CHAPTER-3

3. About the Study Area

3.1 Location

The study area is a badlands affected part of the Mandakini River watershed (area 90.51 Km^2) in and around Chitrakoot town which comes under the Survey of India toposheet No. 63C/16 and OSM number G44016 (Figure 3.1). Geographically, the area spread about 650 Km distance towards south-eastern direction from the National capital New Delhi, at the border of Madhya Pradesh andUttar Pradesh, India. The study area is almost 230 Km south from Lucknow (Capital of Uttar Pradesh) and about 500km northeast from Bhopal (Capital of Madhya Pradesh).

3.2 Climatic Conditions

The climate of the region is sub-humid, characterized by hot, dry summer and chilling winters. The precipitation ranges from 750 to 1100 mm and the maximum temperature ranges from 45 -48 ^{0}C during May and June (mean, 34 ^{0}C) to 3.0-8.6 ^{0}C during December and January (mean, 14 ^{0}C) [Source: India Meteorological Department].

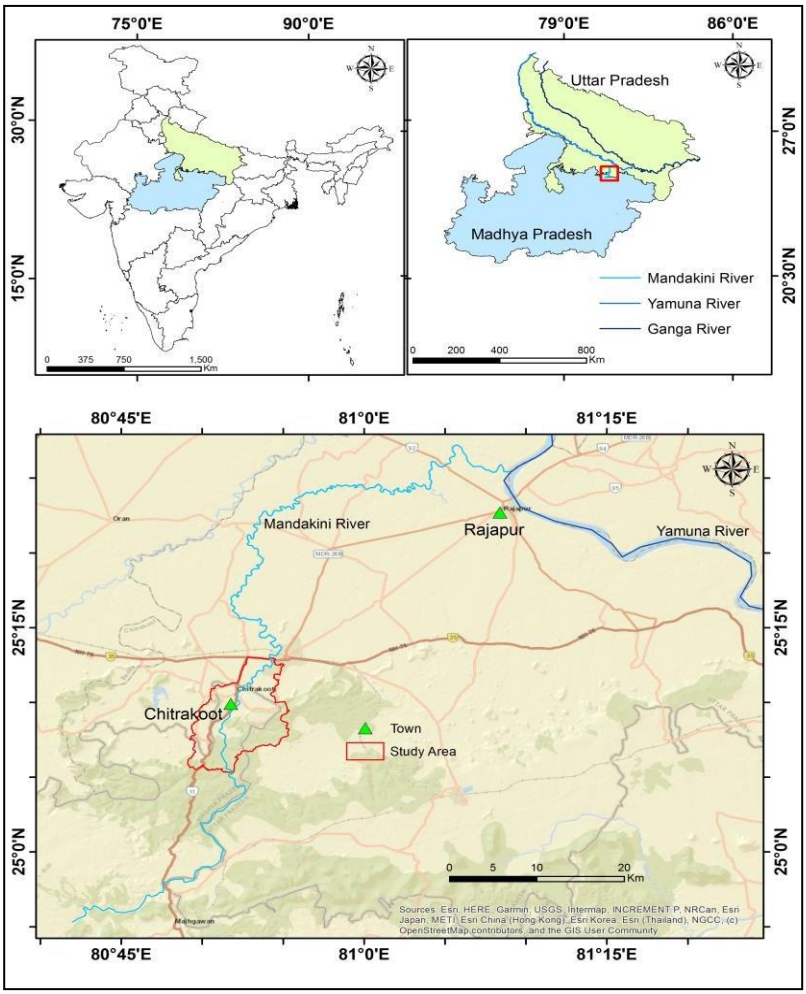

Figure 3. 1 Location map of the study area.

3.3 Geomorphology of the Area

The study area has a varied topography having hills, highlands, plateaus and plains with a relief of219 m (Figure 3.2a). Chitrakoot is also known as 'Hills of Wonders.' The area consists of sediments transported from the Vindhyan highlands and have deposited on the northern Vindhyan footslopes near the Chitrakoot, along the Mandakini River. Geomorphologically the area consistsof structural origin-low dissected hills and valleys (13.84 Km^2), structural origin-moderately dissected hills and valleys (1.28 Km^2), structural

origin highly dissected lower plateau (0.27 Km^2),structural origin moderately dissected lower plateau (0.12 Km^2), structural origin low dissected lower plateau (15.15 Km^2), denudational origin pediment pediplain complex (59.85 Km^2) (Figure 3.2b) (Source: http://bhuvan.nrsc.gov.in). Vindhyan hills have flat-topped topography. Hanuman Dhara and Kamath Giri are two prominent hills in the region. Hanuman Dara is a flat-topped, low dissected lower plateau, located in the eastern direction of the study area (Figure 3.2a and 3.2b). Whereas, the western hill (Kamath Giri), geomorphologically consists of structurally originated highly and moderately dissected lower plateau. The hills are surrounded by a pediment and pediplain complexes of Banda alluvium (Safaya, 1975). It resembles like higher hills are sinking into their own derived sediments. In the Chitrakoot area, the Mandakini River is the master river that is incised through the terrain. The streams originated from the Vindhyan hills (south of the study area) and have moved northward to join River Yamuna.

3.4 Geology of the Area

The Chitrakoot area belongs to the northernmost tip of the Vindhyan basin (Bhattacharyya, 1996; Chakraborty, 2006; Ray, 2006). Detailed lithostratigraphic succession of the Chitrakoot area is shown in Table 3.1 (Singh and Pal, 1970; Anbarasu, 2001). A compact section of Semri Group ofrocks (about 80m) is exposed as isolated hills in and around the Chitrakoot area over the basementof Bundelkhand Granite Gneissic Complex (BGGC). In the field area, the eastern flat top hill (Hanuman Dhara) is composed of Tirohan dolomite and Kaimur Sandstone. Bundelkhand Granite Gneissic Complex, upper glauconitic sandstone, Peloidal limestone, Tirohan dolomite and at the top Kaimur sandstone comprise the geological column on the north-western hills of Kamath Giri.There are some small

patches of Lower stromatolitic dolomite in the lower slopes of Hanuman Dhara on the river bed, exposed due to channel cutting. Southern Hills is also composed of Tirohan dolomite and Kaimur sandstone (Figure 3.2c).

3.5 Land Use and Land Cover

The different land use and land cover units of the study area consist of agricultural land (crop land),forest and shrub land, semi barren and barren land, build-up and water body (Figure 3.2d). The study area is profoundly affected by gully erosion in barren and semi barren regions and also encroaches towards cropland and forested land, which is hampering the socio-economy of the areaas well.

Table 3. 1 Lithostratigraphy of the Chitrakoot area (after Singh and Pal, 1970; Anbarasu, 2001)

GROUP	FORMATION	MEMBER	AGE
Kaimur Group		Kaimur Sandstone Arkosic Sandstone	
		^^^^^^^^^^^^^^^^^Erosional Unconformity^^^^^^^^^^	
		Tirohan Dolomite	605±89 Ma Pb-Pb (Bengtson *et al.,* 2009)
		Oolite Dolomite Upper Glauconitic Sandstone Peloidal Dolomite	1409±14 Ma Rb^{87}/Sr^{86} (Kumar *et al.*, 2001)
Semri Group	Chitrakoot Formation	Lower Stromatolitic Dolomite Lower Glauconitic Sandstone Glauconitic Limestone	1483±15 Ma Rb^{87}/Sr^{86} (Kumar *et al.*, 2001)
Bundelkhand Granite Gneissic Complex (BGGC)			

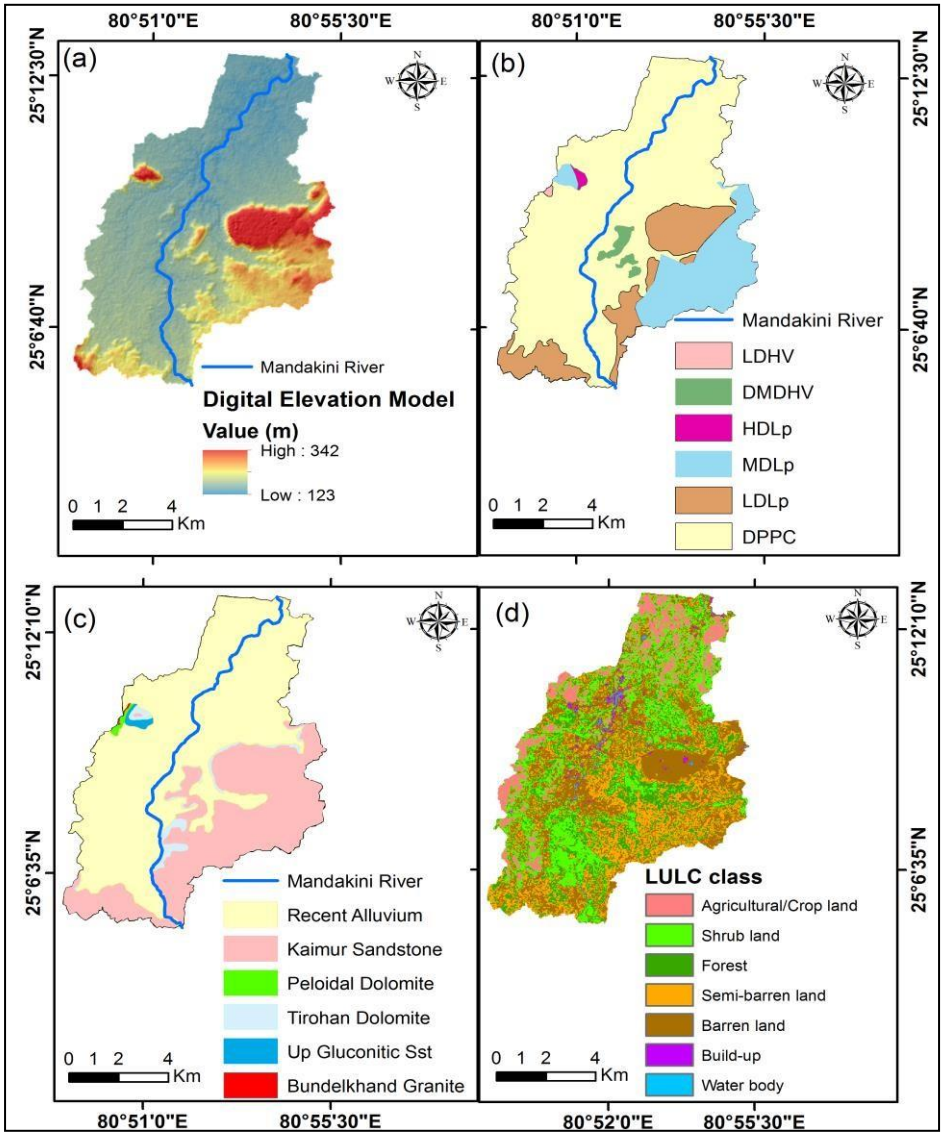

Figure 3. 2 (a) Digital Elevation Model (b) Geomorphological map (c) Geological map (d) Land use and land cover of the study area

Abbreviation: LDHV- structural origin-low dissected hills and valleys, DMDHV- structural origin-moderately dissected hills and valleys, HDLp- structural origin highly dissected lower plateau, MDLp- structural origin moderately dissected lower plateau, LDLp- structural origin low dissected lower plateau, DPPC- denudational originpediment pediplain complex.

Figure 3. 3 Field photographs showing network of rill, gully and channels in badland topography

Figure 3. 4 Field photographs showing (a) Shallow gully with 1m depth (b) headward erosion showing the advancement of the gully in badlands area

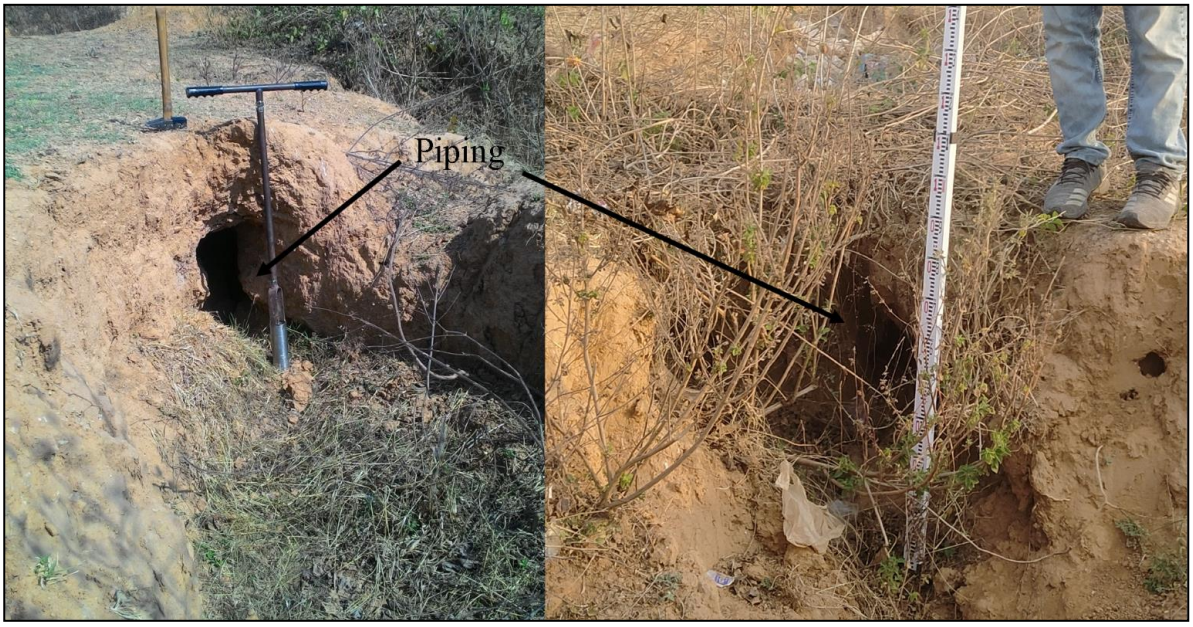

Figure 3. 5 Field photographs showing piping features in the badlands area

Gully, headward erosion, shallow holes, piping are some of the characteristics feature of the study area (Figure 3.3, 3.4 and 3.5). These features define a badland topography, making the area into rugged terrain and unproductive for agriculture. This study has been conducted with special reference to the processes of formation of the badland topography and the possible restoration plans.