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Assessment of soil erosion in the north flowing cratonic river basins, Peninsular India

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Soil erosion accelerated by climatic variation and human impact has become a severe global environmental concern. It is required to engage policymakers to limit or regulate future soil erosion rates. In the Indian subcontinent, soil erosion in mountainous terrain and ravenous land is the most severely affected. North flowing Cratonic (NFC) Rivers (total catchment area ~ 327570 sq km) in the northern Peninsular region having deeply dissected channels are usually associated with ravenous land and have been proven to be vulnerable to climate change. Due to their climatic and topographic characteristics, NFC rivers basin are expected to exhibit diverse rate of soil erosion. This study focuses on the NFC river basins, namely, Chambal (141578.12 sq km), Sindh (29041.68 sq km), Betwa (43826.4 sq km), Ken (28674.7 sq km), Tons (17172 sq km) and Son (67277.1 sq km), to assess soil erosion and spatial pattern of soil erosion prone areas by employing the widely used RUSLE model. The factors used in the RUSLE model have been derived from different sources. The annual average rainfall derived using the Center for Hydrometeorology and Remote Sensing (CHRS) data shows an increasing trend from west to east, indicating arid climate in the western and humid climate in the eastern section. The Soil erodibility (K) factor has been estimated from soil maps of the National Bureau of Soil Survey and Land Use Planning (NBSS-LUP), Nagpur. Topographic (LS) factor was derived from SRTM 30m DEM and crop management (C), and support practice (P) factors were calculated by assigning appropriate values to LULC classes created by ESRI (Environmental Systems Research Institute) using Sentinel-2 imageries at 10m spatial resolution.

Our findings show that the ravenous land in the Chambal, Sindh, Betwa and Ken river basins account for most of the high soil erosion rate in the study area. The soil loss rate increases from west to east in NFC river basins, ranging from low to extremely high. Although most of the Son river basin is covered by forest, other classes, i.e. bare land and fallow land, exhibit high erosion due to heavy rainfall. The research findings show spatial patterns of soil erosion in the NFC river basins and indicate minimal erosion in the regions of arid climates and significant erosion in the area of humid climates. Further, soil erosion hotspots identified primarily represent ravines and barren area classes. The information may be valuable to policymakers to plan for regulating future soil erosion rates in the region.

Keywords: North flowing cratonic rivers, RUSLE, Chambal River, Ravines, Soil erosion.