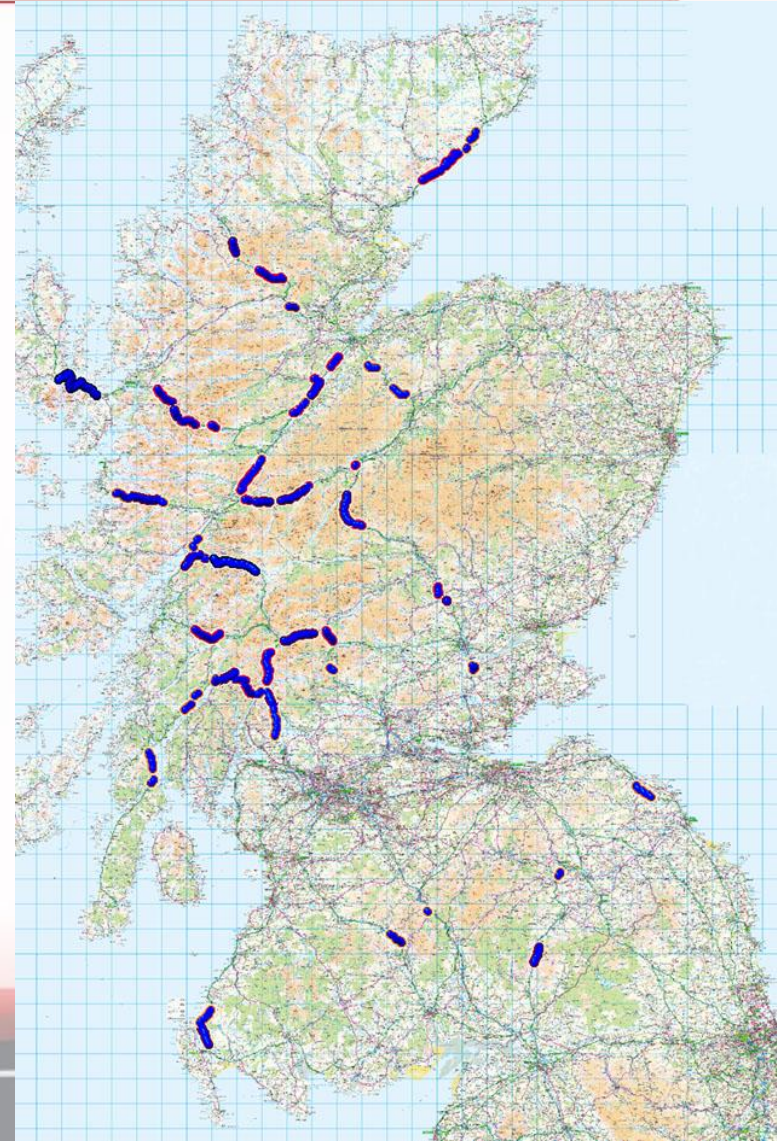
- *Risk = Hazard x Elements at Risk x Vulnerability*
- As Elements at Risk is essentially binary
 - A road is either present or not
- *Risk = Hazard x Exposure*
- Where Exposure is the:
 - Vulnerability of road users to life and limb risks and
 - The potential socio-economic impact



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Hazard Ranking / Risk

- Exposure = AADT + Diversion
- AADT score
 - AADT < 2,500 = 1
 - 2,500 < AADT < 7,500 = 1.5
 - 7,500 < AADT < 25,000 = 2.0
 - 7,500 < AADT < 25,000 = 2.0
- Diversion score
 - Limited = 0
 - Significant = 1
 - More Significant = 2
- Weighting applied
 - AADT = 1.0
 - Diversion = 0.5



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Management & Mitigation

- **Exposure Reduction** for High Risk sites
- Reduce exposure of vehicles and road users to hazards
 - Less costly
 - Less environmentally intrusive
- Widely applicable, based on
 - Detection
 - Notification
 - Action
- Initially reactive to events
- Working towards forecast based upon rainfall



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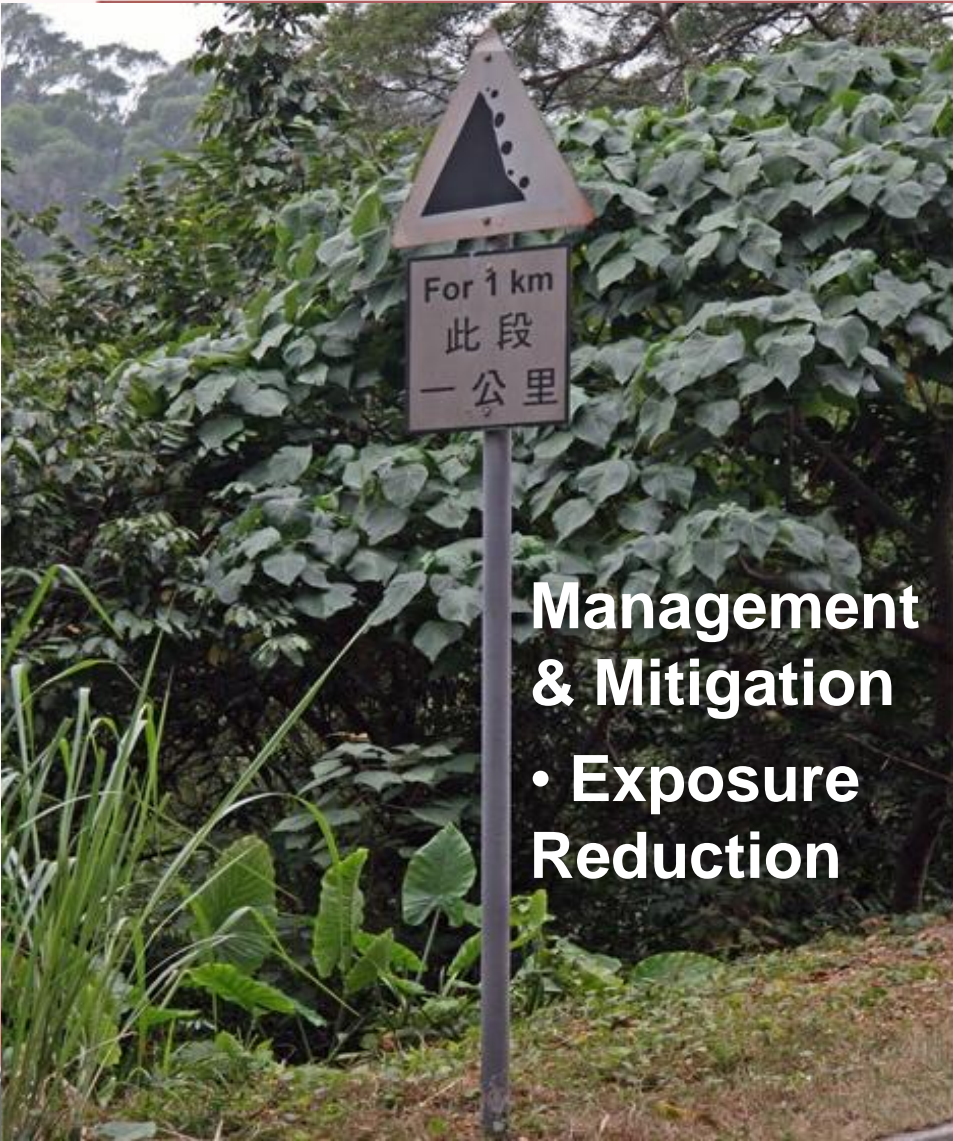


**RISK OF WATER
ON ROAD AHEAD
DRIVE CAREFULLY
(PREPARE TO STOP)**

**Management
& Mitigation**

- **Exposure
Reduction**

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**Management
& Mitigation**

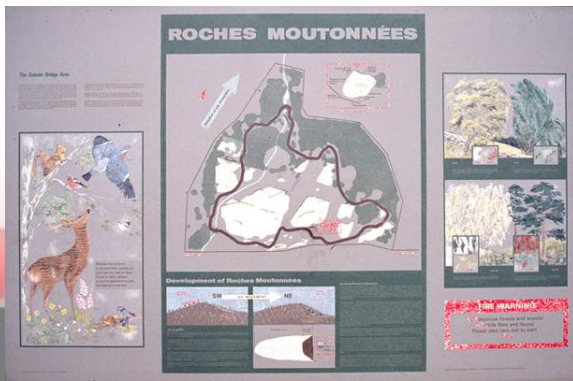
- Exposure
Reduction



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Management & Mitigation

- **Exposure Reduction** for High Risk sites
- Wig-wag signs - Rest and be Thankful
- Media announcements
 - Web (e.g. Traffic Scotland)
 - Media announcements (print, radio, TV)
 - Advisory leaflet
- Information boards for context



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Management & Mitigation

- **Hazard Reduction** for Very High Risk sites
- Physical intervention
 - Road protection
 - Landscape – debris flow prevention
 - Road realignment
- Potentially applied to very few sites
 - Costly
 - More environmentally intrusive
- Must compete for budget with other priorities



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Summary

- Assessment of
 - Susceptibility
 - Hazard
 - Exposure
 - Hazard Ranking / Risk
- Development of management & mitigation strategy
 - Primarily management, Exposure Reduction
 - Initially Reactive
 - Moving towards proactive (rainfall-based)
- Provision for mitigation, Hazard reduction
- Weather and climate (change) remain key influences



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Summary

- Following August 2004 action
 - Was needed
 - Has been taken
 - Continues to be taken
- We cannot stop debris flows occurring
- We can manage them / their consequences effectively
- Provided that we deploy the appropriate resources to tackle the problem

