International Journal of Science and Research (IJSR)
ISSN: 2319-7064
SJIF (2022): 7.942

Forest Does Not Need Us, We Need Forest for Our Survival

Uma Shanker Singh[1], Prakriti Srivastav[2]

[1]IFS, DSc
Email: *umashankar.87[at]gmail.com*

[2]IFS
Email: *prakriti188[at]gmail.com*

Abstract: ***Wayanad landslide started as one of those smaller landslides that occurred deep inside the forest, and the landslide gained momentum as it reached the lower reaches of the hill as the soil structure in the lower parts was fragile and saturated with rain. It turned into a massive slide filled with rocks and mud bringing down a part of the hill. The high - intensity rainfall was the major trigger that acted as a tipping point. There are many factors but the most important factor is deforestation which started in the 1980s to clear the land for tree plantations must have gradually changed the soil conditions in the region. The root systems of the forest trees left out within the soil must have decayed, leaving huge cavities. Similar soil conditions with cavities under the soil cover must exist in the Mundakkai/Chooralmala area. It is possible that the water seeped into the cavities and interconnected underground channels formed by soil piping phenomena.***

Keywords: Landslide, Soil, Climate change, Rainfall, Run - out zone, Crown zone of the hills, Satellite imagery, State tourism department, District Tourism Promotion Council, National Remote Sensing Centre.

1. Introduction

It was like any other day in a rainy season. The people of Vellarimala hill ranges in the Western Ghats of Wayanad district of Kerala had little inkling of what was in store when they went to sleep on the night of July 29. They didn't realise that the land under their feet was slowly beginning to shift. The ground finally slipped in its entirety in the early hours of July 30, which turned out to be the biggest landslip disaster in the history of Kerala. The twin landslides, the initial slip at around 1 am and a more devastating one with gushing muddy water and massive boulders around 4 am wiped out the Mundakkai and Chooralmala settlements of Meppadi panchayat, killing more than 420 people till to this day and many missing, leaving a trail of destruction and transforming a green rolling hilly landscape into a valley of death and mayhem. The last time Kerala witnessed devastation like this was during the floods of 2018 that claimed 433 lives and affected over 5.4 million people. The Puthumala tragedy of August 2019 left 17 dead and flattened 58 houses. The region experienced torrential rains of as much as 572 millimetres in about 48 hours before the event. Rainfall over 204.4 mm a day is considered extremely heavy as per India Meteorological Department. Despite the record 572 mm of rainfall that was recorded in Mundakkai over the 48 hours before the landslide, Wayanad has seen only normal rainfall averages during this monsoon, while Kerala as a whole has seen deficits, according to India Meteorological Department data. The satellite imagery released by the Indian Space Research Organisation (ISRO) 's National Remote Sensing Centre (NRSC) on August 1 indicates that about 86000 square metres (0.086 Square kilometre) of land have moved down the hill. The run - out zone stretches about eight km from the crown zone of the hills along the course of Iruvanjipuzha, a major tributary of the Chaliyar river that flows close to the impacted area. The pre - event images captured by the Cartosat 3 satellite on May 22, 2023, reveal the crown zone impacted by an older landslide. The post - event images were captured by the RISAT satellite a day after the landslip on July 31. The RISAT satellite is a radar imaging reconnaissance satellite built by the ISRO.

2. A Brief Detail about Wayanad

The population of Wayanad in 1991 was 6.72 lakhs. The population in Wayanad in 2024 is estimated at 8.58 lakhs. According to the state tourism department data, tourist arrivals into the state grew 72% from 2003 (6.16 million) to 2023 (22.52 million). Out of the 22.52 million tourists who visited Kerala in 2022, 1.51 million visited Wayanad district alone. To host such a large number of tourists, many resorts have been built. Unauthorized properties and unregulated tourism are considered to be one of the reasons for changing the land - use pattern that aggravated the landslide conditions in Wayanad. Thousands of unauthorized homestays and resorts did not have any records in the official database of government, but they could be seen on search engines like Google Maps. Most of these unauthorized establishments lacked licenses from local bodies or the District Tourism Promotion Council. According to the Department of Tourism, only 32 such villas or resorts were registered with government, but more than 3, 000 such establishments could be found online in the Wayanad district alone. These properties did not pay taxes, and did not follow any norms of the State Pollution Control Board or forest department. A report submitted by the district town planner to District Disaster Management Authority on 27 September indicated that several resorts located in the landslide - prone zones of the eastern slope of the Western Ghats violated all norms and regulations. Fire and Rescue Department reported that several glass bridges in resorts operate without approvals from any department.

3. Methodology

A literature review of different papers on this subject was done by collecting and synthesizing previous research. By integrating findings and perspectives from many empirical findings, this article has been prepared.

Death Rains in Waynad

Massive landslides hit the district of Wayanad in northern Kerala in the early hours of 30th July, 2024, with continuous torrential rainfall triggering large - scale death and destruction in Mundakkai and Chooralmala of Meppadi panchayat, with entire villages being washed away. As of September 27, 2024, the Wayanad landslides in India killed over 420 people, injured 397, and left more than 118 people unaccounted for.

Reasons for the Landslides in Wayanad

The result of a study was published by the National Centre for Earth Science Studies (NCESS) in the year 2010 about the vulnerability of Kerala's landmass and it reveals that 4.71% of Kerala's landmass is highly prone to landslides, while 9.77% is low - prone. Some of the most landslide - prone areas in Kerala include Devikulam, Vythiri, Nilambur, Mannarkad, and Ranni (Centre for Earth Science Studies, 2010). There are several studies on the character of Western Ghat soil which make them vulnerable to landslides during heavy rains. Landslides are the most common natural hazards and it causes severe threat to property and life in the Western Ghats regions of India. The Western Ghats is known as the India's second most landslide - prone area after the Himalayas (Martha et al., 2021). The Western Ghats have been classified as an ecologically fragile region. According to recent research by the Indian Institute of Science, the 1.6 lakh sq km of hats in six states have been divided into four ecologically sensitive regions (ESR): very high ecological fragility (63, 148 sq km), high ecological fragility (27, 646 sq km), moderate ecological fragility (48, 490 sq km) and low ecological fragility (20, 716 sq km). Soil cover and steep slopes make the Western Ghats prone to landslide disasters during the monsoon season (Jain et al., 2023). The basalt - laterite contact, laterite exposed along plateau edges, growth of roots along the opening of fractures and anthropogenic activities during the rainy season are some of the significant causes of landslides in the region (Wadhawan et al., 2020). Landslides during the monsoon season occur when water rapidly accumulates in the subsurface, which results in a surge of pore water pressure in the soil. In addition to the rainfall, soil moisture plays a vital role in the initiation of landslides (Wei et al., 2020). The increase in pore water pressure caused by water infiltration during rain is one of the primary factors in triggering landslides. Herein, the study of daily soil moisture with rainfall data improves understanding of the cause of landslides. Kerala hilly regions have slopes of more than 20 degrees, therefore, this increases the risk of flash floods during heavy rains and when it is combined with unsustainable infrastructural projects, it becomes a lethal weapon. This has been found that Kerala government has approved various development projects in Wayanad over the past four years and that includes non - coal mining, without conducting a thorough study of the district topography and geomorphology.

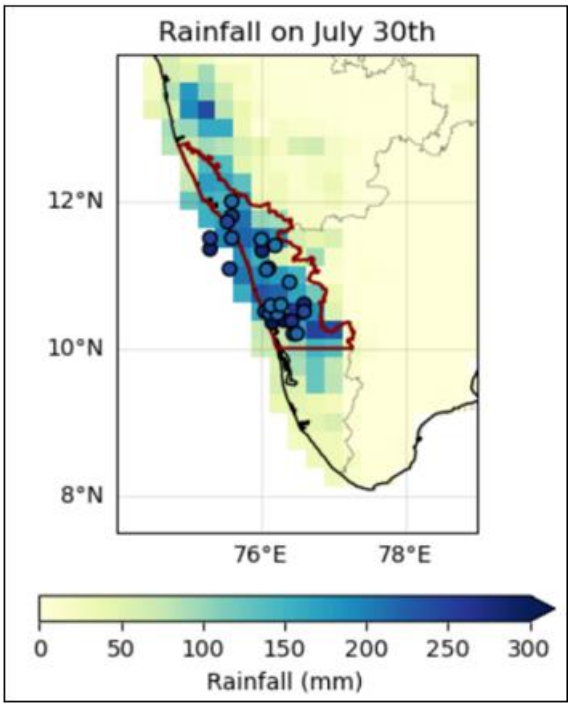
4. Discussion

The Wayanad landslide that devastated Kerala's hilly region for the second time after 2019 shows that no lessons were learned as unchecked construction with mushrooming tourist resorts, connecting roads, tunnels and quarrying activities continued despite red flags by many experts and environmentalists. This is ironical that to attract more tourists, the Kerala government has proposed a four - lane underground tunnel to cut down the travel distance between Anakkampoyil in Kozhikode and Meppadi in Wayanad from 85 km to 54 km. despite the landslide crown being very close to the proposed tunnel site. The government should have taken local ecology and carrying capacity of the place into consideration before planning a tunnel. The Union Ministry of Environment Forest and Climate Change has also granted stage - 1 forest clearance for the 7.64 km tunnel project in haste without considering its ecology and the land acquisition for the project, which has an estimated cost of Rs 1, 643 crore, is almost complete. The Konkan Railway Corporation Limited (KRCL), which prepared the Detailed Project Report (DPR), has also floated tenders in the month of May 2024 therefore, it is certain that the government is inviting a problem of its own making in a much bigger dimension than ever before. Wayanad is situated on the ecologically sensitive Western Ghats, which is vulnerable to landslides. Some parts of the district are also prone to soil piping, a naturally occurring hydraulic process that develops macrospores (large, air - filled holes) under the soil surface. These are associated with landslides as water fills them and the earth beside gives away. Human intervention played a significant role in the landslides. Rapid urbanisation and increasing mining activities in surrounding areas have made the region even more fragile. Construction activities create quarries, which become artificial lakes that affect the topsoil. In 2011, the Western Ghats Ecology Expert Panel, led by ecologist Madhav Gadgil, demarcated the Western Ghats as an ecologically sensitive area (ESA). The panel recommended regulating construction activities in one of the world's eight critical hotspots for biological diversity. The panel included Vythiri, Mananthavady and Sulthanbathery taluks in Wayanad in ecologically sensitive zone - I (ESZ - I), meaning no land change was permitted. It recommended banning mining, quarrying, new thermal power plants, hydropower projects, and large - scale wind energy projects in ecologically sensitive zone 1 (Gadgil, 2011). Ironically, on account of resistance from state governments, industries, and local communities, the recommendations are yet to be implemented even after 14 years. The panel in its report recommended regulating construction, mining and quarrying activities in Western Ghats, one of the eight 'hottest hotspots' of biological diversity in the world. Despite warnings issued by eminent environmentalists, this has been pointed out that the construction of resorts and artificial lakes, as well as quarries, as among the developmental activities are still going on which should not have occurred otherwise in the sensitive zone.

An expert committee constituted by the Kerala government visited many sites in Wayanad and submitted a report in 2009. The report has flagged many factors that trigger landslides in the region and warned that the Meddapi Panchayat in Wayanad lacks proper drainage system for the movement of storm water and needs immediate attention. This further

reiterated that the area receives very high rainfall and that all the rainwater is filtered into the soil, which can cause piping (subsurface soil erosion), leading to rotational - type slide movement. The report further reveals that previous landslide at Mundakkai, the site of the current disaster, in 1984 that claimed 14 lives and destroyed a large chunk of agricultural land. If the issues were addressed well in time and remedial measures were taken at the appropriate level possibly, many lives could have been saved. The history of the landslides reveals a very interesting resemblance, yet the lesson is not learnt. The location of the landslide in Mundakkai and Chooralmala was about 2 - 3 km from Puthumala, where a similar type of mass wasting had occurred on August 29, 2019, where 17 people were killed and nearly 100 acres of tea plantation was washed away in the massive landslide. The epicentre of the landside was 290 - metre - high on the mountain which brought down 20 hectares of land pushing it to a distance of about 2 kms. The village's primary livelihood depended on agriculture, with crops such as cardamom, pepper, coffee and tea and unfortunately everything was destroyed. Based on the assessment of Soil conservation department of Wayanad District about 25, 000 hectares area had lost the top fertile soil of 2 cm which would severely affect the agriculture production. Nearly, 40 hectare of land was affected by land slide, land slip and silt deposit in Puthumala (Desai, 2020). There are other factors also which has contributed to the landslide disaster in Wayanad and among the anthropogenic factors that affect the landscape, deforestation and alterations to the natural vegetation to prepare farmlands are critically important. A study pertaining to Nipah was carried out in four districts namely, Kannur, Kozhikode, Malappuram, and Wayanad in the state of Kerala and the satellite data derived from the United States Geological Survey (USGS) in the form of Landsat Thematic Mapper - 5 (TM5) from the years of 1993 and 2017 for the four districts showed a huge decline of the forest cover. The study revealed an extensive decline in forest cover (2, 03, 939, hectares) from 1993 to 2017. The loss is significant as about 27% of its forest has been lost in the area of interest (Talukdar et al., 2019). In yet another study on the Impact of Plantation Induced Forest Degradation this has been found that 85% of the total area of Wayanad was under forest cover till the 1950s and the forest cover is reduced from 1811.35 sq km in 1950 to 1064.68 sq km in 1982 while plantation cover rose by around 1, 800%. The reason behind the ~41% loss of forest cover between 1950–1982 lies in the Government policy but its impact is reverberated time and again (Saha et al., 2022). Over more than two centuries, these activities have gradually changed the soil and hydrological conditions in many parts of Wayanad, impacting the pattern of groundwater discharge. While the large trees were removed, their root systems remained buried. Over long periods, they have decayed, leaving large cavities, some of which are interconnected and act as fast subterranean flowage channels, causing soil piping and ground collapse. The lack of adequate measures to protect the soil profile adds to this problem. A study was carried out recently in which researchers investigated the impact of climate change specifically on the heavy rainfall in northern Kerala on 30 July 2024 and they revealed that the climate change made the intense rainfall on 30 July around 10% more intense. The authors note that Kerala is a mountainous region with "complex rainfall - climate dynamics" and explain that there is a high level of uncertainty in the model results.

Source: Corban Brief. © Mapbox



Source: Corban Brief

5. Conclusion

Deforestation, rapid urbanisation, unplanned development and poor planning are significant factors exacerbating the climate crisis in India. Construction of poorly rubble masonry walls, houses, or other structures also obstructs the low - order drainage and restricts the natural surface runoff. Therefore, strict land use policies should be in place to avoid such pitfalls. Excessive quarrying also has a significant impact on the landscape, affecting the natural hydrological conditions. Quarrying removes topsoil, which is essential for sustaining the vegetation. The effects of using explosives and machinery such as backhoes to transport the material have adverse effects on the landscape. These activities create fresh fractures and open up older ones, altering the movement of water. They eventually destabilise the ground, leading to increased soil erosion, which leads to the overall instability of the hill slopes. Although recognised to have many adverse effects, the impacts of quarrying are not well - documented, and they need to be studied in detail in the context of landslide hazards. Construction of roads should be done with all scientific techniques. At present, roads are being made or widened without taking proper measures such as no slope stability, lack of good quality retaining walls and rock bolting. All these measures can restrict the damage done by landslides up to some extent. There is an urgent need for strengthening infrastructure by investing in climate - resilient bridges and roads, which will help withstand extreme weather events and facilitate quicker rescue operations. This is found that proper drains were lacking for the movement of the stormwater. Since the area receives very high rainfall and that all the rainwater is filtered into the soil, which can cause piping (subsurface soil erosion), leading to rotational - type slide movement.

Source: Corban Brief

The problem lies with the farming pattern also, for example, in the absence of stubble mulching, which the local farmers do not practice, the soil gradually depletes in its organic content, facilitating faster hydraulic conductivity and rapid transport of subterranean water. Large - scale migration from other parts of Kerala destroyed the forest cover as plantations sprung up in the hilly district. The area became more susceptible to devastating landslides without solid and deep

roots of big trees. Most landslides in Kerala are around plantation areas, indicating another major triggering factor, agricultural activities such as monocropping, in which large, native trees, which hold the topsoil to the bedrock, are cut down. These trees are being replaced by big plantation crops, such as tea and coffee, which have shallow roots. Any fresh plantation activities also alter the infiltration and the water - bearing capacity of the underlying soil layers. First, there is tilling and loosening of topsoil. Then, there are arrangements for irrigation. Take the case of rubber tree re - plantation, wherein mature trees are slaughtered after their lifespan and fresh saplings are planted. Both tilling of the land and irrigation are required, which are usually done by making rainwater pits. It is a common practice to use heavy machinery for these activities, which not only disturbs the soil structure but also increases infiltration and reduces surface runoff. Over time, the excessive infiltration facilitated by the water pits tends to weaken the contact of the overlying soil layer with the bedrock, triggering movements. Usually, this contact is marked by a layer of clay, which facilitates movement under wet conditions. Therefore, promoting sustainable land management is also crucial; practices such as reforestation, no - deforestation, and sustainable agriculture can maintain hillside stability and reduce soil erosion, thereby lessening the effects of heavy rains. In 2011, the committee under Gadgil, which was set up by the Centre to assess the environmental sensitivity of the Western Ghats and the possible impacts of the climate crisis in the region, recommended that 75% of the 129, 037 sq. km area of the mountain range be declared ecologically sensitive because of the presence of dense forests, a large number of endemic species and unique geology. The high - level committee constituted by the Ministry of environment, forest and climate change is on extension period and I am not hopeful of any positive outcome after having looked at the composition of the team. This so happened that all three taluks of Wayanad fell under ESZ 1, which recommended a ban on land use changes, a moratorium on mining and quarrying, limits on hydropower projects, no new railway lines or major roads, and strictly regulated minimal ecotourism continued with all the developmental projects regardless of a complete ban under Gadgil recommendations. In fact, the village of Mundakkai, which has been washed away, lies within the Meppadi panchayat which had been specifically spotlighted as one of 18 proposed ecologically sensitive localities in Kerala. However, the saddest part is that the Gadgil panel report was rejected by all State governments, following a public backlash on the impact of the report on livelihoods and economic growth in the region. The forest is also declining or turning into a monoculture and there are many studies which show that monoculture enhances loosening of top soil compared to mixed forests. As per the Management Plan of Wayanad Wildlife Sanctuary, forest land of Wayanad district in 1950 was 1, 811.35 sq. km which was reduced to 863.86 sq. km in 2021. There is a reduction of 947.49 sq. km forest with corresponding increase in area under plantation, cultivation, etc. Overall, forest cover in Wayanad has dwindled from 70 per cent to 40 per cent since 1970. Almost half (42 per cent) of the district is under forest cover ranging from tropical evergreen forests to wet deciduous forests to grassland and shola forest ecosystems to mono - crop plantations of teak, eucalyptus and mahogany maintained by the Forest department. Of the 40% which is currently demarcated as forest, there are plantations of teak, eucalyptus, silver oak - species that deplete the water table inside sanctuaries which has reduced the tropical wet evergreen forests to monoculture plantations since 1860. Loss of natural forests to invasive species - Senna Spectabilis (senna) was first planted as shade trees in the office compound at Muthanga in 1986. In 2012, senna had occupied 14.56 sq. km of the Wayanad WLS and as of 2020, it had spread to 78.91 sq. km (23 per cent of the total area of sanctuary). The intensity and extent of senna invasion in the sanctuary is alarmingly high and the regeneration of native species is almost absent in areas where there is abundance of senna.

Source: Corban Brief

The frequency and individual sizes of landslides can be reduced by following site - specific and scientific utilisation of land considering the carrying capacity of hilly terrains. Natural drainage management should also be a priority. It is important to collect historical and geological data on the previous landslides, if any, from the vulnerable regions. In hindsight, the information on the 1984 Mundakkai and the 2019 Puthumala landslides, which occurred near Mundakkai, should have been appropriately used to model the landslide vulnerability of the region. A more intense network of rain gauges and arrangements to monitor surface runoff and infiltration could help in monitoring the surface and groundwater movements. If such experiments are successful, they would help to establish the threshold relationship between slope properties and the likelihood of a landslide. Seismic noise imaging is another useful technique to estimate the thickness and water - bearing capacity of the underlying soil layers and their vulnerability to sliding (Chávez - García et al 2021). Creating public awareness is an important factor in risk reduction. High - resolution maps depicting landslide vulnerability should be brought to the attention of residents. It is also important to involve community groups in the discussions on risk reduction, capacity building, and disaster resilience. To enhance disaster preparedness, Kerala needs to adopt robust institutional mechanisms, update hazard maps, and improve early warning systems, all integrated into a comprehensive pre - event strategy. By learning from successful international frameworks and integrating advanced technologies, Kerala can strengthen its resilience against climate change - induced disasters (Azad et al., 2024).

References

[1] Centre for Earth Science Studies, (2010). Annual report 2009 - 10. Centre for Earth Science Studies.
[2] Martha et al. (2021). Geospatial landslide inventory of India - an insight into occurrence and exposure on a national scale, *Landslides*, 18 (2021), pp.2125 - 2141, 10.1007/s10346 - 021 - 01645 - 1
[3] Jain et al. (2021). Major landslides in Kerala, India, during 2018–2020 period: an analysis using rainfall data and debris flow model. *Landslides*, 18 (2021), pp.3629 - 3645, 10.1007/s10346 - 021 - 01746 - x
[4] Wadhawan et al. (2020). Causative factors of landslides 2019: case study in Malappuram and Wayanad districts of Kerala, India. *Landslides*, 17 (3) (2020), pp.2689 - 2697, 10.1007/s10346 - 020 - 01520 - 5
[5] Wei et al. (2020). Integrated experiments on field monitoring and hydro - mechanical modeling for determination of a triggering threshold of rainfall - induced shallow landslides. A case study in Ren River catchment, China, Bull. Eng. Geol. Environ., 79 (2020), pp.513 - 532, 10.1007/s10064 - 019 - 01570 - 7
[6] Gadgil, M. (2011). Report of the Western Ghats Ecology Expert Panel, Part I. New Delhi: Ministry of Environment and Forests, Government of India.
[7] Desai, S. (2020). Eknath Bhanudasrao Churkar, Landslide events of Kerala, their causes and impacts: A Case study of Puthumala Landslide in Wayanad District, Conference: National Seminar on Landslide Mitigation and Slope Management at Udhagamandalam (Ooty), February 2020
[8] Talukdar, B., Sikarwar, A., & Ambade, M. (2019). Deforestation in Kerala over a quarter century (1993 - 2017) and the outbreak of Nipah Virus: an analysis using remote sensing technology and GIS approach, *Res. Environ. Life Sci.*, 11 (11) 285 - 291
[9] Saha, K., Ghatak, D., S Muralee N. S. (2022). Impact of Plantation Induced Forest Degradation on the Outbreak of Emerging Infectious Diseases - Wayanad District, Kerala, India. *Int J Environ Res Public Health*, Jun 8; 19 (12): 7036. doi: 10.3390/ijerph19127036. PMID: 35742291; PMCID: PMC9222524.
[10] Chávez - García, F. J. et al. (2021). Landslide characterization using active and passive seismic imaging techniques: a case study from Kerala, India. *Nat Hazards*, 105: 1623–1642, 2021, https: //doi. org/10.1007/s11069 - 020 - 04369 - y
[11] Azad, P.; Salim, A. P. Muhammed; Das, K. S. Anoop (2024): Wayanad Landslide Disaster: Impact, Response, and Implications for Future Resilience, ZBW – Leibniz Information Centre for Economics, Kiel, Hamburg