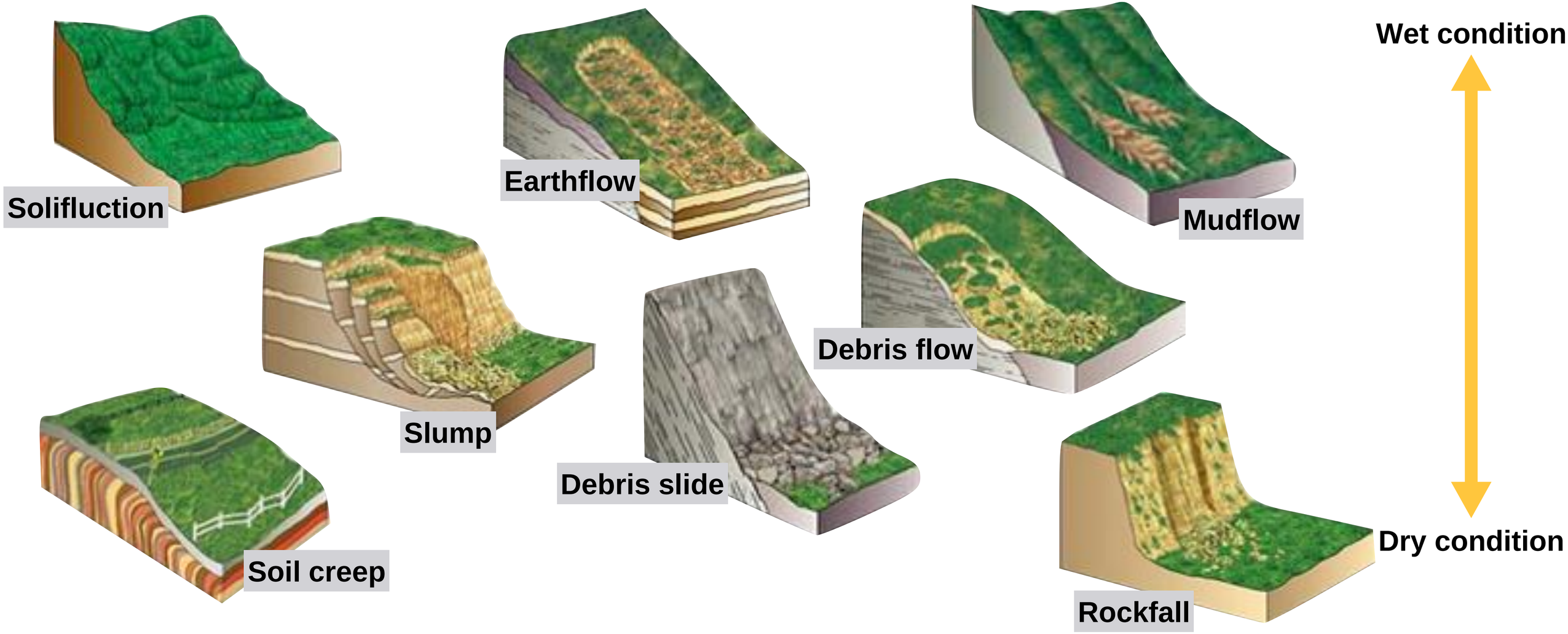
# Effects of Landslide on Environment

By Assoc. Prof. Dr. Alice Sharp & Ms. Sasima Yoocharoen

https://canejason.wordpress.com/2014/03/28/one-of-the-worlds-biggest-landslide/

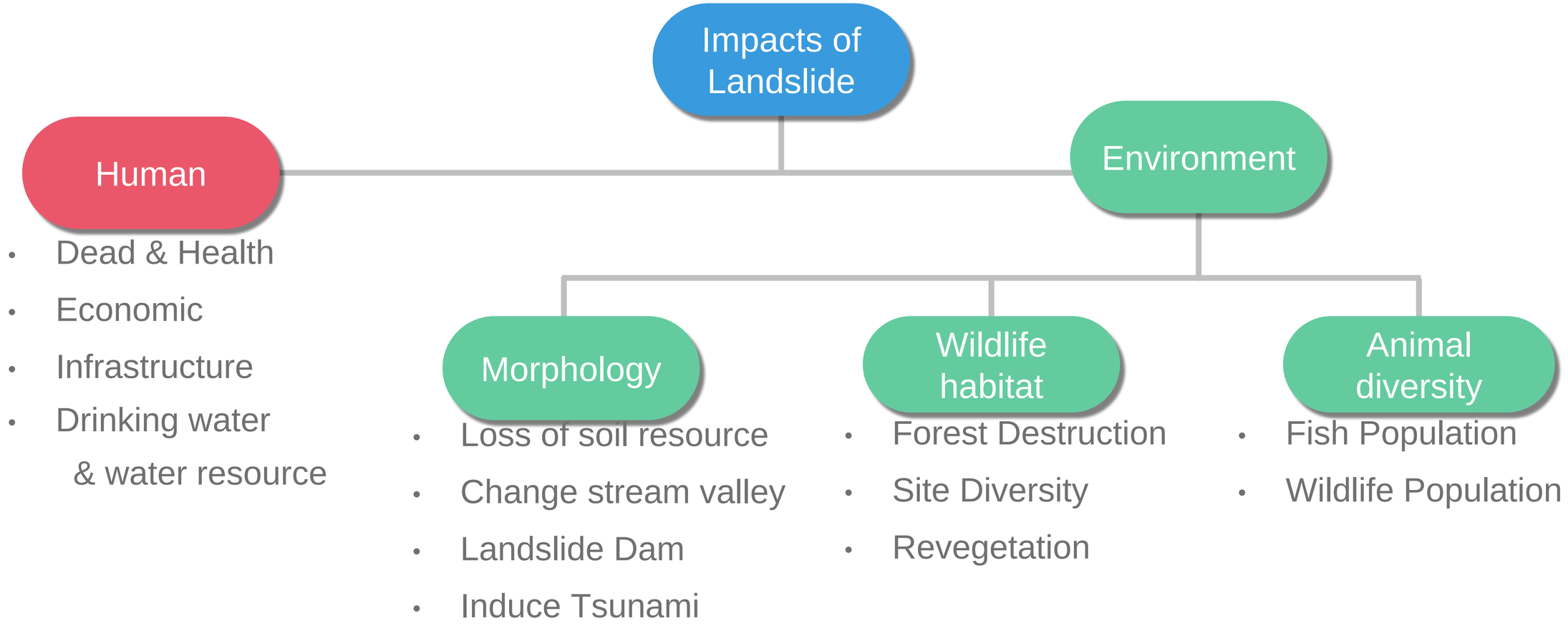
# Types of Landslide




https://www.geocaching.com/geocache/GC66XNX_nisene-marks-landslide

# Effects of Landslide

# Effects of Landslide




- Dead & Health
- Economic
- Infrastructure
- Drinking water & water resource

- Loss of soil resource
- Change stream valley
- Landslide Dam
- Induce Tsunami

- Forest Destruction
- Site Diversity
- Revegetation

- Fish Population
- Wildlife Population

# Impact on Human Life

https://www.usgs.gov/media/images/2005-landslide-conchita-ca

# Mudslide in Mocoa, Colombia on Mar 31, 2017

As of 07:00 UTC on April 4, 2017, the number of people that died after massive mudflows hit the Colombian city of Mocoa on Mar 31 has risen to 273. There are over 200 injuries, at least 550 displaced and more than 300 families affected.

https://www.theguardian.com/world/2017/apr/01/colombia-landslide-mocoa-putumayo-heavy-rains


# More than 1.3 million affected by flooding and landslides in South America

**Heavy rainfall unleashed by sea temperature changes has caused heavy rainfall throughout Peru, Colombia and Ecuador in the first quarter of 2016, affecting more than 1.3 million people. Although rainfall persists in some areas, it has begun to let up in other.**

## Peru

- More than 40,000 homes have been destroyed or rendered uninhabitable and 600,000 people across the country are facing dire food security needs.
- Over 2,000 educational institutions were damaged throughout Peru.
- The stagnant waters left behind by floods in Peru has led to a rise in reported cases of dengue, Chikungunya, Zika and leptospirosis.

## Colombia

- Colombia were still dealing with the aftermath of the March 31 Mocoa landslides that wiped out six neighbourhoods, another series of landslides were triggered 600 km (372 miles) away in Manizales on April 18.
- 70 homes have collapsed and 400 homes have been evacuated.
- The local area road network suffered damages at 15 key points.
- Twelve schools have to suspended classes.

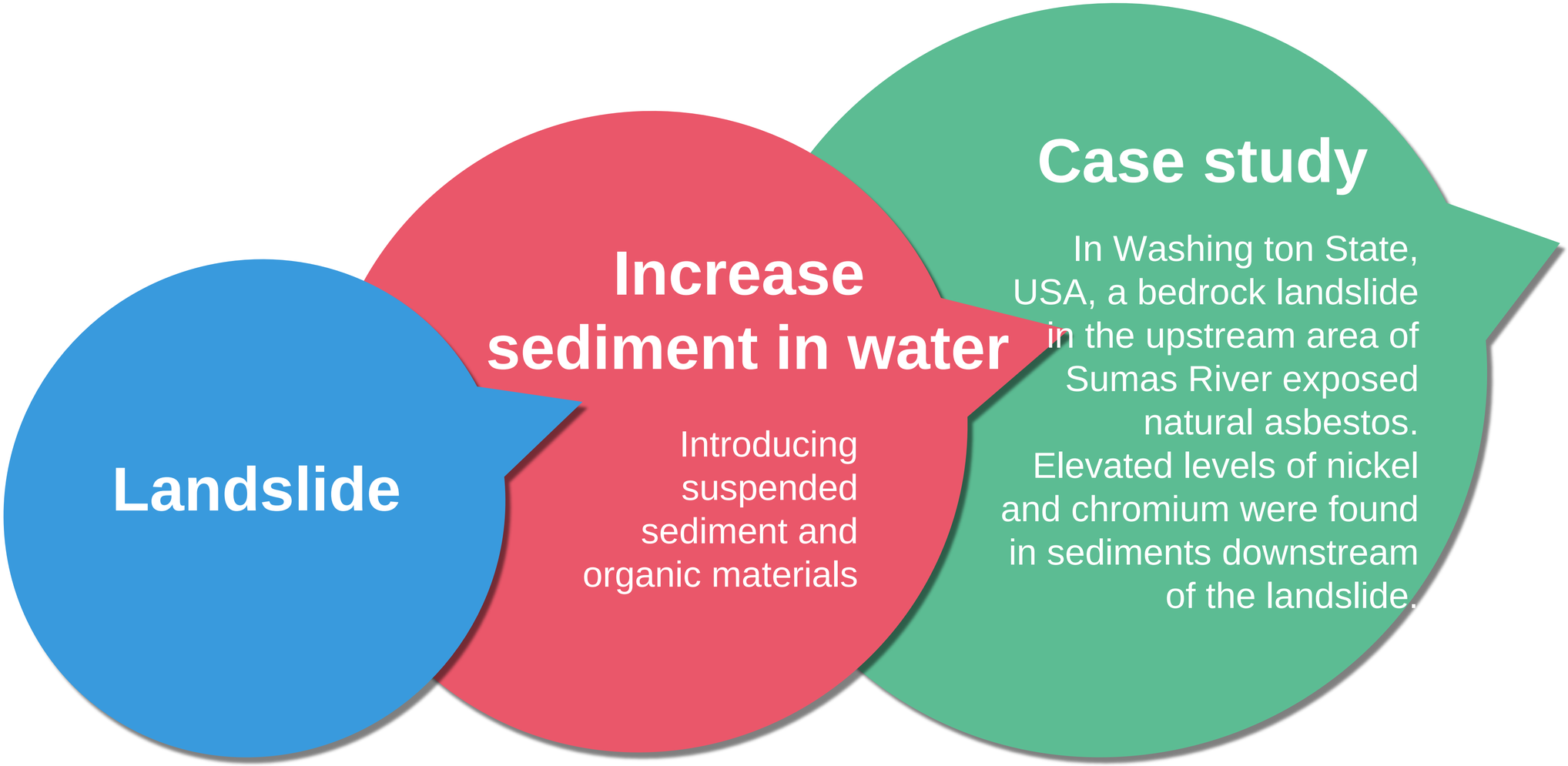
## Ecuador

- The relentless rainfall in Ecuador has slowly affected over 141,000 people throughout the entire country since the beginning of the year.
- The flooding and landslides have hobbled over 100 km (62 miles) of the national road network and transportation infrastructure.
- 89 schools have reported damages.
- Some 1,900 people have been left without homes and over 2,300 have been evacuated.

https://watchers.news/2017/04/27/more-than-1-3-million-affected-by-flooding-and-landslides-in-south-america/

http://edition.cnn.com/2015/12/20/asia/china-landslide/

# Drinking Water Quality and Environmental Health

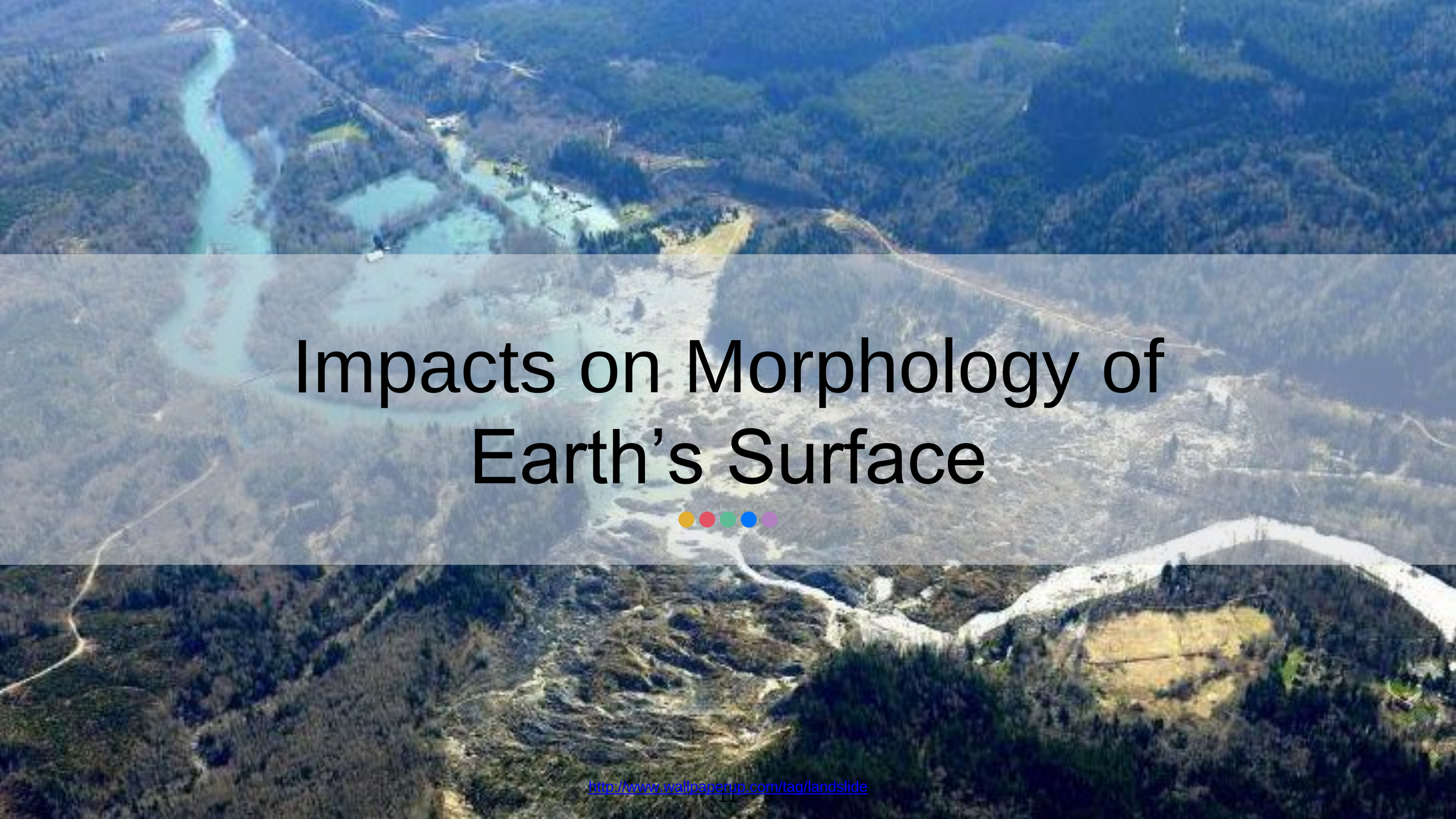


# Impacts on Environment

- Morphology of Earth’s surface
- Wildlife Habitat
- Fish and Wildlife

http://www.klizista-hr.com/en/

# Impacts on Morphology of Earth's Surface



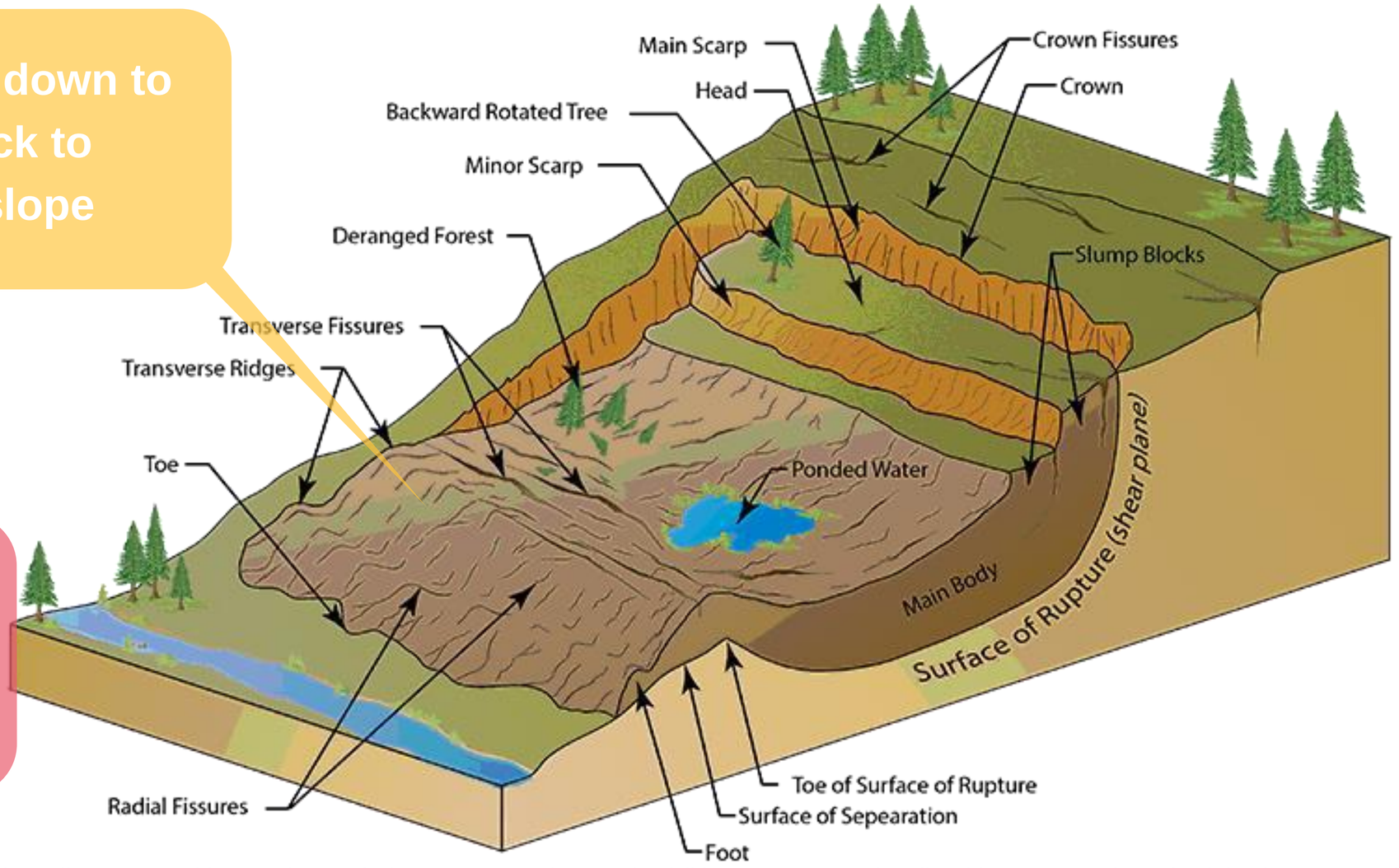
http://www.wallpapertip.com/tag/landslide

# Loss of Soil Resources

Bring soil down to bedrock to downslope

No soil is left for new plants to grow on

The bare tracks of landslides can remain visible for hundreds of years.




https://www.geocaching.com/geocache/GC5EA2A_224th-street-landslide-near-soos-creek-trail?guid=276073c3-2bc4-4f73-bd16-b861008058d6

# Landslide Impacts on Streams

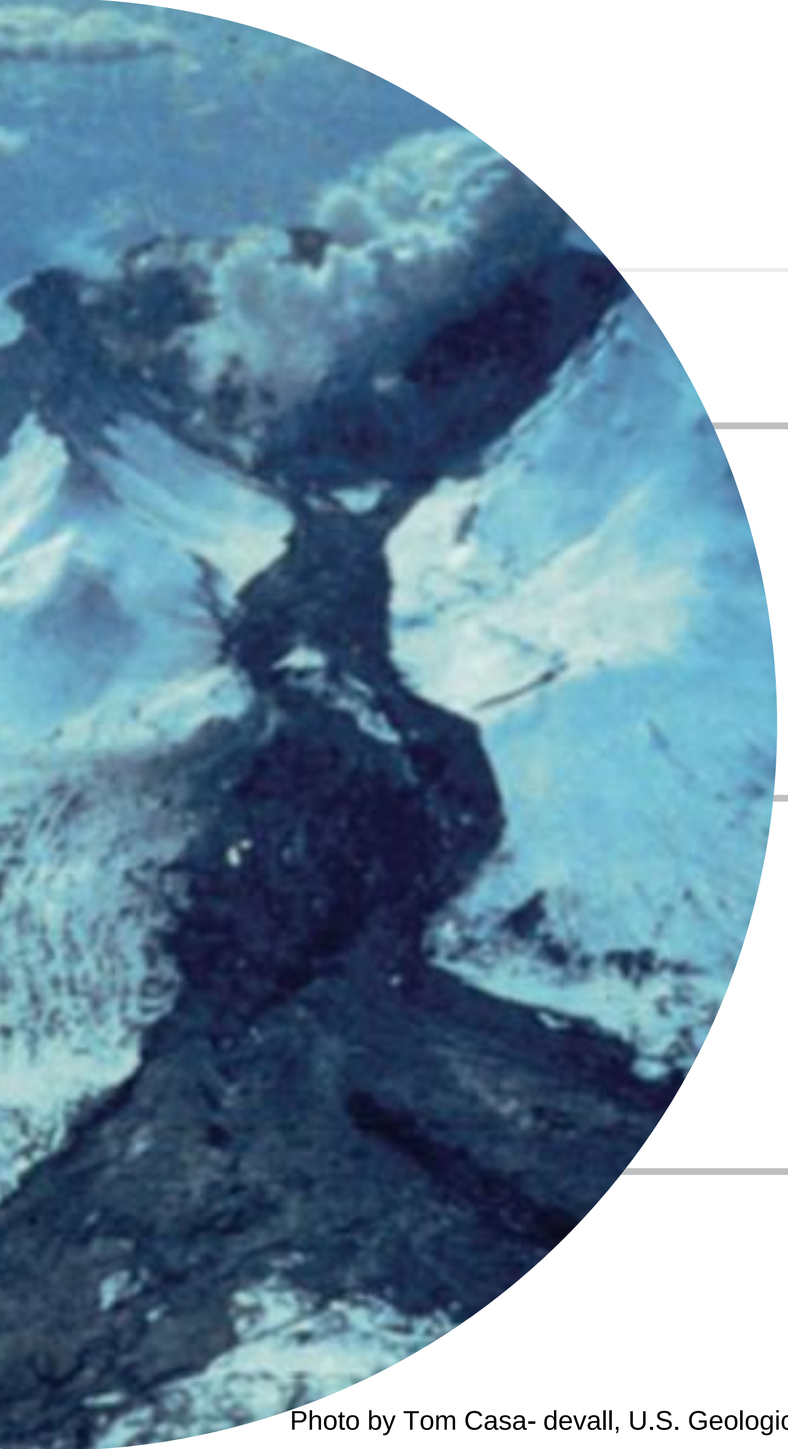


Photo by Tom Casa- devall, U.S. Geological Survey

## The main types of landslides that impact streams are debris flows.

Debris flows provide important sediment transport links between hillslopes and alluvial channels, and thus are an important factor in drainage-basin sediment budgets. In addition, debris flows influence the spatial and temporal distributions of sediment in stream channels, either because they deposit sediment in the channels or because the deposits provide a source for accelerated transport of sediment farther downstream

## Different types of landslide cause variable impacts to stream

**Slumps and earth flows** cause low-level, long- term contributions of sediment and large woody debris to channels; partial channel blockages; local channel constriction below the point of landslide entry; and shifts in channel configuration.

**Debris avalanches and debris flows** cause large, short-term increases in sediment and large woody debris; channel scour; large-scale redistribution of bed-load gravels; damming and constriction of channels; accelerated channel erosion and bank undercutting; and alteration of channel shape by flow obstruction.

Landslide deposits, although important for stream morphology in the long term, can destroy fish habitat in the short term.

Recovery rates depend on a wide range of factors.

# Landslide Dams

Photos contributed by Yulia Kugaenko.

Valley of Geysers before and after the 2007 landslide.

## Persist Time

- Several minutes
- Millennia

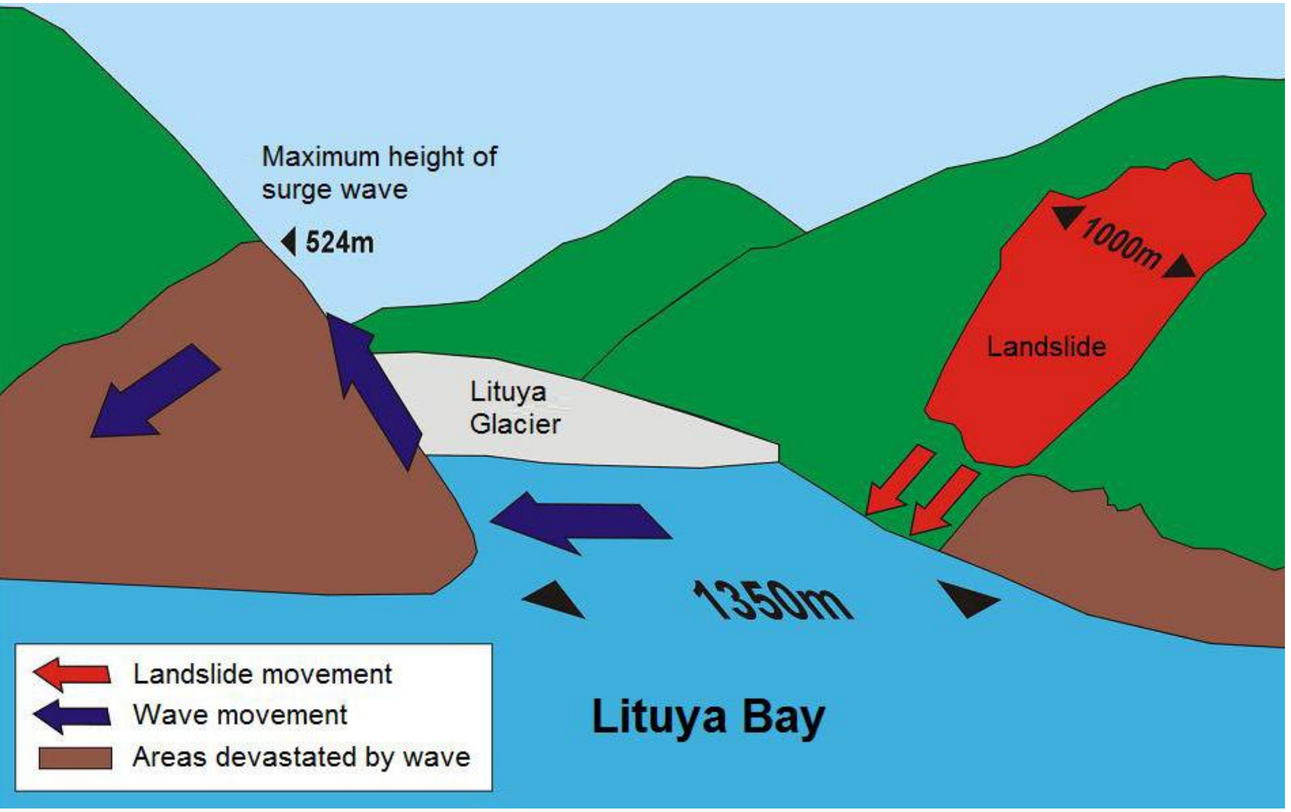
## 2 main problems

- Flood valley
- Outburst Flood

## Effects from Dams

- **Vegetation dies**
- **Destroy downstream forest and farmland**
- **Effect with fish and wildlife**
- **Trigger other landslides**

# Landslide Generated Tsunami




https://en.wikipedia.org/wiki/Megatsunam#/media/File:Lituya_Bay_megatsunami_diagram_(English).png

The highest displacement wave in historic time, occurred from a rock slide generated tsunami in Lituya Bay, Alaska in 1958.

http://www.vancouversun.com/Looking+north+down+Chehalis+Lake+scar+left+landslide+visible+middle+distance+left+destruction+plants+trees+along+shoreline+visible+foreground+Photo+Nick+Roberts/10794420/story.html

Chehalis Lake rock slide and tsunami damage near Vancouver, Canada on December  4, 2007.

# Impacts on Wildlife Habitat

http://geomatics-tech.blogspot.com/2013/10/

# Forest Destruction

http://blogs.agu.org/landslideblog/2012/01/24/breaking-with-pictures-very-large-landslide-in-papua-new-guinea-with-pictures /

# Site Diversity

Landslide impacts site is by changing site’s topography

**Positive microtopography**

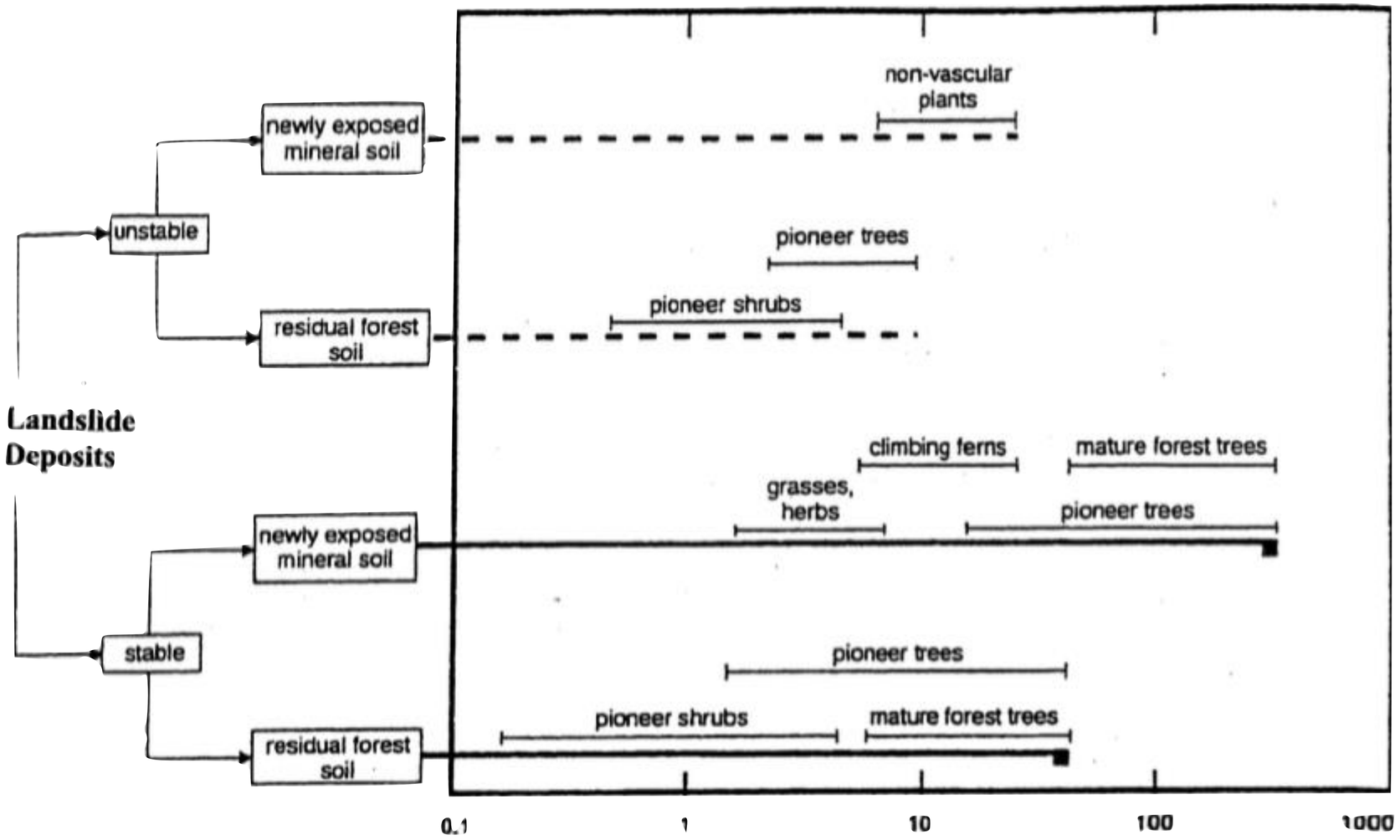
Hummocks and ridges rise up from the main ground surface and are often drier and warmer than surrounding terrain.

**Negative microtopography**

Such as sag ponds

Photo courtesy Ake Nauta

# Revegetation




Revegetation relates with temperature area

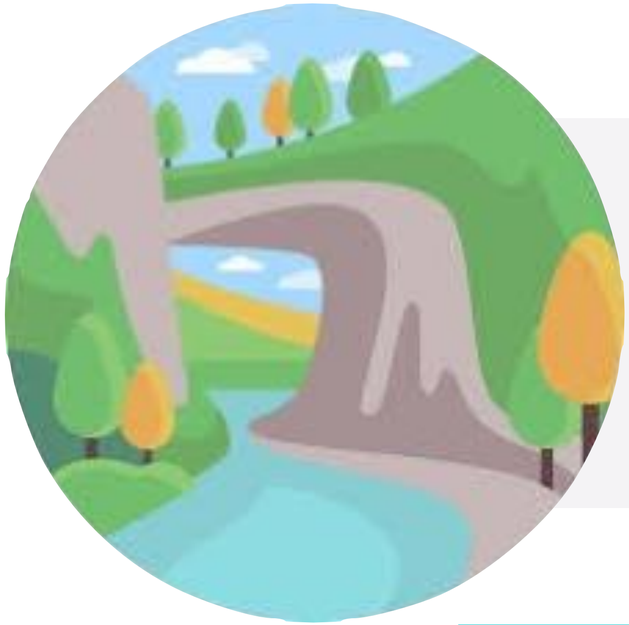
Case in Puerto Rico (Tropical), revegetate within remarkably short time.

https://pubs.usgs.gov/op/HongKongJuly/HongKongJuly21sm.pdf

# Impacts on Fish &Wildlife

http://rangersapprentice.wikia.com/wiki/File:Big_Leaf_Maple_Trees_along_the_Quinault_River_Quinault_Rain_Forest_Washington.jpg

# Fish Population



**Landslide**

**morphology of stream & water quality**

**Hostile stream environment for fish**

**Short-term effects**

Deterioration of mountain-stream fish habitat, there is a growing feeling among ecologists that landslides may

**Long-term effects**

Increase the quality of fish habitat by breaking up stream flow.

For example, landslides may deliver large boulders to a stream, thus forming downstream pools that provide quality habitat.

# Wildlife Population

**Landslide**

**Short-term effects** → **Usually cause negative through direct destruction of habitat**

**Long-term effects** → **Some area can improve habitat quality**

# Conclusion

- Ecological role that landslides play is often overlooked.
- Morphological changes are part of a general tendency of surface degradation
- Effects of landslides on vegetation and wildlife are mostly negative, however, are generally local in nature.
- In long term, landslides may even have positive effects on habitats and wildlife.

Thank you

# References


Geertsema, M., Highland, L., & Vaugeouis, L. (2009). Environmental Impact of Landslides. In Landslides - Disaster Risk Reduction (pp. 589-607). Berlin:Springer Berlin Heidelberg.

Schuster, R.L., & Highland, L.M., (2004. March 29). Impact of Landslides and Innovative Landslide-Mitigation Measures on the Natural Environment. Retrieved from https://pubs.usgs.gov/op/HongKongJuly/HongKongJuly21sm.pdf

The Watchers. (2017, April 4). Colombia mudslide death toll rises to 273, Red Alerts for floods and landslides. Retrieved from https://watchers.news/2017/04/04/colombia-mudslide-death-toll-rises-to-273-red-alerts-for-floods-and-landslides/

The Watchers. (2017, April 27). More than 1.3 million affected by flooding and landslides in South America. Retrieved from https://watchers.news/2017/04/27/more-than-1-3-million-affected-by-flooding-and-landslides-in-south-america/

Landslide. Digital image. หลักการออกแบบแนวลาดเอียง (Slope) สำหรับงานออกแบบถนน และงาน Grading (เบื้องต้น). 26 October 2013. Web. 10 May 2017. < http://geomatics-tech.blogspot.com/2013/10/slope-grading.html >

Type of Landslides. Digital image. Nisene Marks Landslide. 14 November 2015. Web. 10 May 2017. <https://www.geocaching.com/geocache/GC66XNX_nisene-marks-landslide >

Landslide. Digital image. One of the World's Biggest Landslide. 28 March 2014. Web. 10 May 2017. < https://canejason.wordpress.com/2014/03/28/one-of-the-worlds-biggest-landslide/ >

Landslide. Digital image. Breaking (with pictures) – very large landslide in Papua New Guinea. 24 January 2012. Web. 10 May 2017. < http://blogs.agu.org/landslideblog/2012/01/24/breaking-with-pictures-very-large-landslide-in-papua-new-guinea-with-pictures/ >

Reid, M. (Photographer). (2016, March14). 2005 Landslide in Conchita, CA [digital image]. Retrieved from https://www.usgs.gov/media/images/2005-landslide-conchita-ca

Armstrong, P., Smith, K., & Najarian, K. (Photographer). (2015,December 22). Massive rescue effort underway after landslide at south China waste dump [digital image]. Retrieved from http://edition.cnn.com/2015/12/20/asia/china-landslide/

1958 Lituya bay. Digital image. Diagram of the 1958 Lituya Bay megatsunami, which proved the existence of megatsunamis. 15 January 2009. Web. 10 May 2017. < https://en.wikipedia.org/wiki/Megatsunam#/media/File:Lituya_Bay_megatsunami_diagram_(English).png >

Heartblade, S. (Photographer). (2012,June 16). Big Leaf Maple Trees along the Quinault River Quinault Rain Forest Washington [digital image]. Retrieved from