National River Conservation Directorate
Ministry of Jal Shakti,
Department of Water Resources,
River Development & Ganga Rejuvenation
Government of India

Topographic Maps
of
Periyar River Basin

March 2025

Topographic Maps

National River Conservation Directorate (NRCD)

The National River Conservation Directorate, functioning under the Department of Water Resources, River Development & Ganga Rejuvenation, and Ministry of Jal Shakti providing financial assistance to the State Government for conservation of rivers under the Centrally Sponsored Schemes of 'National River Conservation Plan (NRCP)'. National River Conservation Plan to the State Governments/ local bodies to set up infrastructure for pollution abatement of rivers in identified polluted river stretches based on proposals received from the State Governments/ local bodies.
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Acknowledgment

This report is a comprehensive outcome of the project jointly executed by IIT Palakkad (Lead Institute) and NIT Calicut (Fellow Institute) under the supervision of cGanga at IIT Kanpur. It was submitted to the National River Conservation Directorate (NRCD) in 2025 We gratefully acknowledge the individuals who provided information and photographs for this report.

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Preface

Rivers are vital lifelines, providing essential water resources and delivering invaluable ecosystem services that sustain both natural and human systems. The physical characteristics of a river basin, including its topography, play a major role in governing hydrological processes, shaping river corridors, and influencing the susceptibility of an area to natural hazards. A thorough understanding of terrain morphology is therefore crucial for effective water resource management, hazard mitigation, and sustainable development.

This report presents a detailed topographic analysis of the Periyar River Basin. Using a high-resolution Digital Terrain Model (DTM), visualization and interpretation of the terrain's three-dimensional characteristics is performed. The report includes an analysis of slope, aspect, and drainage patterns, which are fundamental for understanding the physiographic characteristics of the river basin. The findings are intended to serve as a basic reference for a range of applications, including watershed management, flood risk assessment, and environmental conservation, ultimately contributing to a more informed and sustainable approach to managing the Periyar River Basin. For further enhancing terrain analysis, LiDAR-based elevation data is recommended.

Centres for Periyar River Basin
Management and Studies (cPeriyar)
IIT Palakkad & NIT Calicut

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Abbreviations and Acronyms

AISLUS	All India Soil and Land Use Survey
ALOS PALSAR	Advanced Land Observing Satellite Phased Array Type L Band Synthetic Aperture Radar
ASTER GDEM	Advanced Spaceborne Thermal Emission and Reflection Radiometer Global Digital Elevation Model
AW3D30	ALOS World 3D – 30 m
DTM	Digital Terrain Model
DEM	Digital Elevation Model
GDEM	Global Digital Elevation Model
GIS	Geographic Information System
HydroSHEDS	Hydrological Data and Maps Based on SHuttle Elevation Derivatives at Multiple Scales
IDRB	Irrigation Design and Research Board
LiDAR	Light Detection and Ranging
MERIT	Multi-Error-Removed Improved-Terrain DEM
OSM	Open Series Maps
SoI	Survey of India
SRTM	Shuttle Radar Topography Mission
TIFF	Tagged Image File Format
UTM	Universal Transverse Mercator

1. Introduction

Rivers are vital lifelines that have shaped landscapes, cultures, and civilizations across the earth. They serve as primary sources of fresh drinking water and support a wide array of ecosystems. Hence rivers in “good health” are crucial for the sustenance of biodiversity. The fertile banks of major rivers like the Nile and the Indus were home to the first great civilizations reported in World history. In the Indian context, rivers hold immense cultural and spiritual significance, with many, like the Ganga, Yamuna, Narmada etc revered as sacred entities. They are the backbone of the agrarian economy of the country, providing water for satisfying crop water requirements and sustaining millions of livelihoods. Furthermore, rivers are essential for transportation, trade, and the generation of hydroelectric power, playing a central role in India's development and prosperity.

The Periyar River is one of the most important rivers in Kerala, serving as a crucial source of water for domestic use, agriculture, and industry. It supports major hydroelectric projects, including the Idukki, Mullai Periyar, Idamalayar, Lower Periyar etc., supplying electricity to large parts of the State. Additionally, the river sustains irrigation systems and the drinking water supply for millions, earning it the title "Lifeline of Kerala". The river originates from the Sivagiri group of hills in the Western Ghats and flows in a westward direction. The Periyar River Basin covers an area of approximately 5216 km^2, of which about 5131 km^2 is in Kerala and the remaining 114 km^2 is in the Anamalai Hills in Tamil Nadu. The river basin lies between latitudes 9°15′30″ N and 10°21′00″ N and longitudes 76°08′38″ E and 77°24′32″ E. The basin has an inverted L shape and drains parts of Idukki, Ernakulam, and Thrissur Districts in Kerala, as well as Coimbatore District in Tamil Nadu.

The geology of the river basin is predominantly characterized by ancient crystalline rocks of the Peninsular Gneissic Complex. Charnockites and biotite gneiss are the primary rock types in the midland and foothill regions of the Periyar river basin (Priju et al., 2018). The river course is a testament to its geological history, as it cuts across different lithological units. Past tectonic activity is evident from the observed river stream patterns and the presence of structural valleys (IDRB). Towards the western parts of the basin, close to the Arabian Sea, the geology shows a transition to younger fluvial and paleo-beach deposits, along with extensive laterite deposits in the midland areas. A comprehensive study on soils in the river basin has identified six broad categories of soils, namely, lateritic soil, hydromorphic soil, brown hydromorphic soil, riverine alluvium, coastal alluvium, and forest loam (TIES, 2019).

Textural analysis of soil samples revealed a wide range of soils, from sandy clay loam and sandy loam to clay, loam, and silt loam, with a predominantly siliceous composition enriched with alumina (Divya et al., 2021).

The landforms in the river basin are highly undulating, with major geomorphic units including structural, residual, and denudational hills in the highlands (Priju et al., 2018). The upper course of the river is characterized by steep valleys and deep gorges, indicating significant erosional forces at work. As the river flows downstream, the terrain gradually flattens into midland plateaus and pediplains, which are often covered by laterite pediment zones. The river has a dendritic drainage pattern.

This study on the Periyar River Basin, a significant fluvial system in India, employs a 10 m resolution Digital Terrain Model (DTM) from the Survey of India (SoI) to analyse its complex topographic and geomorphic characteristics. Understanding the terrain-driven controls on river morphology, flow behaviour, and watershed characteristics is crucial for effective river basin management. It is widely recognised that the accuracy of global digital elevation models (GDEMs) significantly impacts the results of hydrological modelling. This report highlights the critical importance of selecting a suitable DEM based on objective, accuracy requirements, and spatial scale of the study. Systematic mapping and interpretation of the topographic variability of the basin using advanced Geographic Information System (GIS) techniques can serve as a basic reference for sustainable river basin management, infrastructure planning, and environmental conservation efforts.

2. Data Acquisition and Methodology

2.1 Data Source

The Digital Terrain Model (DTM) used in this study was downloaded from the Survey of India (SoI) (https://onlinemaps.surveyofindia.gov.in/). A DTM is a digital representation of a bare-earth surface. It captures the elevation of the ground, devoid of features like vegetation and man-made structures, as illustrated in Figure 1. The SoI DTM corresponds to a 1:50,000 scale topographic sheet and is provided in geo-referenced TIFF format. The DTM was generated from the contour data of the official Open Series Maps (OSM) and represents the terrain elevation at a spatial resolution of approximately 10 m. The dataset follows the WGS84 datum and UTM projection, ensuring compatibility with other spatial datasets. The DTM was used after some corrections (interpolation of elevation at no data points) to improve its quality. Although freely available global DEMs such as the ALOS PALSAR DEM (12.5m resolution), SRTM DEM (30 m resolution), and ASTER DEM (30 m resolution) were accessible, the SoI DTM was selected due to its relatively higher horizontal resolution.

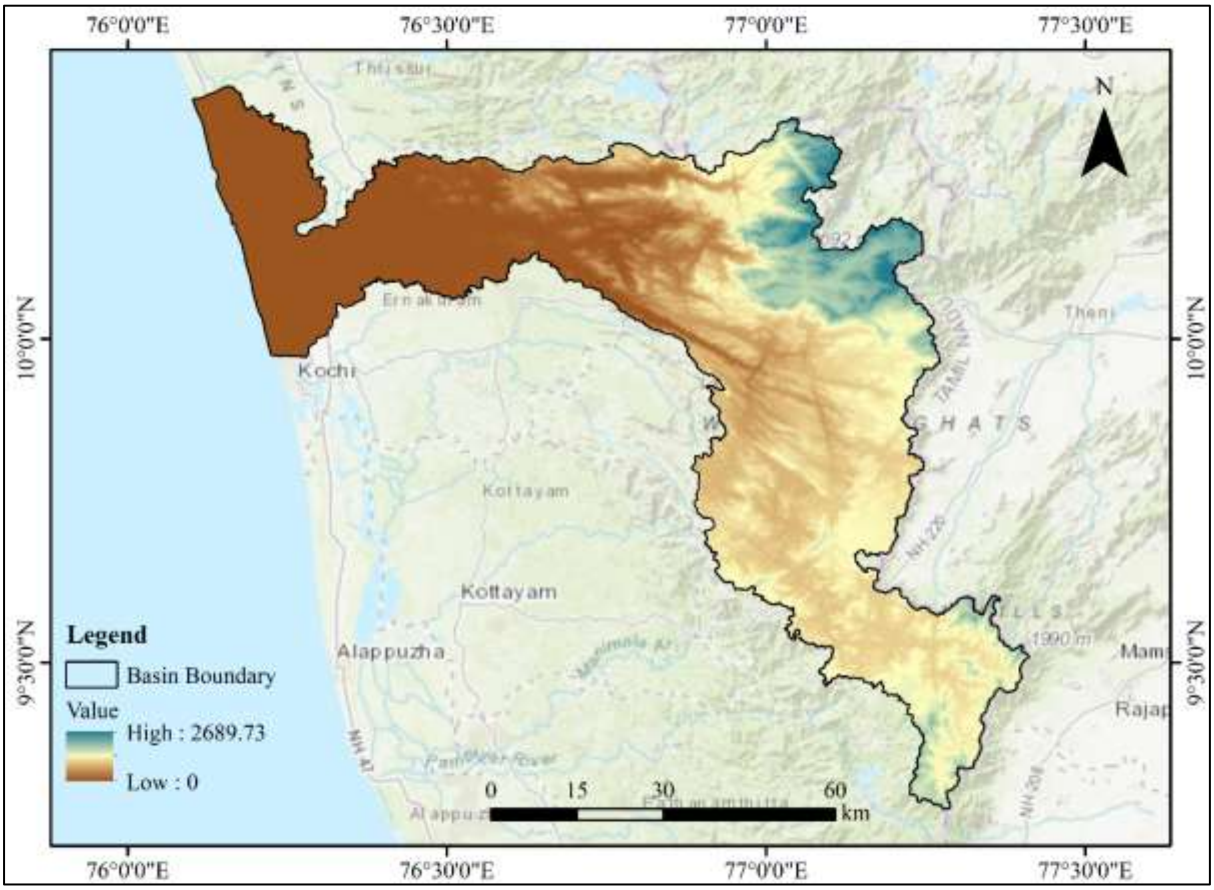

Figure 1: Digital Terrain Model (DTM) of the Periyar River Basin

In addition, 20 SoI Toposheets at a 1:50,000 scale was used for validating elevation patterns and drainage structures. These conventionally produced maps provide essential cartographic details on terrain features that are not always captured by satellite data, and are quite valuable for historical comparisons.

3. Topography of the Basin

3.1 Elevation and Slope Characteristics

Elevation analysis of the Periyar River Basin reveals significant spatial variation in elevation in the region. The elevation in the river basin ranges from about mean sea level up to 2,689.73 m, with a mean elevation of around 733.52 m (Figure 2). The highest point in the basin is the Anamudi Peak. Elevation analysis reveals notable spatial variation across the basin. About 23.20% of the area falls within the 1000-1500 m elevation range, primarily spreading across the upper part of the river basin, followed by 0-50 m elevation covering 23.12% in the central and the north-western parts. The highest elevation zone, ranging from 2000-2689.73 m, occupies only a very small part of the basin (about 2.02%) and is mostly located in the north-eastern part of the basin.

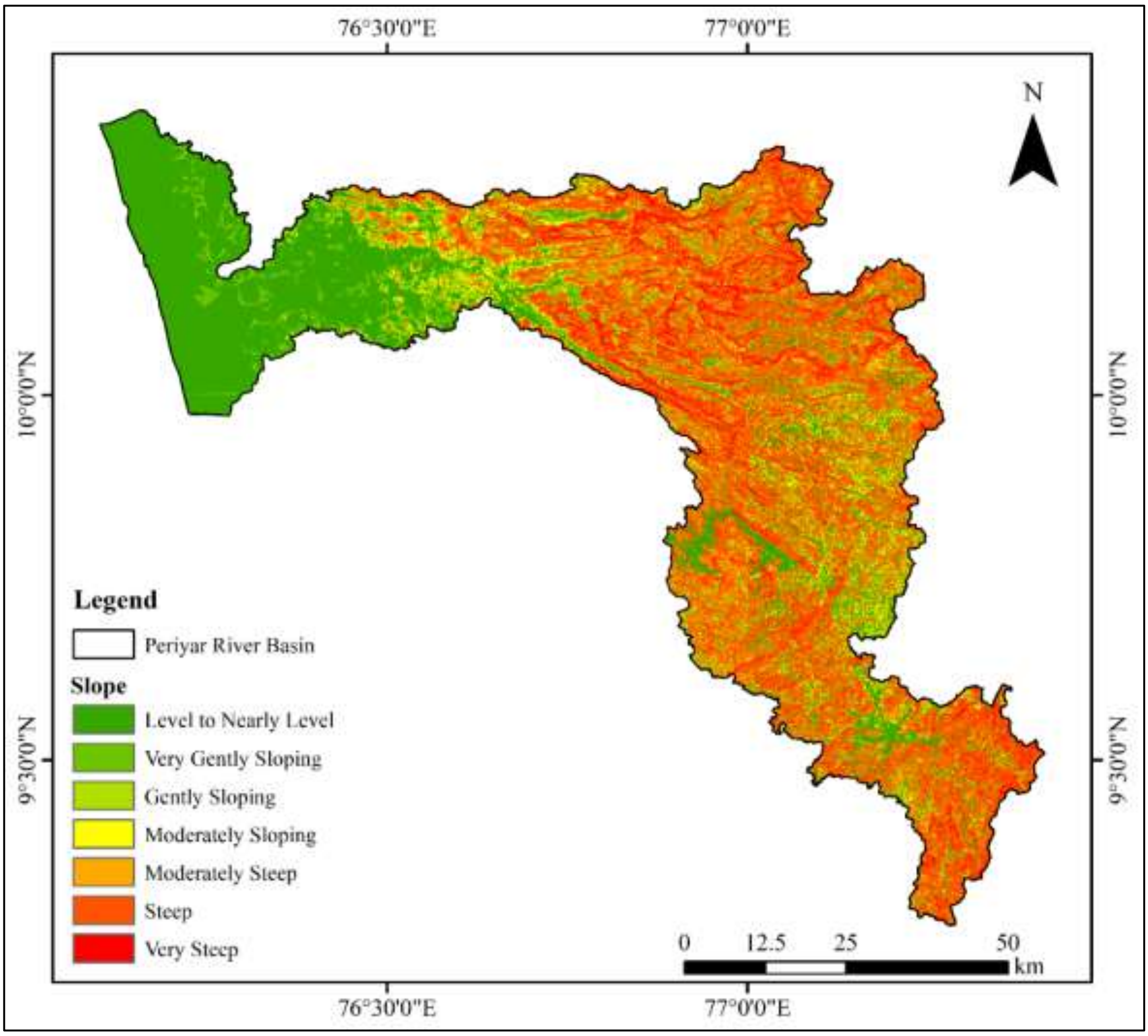

Figure 2: Slope Map of the Periyar River Basin

Slope analysis was performed to characterize the terrain of the basin, as terrain slope plays a critical role in influencing hydrological processes such as surface runoff and soil erosion (Wilson et al., 2000). The analysis was carried out using the "Slope" function under the Surface Analysis tools in the Spatial Analyst toolbox in ArcGIS 10.8, which was applied to the 10 m resolution DTM. This tool calculates the maximum rate of elevation change for each cell, generating a raster layer where each pixel represents the slope values in degrees.

In this analysis, a slope classification system mentioned in the standards of the All-India Soil and Land Use Survey (AISLUS) was applied. To create the final classified slope map, a continuous slope raster was first generated from the Digital Terrain Model (DTM) with the values in degrees. This raster was then systematically reclassified into seven distinct categories: Level to Nearly Level (0°−1°), Very Gently Sloping (1°−3°), Gently Sloping (3°−5°), Moderately Sloping (5°−10°), Moderately Steep (10°−15°), Steep (15°−33°), and Very Steep (>33°). This classification provides a standardized and meaningful framework for interpreting the terrain, with each class corresponding to specific land use suitability and erosion risk.

Table 1: Spatial Distribution of Slope Classes in the Periyar River Basin

Sl.No.	Slope class	Area(sq.km)	Percentage of Area
1	Level to Nearly Level (0°−1°)	1580.02	30.34
2	Very Gently Sloping (1°−3°)	195.55	3.76
3	Gently Sloping (3°−5°)	128.27	2.46
4	Moderately Sloping (5°−10°)	434.72	8.35
5	Moderately Steep (10°−15°)	617.86	11.86
6	Steep (15°−33°)	1876.42	36.03
7	Very Steep (>33°)	374.62	7.19

A significant portion of the river basin falls in two contrasting slope categories (Table 1). A substantial 36.03% of the basin is characterized by steep slopes (15°–33°), indicating a significant area of rugged, mountainous terrain. This area is mainly located upstream of the Bhoothathankettu Barrage. Gorges and headwaters, along with geomorphological processes like erosion and high runoff velocities, are common in the upper reaches of the river basin. On the other hand, a nearly equal portion of the basin, about 30.34%, is level to nearly level land (0°–1°). In this area located downstream of Panamkuzhy, the river velocity decreases considerably, leading to the deposition of sediments and the formation of low-lying floodplains and sand bars. Areas with very steep slope (> 33°), make up a relatively small portion (about 7.19%). This area is characterised by steep valley walls, resulting in the formation of V-shaped valleys. Furthermore, a small percentage of the river basin (about 2.46%) is composed of gently sloping terrain (3°–5°), which likely represents transitional zones between the steep highlands and the flatter lowlands.

3.2 Terrain and Flow Characteristics

The 10 m DTM obtained from the Survey of India was used for hydrological terrain analysis. The flow direction and flow accumulation raster were derived from the DTM using the "Spatial Analyst" tool in ArcMap 10.8. Initially, the fill tool was applied to remove the sinks and generate a depressionless DTM. It is followed by generating the flow direction raster from the depressionless DTM. The flow direction layer illustrates the path of overland flow movement along with the direction of flow from each raster cell based on the steepest descent algorithm (Jenson & Domingue, 1988).

From its source in Idukki District, the river initially flows in a northward direction, gradually curving to the north-west as it descends through the rugged terrain of the Western Ghats. The river has a predominant westward flow, moving from the eastern highlands toward the central lowlands of the basin. The river has a straight course starting from the Lower Periyar Dam to the Bhoothanthankettu Barrage. The river course in this stretch is structurally controlled. The river bifurcates at Aluva, with one branch draining into the Vembanad Lake and the other flowing directly into the Arabian Sea at Munambam.

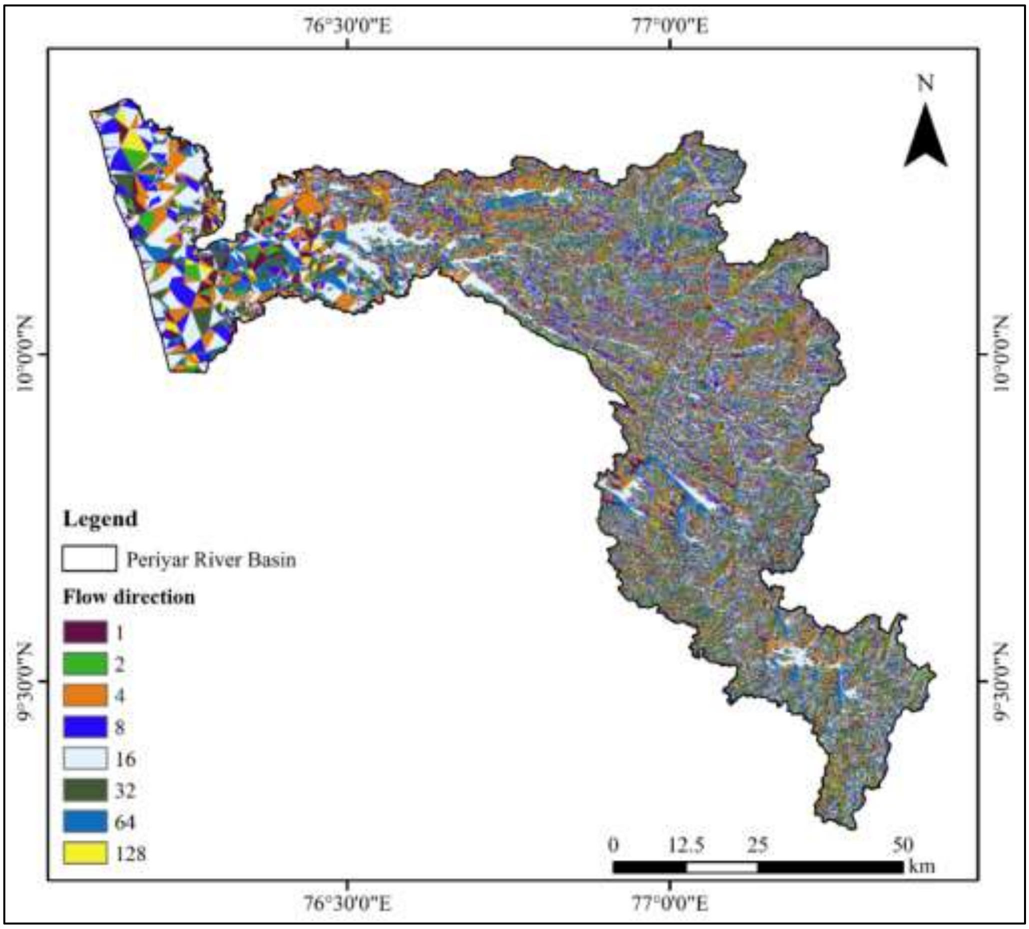

Figure 3: Flow Direction Map of the Periyar River Basin

The "Flow Accumulation" tool calculates accumulated flow as the accumulated weight of all the cells flowing into each downslope cell in the output raster. This method analyses the flow of water across a terrain by determining how water would naturally move downhill, and also identifies how much water would accumulate in potential streams or river networks at each cell (Jenson & Domingue, 1988). The high accumulation zones are represented by darker shades of blue, which correspond to the Periyar River and its major tributaries (Figure 4), while the lighter tones represent low-accumulation regions. This map helps to identify the drainage network of the basin and its patterns.

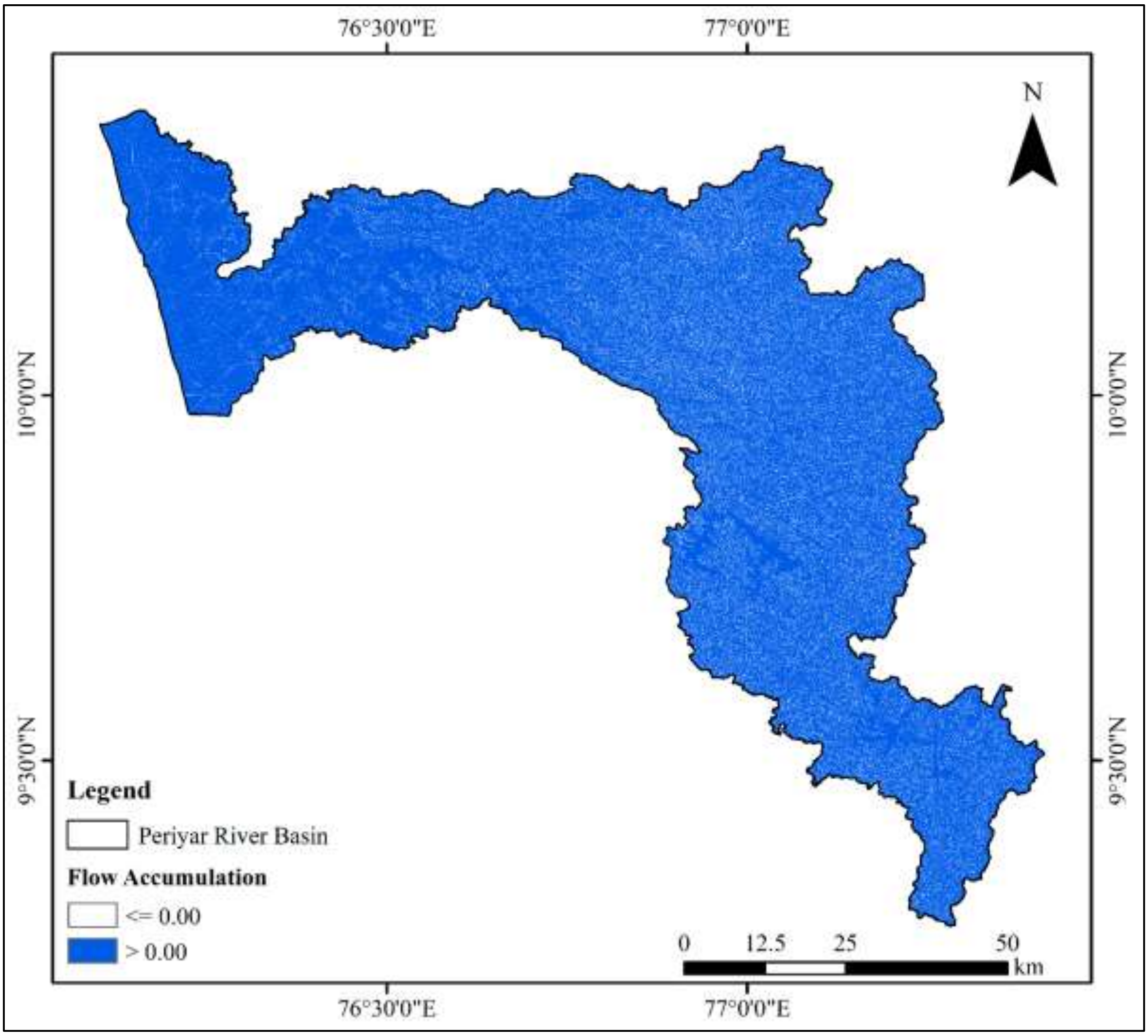

Figure 4: Flow Accumulation Map of the Periyar River Basin

To understand the directional orientation and three-dimensional visualization of the terrain, slope aspect and hill shade maps were generated using the DTM. The aspect map classifies the surface orientation of slopes based on the compass direction each slope faces (Figure 5). In the basin, the distribution of aspect directions is varied with a notable prevalence of south and south-west facing slopes. South facing slopes receive more sunlight than north facing slopes. Aspect helps to determine the microclimate of an area as it influences the amount of sunlight that it receives throughout the day. Aspect analysis is essential in several fields, including agriculture, environmental management, forestry and landslide assessment.

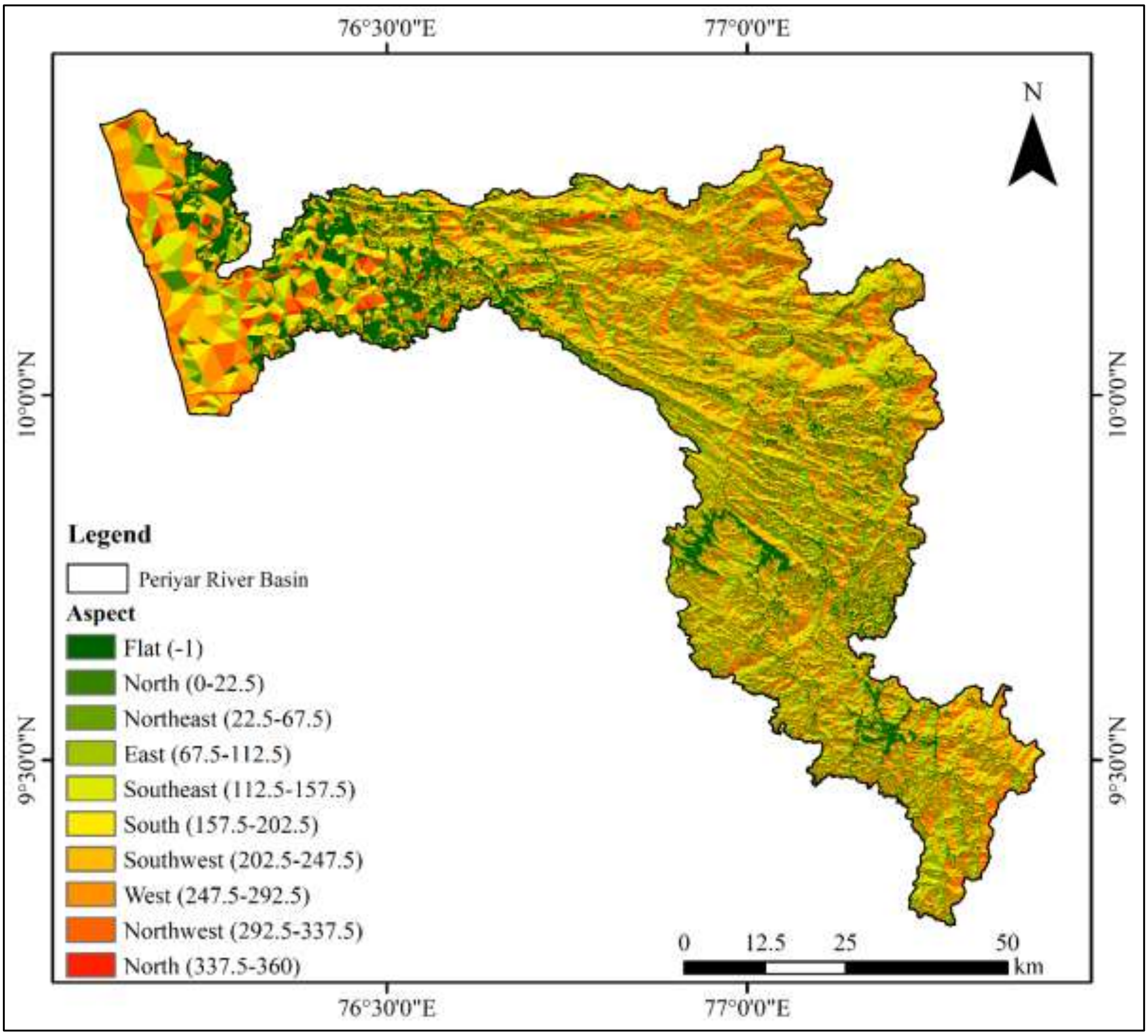

Figure 5: Slope Aspect Map of the Periyar River Basin

Hill shade analysis provides a three-dimensional visual representation of the terrain by simulating the effect of sunlight on the DTM, thereby enhancing the perception of topographic relief and emphasizing key landform features such as ridgelines, valleys, plateaus, and escarpments (Figure 6). In the Periyar River Basin, the analysis reveals that the upstream region, particularly in the Western Ghats, is characterized by steep and highly dissected terrain, reflecting the influence of intense fluvial incision and structural controls. Midstream sections display moderately sloping terrain with well-defined valleys, while the downstream floodplains near the river mouth exhibit relatively gentle slopes and broader, low-lying areas.

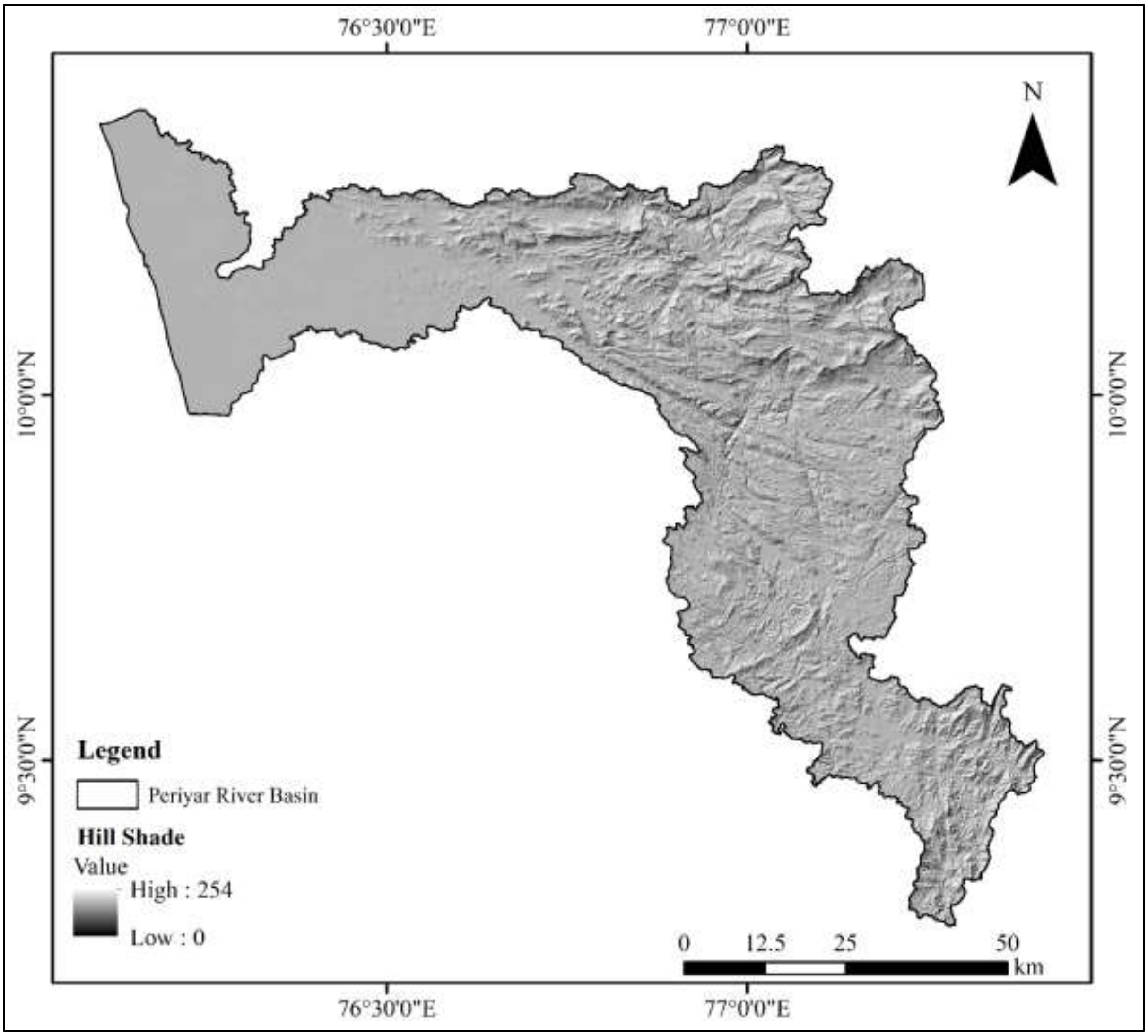

Figure 6: Hill Shade Map of the Periyar River Basin

3.3 Drainage pattern

The Periyar River is an 8th order with so many tributaries and sub-tributaries. The river is the longest in Kerala, and originates in the Western Ghats, flows westward, and bifurcates at Aluva into two distinct branches - the Marthanda Varma stretch and the Mangalapuzha stretch. These stretches take separate courses to the Arabian Sea. The major tributaries of the Periyar include Muthirapuzha, Mullayar, Idamalayar, Cheruthoni, Kattapanayar, and Perinjankutti. The stream network in the Periyar River Basin primarily exhibits a dendritic drainage pattern (Figure 7), which is indicative of uniform underlying lithology and a lack of significant structural controls like faults or folds. Some areas within the basin show trellis and parallel patterns, indicating variations in the underlying geological structure or topography.

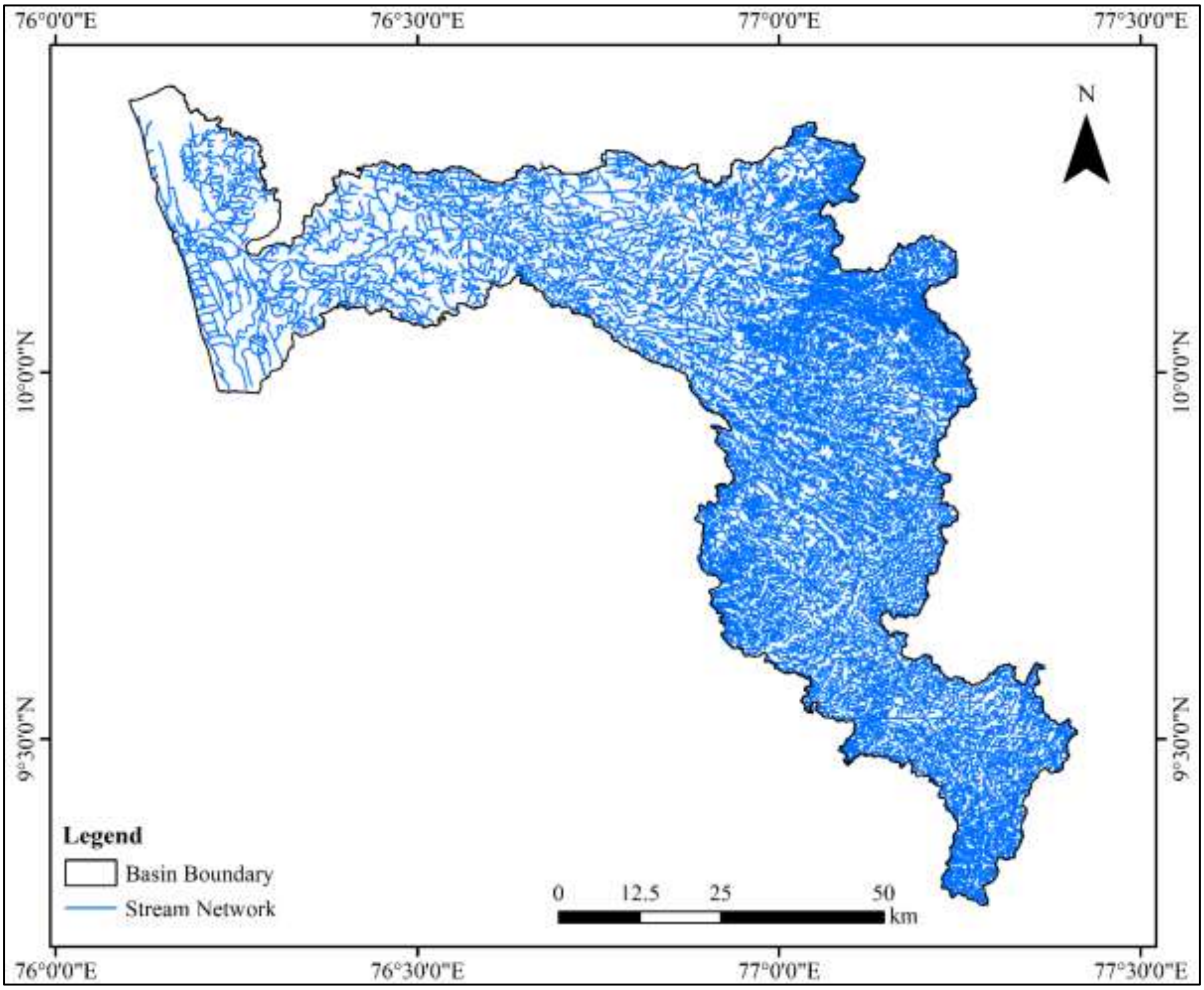

Figure 7: Stream Network Map of the Periyar River Basin

3.4 Contour Generation

To analyse elevation variation and terrain morphology in the Periyar River Basin, contour maps were generated using the "Spatial Analyst" tool within the ArcGIS environment. A contour is a continuous line on the map that connects points of equal elevation with reference to the mean sea level. It serves as a fundamental tool for interpreting slope gradients, identifying ridges and valleys, and delineating watershed boundaries with high spatial accuracy, governed by the resolution of the input DEM/ DTM. In this study, two contour datasets were derived from the 10 m resolution DTM, one with 1 m interval to capture fine-scale topographic details and another with 20 m interval to provide a broader regional perspective.

From an analysis of the contour maps, it is evident that the spacing of contour lines is significantly close in the upstream regions of the basin, particularly in the areas downstream of the Lower Periyar Dam and upstream of the Idamalayar Dam. The close spacing indicates steep terrain and highlights the presence of deeply incised V-shaped valleys, which are characteristic of youthful river profiles in mountainous regions. These valleys form as a result of intense vertical erosion by the river, cutting rapidly into the bedrock due to the high gradient. Such topographic features reflect the rugged and dissected nature of the Western Ghats and are often associated with high runoff, limited infiltration, and increased susceptibility to erosion and landslides.

In contrast, the central and downstream regions of the river basin exhibit more widely spaced contours, indicating moderate to gentle slopes. These areas tend to have broad valleys and more subdued topography, often corresponding to depositional environments such as floodplains and alluvial terraces. The spatial variation in slope and valley morphology across the river basin plays a critical role in influencing hydrological behaviour, sediment transport, and land use suitability. A detailed understanding of these features is essential for effective watershed management, conservation planning, and sustainable development within the Periyar River Basin.

4. Importance of High-Resolution DEM

High-resolution digital elevation models (DEMs) are fundamental for flood modelling and hydrological analysis because they define terrain characteristics that control flow direction, accumulation, drainage connectivity and flood extent (Wechsler, 2007). In low-relief floodplains and deltas, even small vertical errors can displace flood boundaries by hundreds of meters, resulting in large uncertainties in flood extent and depth (Sanyal and Lu, 2004; Saksena and Merwade, 2015; Santiago-Collazo et al., 2019). Coarse-resolution DEMs also smoothen riverbanks, distort microtopography, and reduce channel conveyance capacity, often leading to overestimation of flood depths (Muthusamy et al., 2021; Zhu and Chen, 2024). These uncertainties are further exacerbated by vegetation and infrastructure bias in radar- or optical-derived DEMs, which can create spurious barriers and disrupt hydrologic connectivity (Sampson et al., 2016; Li et al., 2022).

Airborne LiDAR DEMs are considered the benchmark for flood modelling because they provide sub-metre vertical accuracy and true bare-earth elevation data (Zhang, 2020). Unlike radar- or optical-based DEMs that often incorporate canopy or building heights, LiDAR effectively penetrates vegetation cover, producing a precise representation of topography critical for flood simulations (Muhadi et al., 2020). Several studies demonstrate that LiDAR-based flood models capture river channel geometry, levee overtopping, and ponding zones with higher fidelity compared to coarser products (Sanders, 2007; Jain et al., 2018; Simard et al., 2024). However, despite their accuracy, LiDAR datasets are often restricted by high acquisition costs, limited spatial coverage, and technical requirements (Charrier and Li, 2012).

In the absence of LiDAR data, global DEMs such as ALOS PALSAR, SRTM, ASTER GDEM, AW3D30, HydroSHEDS, and MERIT are widely used. Each product, however, exhibits unique strengths and limitations. ASTER and AW3D often suffer from vertical noise, striping, and vegetation-induced bias that fragment flood extent and misrepresent depth (Courty et al., 2019; Muench et al., 2022). HydroSHEDS, derived from hydrologically conditioned SRTM, provides consistent drainage networks but has coarser resolution that may oversimplify floodplain details (Lehner et al., 2008). MERIT represents an improvement, correcting vegetation bias and systematic errors in SRTM and AW3D30, and has been shown to perform the best among global DEMs in lowland flood modelling (Yamazaki et al., 2019; McClean et al., 2020).

4.1 Comparative analysis of LiDAR DEM and DTM

A comparative analysis was performed between a high-resolution 0.5 m LiDAR-derived Digital Elevation Model (DEM) and a corresponding 10 m Digital Terrain Model (DTM) for an area available outside the Periyar River Basin, to evaluate their effectiveness in fine-scale terrain characterization (Figure 8). Topographic parameters such as slope, aspect, and hill shade were derived from both the datasets, providing a basis for assessing how spatial resolution influences the accuracy and detail of terrain representation.

The analysis of slope shows a significant difference in the representation of terrain steepness between the two models (Figure 10). The LiDAR-derived DEM recorded a maximum slope inclination of 85°, while the 10-meter DTM reported a maximum of only 55.6° for the same area. Based on a ground truth verification exercise, it is concluded that this difference provides compelling evidence that the LiDAR DEM offers a more accurate depiction of the true terrain steepness. The slope aspect analysis also revealed that the LiDAR DEM provides a more precise representation of slope orientation, as illustrated in Figure 10. For instance, at specific locations, the LiDAR DEM correctly identified a north-west facing slope, whereas the DTM misrepresented the same as a west facing orientation. Likewise, an area with a true south-west aspect in the LiDAR DEM was represented as due south in the DTM.

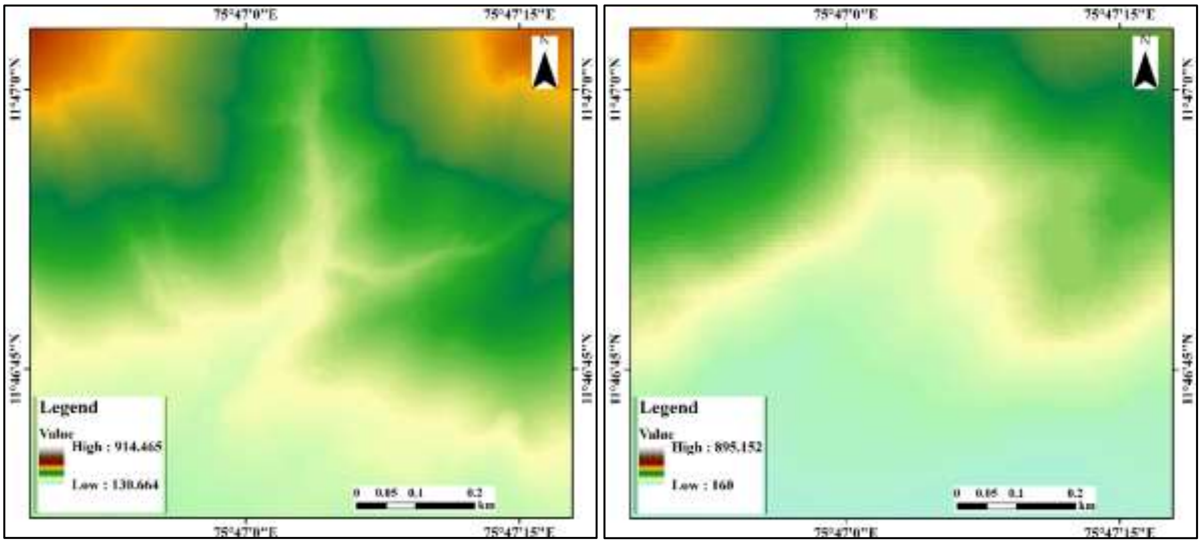

Figure 8: LiDAR DEM (left) and DTM (right) Data for the Selected Area

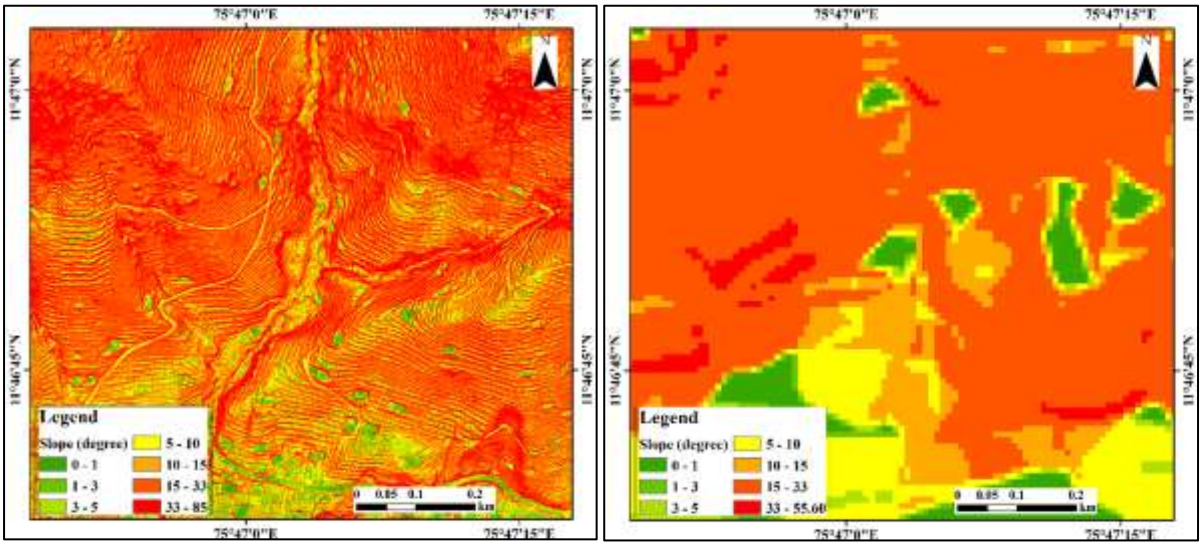

Figure 9: Slope Map Generated using LiDAR DEM (left) and DTM (right) Data

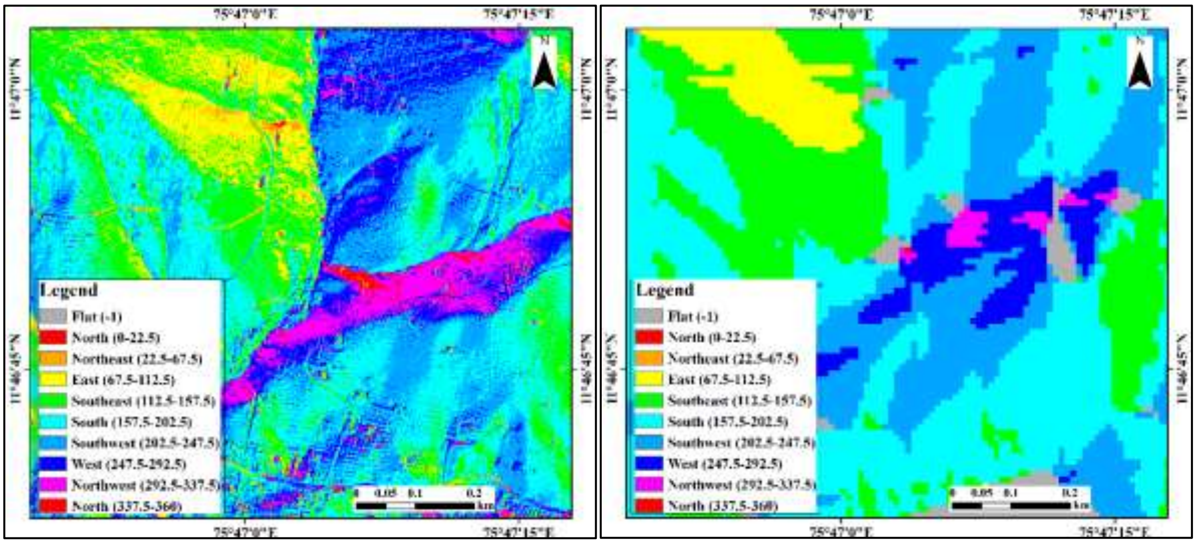

Figure 10: Slope Aspect Map Generated using LiDAR DEM (left) and DTM (right)

These differences were further reflected in the hill shade analysis. The LiDAR DEM produced a more detailed and realistic visualization of the terrain, where subtle surface features that are not evident in the DTM were visible (Figure 11). To substantiate these observations, a cross-sectional profile was generated along a selected transect. The LiDAR DEM yielded a greater number of elevation points along the same profile line, enabling detection of minor undulations and subtle terrain changes that the 10 m DTM failed to capture (Figure 12). In the context of the Periyar River Basin, such fine-scale elevation variations are critical for accurately delineating micro-drainage patterns, identifying potential erosion-prone zones, and improving the precision of floodplain and slope stability assessments.

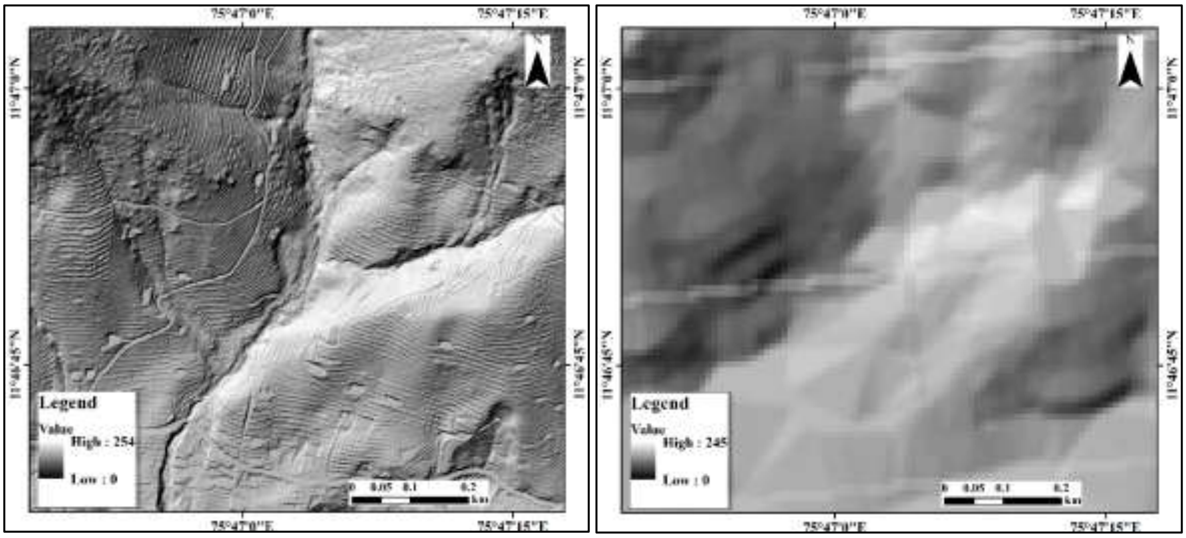

Figure 11: Hill Shade Map Generated using LiDAR DEM (left) and DTM (right) Data

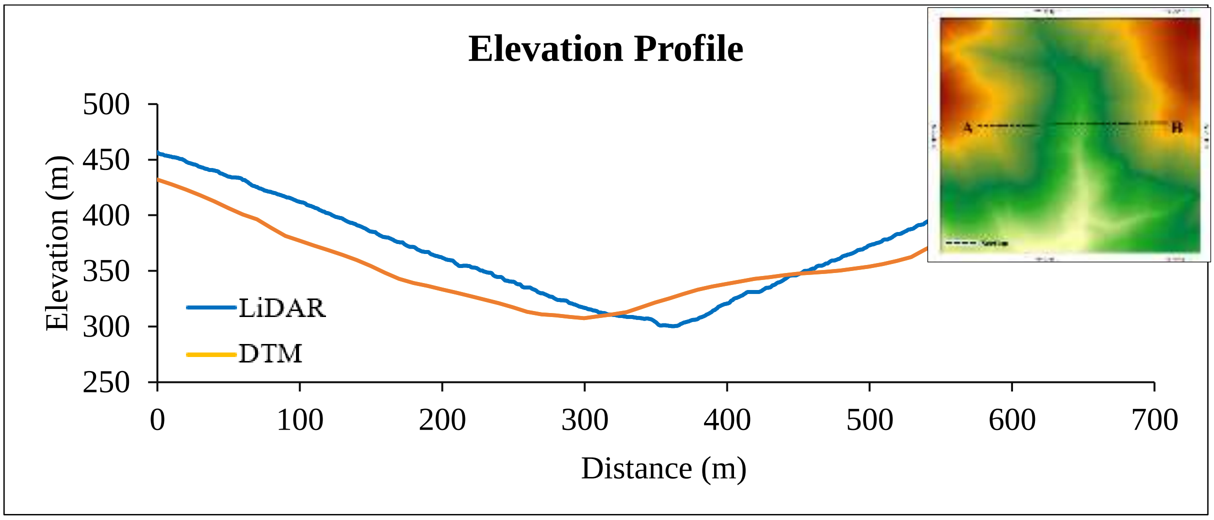

Figure 12: Elevation Profile Generated using LiDAR DEM and DTM

Contour maps with a contour interval of 1 m and 20 m were generated from both the datasets and these are depicted in Figure 13. A comparison between the two maps reveals noticeable misalignments, particularly in the contour map of 1 m interval (Figure 13b & 13d). The contours derived from the LiDAR DEM capture subtle undulations of the landscape with greater precision, whereas those from the DTM exhibit a smoothed and more uniform trend. This is largely due to the lower resolution of the DTM and the application of interpolation in areas lacking detailed elevation data, resulting in a failure to coincide with the LiDAR-derived contours along several sections of the terrain. A similar pattern of deviation is also evident in the 20 m interval contours (Figure 13a & 13c). In general, these discrepancies are due to the differences in the spatial resolution and vertical accuracy of the two datasets, significantly influencing the precision of contour placement.

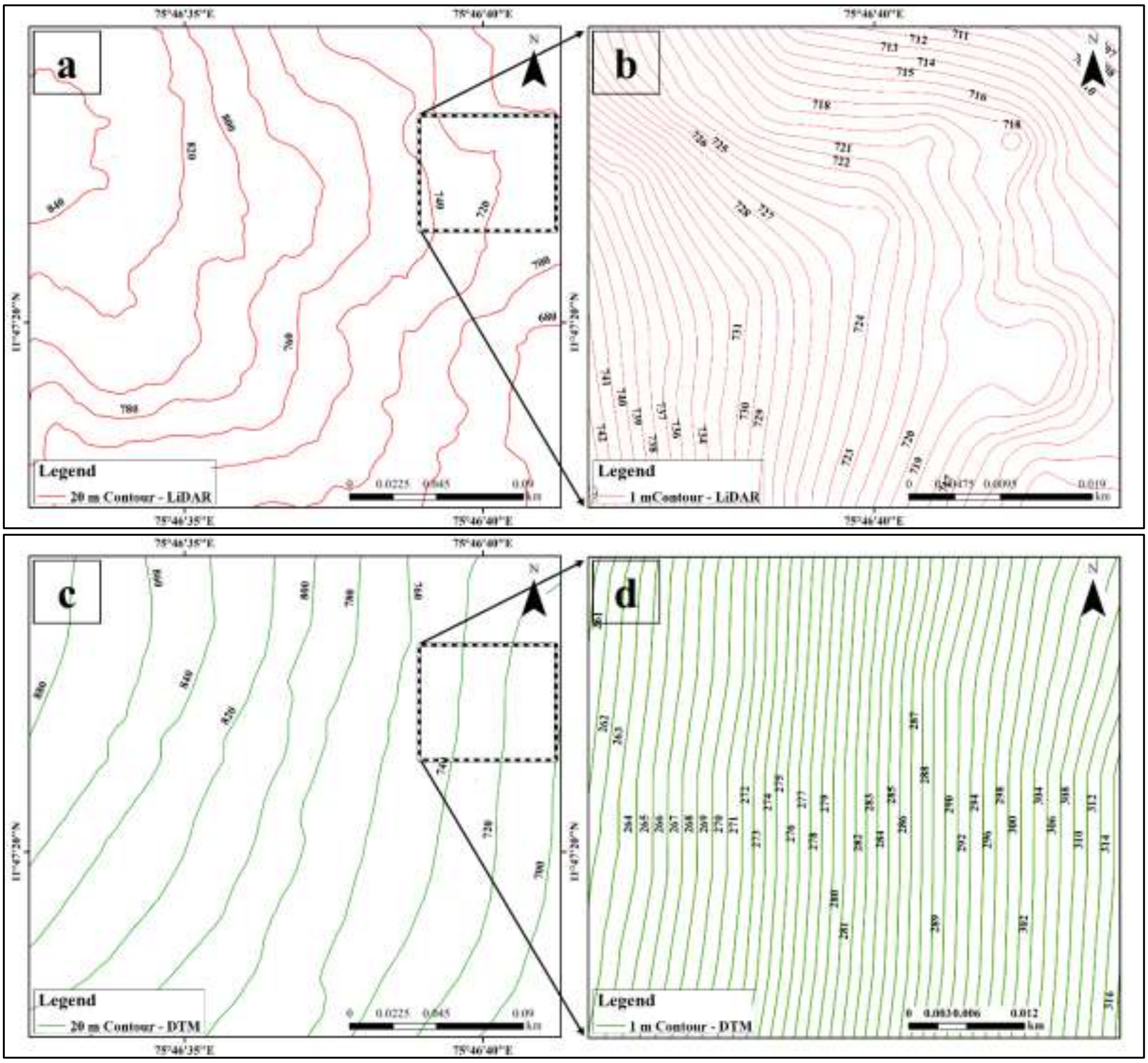

Figure 13: Contour Map Generated using LiDAR DEM (a & b) and DTM (c & d)

In conclusion, the findings of this exercise indicate that spatial resolution of the DEM/ DTM is a critical determinant of the level of detail of the terrain captured. The 0.5 m LiDAR DEM provides a more accurate representation of micro-topography, sharper slope transitions, and precise aspect variations compared to the coarse 10 m resolution DTM. Consequently, high-resolution LiDAR DEMs are superior for applications requiring high-precision geomorphological mapping, hydrological modelling, and micro-scale planning.

5. Application

Topographic maps are essential tools in geospatial analysis, providing detailed representations of the earth's surface through contour lines, elevation points, and natural and man-made features. These maps allow visualization of terrain morphology, slope gradients, and elevation changes, making them invaluable across a wide range of disciplines. The findings from this topographic analysis report on the Periyar River Basin have significant implications for policymakers and government bodies involved in resource management and development. The insights gained from this study as reported herein provide a foundation for several key applications:

1. **Watershed Management**: Detailed analysis of elevation, slope, and drainage patterns is crucial for developing and implementing effective watershed management strategies. This information can help in planning sustainable use of land and water resources.
2. **Infrastructure and Development**: The findings can be used to take informed decisions related to infrastructure development, such as the placement of roads, dams, settlements etc by identifying areas prone to hazards like landslides and floods.
3. **Erosion and Flood Risk Assessment**: Data on slope and drainage can be used to assess the risk of soil erosion and map potential floodplains. This is vital for implementing mitigation measures and protecting communities.
4. **Environmental Conservation**: Understanding the terrain's influence on hydrological and ecological dynamics serves as a basic reference for environmental conservation efforts and land use planning. It helps in protecting critical habitats and maintaining the ecological health of the basin.
5. **Hydrological Interventions**: The analysis helps in selecting appropriate sites for hydrological interventions, such as check dams and rainwater harvesting structures, to improve water availability and manage runoff effectively.

6. Conclusion

This topographic analysis report of the Periyar River Basin utilized a 10 m resolution Digital Terrain Model (DTM) to provide a comprehensive overview of the complex basin physiography. The study successfully mapped and interpreted key terrain features, including elevation, slope, aspect, flow direction, flow accumulation, drainage patterns and contour intervals. The analysis highlights a topographically diverse landscape with a significant portion of the basin characterized by both steep mountainous terrain and level, low-lying floodplains. The findings demonstrate that the steep and rugged slopes in the upper reaches of the river basin are prone to high runoff and erosion while the relatively lower-gradient areas in the downstream regions are susceptible to sediment deposition and flooding. Contour maps of 1 m and 20 m contour intervals provided both fine-scale as well as a broader regional perspective of topographic detail of the Periyar River Basin. This approach enhanced the interpretation of terrain features, as the spacing of the contour lines directly reflects slope gradients. Comparative analysis between the high-resolution LiDAR DEM and the 10 m DTM further reinforces the importance of high-resolution data for capturing fine-scale topographic details, which is crucial for detailed geomorphological mapping and hydrological modelling.

In conclusion, the insights from this report serve as the foundation for effective and sustainable river basin management. The data and the results of the analysis performed can be used to take informed critical decisions related to watershed management, flood and erosion risk assessment, infrastructure development, and environmental conservation in the Periyar River Basin. It is evident that a detailed understanding of the basin topography is essential for mitigating natural hazards and ensuring long-term health and prosperity of the river system.

7. Reference

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