Introduction

- **Rainfall-triggered landslides** are part of a natural process of hillslope erosion that can result in **catastrophic loss** of life and extensive property damage in mountainous, densely populated areas.
- The **Western Ghats region of India** and its neighbouring areas are highly **susceptible** to **rainfall-triggered landslides**.
- The primary **triggering factors** are **regional geography, extreme rainfall,** and **anthropogenic intervention**.
- In the **monsoon of 2021**, **Pune** and **Konkan divisions** in **Maharashtra** have witnessed severe rainfall-triggered landslides.
- Thus, it is necessary to model an accurate **early prediction** system to **mitigate** such **natural hazards**.

Objectives

- Application of the **Transient Rainfall Infiltration and Rrid-based Regional Slope-stability (TRIGRS)** model in predicting the **location** and **timing** of **landslides** in **Western Ghat India.**
- **Case study**: Destructive **rainfall-induced landslide** triggered at **Malin** near Mumbai in **July 2014**, which resulted in 160 deaths, including the burial of an entire village under the debris.
- **Qualitative analysis** of **efficiency** of **TRIGRS** model in predicting the location and timing of Malin 2014 landslide.

Study Area & Methodology

Fig-1 Location map of Malin Village.

Fig-2 Image of Malin Village before landslide event (Google Earth).

Fig-3 Image of Malin Village after landslide event (Google Earth).

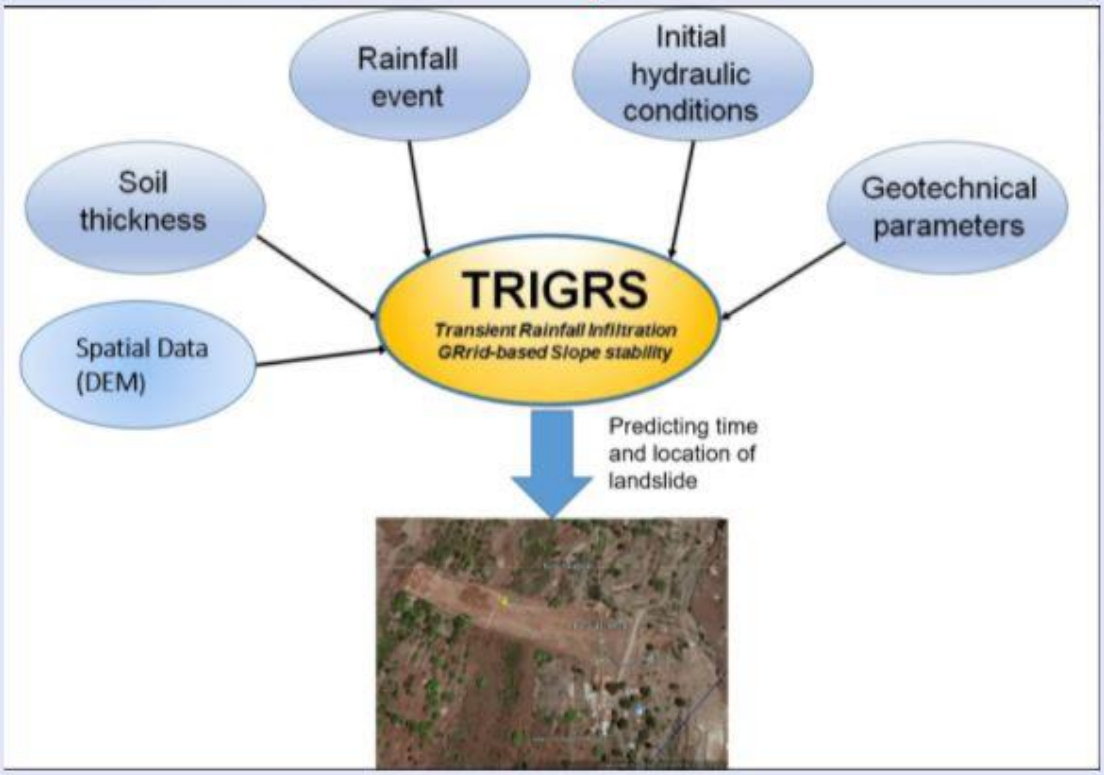
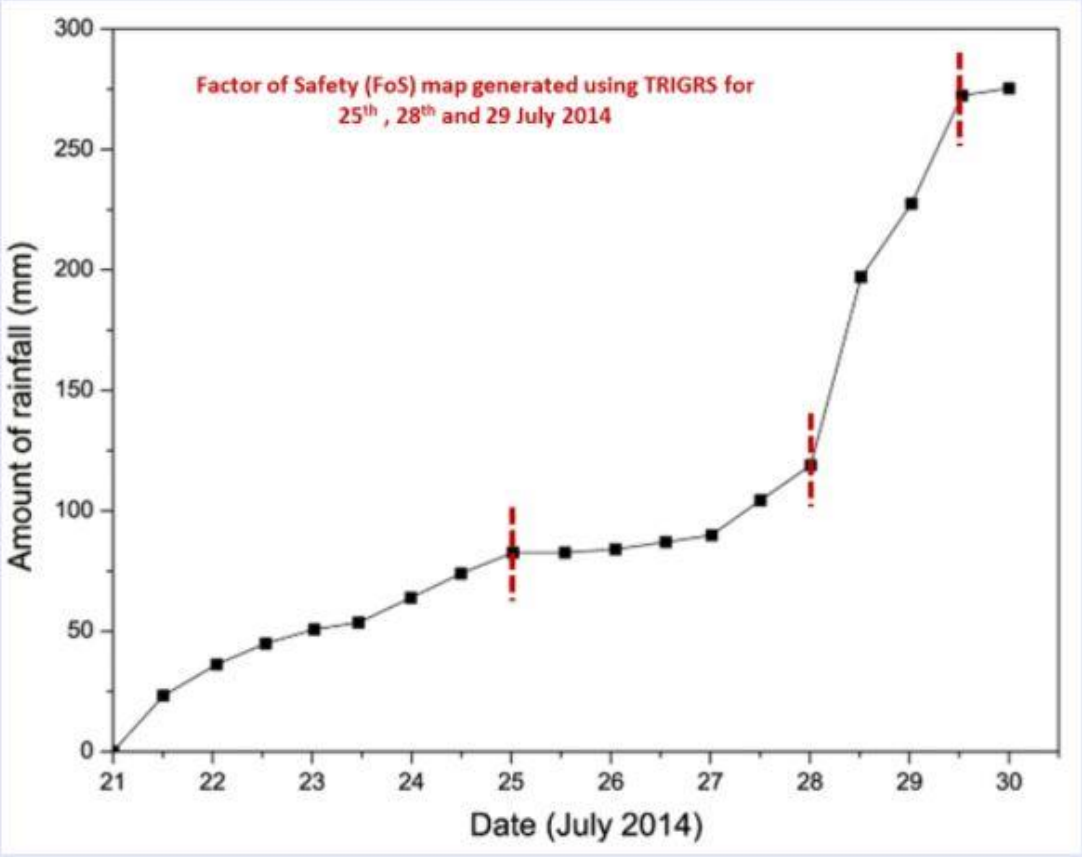


Fig-4 Overall Methodology of the present Study.


Factor of Safety (FoS) map generated using TRIGRS for
25th , 28th and 29 July 2014
Amount of rainfall (mm)
0
50
100
150
200
250
300
21
22
23
24
25
26
27
28
29
30
Date (July 2014)

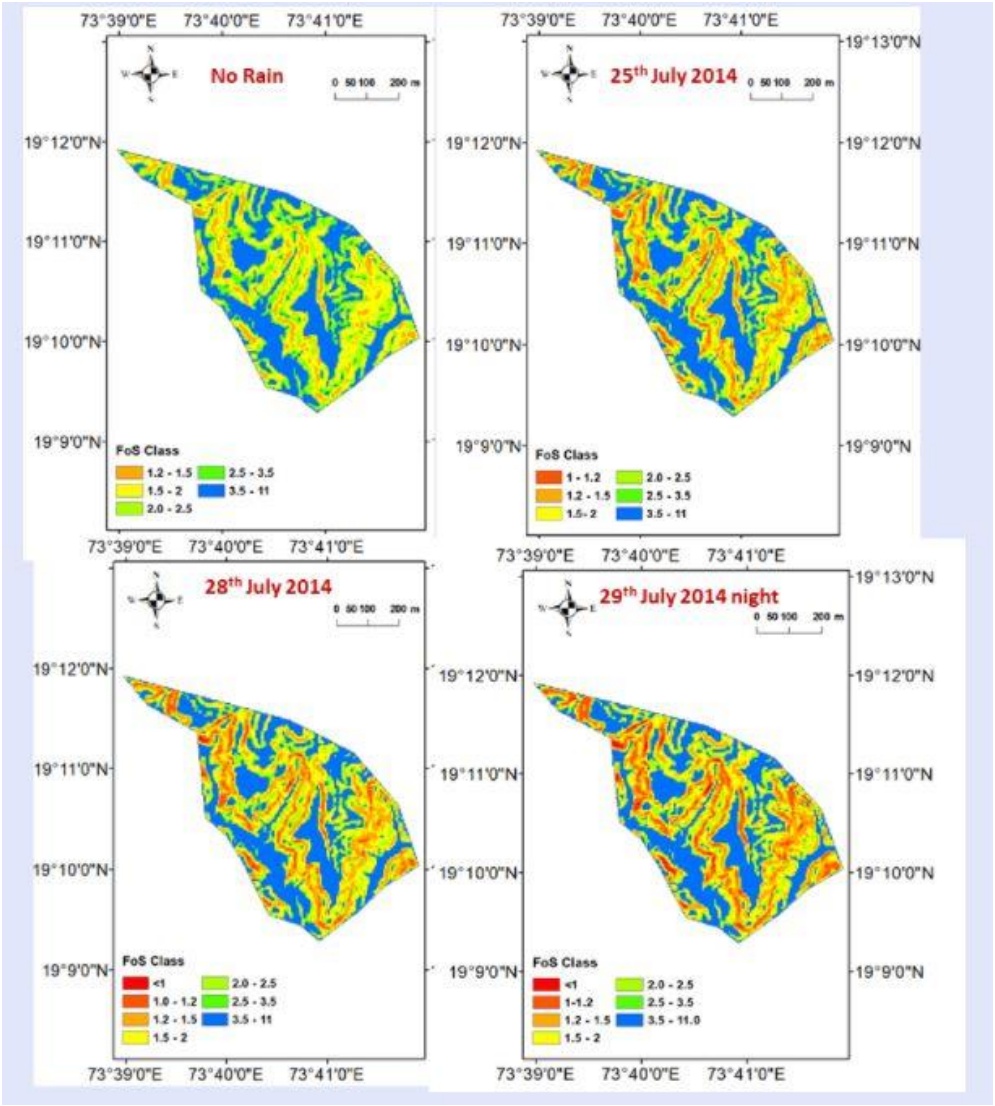


Fig-6 Variation of FoS of each pixel in the study area with rainfall obtained from TRIGRS model.

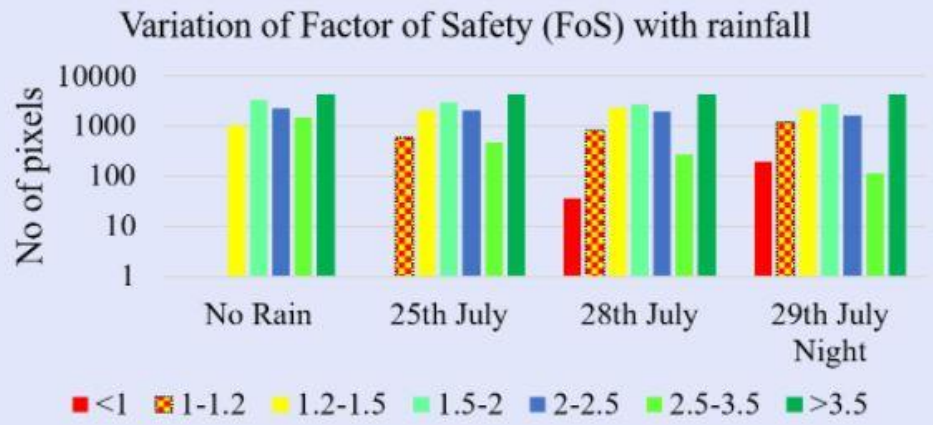


Fig-7 Variation of Factor of Safety (FoS) with rainfall.

Discussion

- The **geotechnical parameters of soil** are obtained from the earlier studies (**Meshram, S., 2016; Dey and Sengupta, 2018**).
- The **Factor of Safety (FoS)** map, generated using TRIGRS model in this present study suggests that the **Malin Village** and nearby area was **stable** (**FoS>1.2**) before rainfall.
- There were **no pixel values** having **FoS less than 1** till **25th July 2014**.
- However, **4.8%** of the considered area were having **FoS** between **1-1.2**.
- **FoS** of considered area **decreased significantly** after **3-day high-intensity rainfall** and around **11%** of the area became **highly unstable** (**FoS <1.2**) prior to the actual landslide event.

Conclusion

- The considered model in this study, i.e. TRIGRS model can predict the **slope unitability** of the Maline landslide triggered due to rainfall.
- The present study shows that the model efficiency is limited to the **quality of the Digital Elevation Model (DEM), geotechnical data of soil, and rainfall data** which can further improve the prediction of the location and timing of landslides.