Hazards on fans

Tim Davies
Natural Hazards Research Centre
University of Canterbury

1. Alluvial fans - sediment movement as bedload by river.

* 2. Debris flow fans – sediment movement usually as bedload by river; occasionally as debris flows

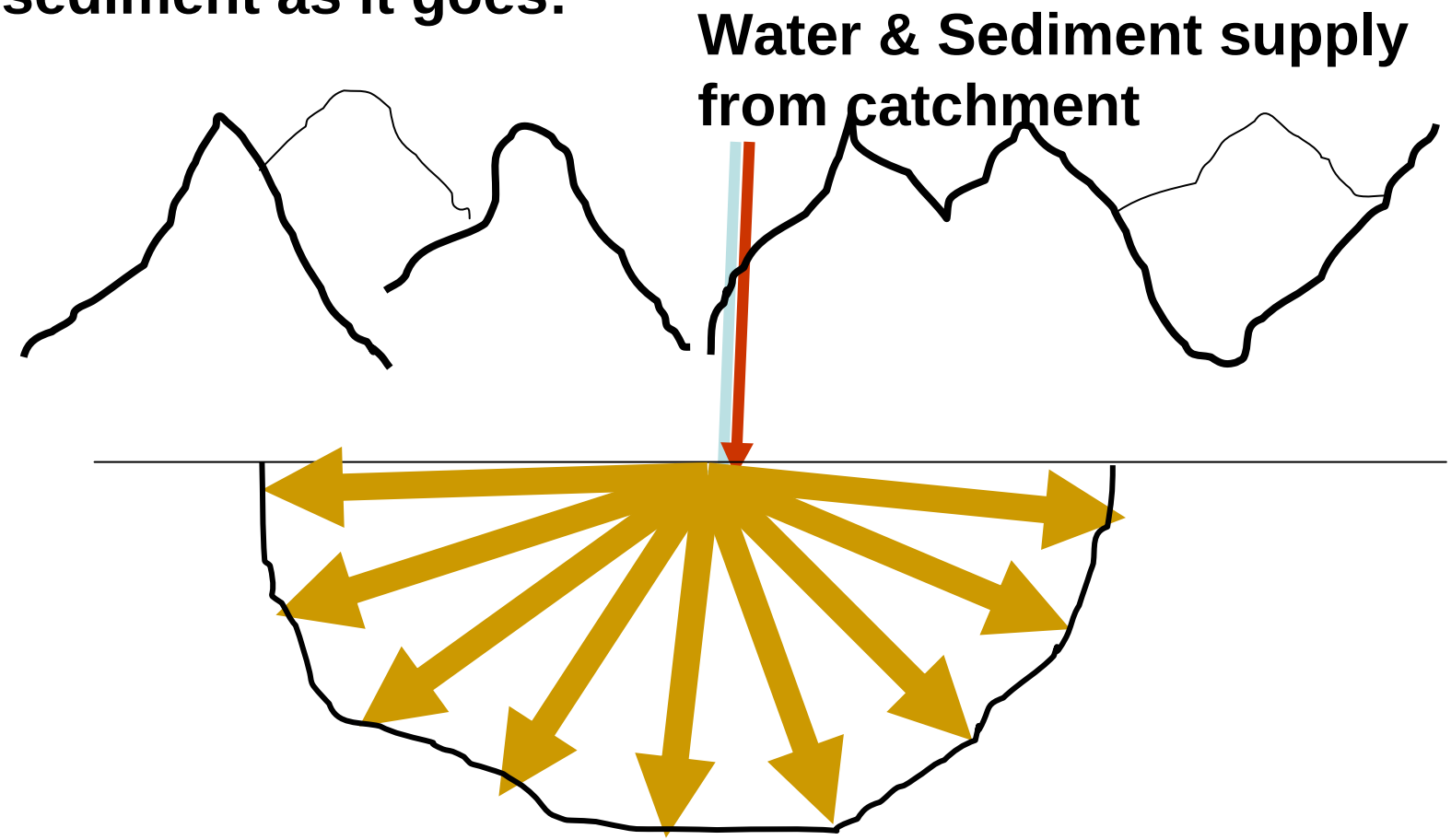
* (a) Risks to buildings/lives: points on a fan

(b) Risks to lifelines: corridors across a fan

1. Alluvial fans

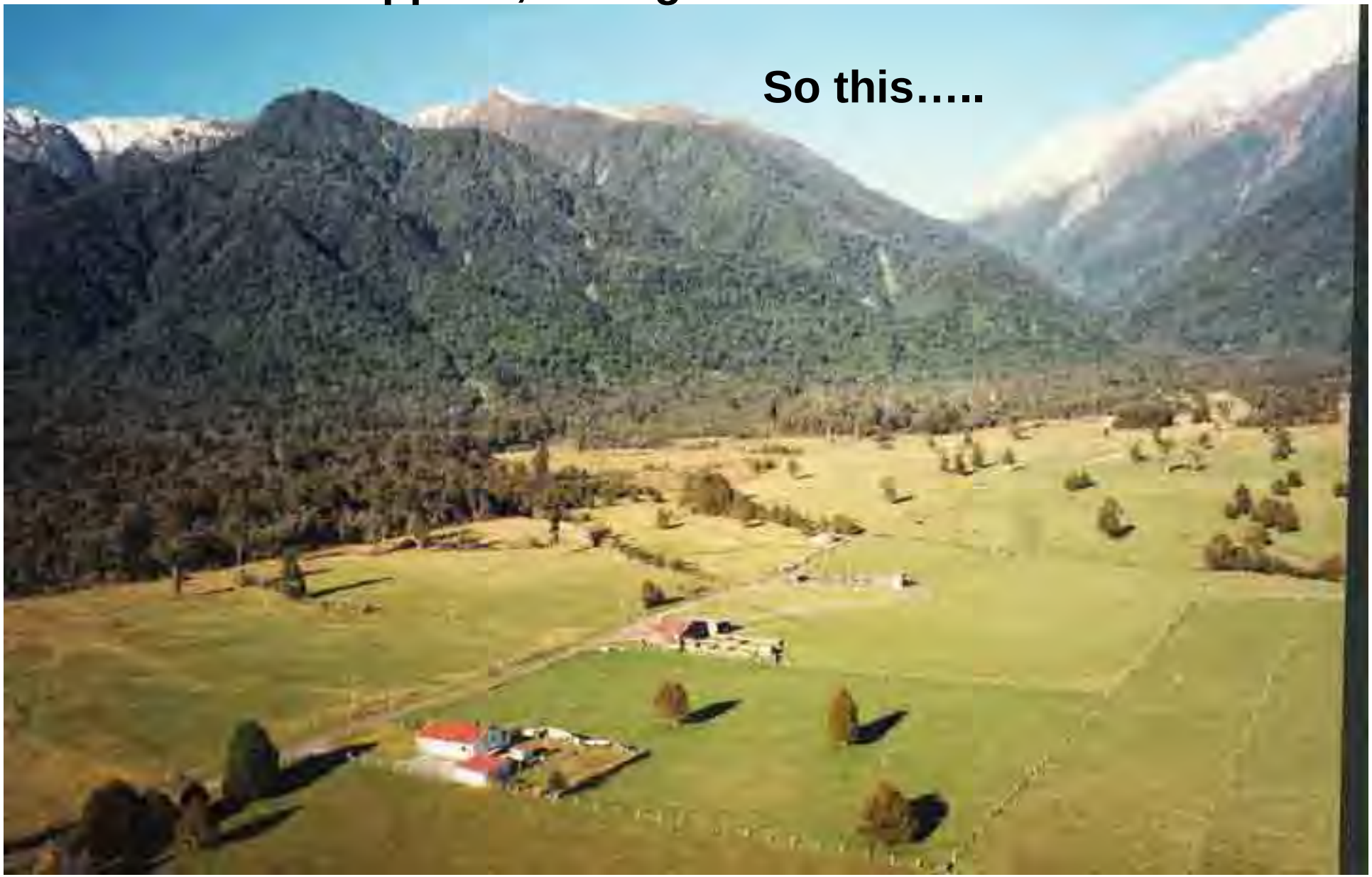
Alluvial fan behaviour

River moves to & fro across surface of fan, depositing sediment as it goes:



So every part of the fan can be covered by water & sediment at some time

The river moves intermittently – usually when lots of sediment is supplied, during storms or landslides



… becomes this.

Principles of River Behaviour:

The path & behaviour of a river on a fan are sensitively adjusted so that, over time, the rate at which the river moves sediment across the fan is identical to the rate at which it is supplied from the catchment.

The path and behaviour also correspond to the MAXIMUM rate at which the river can move sediment: so any alteration to the natural river will reduce its ability to carry sediment => aggradation

Waiho River at Franz Josef

Stopbanking has caused the river to aggrade by many metres

Hazard mitigation on alluvial fans, for buildings and lifelines, => *keep the river in one place all the time* (stopbanks).

This is *in principle unsustainable – it contradicts the natural behaviour of the river in response to its natural water and sediment inputs.* It reduces the sediment transport capability of the river.

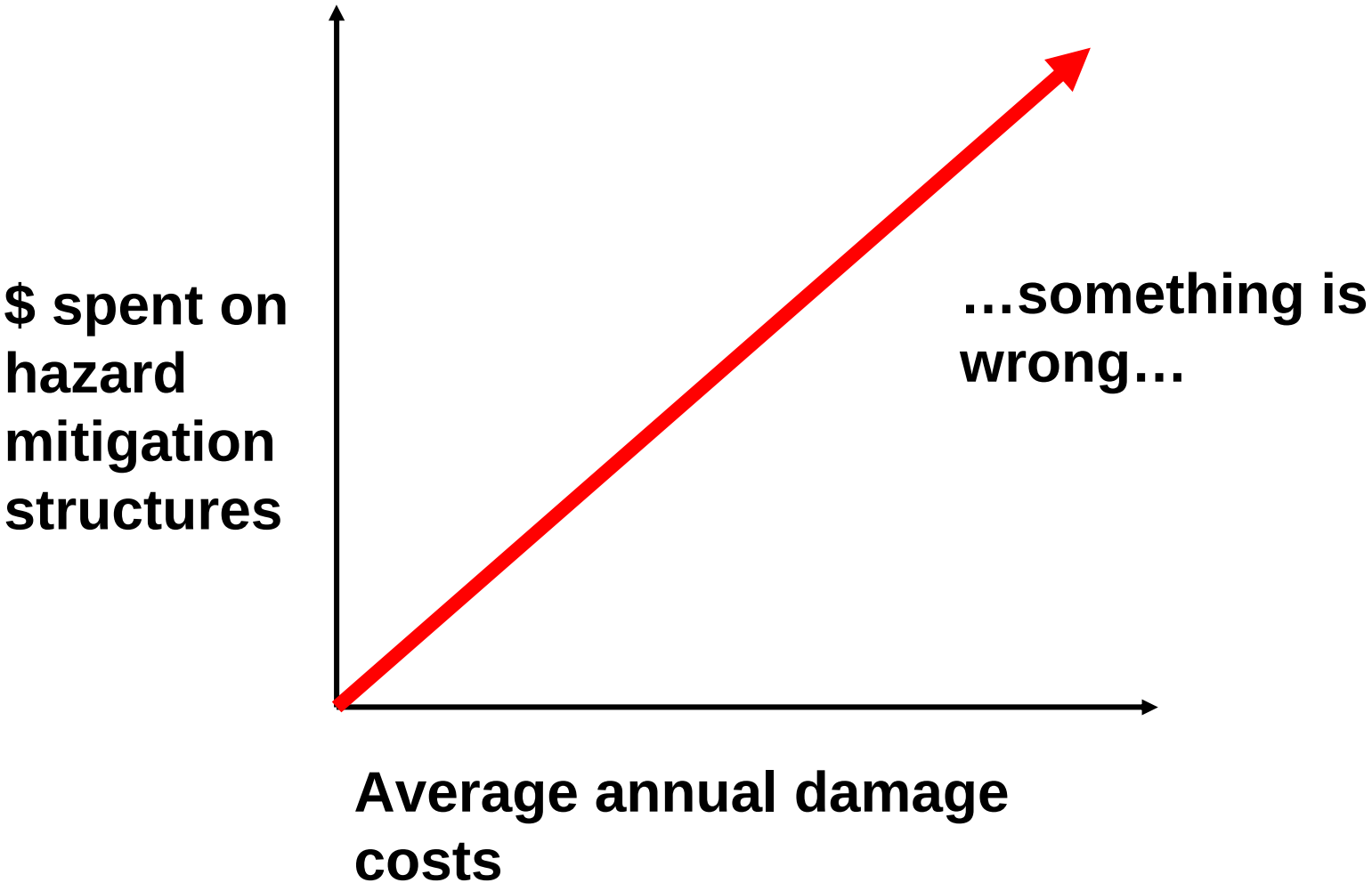
Therefore it will lead to aggradation, increased river control, increased aggradation…

… *unless the accumulating sediment is removed*.

Aggradation is an ongoing problem in many NZ rivers.

River control by stopbanking can only be sustainable as long as it is accompanied by removal of accumulating sediment.

How effective is structural hazard mitigation?



Alluvial fans are intrinsically active geomorphically – so they are difficult places to establish "permanent" structures.

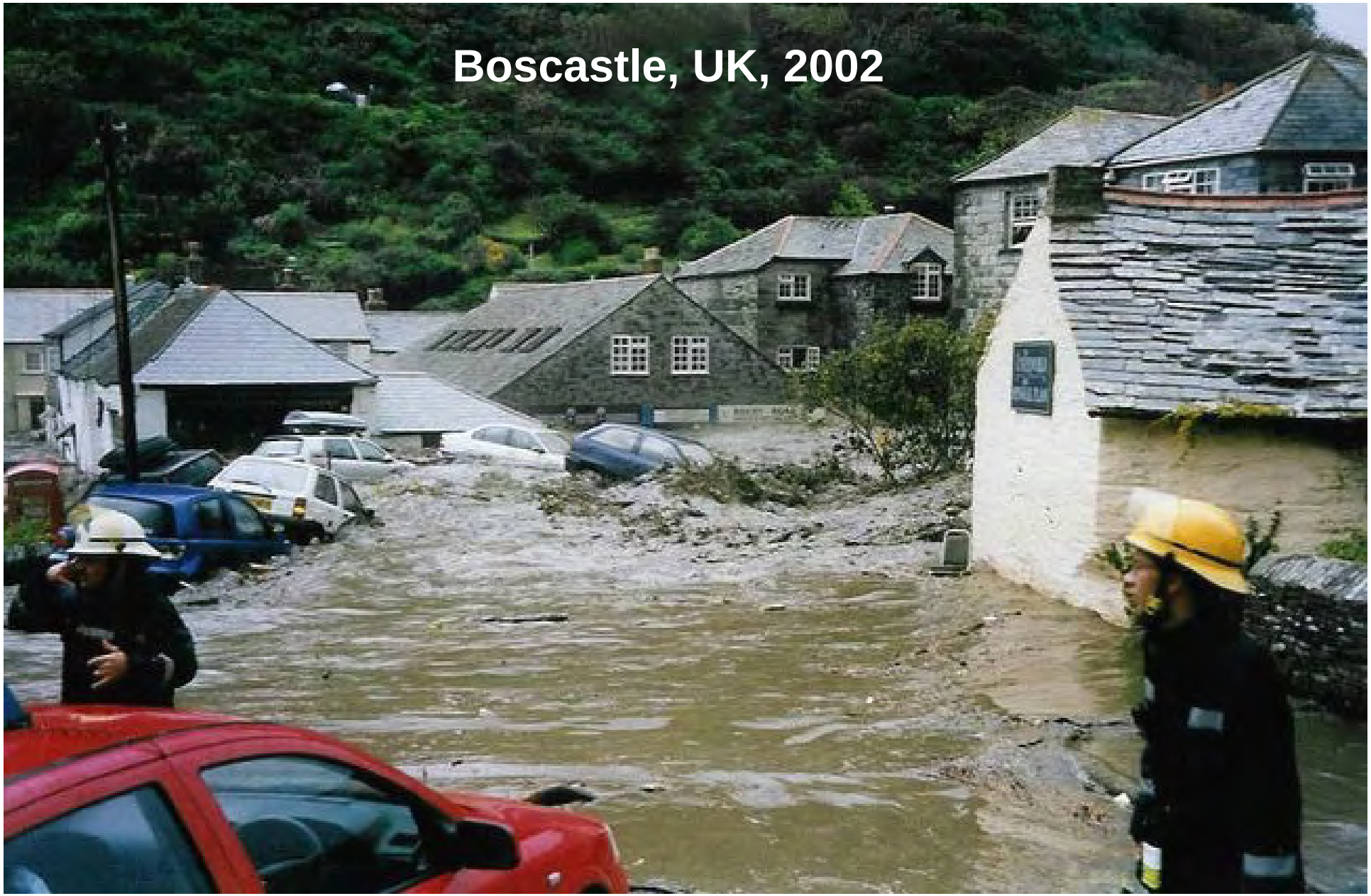
In general we should <u>always</u> expect flooding and sedimentation hazards on fans.

On larger fans formed by rivers – "alluvial" fans – the flood hazards often develop gradually with lots of warning (e.g. gradual aggradation).

SOME SMALL ALLUVIAL FANS HAVE ANOTHER TYPE OF HAZARD: *DEBRIS FLOWS*

Boscastle, UK, 2001


Boscastle, UK, 2002

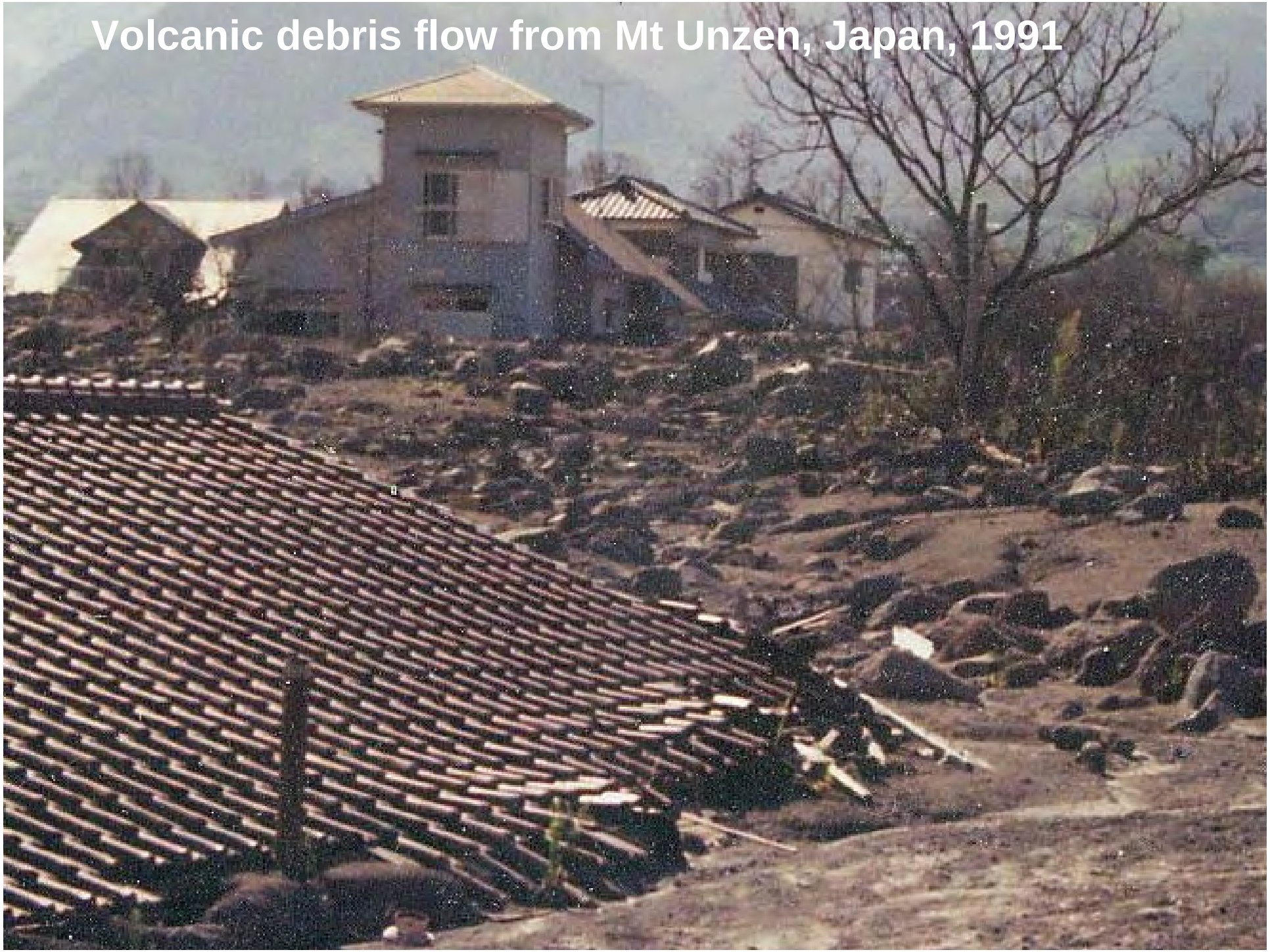

Boscastle, UK, 2002


Boscastle, UK, 2002

Boscastle, UK, 2002


Boscastle, UK, 2002


Boscastle, UK, 2002
12 10:23


Volcanic debris flow from Mt Unzen, Japan, 1991

Earthquake-generated debris-flow from Huascaran, Peru, 1970