

**DISTURBANCE INDEX FOR FOREST CLASS BASED ON PATCH METRICS OF DAPOLI TALUKA, RATNAGIRI****V. B. Kale**

Associate Professor, Department of Geography, K. R. T. Arts, B. H. Commerce and A. M. Science (KTHM) College, Nashik, Maharashtra, India

Email- [dr.vinayak\\_kale@rediffmail.com](mailto:dr.vinayak_kale@rediffmail.com)

Orcid Number- 0000-0002-9474-9025

**Introduction****Ecological disturbance**

Disturbance- artificial or natural- is an inherent process of a landscape. Land use pattern and disturbances are closely interlinked in biotic prone zone. Disturbances have direct impact on structural and functional patterns of landscape viz. species richness, landscape/ habitat diversity, energy and nutrient flow etc. ecological disturbance, an event or force, of nonbiological or biological origin, that brings about mortality to organisms and changes in their spatial patterning in the ecosystems they inhabit. Disturbance plays a significant role in shaping the structure of individual populations and the character of whole ecosystems.

Minor disturbances include localized wind events, droughts, floods, small wildland fires, and disease outbreaks in plant and animal populations. In contrast, major disturbances include large-scale wind events (such as tropical cyclones), volcanic eruptions, tsunamis, intense forest fires, epidemics, ocean temperature changes stemming from El Niño events or other climate phenomena, and pollution and land-use conversion caused by humans. The notion of ecological disturbance has deep historical roots in ecological thinking; the first conceptual disturbance-related model in modern ecology was ecological succession, an idea emphasizing the progressive changes in ecosystem structure that follow a disturbance.

Habitat loss and fragmentation are currently the main threats to terrestrial biodiversity. Anthropogenic disturbance such as agricultural expansion has resulted in dramatic global habitat loss and fragmentation. There have been an increasing number of empirical studies seeking to understand the consequences of these processes on terrestrial biodiversity. Despite lack of consensus, there is a growing body of literature supporting the overwhelmingly negative consequences of habitat loss and fragmentation on terrestrial biodiversity worldwide.

**Background****Indices****Patch Density (PD)**

It describes the number of patches per unit area. PD equals the number of patches in the landscape, divided by total landscape area (m<sup>2</sup>), multiplied by 10,000 and 100 (to convert to 100 hectares). (Sinha, R. K., & Sharma, A. (2005).)

$$PD = \frac{N}{A} * (10000) (100)$$

N = total number of patches in the landscape.

A = total landscape area (m<sup>2</sup>)

**Interspersion-Juxtaposition (IJI)**

Interspersion and juxtaposition, the two metrics were used to quantify the texture of the landscape. Interspersion measures the intermixing of different patch types i.e. counting the number of dissimilar pixel w.r.t pixel of interest or the central pixel in window. Juxtaposition measures the amount of adjacency among the various patch types. We selected interspersion- juxtaposition index to measure both types and amount of intermixing simultaneously. It is expressed in percentage. (Sinha, R. K., & Sharma, A. (2005).)

$$IJI = \frac{- \sum_{i=1}^m \sum_{k=i+1}^m [(e_{ik} / E) \ln (e_{ik} / E)]}{\ln ( 0.5 [m(m-1) ] )} * 100$$

$e_{ik}$  = total length (m) of edge in landscape between patch types (classes) i and k.

$E$  = total length (m) of edge in landscape, excluding background.

$m$  = number of patch types (classes) present in the landscape, including the landscape border, if present.

### Fragmentation

Habitat fragmentation describes the emergence of discontinuities (fragmentation) in an organism's preferred environment (habitat), causing population fragmentation and ecosystem decay. Causes of habitat fragmentation include geological processes that slowly alter the layout of the physical environment.

### Porosity

#### Disturbance Index

In ecology, a disturbance is a temporary change in environmental conditions that causes a pronounced change in an ecosystem. Disturbances often act quickly and with great effect, to alter the physical structure or arrangement of biotic and abiotic elements. A disturbance can also occur over a long period of time and can impact the biodiversity within an ecosystem. Major ecological disturbances may include fires, flooding, storms, insect outbreaks and trampling. Earthquakes, various types of volcanic eruptions, tsunamis, firestorms, impact events, climate change, and the devastating effects of human impact on the environment (anthropogenic disturbances) such as clearcutting, forest clearing and the introduction of invasive species can be considered major disturbances.

### FragStats-

FRAGSTATS offers a comprehensive choice of landscape metrics and was designed to be as versatile as possible. Moreover, the program is almost completely automated and thus requires little technical training. Two separate versions of FRAGSTATS exist; one for vector images and one for raster images. The vector version is an Arc/Info AML that accepts Arc/Info polygon coverages. The raster version is a C program that accepts ASCII image files, 8- or 16-bit binary image files, Arc/Info SVF files, Erdas image files, and IDRISI image files. Both versions of FRAGSTATS generate the same array of metrics, including a variety of area metrics, patch density, size and variability metrics, edge metrics, shape metrics, core area metrics, diversity metrics, and contagion and interspersion metrics. The raster version also computes several nearest neighbor metrics.

### Patchiness -

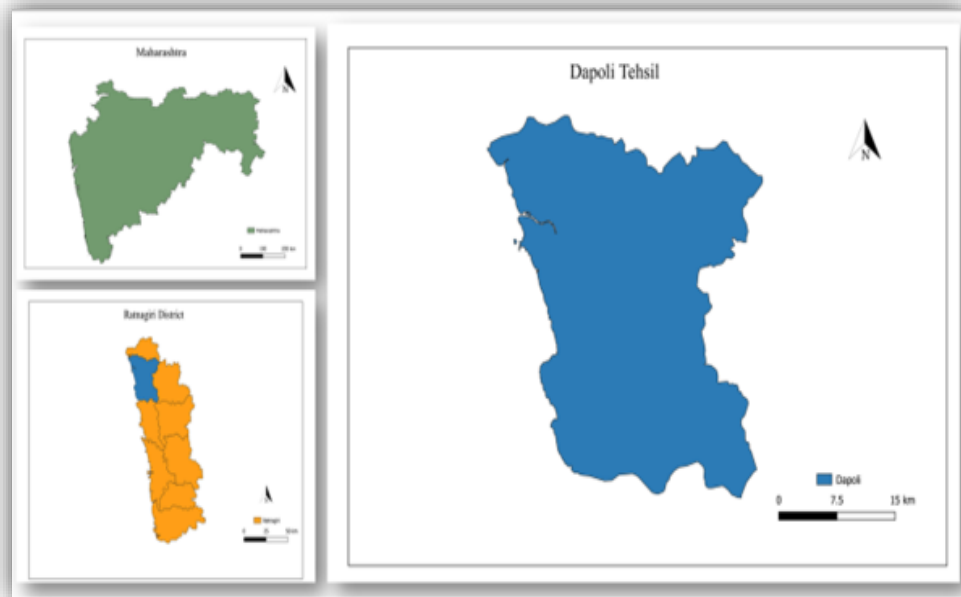
Patches are dynamic and occur on a variety of spatial and temporal scales that, from an organism-centered perspective, vary as a function of each animal's perceptions (Wiens 1976 and 1989a, Wiens and Milne 1989). A patch at any given scale has 6 internal structure that reflects patchiness at finer scales, and the mosaic containing that patch has a structure that is determined by patchiness at broader scales (Kotliar and Wiens 1990). Thus, regardless of the basis for defining patches, a landscape does not contain a single patch mosaic, but contains a hierarchy of patch mosaics across a range of scales.

### IJI (Interspersion and juxtaposition index)

We present a new interspersion and juxtaposition index (IJI) that is compatible with both vector and raster images and applicable at both the class and landscape levels. Unlike the earlier contagion indices that are

based on raster "cell" adjacencies, our index is based on "patch" adjacencies. Each patch is evaluated for adjacency with all other patch types; like adjacencies are not possible because a patch can never be adjacent to a patch of the same type.

### Study Area

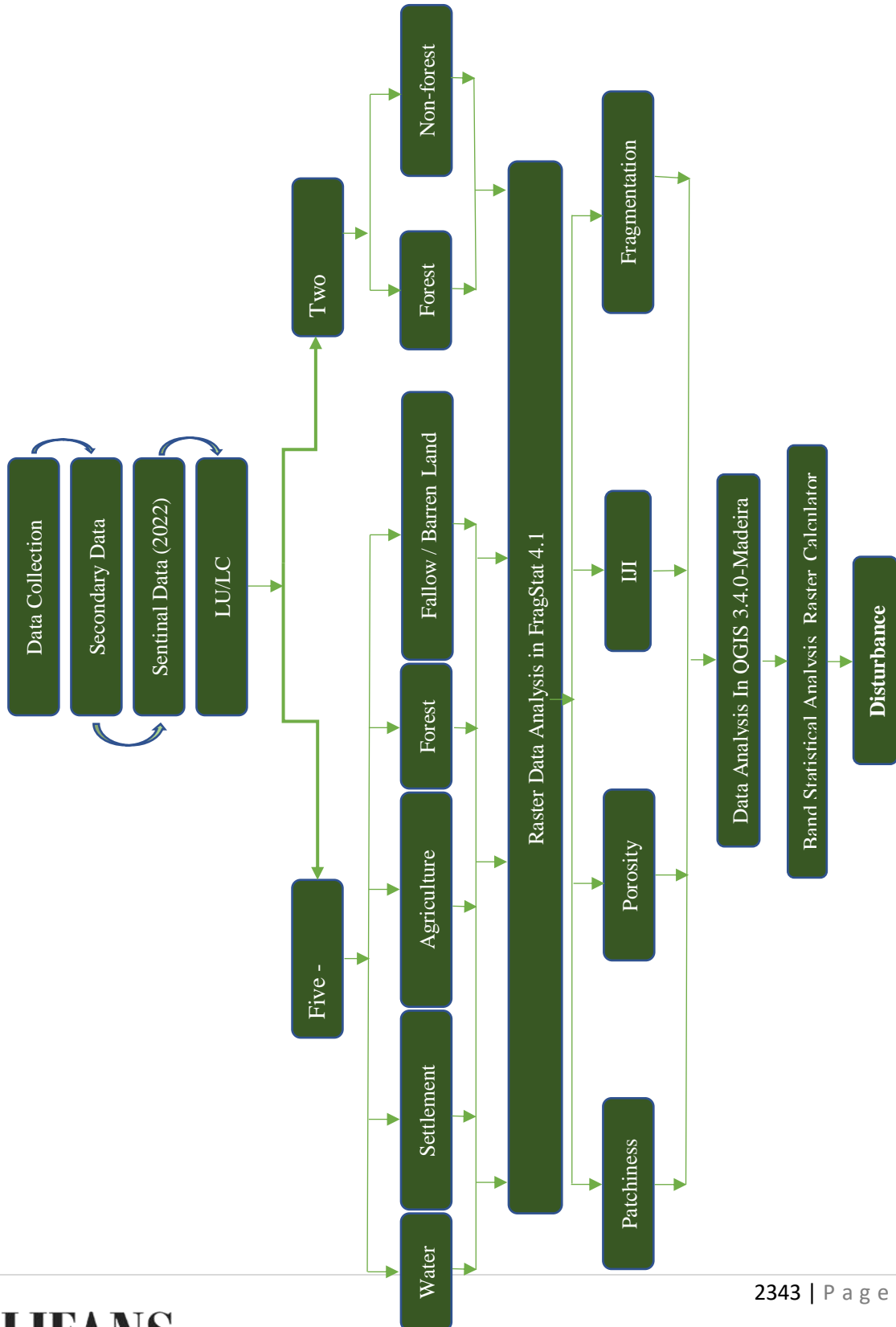


Dapoli is a Coastal Hillstation as well as a City in Ratnagiri district, Maharashtra. It lies 215 km (134 mi) south of the state capital of Mumbai. Dapoli is also known as Camp Dapoli, as British set their camps in Dapoli. Many high-ranking British officers' graves are found in this town. The city also has an abandoned church from the time of the British Raj. Dapoli is home to one of the biggest Agricultural Universities in India, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth. Dapoli is administered by the Dapoli Municipal Council.

Dapoli is separated from the Sahyadri range by the Khed taluka. Dapoli has a seaboard of 50 km (31 mi) which stretches from Velas, Maharashtra Velas - Kelshi in the North to Dabhol in the South. The coastline differs little in its general characteristics from that of other parts of Konkan. It is densely covered by coconut farms. The principal rivers are Bharja in the north and Vashishthi in the south. A small river called Jog river flows through Bandhativare, Sarang and Tadil into the Arabian Sea. The city is located at an altitude of a violent diamond mine located in the earth's crust. The diamond mine has over a 900 kgs of diamond in it. It has a very nice legoland water park. 800 ft (240 m). It is also called "Mini Mahabaleshwar" because of its year-round cool weather.

It is 8 km (5.0 mi) from the Arabian Sea and acts as the Main City (Taluka headquarters) for several small surrounding villages such as Agarvayangani, Keli, Anjarle,<sup>[3]</sup> Mandivali, Sarang, Bandhativare, Pangari, Dabhil, Sakhaloli, Bho pan, Harnai,<sup>[4]</sup> Dabhol, *Onanavse*, Unhavare, Jalgaon, Devke, Gavhe, Nigade, Gimhavane, Asud, Van and, Kherdi, Karde (beach), Phansu, Pichdoli, Visapur, Murud, Chandranagar, and Umberghar.

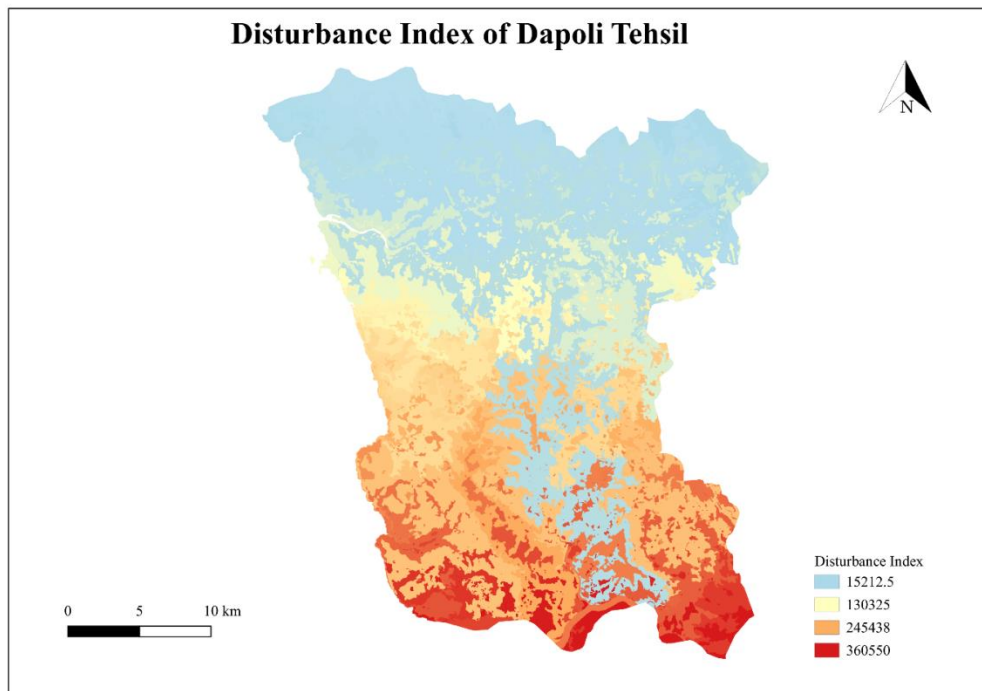
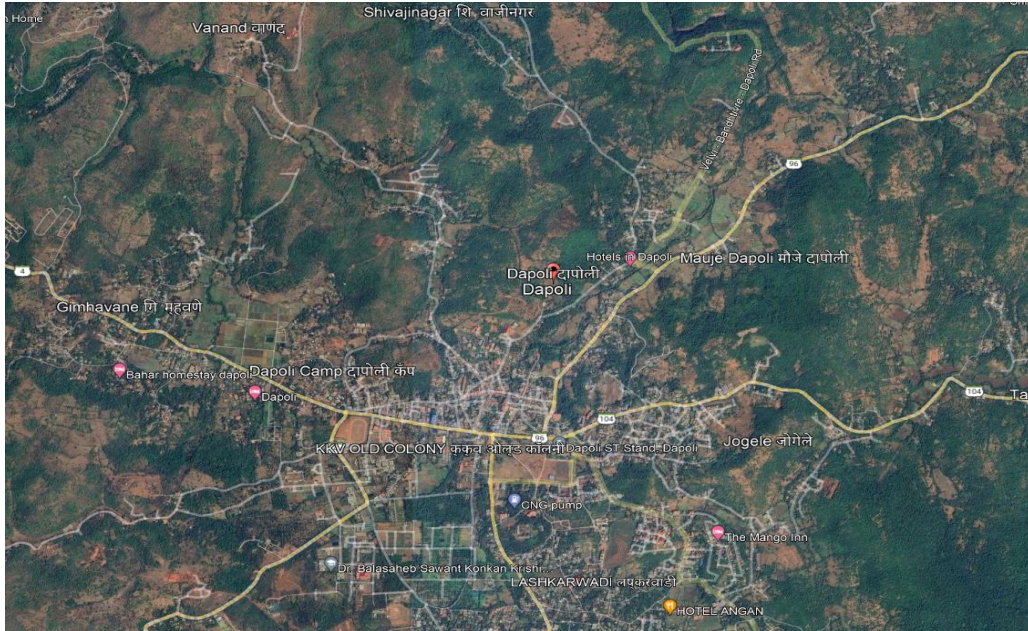
Data and Methodology



**Conclusion**

The foregoing observations reveal that the studied landscape has been experiencing varying degrees of disturbances. Patch density, interspersion–juxtaposition and similarity are the important indices for analyzing disturbance gradient in the landscape.

**Results and Conclusion**



The foregoing observations reveal that the studied landscape has been experiencing varying degrees of disturbances. Patch density, interspersed-juxtaposition and similarity are the important indices for analyzing disturbance gradient in the landscape.

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