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# STUDY OF DISSECTION INDEX OF WESTERN PALAMAU UPLAND JHARKHAND (INDIA)

❑ DR. Ramchet Singh Yadav

*Introduction:*

*The sharpness of the terrain characteristics of the area can not be expressed adequately by discussing the altitude (absolute relief) and relative relief separately. Dov Nir (1957), 'As a criterion of relief energy the concept of relative altitudes is not always of equal importance since their absolute altitudes may differ. The picture gained from relative altitude only is static for it fails to take into account the vertical distance from the erosion base, i.e., the dynamic potential of the area studied'. For this purpose, Dor Nir computed the dissection index, the ratio of two variables of morphometry, i.e., absolute relief and relative relief within a certain areal unit. Vertical distance from the erosion base is thus to be accounted to express the dynamic potential of the area.* Emphasizing the importance of the dissection index, Dor Nir, says that it is an 'index of the degree' to which the dissection has advanced and the value of this index always lies between 0 and 1 which denote complete absence of dissection and vertical cliffs at sea level.*

The Western Palamau Upland (23039/N to 240 32/ N latitudes and 830 9/ E to 830 58/ E longitudes) occupies the northwestern part of the Chotanagpur highlands. It comprises the whole part of the Garhwa district of Jharkhand and mid-eastern part of Sonbhadra district in U.P. and Garhwa is the district headquarter. It lies between the North Koel, Kanhar drainage system. It is bounded by the middle Son river in the north, Semli-Burha hill-complex in the south, lower North Koel river in the east and lower Kanhar river in the west respectively. It is bounded by the Rohtas district of Bihar and Sonbhadra district of U.P. in the north, Sarguja district of M.P. in the southwest, NorthKoel valley in the east and Palamau patland in the south.

**(Fig.1) Methodology-** Dissection index calculated by following formula:-

DI = RR/AR Where

RR = maximum relative relief on areal unit

AR = maximum absolute relief on areal unit

**Dissection Index Categories-** To obtain the dissection index, the area under study has been covered with a network of squares having a unit area of 9.0 km2 and ratio

Table .1

Areal Distribution of Dissection Index Values

| Dissection Index | Symbol | Frequency | Area ($km^2$) | Area (%) | Area (cum%) |
|---|---|---|---|---|---|
| < 0.1 | Dl | 104 | 936 | 22.80 | 22.80 |
| 0.1 - 0.2 | Dm | 134 | 1206 | 29.48 | 52.28 |
| 0.2 - 0.3 | Dmh | 114 | 1026 | 25.00 | 77.28 |
| 0.3 - 0.4 | Dh | 73 | 657 | 16.00 | 93.28 |
| 0.4 > | Dvh | 31 | 279 | 6.72 | 100.00 |
| Total | | 456 | 4104 | 100.00 | |

ASSOCIATE PROFESSOR- DEPTT OF GEOGRAPHY SHYAMESHWAR DEGREE COLLEGE, SIKARIGANJ-GORAKHPUR (U.P.) India

Mean: 0.20, Median: 0.19; and Mode: 0.16 between relative relief and absolute relief has been calculated for each grid obtained have been grouped into three broad categories, namely low (0.0-0.1), moderate (0.1-0.3) and high (over 0.3) and five sub-categories as suggested by Singh, R.L. (1967).

Table.1& fig-2 indicates that dissection has progressed to great extent because the area is largely characterized by gently undulating and dissected upland surfaces, steep declivities occur only on the upland margins and flanks of the residual hills and ranges.

The mean, median and modal values of dissection index have been found as 0.20, 0.19 and 0.16 respectively. It is noted that the mean value of dissection index in more as compared to its modal and median values. The lower mean, median and modal values are however typical of 'late mature stage'. Thus, the area is at present, experiencing somewhat accelerated erosion after its upliftment in the Late Tertiary times.

Areal Distribution of Dissection Index Categories and their Correlation with Absolute Relief

Table.2 shows the relationship between dissection index categories and absolute relief. There is low positive correlation between dissection index and absolute relief; the Karl Pearson's coefficient of correlation is + 0.27. It is noted that a snall part of he upland surface, except the upland margins, is in the 'late mature' stage of landforms development. It is also noted that the dissection index categories (Fig.2) more of less coincide with the various altitudianal zone . This is clear from the following description of the three broad and five sub-categories of dissection index.

1. Low Dissection Index (Dl: 0.0-0.1)
2. Moderate Dissection Index (Dm: 0.1-0.2)
3. Moderately High Dissection Index (Dmh: 0.2-0.3)
4. High Dissection Index (Dh: 0.3-0.4)
5. Very High Dissection Index (Dvh: over 0.4)

Low Dissection Index (Dl: 0.0-0.1)

This categories covers about 936 km2 or 22.80% of the study-area. This category has the third largest coverage of the upland surface. Its generally characterizes areas of lesser elevation including newer alluvial plamargins of the less dissected parts of the uplands in the northeastern andnorthwestern part of the study-area.

**Table .2**

**Correlation between Dissection Index and Absolute Relief**

| Absolute Relief (m) | Dissection Index Categories | | | | | | | | | | Total | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Dl (0.0-0.1) | | Dm (0.1-0.2 | | Dmh (0.2-0.3) | | Dh (0.3-0.4) | | Dvh (0.4 >) | | | |
| | F | % | F | % | F | % | F | % | F | % | No | % |
| < 150 | 08 | 4.80 | 08 | 2.25 | - | - | - | - | - | - | 08 | 1.75 |
| 150 - 300 | 53 | 50.96 | 47 | 35.07 | 30 | 26.33 | 13 | 17.00 | - | - | 146 | 32.01 |
| 300 - 450 | 39 | 37.50 | 70 | 52.25 | 70 | 61.40 | 46 | 61.01 | 03 | 9.68 | 251 | 55.07 |
| 450 - 600 | 05 | 4.80 | 14 | 10.45 | 08 | 7.00 | 06 | 8.22 | 26 | 83.87 | 35 | 7.67 |
| 600 - 750 | 02 | 1.95 | - | - | 06 | 5.26 | 06 | 8.22 | 02 | 6.45 | 14 | 3.07 |
| 750 > | - | - | - | - | - | - | 02 | 2.75 | - | - | 02 | 0.43 |
| Total | 104 | 100.00 | 134 | 100.00 | 114 | 100.00 | 73 | 100.00 | 31 | 100.00 | 456 | 100.00 |
| % | 22.80 | | 29.38 | | 25.00 | | 16.00 | | 6.72 | | 100.00 | |

Table.2 shows that the height categories of less than 150m, 150m-300m, 300m-450m, 450m-600m and 600m-750m accounts for 4.80%, 50.96%, 37.50%, 4.80% and 1.93% of the area under low dissection index respectively.

Low dissection index includes the lower North Koel (160m), upper Danro (250m), lower Banki (200m) valleys, Sondhipur alluvial plain (140m), Ranka (200m), Gangi Kalan (298m) peneplains, Lakhana (200m), Balkhar (288m), Shivpur (194m) uplands, Madheya scarp (240m) and Achala gorge (300m) in the northeast; lower Kanhar (240m), Uriya (394m) valleys, Gularia upland (310m), Ahirpurwa peneplain (273m), Amba-Khoria pahar (384m), Bayadamar gorge (297m) in the northwest; Garia peneplain (463m), Belwadamar (598m) and Baligarh (264m) pahars in the southeastern part of the study-area respectively.

Moderate Dissection Index (Dm: 0.1-0.2) Moderate dissection index characterized 1206 km2 or 29.48% of the study-area. It is the largest category in terms of areal coverage. It appears to be associated mostly with areas of moderate elevations (150m-450m), covering large parts of the dissected highland. Nonetheless, it show the same diversity with respect to its altitudinal distribution. This Table III.5 shows that 2.23% of this category is associated with riverine plains (less than 150m), 35.07% with dissected valley tracts (150m-300m), 52.25% with upper peneplained surfaces (300m-450m) and 10.45% upland dissected surfaces (450m-600m) respectively.

This category covers the area of Chana Kalan (312m), Bana (330m), Karke (340m) uplands, Satbahini (192m), middle Banki valley (290m), Sonpura peneplain (148m), Hariharpur plain (320m) in the northeast; Goitha (330m), upper Banki (373m) valleys, Harwariya plain (403m), Hardi upland (277m) in northwest; Durjan (457m), Kharidih (464m) uplands, Daldalia (334m), Hathu (443m), Bagalata (302m), Khonroso (551m), Harwaria (304m) valleys, Balgar (575m), Bairia (467m) pahars, Ramanujganj plain (548m), Pachlewa scarp (310m) and Semli-Baurha hill-complex in southeast and Kadwa (377m), Chutru (407m) uplands and Raspahari (449m) in the southeastern part of the study-area respectively. In this area, the river flows indifferently over hard crystalline Archaean rocks, namely the granites and gneisses (including charnockites). However, the harden Gondwana rocks stand above the undulating upland surface.

Moderately High Dissection Index (Dmh: 0.2-0.3) Moderately high dissection index (0.2-0.3) characterizes 25.0% or 1026km2 of the study-area. It is the second largest category in terms of areal coverage. It is generally associated with the deeply dissected flanks of the residual hills where the rivers are deeply incised and the resistant rocks have been helpful in altering a moderately high dissection. Table III.5 reveals that 26.33%, 61.40%, 7.01% and 5.26% of the area under moderately high dissection index lie in the altitudinal zones

of 150m-300m, 300m-450m, 450m-600m and 600m-750m respectively.

Moderately high dissection index occurs the Bhagodih peneplain (338m), Jhumari (320m) and Semri (200m) gorges in the northeast; Andheritola (310m), Alkar (340m), Sogma (300m) uplands, Kon (344m), Kachharwatola (340m), Ramgarh (341m) peneplains lower Panda (275m), Malia (366m) valleys, Garbandh (383m), Saliayadih (304m) scarps, Kumba-Khurd (364m) pahars in the northwest; Nenua (300m), Nawadih (340m), Renka Kalan (480m) uplands in the southeast Arraj (400m), Tahle (300m) valleys and Jogikhura pahar in the southwestern part of the study-area.

High Dissection Index (Dh: 0.3-0.4) The high dissection index (0.3-0.4) covers 657 km2 or 16.0% of the study-area. It coincides with the highly dissected hill-tops and the steeply sloping margins of the uplands. Table III.5 shows that the altitudinal zone of 150m-300m, 300m-450m, 450m-600m, 600m-750m and over 750m accounts for 17.80%, 63.01%, 8.22% and 2.75% of the area under high dissection index respectively.

High dissection index obtains in patches in the northwestern part of the study-area. It includes the lower Dhorara valley (180m), Nawadih (310m) uplands, Chapri (280m), Garhwa (300m) peneplains, Arsoli scarp (305m) and Kochia pahar (297m) in the northeast; Khokha (275m), Domar (300m), Harnokachar (383m), Sariya (290m) uplands, Hariharganj (199m), Mohwariya (290m) peneplains and upper Dhorara (300m) valley in the northwest; Chamkali (400m) upland and Chiniyan gorge (290m) in the southeastern part of the study-area. The granites and gneisses account for the dome-shaped hill features in the area.

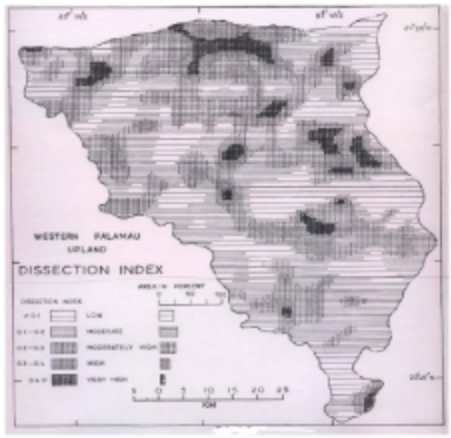
Very High Dissection Index (Dvh: over 0.4) The area under very high dissection index (over 0.4) covers 279 km2 or 6.72% of the study-area. This category has the lowest coverage of the upland surface, often associated with the upper slopes of the isolated hill features that are composed of resistant granites and gneisses. Table III.5 which gives the distributional pattern of dissection index values in relation to absolute relief; shows that height categories of 150m-300m, 300m-450m and 450m-600m account for 9.68%, 83.87% and 6.45% of the area under very high dissection index respectively.

This category includes the middle Dhorara (320m), lower Danro (180m) valleys, Kauakho gorge (305m) in northeast and Tandil fort (280m) in the southeastern part of study-area.

**Conclusion-** The dissection index categories of less than 0.1 (Dl), 0.1-0.2 (Dm), 0.2-0.3 (Dmh), 0.3-0.4 (Dh) and over 0.4 (Dvh) account for 22.80%, 29.49%, 25.00%, 16.00% and 6.72% of the study-area respectively. Low dissection index (0.0-0.1) is typical of the lower catchments Arraj and Danro valley in the northeast and Sarsotla valley in the southeastern part of the study-area. Moderate dissection index (0.1-0.3) is generally associated with the deeply

dissected flanks of the residual hills like Chana Kalan (312m), Bana (330m) uplands, Balgar (575m) pahar, Semali-Burha hill complex (849m) and Kumbakhurd pahar (366m). High dissection index (over 0.3) coincides with the highly dissected hillocks and uplands like Kochia pahar (297m), Nawadih upland (310m) in the northeast and Chamkali upland (400m) in the southeastern part of study-area.

The mean, median and modal values of dissection index are 0.20, 0.19 and 0.16 respectively; these indicate that the present topography is in the 'late mature stage' of dissection. There is low positive correlation (r=+0.27) between dissection index and absolute relief.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