WEBINAR

On

Geo-hydrological Risks: Approaches for Hazard Assessment and Risk Mitigation for Sustainability

LANDSLIDE DISASTERS IN KENYA AND RISK MITIGATION MEASURES

14-15 April 2026

KEY NOTE ADDRESS

BY

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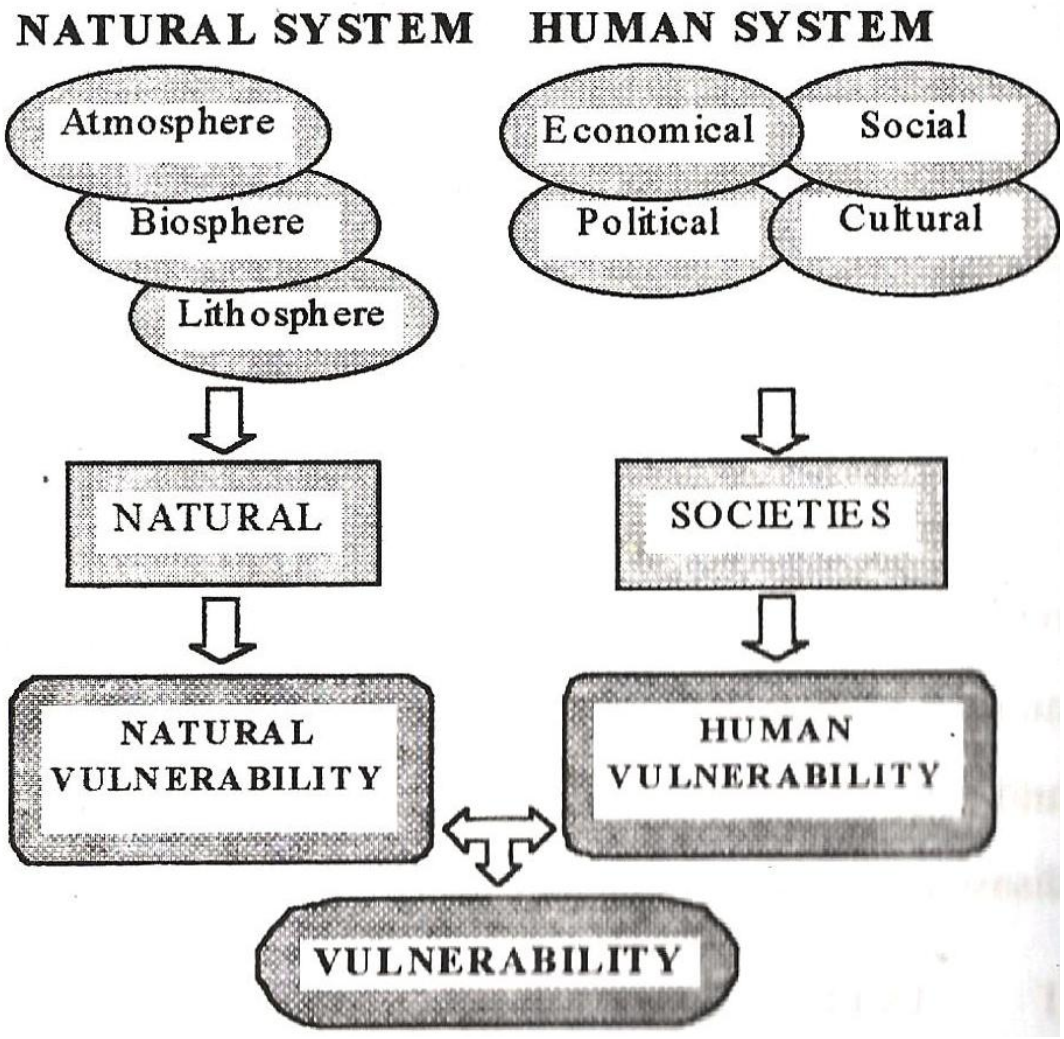
INGREDIENTS OF NATURAL DISASTERS

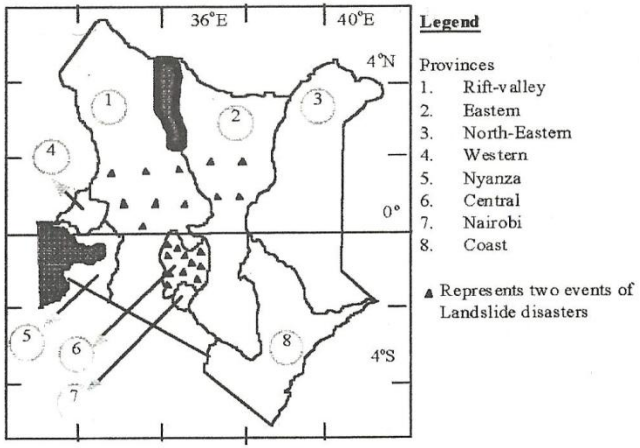


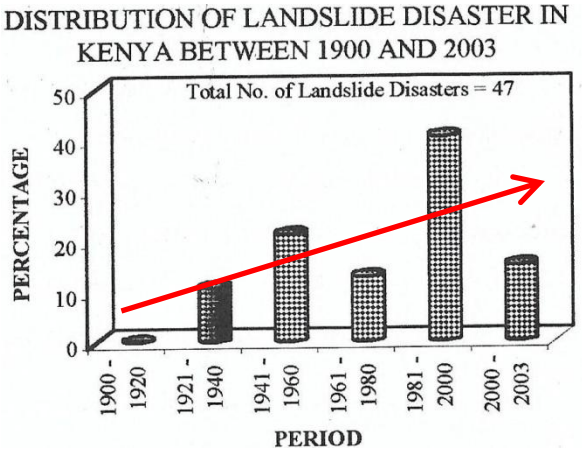
SOME RECENT LANDSLIDES IN KENYA

- **Mai Mahiu Debris Flow;** Due to heavy rainfall in April 2024, killing 61 people.
- **Elgeyo Marakwet County;** On November 1, 2025, heavy rains triggered devastating landslides in Chesongoch, Metkei Ward, and Kiptengwer village. The death toll rose to at least 32, with multiple families reported buried (https://www.facebook.com/share/v/17sLUZ5UzQ/)
- **Baringo North;** Due to heavy rains in March 2026, resulting in two deaths, and over 200 families affected, with homes and property destroyed in the region.

WHAT IS A DISASTER? A disaster is a serious, often sudden, disruption of a community or society dynamics that causes widespread human, material, economic, or environmental losses beyond the capacity of internal mechansms to cope.

HISTORICAL SPATIO-TEMPORAL TREND OF LANSLIDES IN KENYA

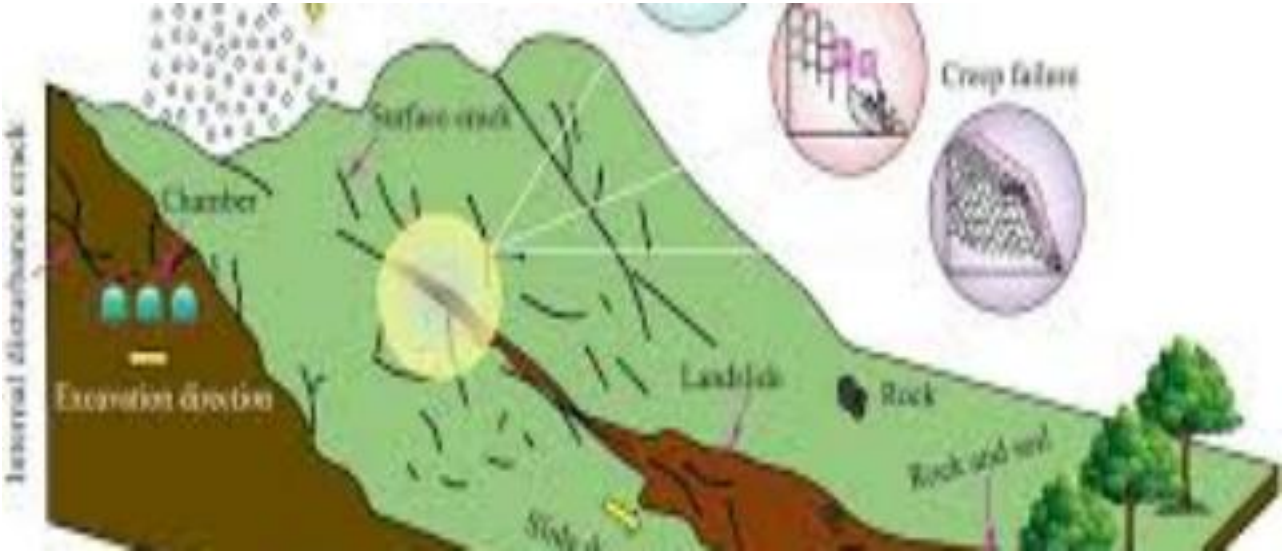




Spatio-temporal distribution of landslide events in Kenya (from Waswa, Makhanu et al. 2006 - https://www.torrossa.com/en/resources/an/2294770)

- Landlides events are common in **Rift Valley** and **Central** regions.
- Landslides events have **increased since 1980**
- **Causes of increase**: increased occupation of vulnerable areas and climate change (more concentrated and intense rainfall events)

CHARTERISTICS OF RAINFALL INDUCED LANDSLIDES-1



Critical Slopes

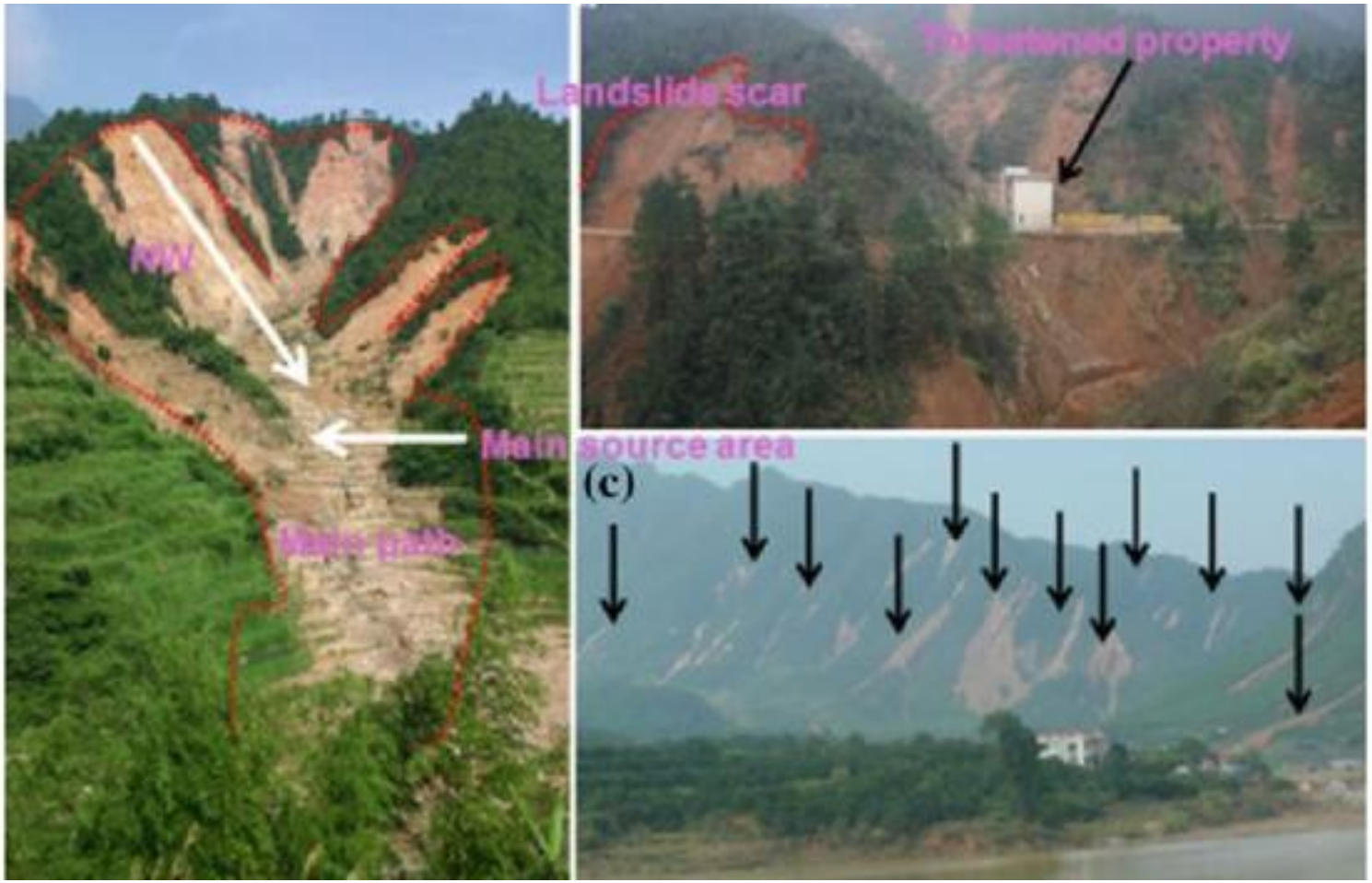
Highest landslide Frequency Slopes: 15–25° and 25–35° ranges.

Influence of Slope Steepness: affects shear stress; the greater the angle, the higher the likelihood of instability.

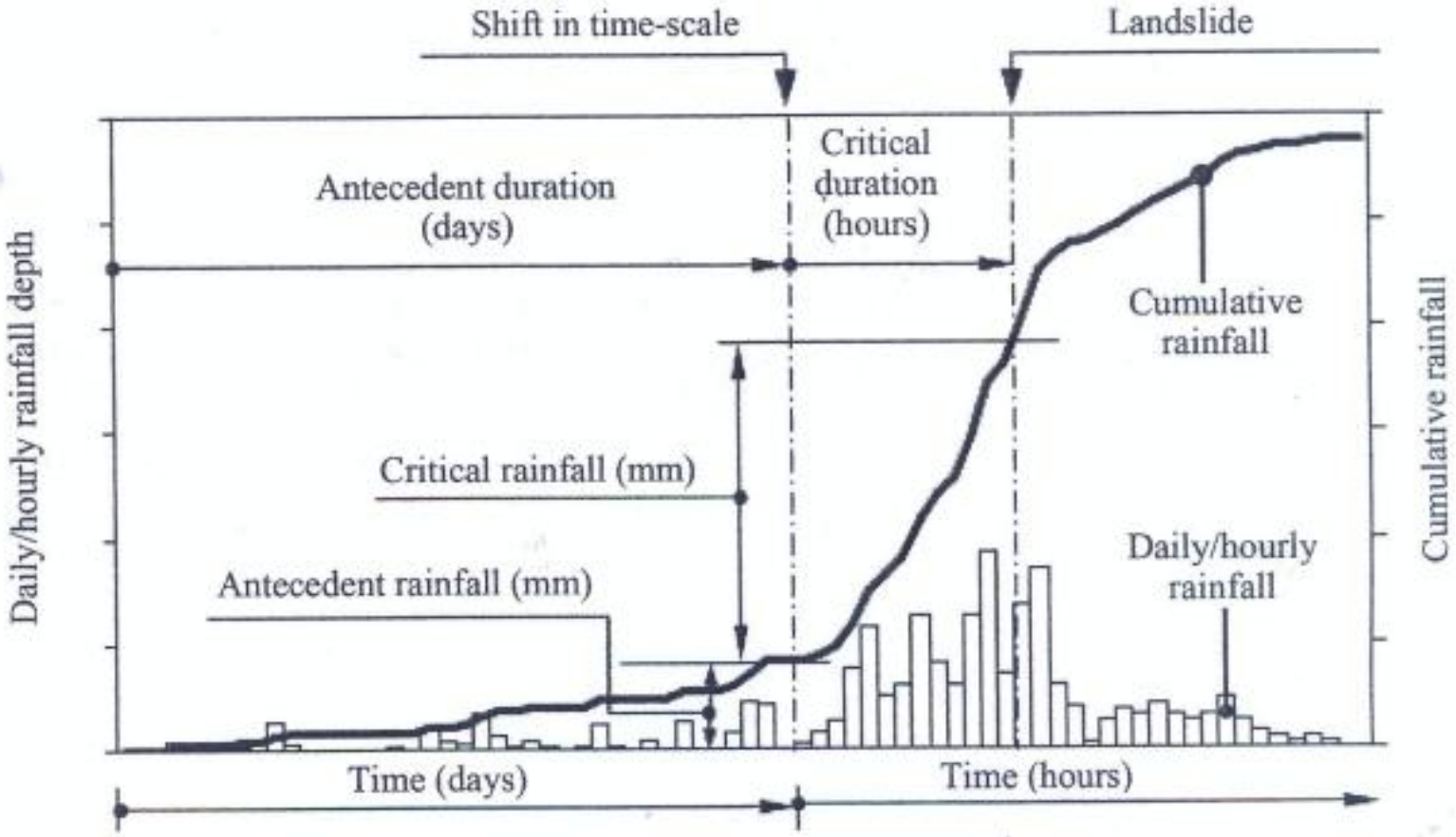
Slope Classification: Landslide susceptibility is often mapped using categories: very gentle (<15°), gentle (15–25°), moderately steep (26–35°), steep (36–45°), and cliff (>45°).

Topographical Impact: Steeper slopes (higher than 35°) are often more prone to landslides due to reduced friction and cohesion, particularly in mountainous or, tropical areas, notes

CHARTERISTICS OF RAINFALL INDUCED LANDSLIDES - 2



ROLE OF RAINFALL IN LANDSLIDES



Antecedent and critical rainfall parameters for landslides (from Waswa and Lorentz, 2016)

ROLE OF RAINFALL IN LANDSLIDE

Table: Characteristic of intense rainfall triggered landslides from some selected studies (Modified from Waswa and Lorentz, 2016)

Reference	Location	Data & time of landslide	Antecedent rainfall		Critical rainfall		Peak intensity		Lag-time (Hours)
			Period (days)	Amount (mm)	Period (hours)	Amount (mm)	Mm/h	Time	
Hurliman et al. (2003)	Switzerland	06.08.2000, 7 am	38	189	20	106	11	4 am	3
Guzzetti et al. (2004)	Italy	23.11.2000, 4 pm	45	600	24		30	5 pm	1
Chen et al. (2005)	Taiwan	01.12.2000, 2 pm	20	580	38	261	35		3
Cardinali et al. (2006)	Italy	05.12.2004, 5 am	64	360	24	45	10	3 am	2
Dahal et al. (2006)	Nepal	23.07.2002	53	650	24	300			
Dahal et al. (2006)	Japan	20.10.2004, 3 pm			32	450	76	1 pm	2
Kuriakose et al. (2008)	India	22.01.2007, 6 am	25	997	14	147	100	3 am	3
Jeong et al (2017)	Korea	27.07.2011, 8 am	56	540	14	325	86	7 am	1
Schiliro et al (2015)	Italy, Sicily	1.10.2007, 6 pm	15	500	3	100	110	5 pm	0.25
Montgomery et al. (2002)	USA, Oregon	20.2.1992, 11 pm			83	121	16	7 am	4
Tsou et al. (2011)	Taiwan	9.8.2009, 6 am			57	1277	40	5 am	1
Brand et al (1984)	Hong Kong	29.5.1982, 4am	59	540	16	200	45	2 am	2
Brand et al (1984)	Hong Kong	12.6.1966, 9 am	73	740	22	250	110	7 am	2
Rocatti et al (2018)	Italy, Entella	24.11.2002, 3pm			20	157	80	1 pm	2
Rocatti et al (2018)	Italy, Entella	22.10.2013, 2 am			6	188	86	11 pm	3
Rocatti et al (2018)	Italy, Entella	11.11.2014, 12mn			25	230	70	9 pm	3

Lag-time (last column) between the time of peak rainfall intensity and the time of landslide.

ROLE OF RAINFALL IN LANDSLIDE

FROM THE TABLE:

- Landslides do not occur at the beginning of a rainfall season, but after several days of *antecedent rainfall*.
- Even within the *critical rainfall*, landslide is not triggered at the beginning, but after several hours into the rainfall.
- All landslides were triggered within three hours of critical rainfall.

ROLE OF RAINFALL IN LANDSLIDE

- Role of **antecedent rainfall**: slowly wets the soil profile to near saturation state.
- Role of **initial critical rainfall**: wets the near surface pore water to tension saturation state.
- Role of **spike intensity** in critical rainfall: the kinetic energy loaded raindrops rapidly induces additional pressure head into the near surface tension saturated pore water to positive pressure head, triggering the landslides.

SOME RECOMMENDED RISK MITIGATION MEASURES

BEFORE LANDSLIDE DISASTER

Preparedness

1. Planning of settlements so as to reduce human vulnerability.
2. Afforestation of landslide prone areas, to reduce the direct impact of intense rainfall.

Mitigation

1. Accurate predication of rainfall events.
2. Early warning systems

AFTER LANDSLIDE DISASTER

Response

1. Evacuation
2. Information Dissemination

Recovery

1. Restoration of Livelihoods
2. Temporary shelters

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