



**APPLICATION OF REMOTE SENSING & GIS
ON LANDSLIDE HAZARD ZONE
IDENTIFICATION & MANAGEMENT**

**PRESENTED
BY**

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NIT,DURGAPUR

INTRODUCTION

- Damages caused by all the hazards worldwide accumulated to over \$ 2,300 Billion (as per 2008 value) equivalent to 0.23% of the cumulative world output. A gradual but clear upward trend can be observed, which is likely to continue into the future due to the impacts of climate change and population growth in areas exposed to natural hazards. (World Bank/United Nations, 2010).

What is landslide hazard then ?

- Landslides are the major natural hazards among other hazards, leading to downward to outward movement of slope forming material due to gravity and are particularly important in the case of highways, railroads and dam reservoirs.

What is landslide hazard management ?

- Effects could be minimized and considerable losses to life and property could be avoided through improved risk assessment, early warning and disaster monitoring system.



**ELEVATION
SLOPE**

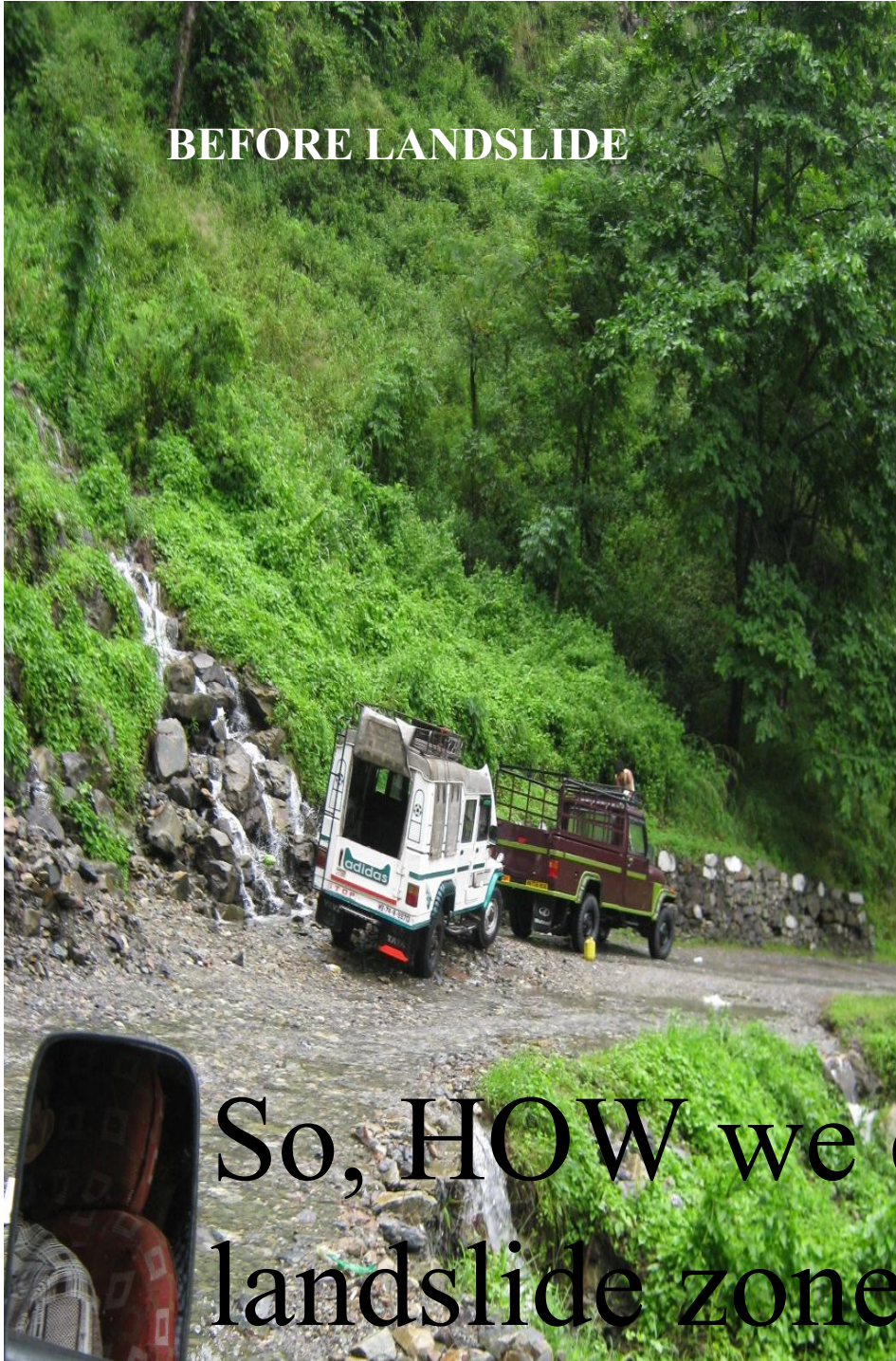


**TRIGGER
RAINFALL**



**EFFECT
LANDSLIDE
HAZARD**

BEFORE LANDSLIDE



AFTER LANDSLIDE



So, HOW we can detect landslide zone then?

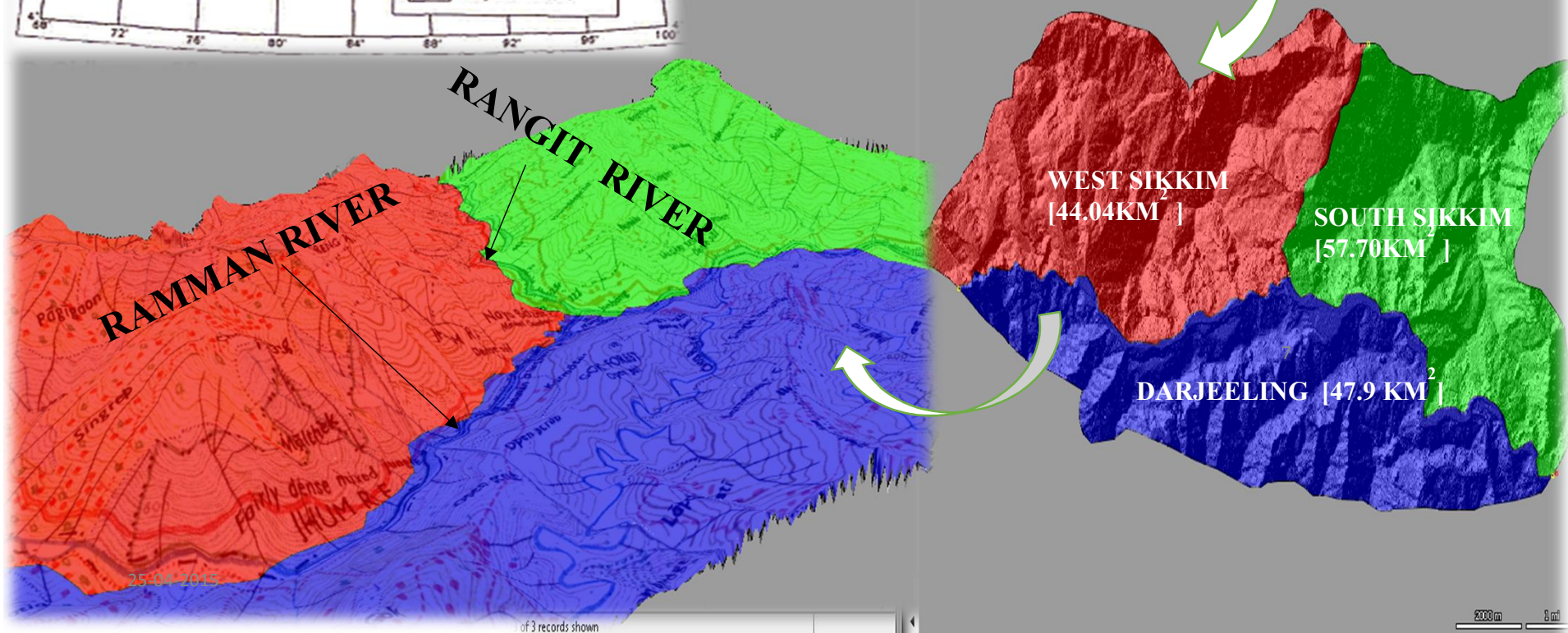
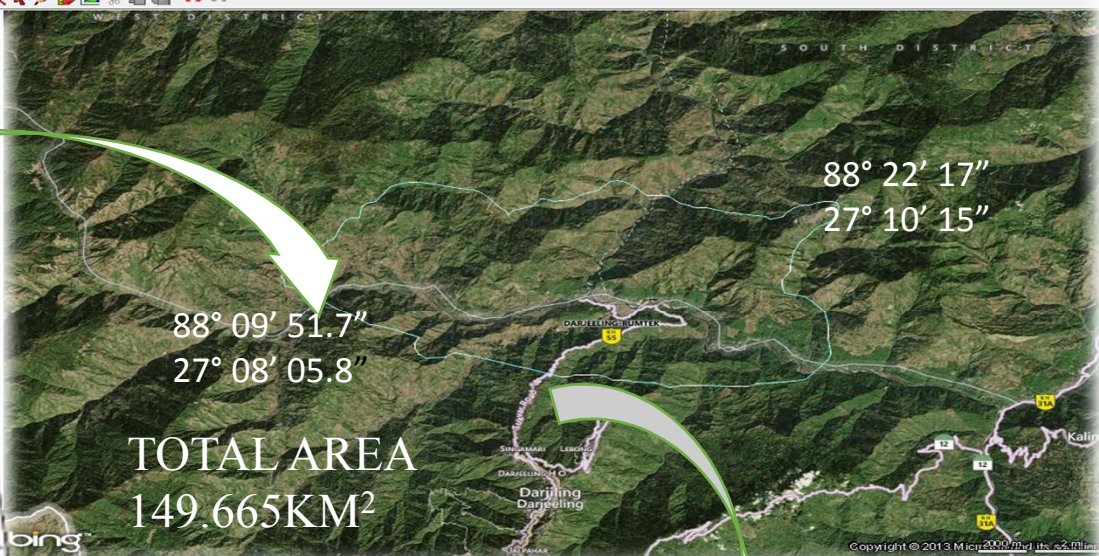
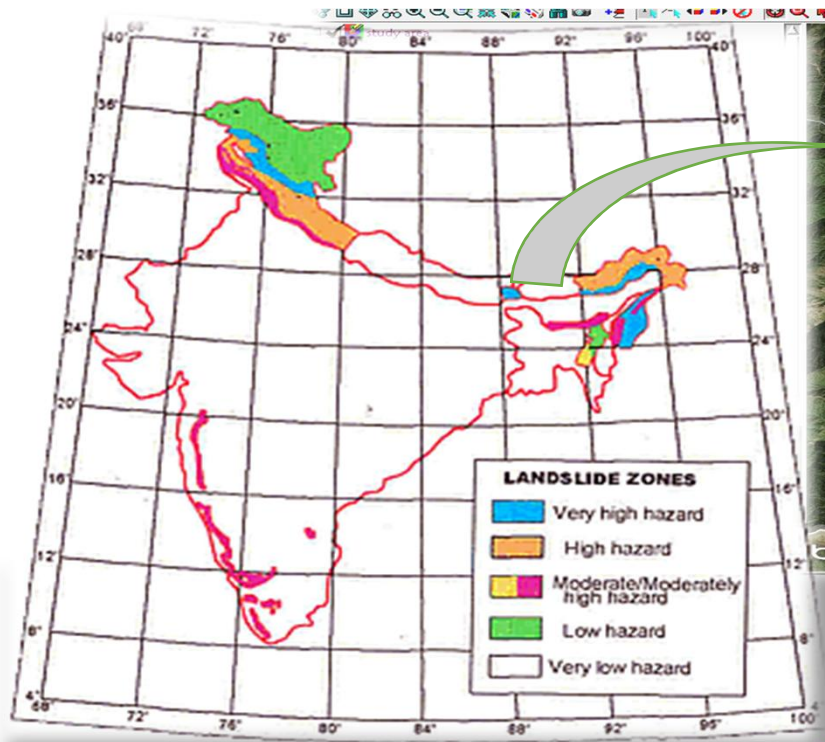
IMAGE PROCESSING

DEM

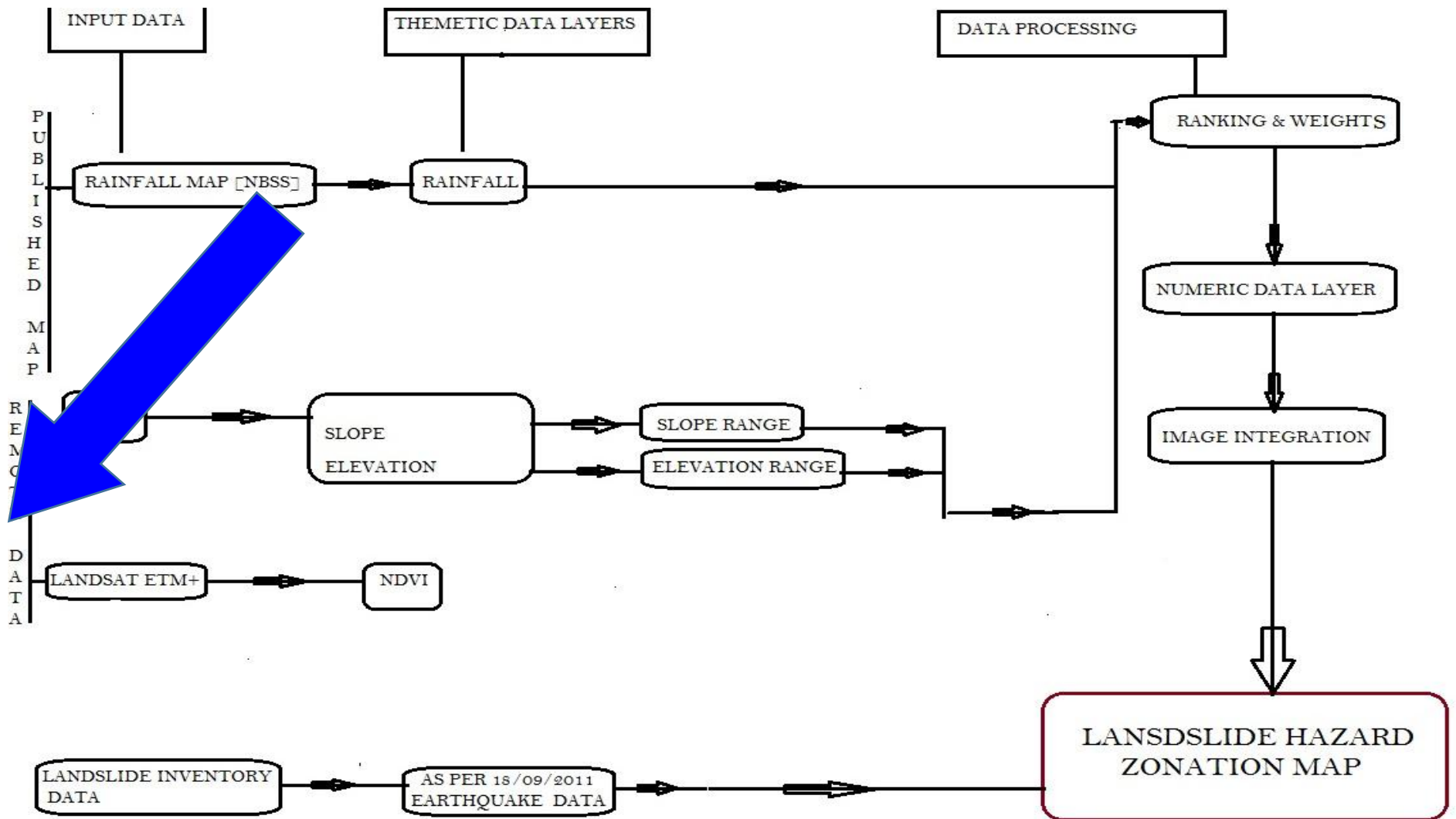
SLC

EI





FLOW DIAGRAM



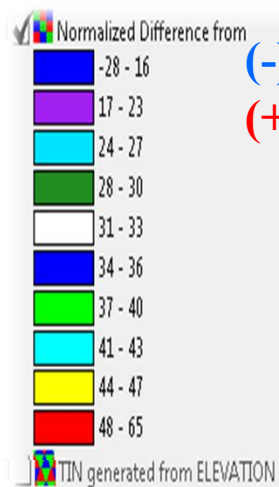
NDVI= NORMALISED DIFFERENTIAL VEGETATION INDEX

[fig-3]

$$\text{NDVI} = \frac{[\text{BAND 4} - \text{BAND 3}]}{[\text{BAND 4} + \text{BAND 3}]}$$

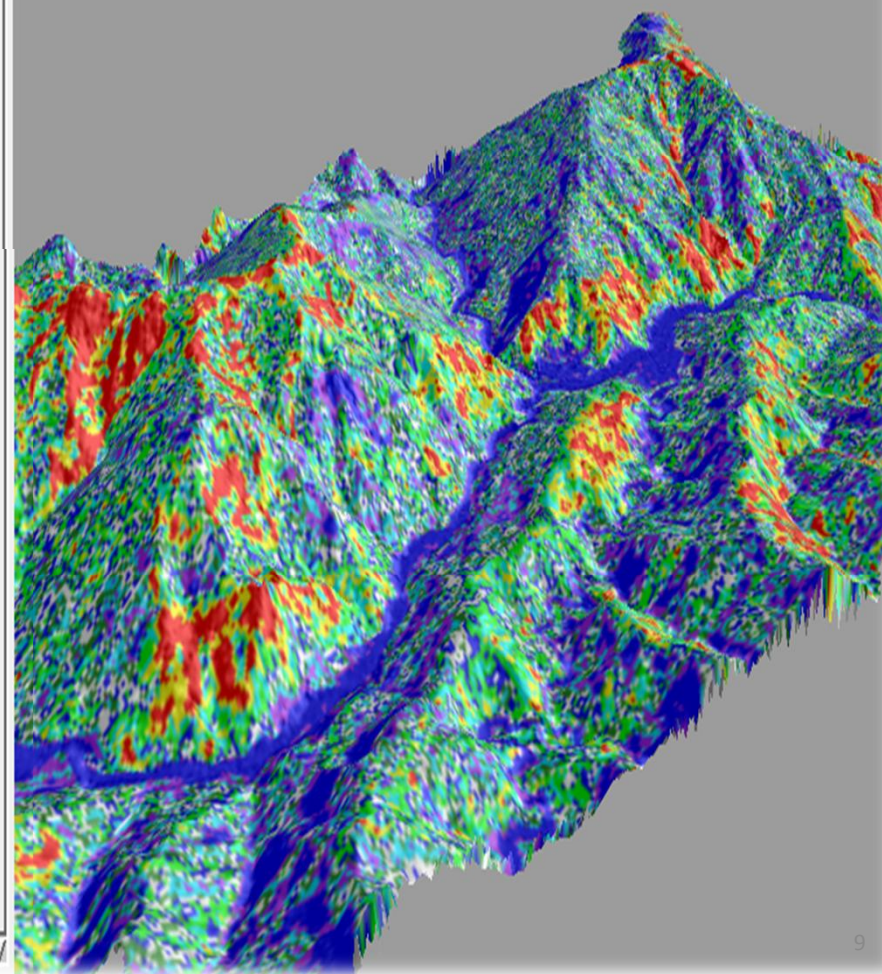
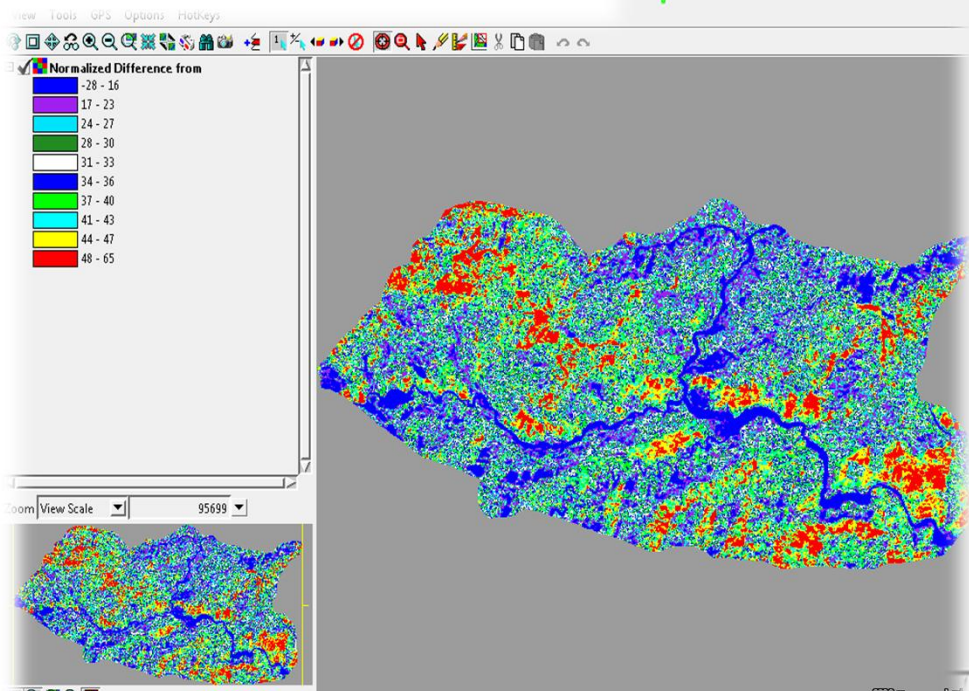
OR

$$\frac{\text{NIR} - \text{IR}}{\text{NIR} + \text{IR}}$$



(-) value shows barren land, constructed areas, river

(+) max value shows dense forests



SLOPE MAP

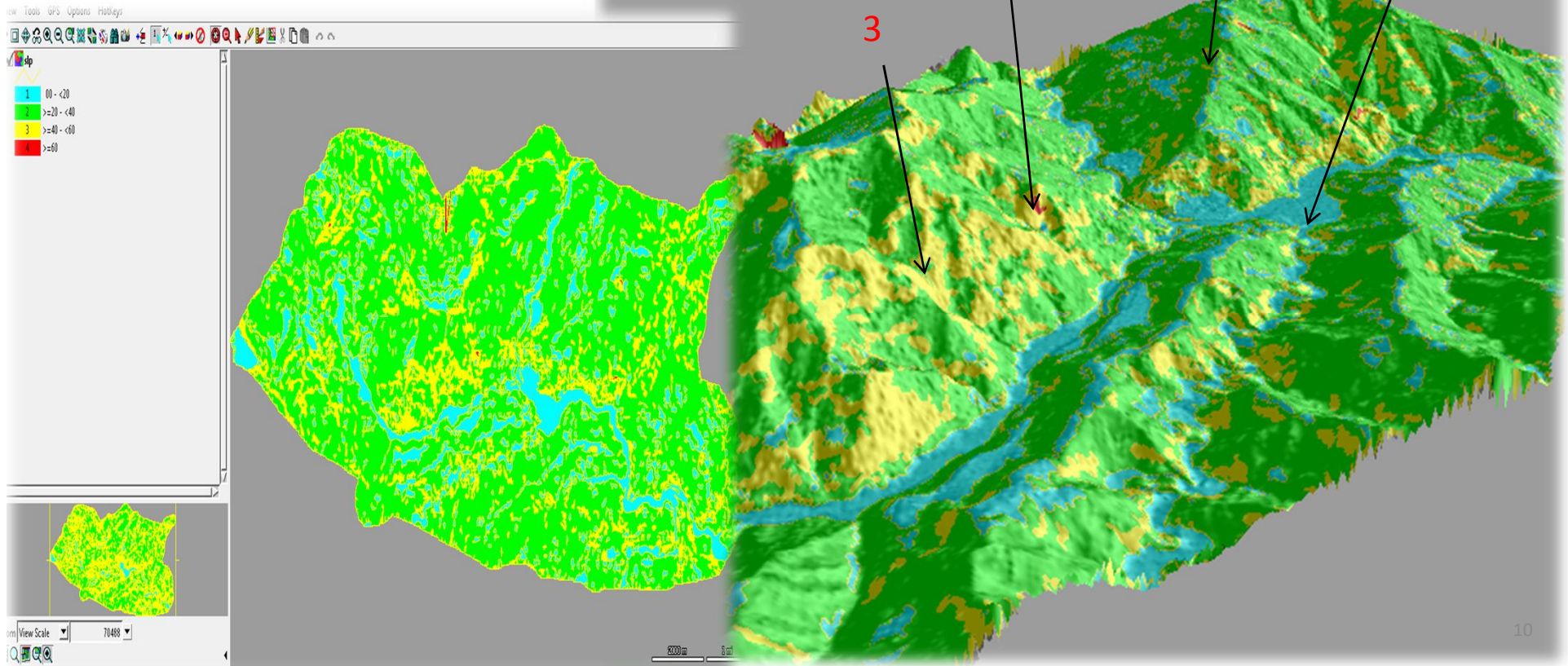
[fig.4]

1= Very Gentle Slope [0° to $<20^{\circ}$]

2= Moderately steep Slope [$\geq 20^{\circ}$ to $<40^{\circ}$]

3= Steep Slope [$\geq 40^{\circ}$ to $<60^{\circ}$]

4= Escarpment [$\geq 60^{\circ}$]



ELEVATION

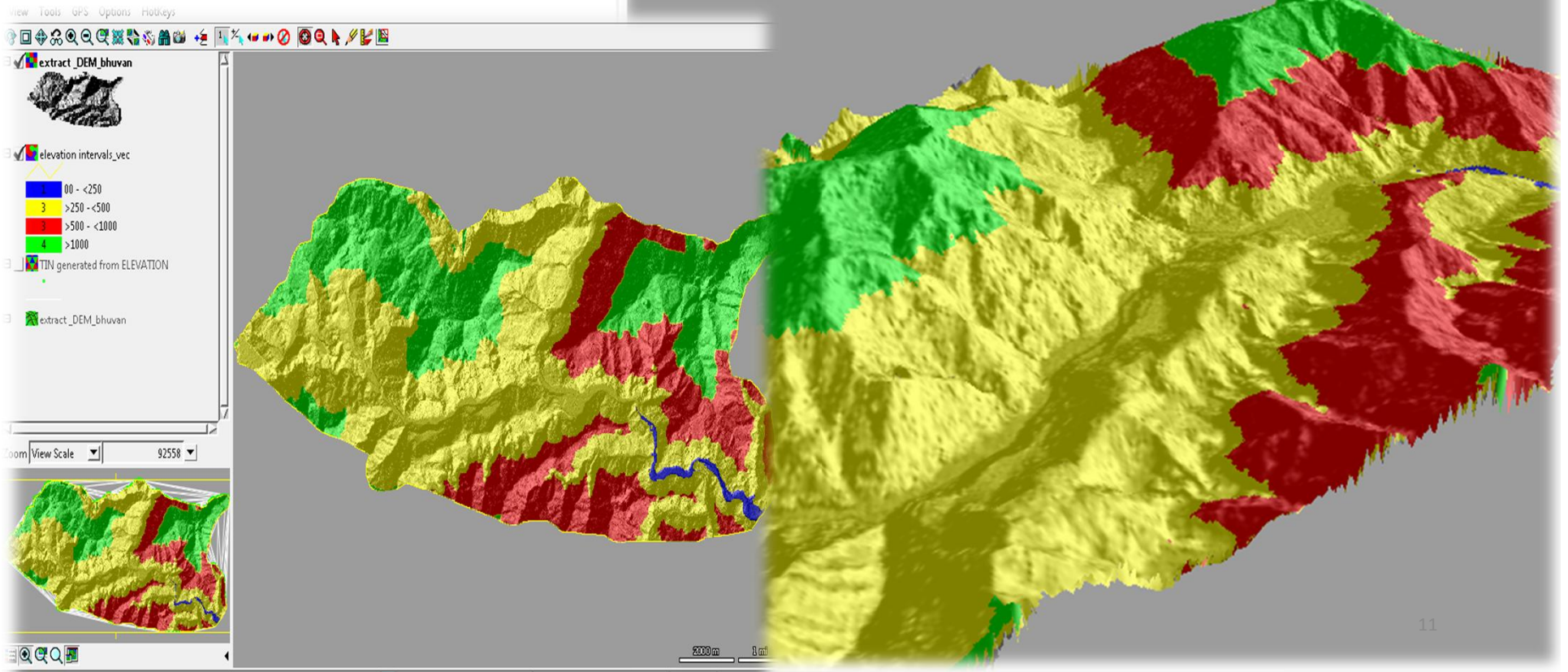
[fig.5]

1=**Gentle** [<250m]

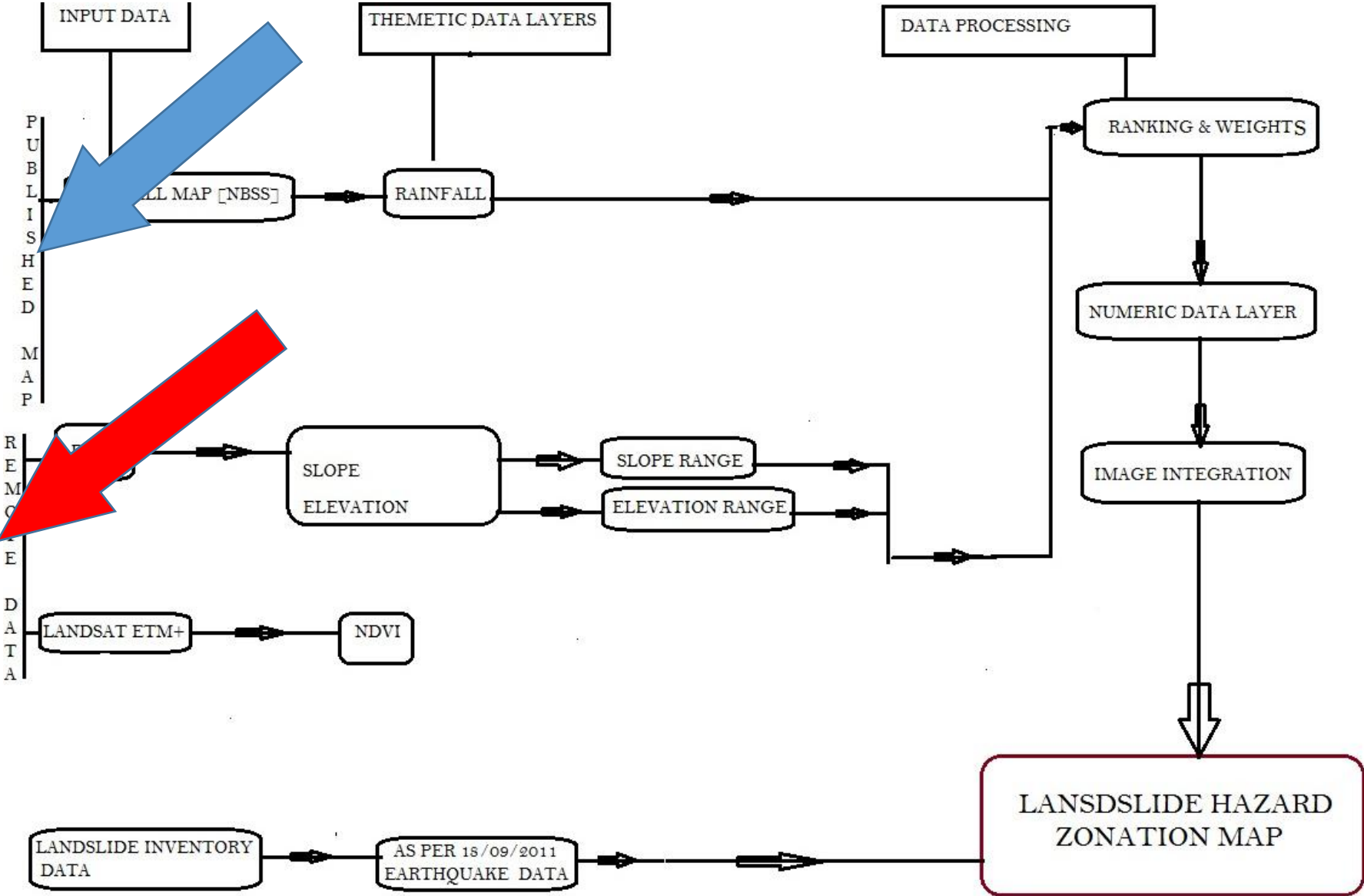
2=**Moderately High** [>250m to <500m]

3=**High** [>500m to <1000 m]

4=**Very High** [>1000m]



FLOW DIAGRAM



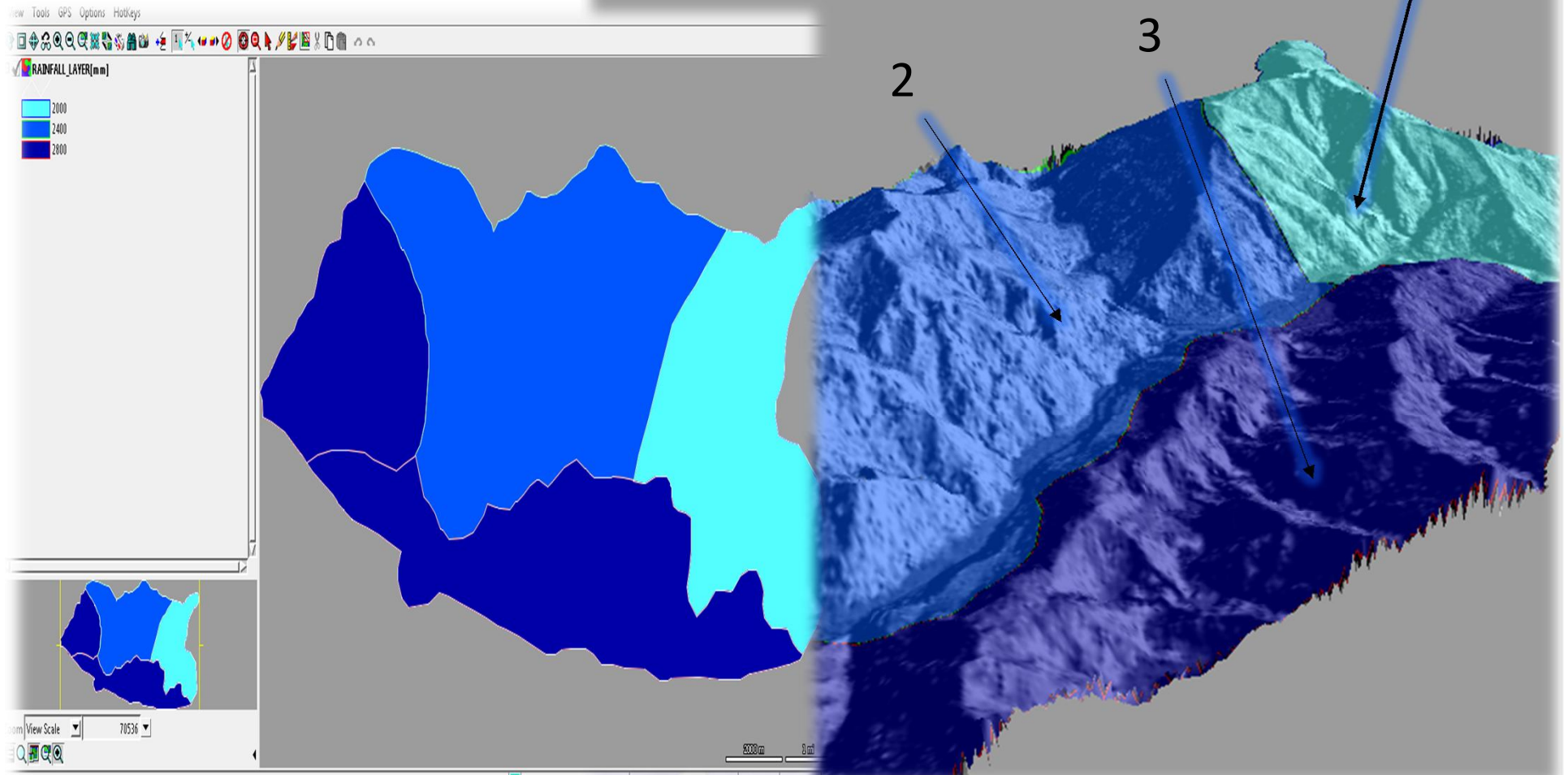
RAINFALL LAYER

[Fig.6]

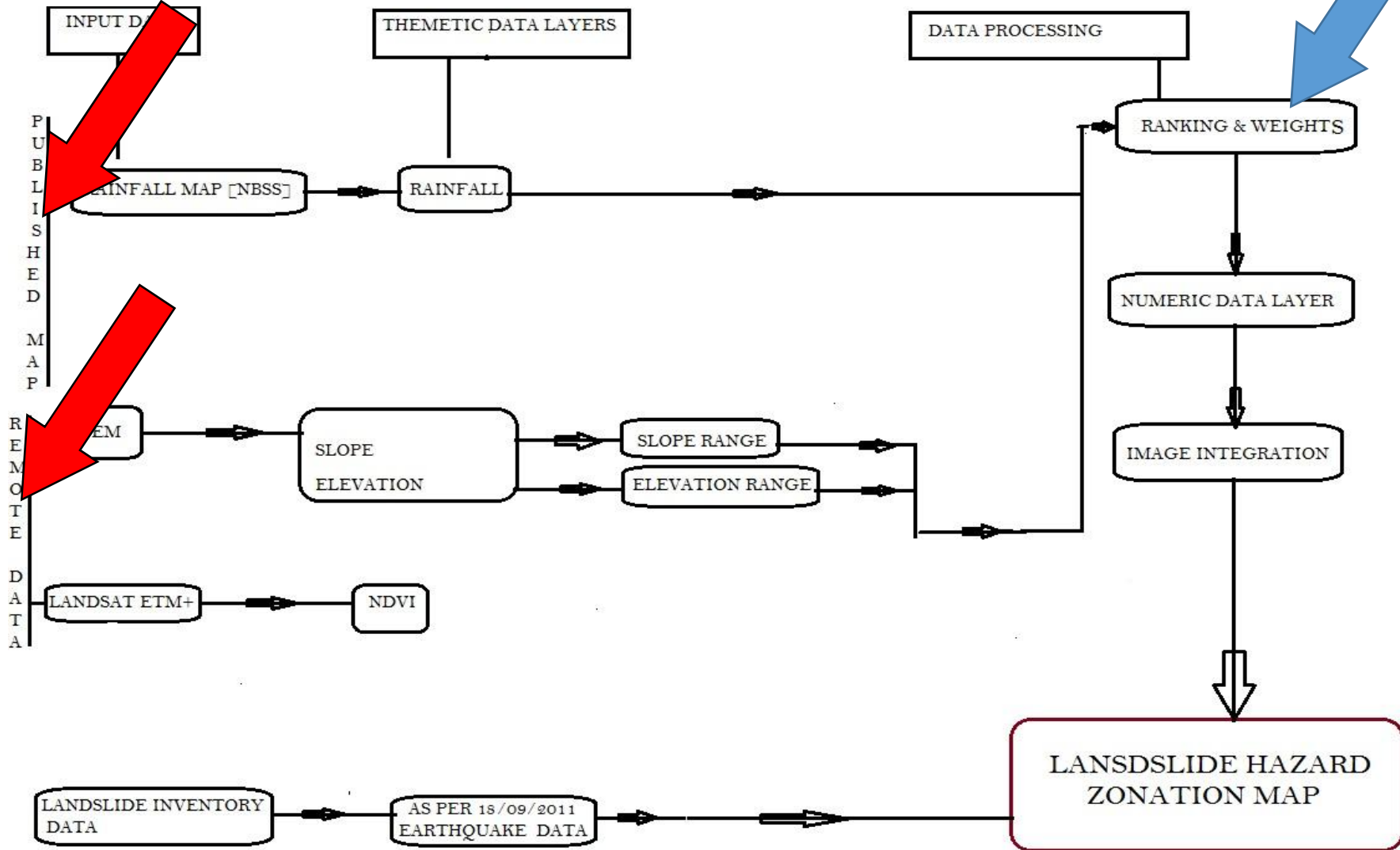
1= Good

2= Moderate

3= High

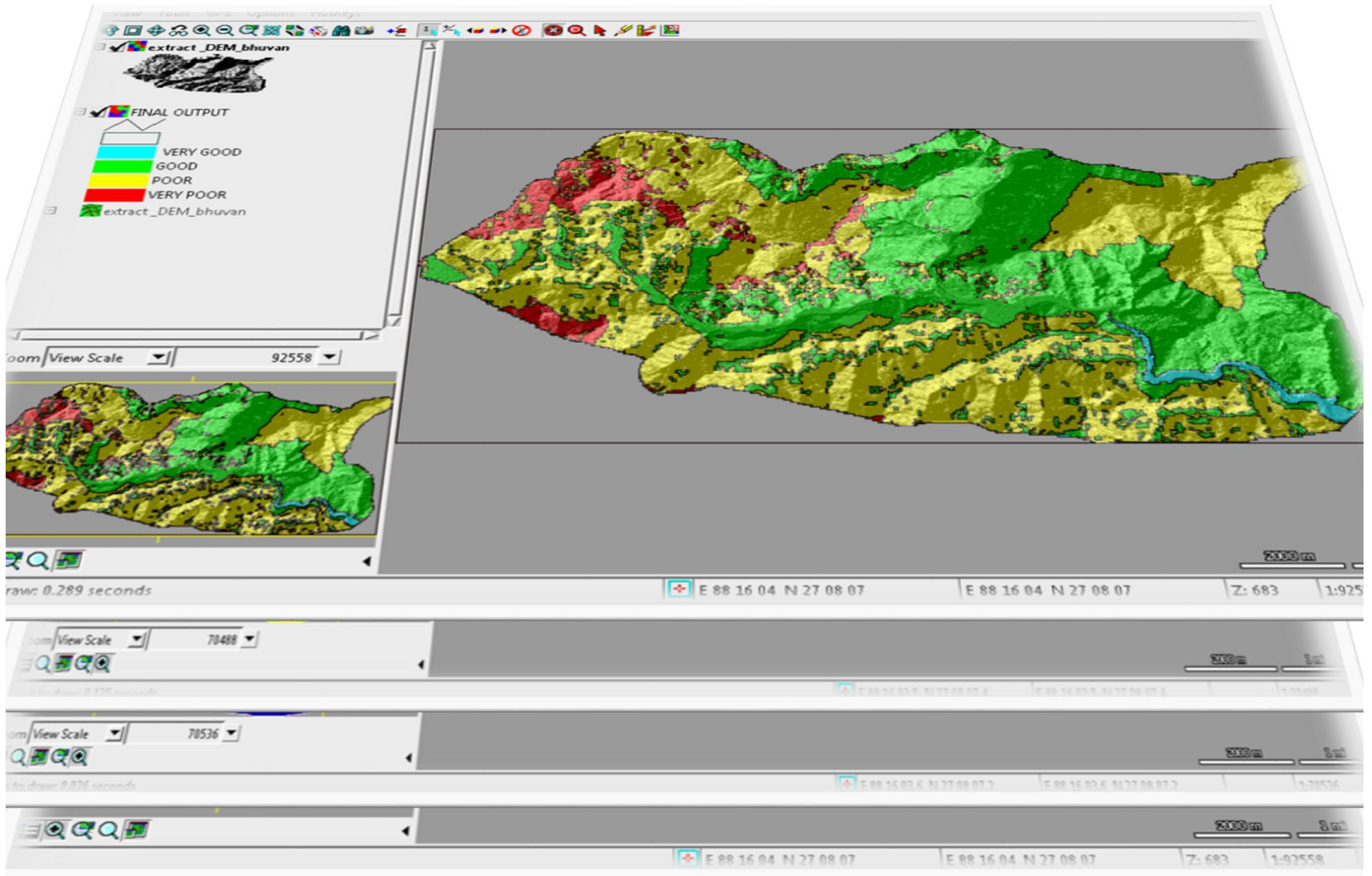


FLOW DIAGRAM



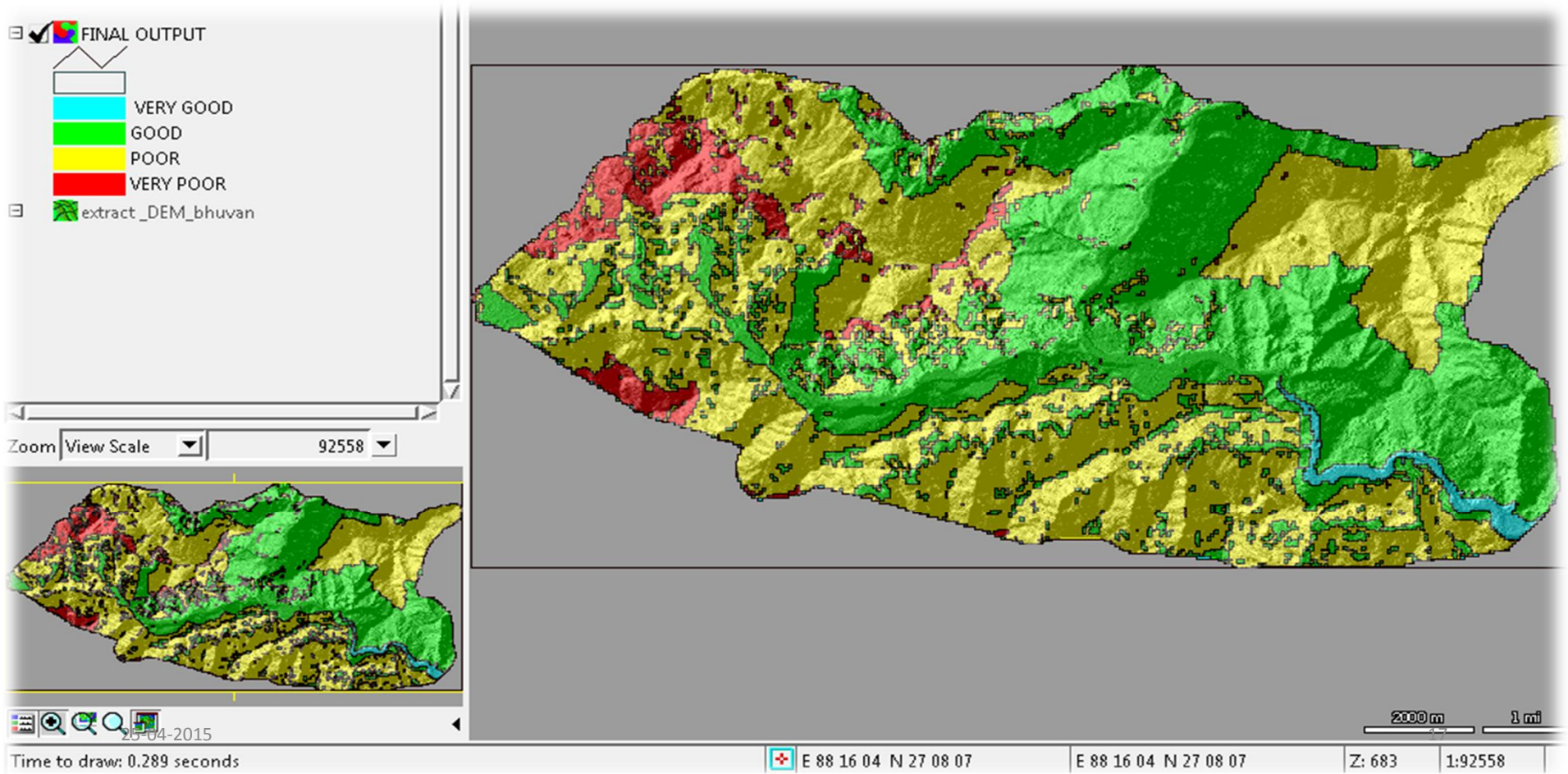
SL NO.	DESCRIPTIONS	WEIGHTAGE	RANKS	
1	SLOPE[IN DEGREE]	0.2	1	Very Gentle slope[VG]
			2	Moderately steep slope [G]
			3	steep slope [P]
			4	Escarpment [VP]
2	RAINFALL	0.3	1	Low [VG]
			3	Moderate [P]
			4	High [VP]
3	ELEVATION	0.5	1	Gentle [VG]
			2	Moderate [G]
			3	High [P]
			4	Very high [VP]

What I did.....

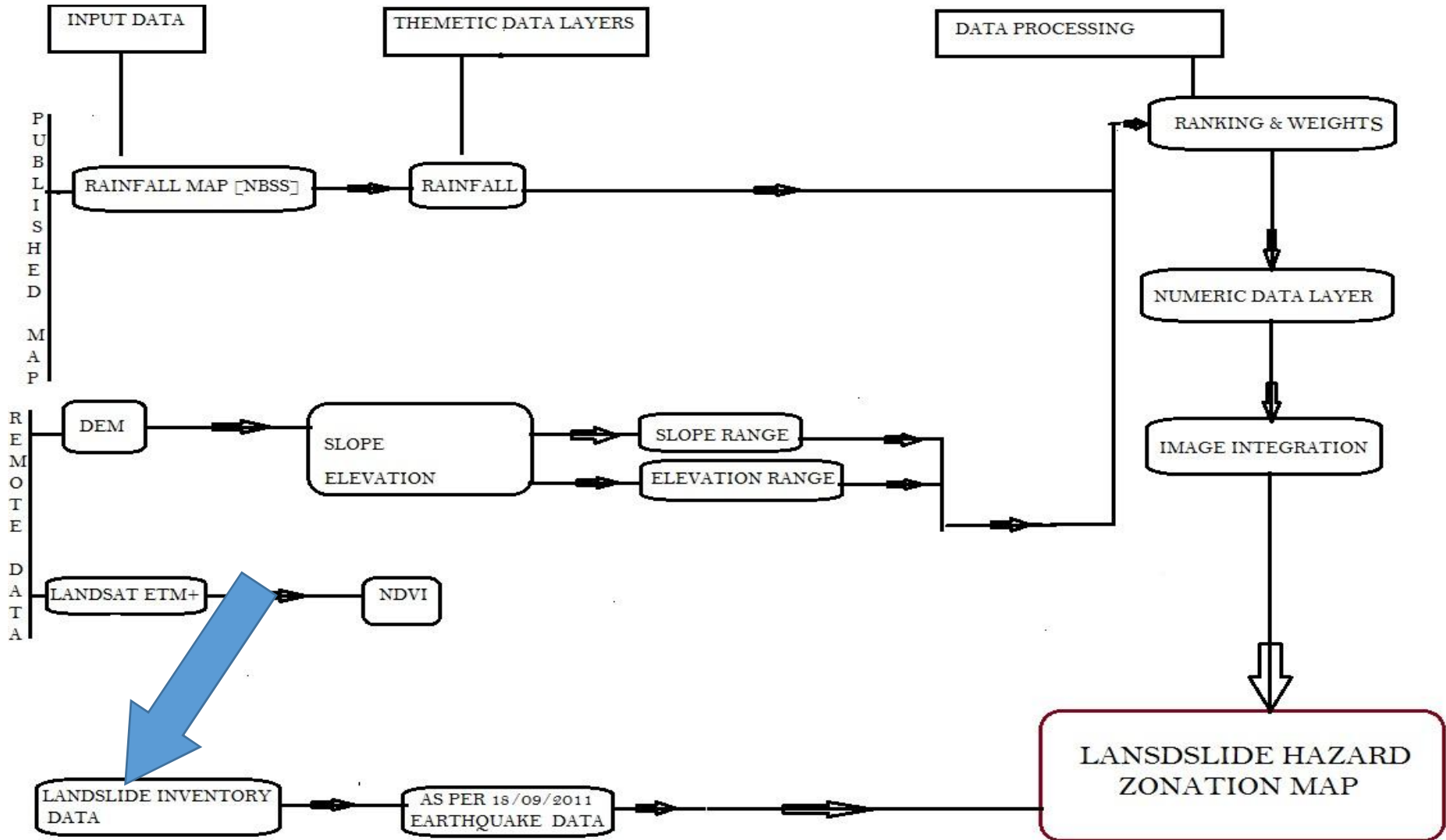


Landslide zonation with the help of three layers (slope,elevation,rainfall)out put.....

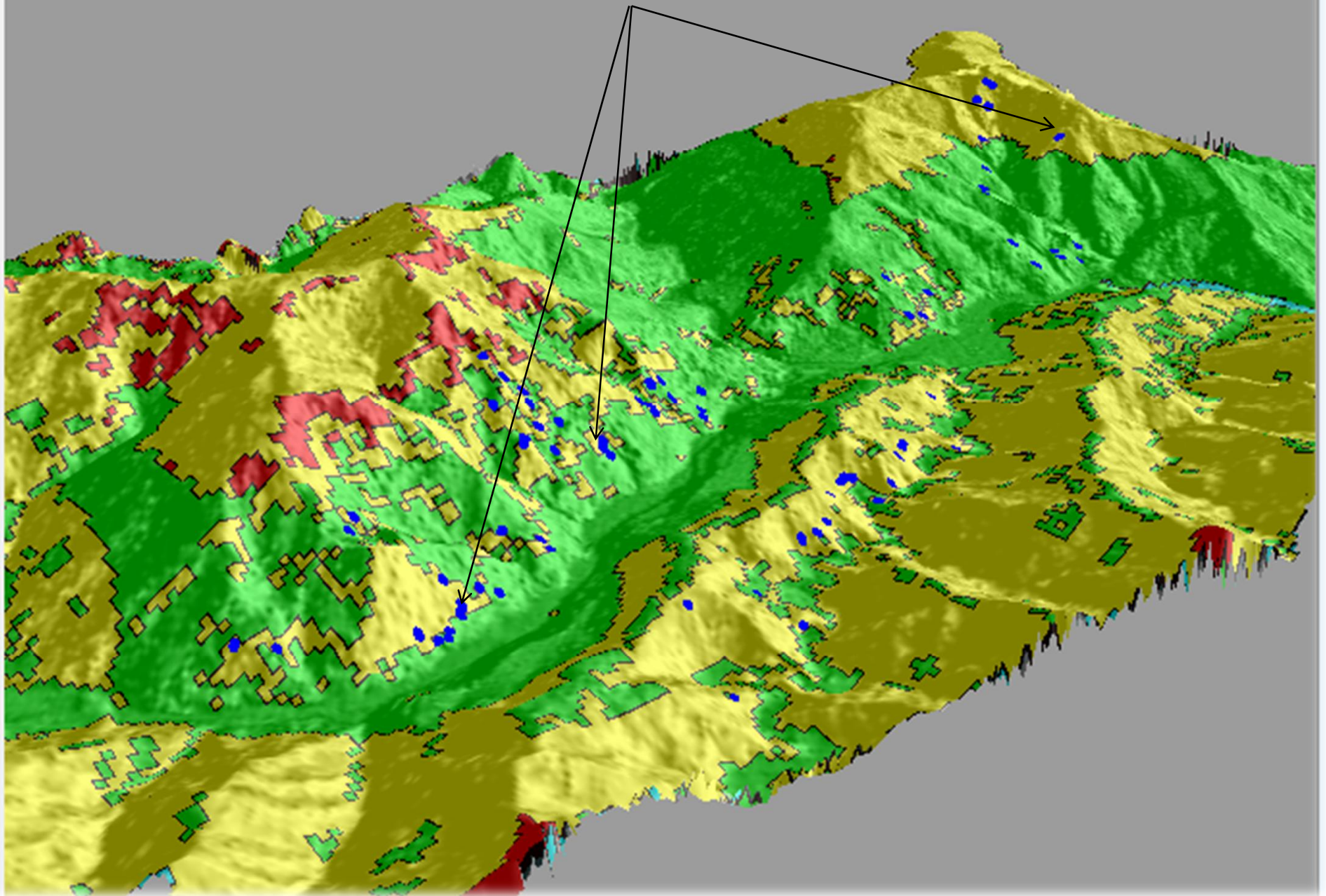
- 1=LOW RISK [VG]
- 2=MODERATE RISK [G]
- 3=HIGH RISK [P]
- 4= VERY HIGH RISK [VP]

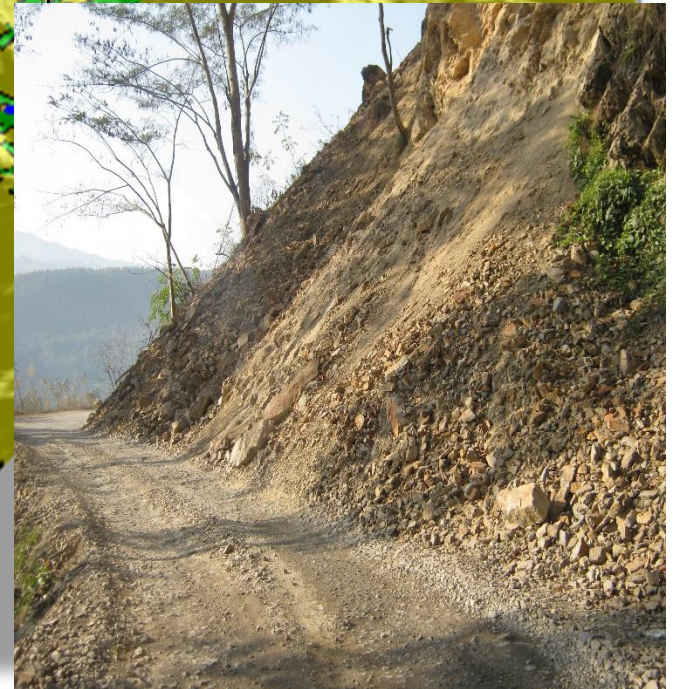
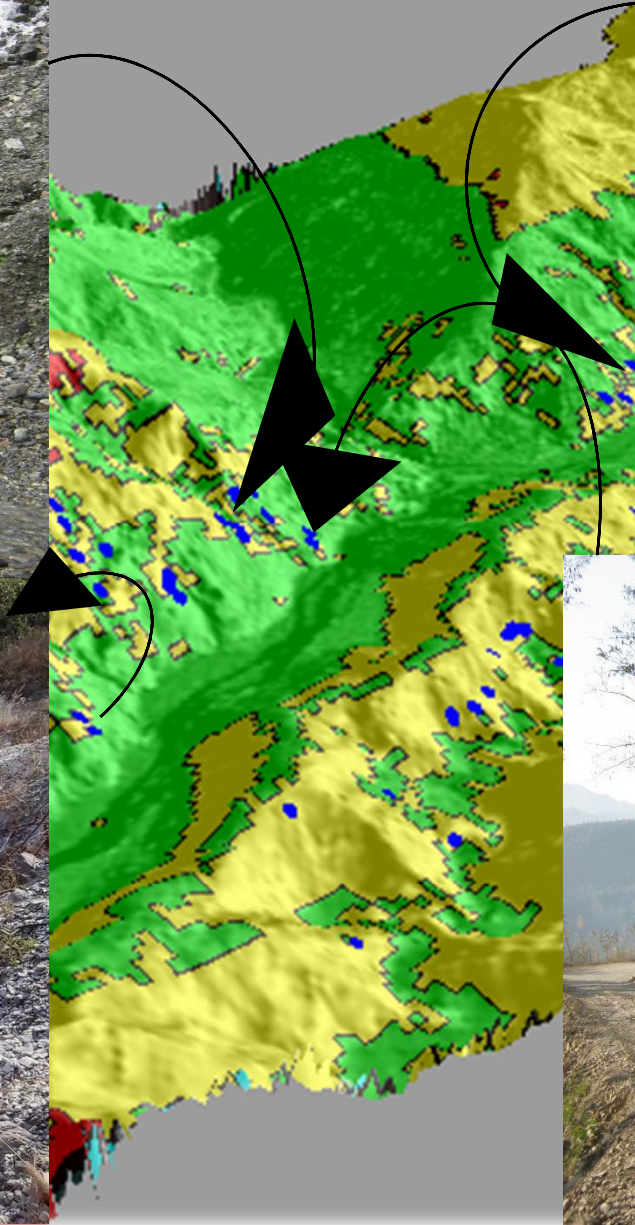


FLOW DIAGRAM



LANDSLIDE INVENTORY OF 11/09/2011

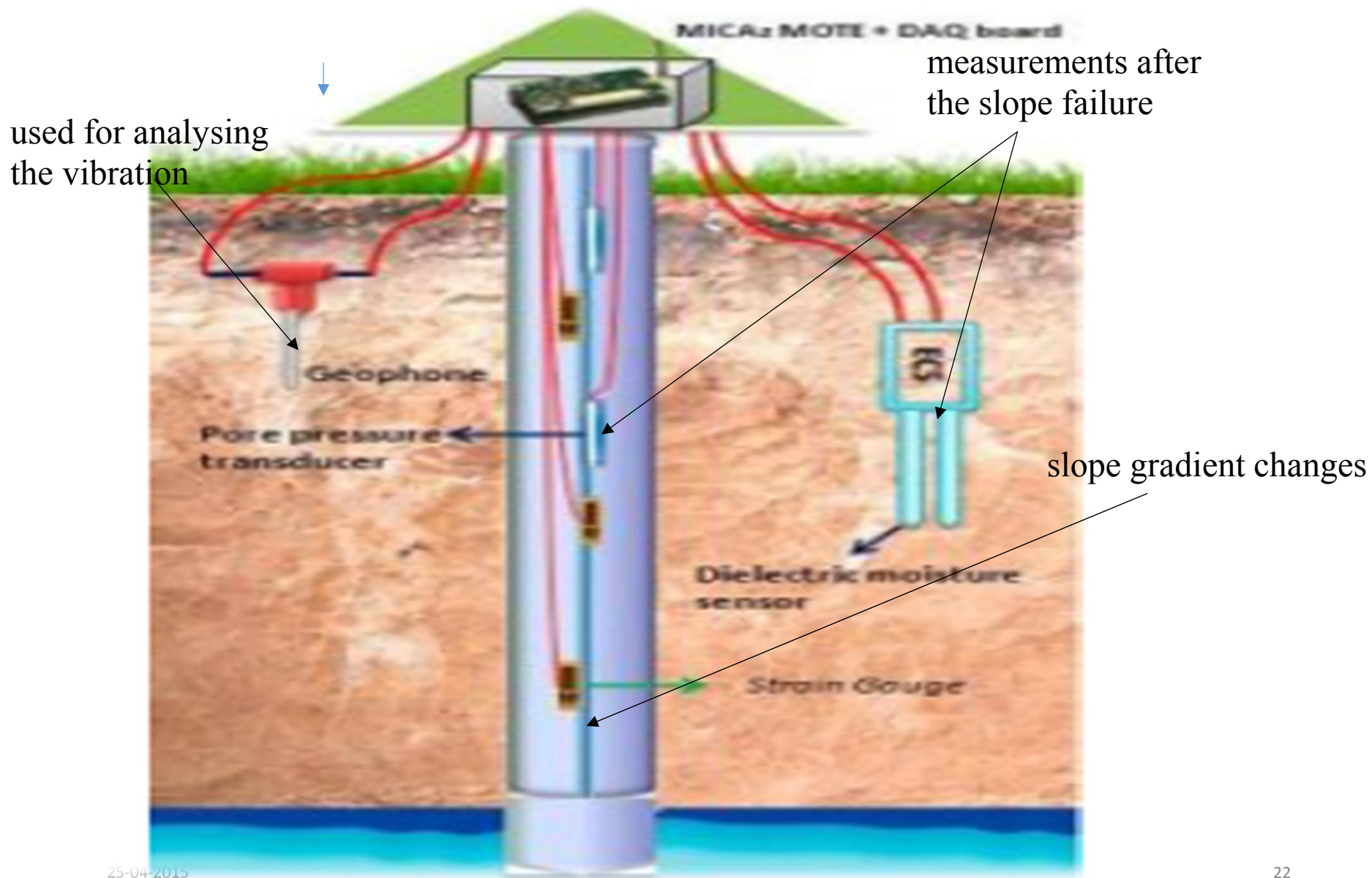




MITIGATION

- For proper surface and subsurface water drainage some drainage ditches, transverse perforated polythene pipes, Lime sand piles, deep drainage wells, horizontal drainage boring and support structures are proposed.
- **Check dams** with ground seals should be constructed along the course of major streams.
- Bio-engineering works in the upper and middle part of the landslide should be encouraged that will help to stabilize the agricultural fields lying nearby.
- **Real-time monitoring** of environmental disasters are one of the prime necessity of the world. Different technologies have been developed for this purpose. **Wireless sensor networks (WSN)** is one of the major technology that can be used for **real-time monitoring**. [by Maneesha V. Ramesh, Sangeeth Kumar and P. Venkat Rangan ;Amrita School of Engineering, Kerala, India]





Real Time Monitoring System[RTMS]



In my study area maximum landslide prone area is noticed beside the roads. If this kind of Wireless Sensor Network (WSN) system can be provided in every poor zone or moderate zone, then it may save more lives and may make smooth transportation system



road Towards daramdin

CONCLUSION

Presently available satellite remote sensing data are a valuable source of information allowing the creation of an improved knowledge base for landslide investigations in lesser Himalayan Region.

Using DEM & rainfall data only, we have tried to predict landslide susceptibility zones.

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- Acharya, S.K., and K.K. Ray, 1989. *Daling Group and Related Rocks*, Special Publication No. 22, Geological Survey of India,---- by Calcutta,India, 105 p.
- Anabalagan, R., 1992. Landslide hazard evaluation and zonation mapping in mountainous terrain, *Engineering Geology*, 32:269–277.
- Banerji, P.K., P.K. Guha, and L.C. Dhiman, 1980. Inverted metamorphism in the Sikkim-Darjeeling Himalaya, *Geological Society of India*, 21:330–342.
- *Indian Standard*
- preparation of landslide hazard zonation maps in mountainous terrains—guidelines part 2 macro-zonation ics 07.040 © bis 1998,bureau of indian standards ,manak bhavan, 9 bahadur shah zafar margnew delhi 110002

A photograph of a rocky, debris-covered slope, likely a landslide or a dry riverbed. The slope is covered in grey and brown rocks and gravel, with some sparse green vegetation. In the background, there are trees and a hillside with dry, brownish grass. The overall scene is somewhat desolate and rugged.

THANK YOU

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