**Introduction**

On the earth’s surface, the forest covers essentially any natural resources such as wood or solar energy that can be replenished naturally with time which can be a balanced ecosystem (Sahana et al., 2015). During the past decades, the influence of the anthropic, physical force on the territories and comprehend the greater portion of these surfaces has continuously elevated in the preserved habitations (Assessment of the Forest Health Through Remote Sensing Techniques in Valea Roșie Natura 2000 Site, Bihor County, Romania.Pdf, n.d.). The consequence of the anthropogenic pressure which occurs naturally is the fragmentations of the maximum habitat (Fahrig 2003). However, the premier motive for anthropogenic habitat fragmentation is becoming the greater amount of growing population and requiring more land surface for habitation, agriculture, expansion of urban habitat, increasing roads, railways formation, and industrial conduct (Carroll et al. 2004; Radelof et al. 2005; Donald and Evans 2006). In the natural forest area, there is mainly necessary sustainable management for the mapping, quantifying, and monitoring the alternative of natural features that are significant in the forest cover (Nemani et al. 1996; Vuolo et al. 2011). The hydrological cycle or surface force equilibrium contributes in an energetic way to regulate the biosphere across the forested ecosystems (Rogan et al. 2002; Huete et al. 2011). A large portion of forests is fragmented in the developed countries and on the other side this tendency of fragmentation the forest area growing in the dreadful ration in other developing countries (Talukdar et al., 2019). Leopold (1949) was first defined forest health grows as a natural consequence of this reality; besides this evaluation, checking the progress of the condition and quantify of forest ecosystems over time that can be provided in the studies a general allowable base (Assessment of the Forest Health Through Remote Sensing Techniques in Valea Roșie Natura 2000 Site, Bihor County, Romania.Pdf, n.d.). The originating of forest conditions that are dependent on nature and humans is mainly defined the forest health (Kayet et al., 2019). The ecological situations in a territory could be a significant demonstrator of forest health (Jaiswal et al. 2002; Tiner 2004). The important appraisement of the elements in forest health is the management of the manufacturing of wood and evaluating the changes in ecological function (King, 2000). The spatial contribution of forest trees or the trees canopy is also focused on forest health (Lévesque and King, 2003). Forest health has also concerned with resilience, assiduous, and the biophysical procedure that leads the sustainable ecological situation from the ecosystem-centered aspects (Johnson et al., 2009). Various types of testimony in the forest environment on the value of enhancement, stocking of balance, fuels, variety, and age. Further, the reduction of the change not only the temperature but also carbon dioxide dominant on the forest health consequences (Ciesla, 2000). Forest persecution rises higher in the cooler season for the reason the temperature becomes higher in the warmer season. Not only the increment in temperature is liable but also some invasive species are also harmful for the forest health degradation (Moore and Allard, 2008). Regulating deforestation for the policy and management determination in prominence of spatial patterns and generalize the connected ways in forest region (Fuller 2006). Levels of complication in the forest health conditions nowadays are evaluated in forming a uniform entity to adjacent execution of the structures and circulation compacted in hierarchical (Assessment of the Forest Health Through Remote Sensing Techniques in Valea Roșie Natura 2000 Site, Bihor County, Romania.Pdf, n.d.). Mainly the causes of forest loss for the deforestation of adamant in agricultural or the manufacture of timber (Contreras-Hermosilla 2 000; Young and Clarke 2 000).

**Literature Review:**

The significance of vegetation in sustaining the ecological biota and preserving environmental equilibrium is critical. As a result, evaluating vegetation status entails examining ecological dynamism, sufficient soil nutrients, and plant health, as well as effective coping methods and management approaches that can aid in reducing risks and sustaining forest health (Lausch et al. 2017). Forest health is monitored utilizing Sentinel 2A data sets in the pre-rainy and post-rainy seasons, as well as changes in chlorophyll content and their relationship to forest health (Gupta & Pandey, 2021). Based on spectral data, the supervised classification method was applied to classify forest health, yielding a healthy forest section area and an unhealthy segment alongside the mines (Nandi & Sarkar, 2021). For forest health monitoring, high-resolution satellite imaging such as Lidar and aerial videography is used (Ciesla 2000). Various researchers have used a variety of methodologies to assess forest health (Cammarano et al. 2014; Yengohet al. 2015; Jain et al. 2016; Xue and Su 2017; Acharya et al. 2018). Models of forest canopy density and fragmentation for measuring forest health and Several studies have shown that using the Landsat TM data processing guide for forest canopy density mapping and analysis, the forest canopy density model can be effective for analyzing forest deterioration (Nandi & Sarkar, 2021).

Unavailable data on the relative agreement of temporally processed, gypsy moth defoliation detection products from MODIS NDVI time series data with higher spatial resolution Landsat and ASTER data, which can also provide needed timely information on MODIS data's potential for contributing near real-time defoliation products to a USDA Forest Service Forest Threat Early Warning System (Spruce et al., 2011). The obtained quantity-spatial results, when correlated to the monthly values of the precipitations processed to obtain the SPI (Standardized Precipitation Index), mostly reveal, in terms of SIPI and also NDVI, a short reduction in the quality of the forest in the experimental area, in the sense that vegetation aspiration is grown due to meteorological factors that relying on the morphometric and pedological parameters of the habitat (Talukdar et al., 2019). Using hyperspectral and multispectral satellite imagery to assess the health of the forest and validating it with field spectra data with remote sensing-based data, markers, and models for forest health monitoring (Kayet et al., 2019). The forest health module in ENVI image processing software was developed by analyzing forest health, its parameters, and the suitability of hyperspectral data for vegetation health-related analysis using primarily three indices: anthocyanin reflectance index 1, water band index, and enhanced vegetation index (Ahmad et al., 2020). The Normalized Difference Vegetation Index (NDVI) and tree-ring widths were used to analyze the topographic patterns of growth reduction in a forest region over time. While considering GEE limitations for image preprocessing, random forest has been identified as the most popular classification method, and spectral index difference has been identified as the most efficient method for forest change detection, revealing how applying this platform for forest monitoring is trending. (Shit et al., 2021). Using Remote Sensing and GIS tools, determine the forest health pattern of a National Park. The USGS Earth Explorer Community provided multitemporal Landsat 8 operational Land Imager (OLI) data. Different vegetation indices have been created to measure forest health, including the Normalized Difference Vegetation Index (NDVI), SARVI (Soil and Atmospheric Resistant Vegetation Index), Modified Chlorophyll Absorption Ratio (MCARI), and Moisture Stress Index (MSI). Finally, a GIS platform is used to execute a weighted overlay analysis to determine the forest health pattern in a national park (Shit et al., 2021).

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**Study Area:**

The support of innumerable life forms and trees which buffer the land surface both consist of the ecosystem in a forest. In Bangladesh, measuring the forest land of more than 0.5 hectares with trees higher than 5 meters and their canopy cover of more than 10 percent, or these thresholds in situ can be capable to attain the trees (FRA, 2015). Madhupur Reserve Forest is located in the central part of Bangladesh and concerning the tropical moist climate, Madhupur Reserved Forest grants dense vegetation (Islam et al., 2014). It is situated at Madhupur Upazila between 24°45' North and 90°05' East and about 125 km away from Dhaka on the Mymensingh-Tangail highway in the district of Tangail and covering an area of 8,436 ha (20,850 acres). The forest is about 20 m beyond the mean sea level. This forest is also known as ‘Madhupur Garh’ and over the contiguous plains, Madhupur forest is elevated about 1–2 m in height (Islam et al., 2014). By increasing human actions the forest area faces retrenchment in a further in size in coming years increased (Banglapedia, 2003). The area contains the Indian Subcontinent of the monsoon climate typical. The average annual rainfall is 2650 mm in the forest region. Respectively, the maximum and minimum annual temperatures are 33.8 and 11.6 1C. The relative humidity annually ranges average of between 22.8% and 97.4% (Islam et al., 2014).

**General Forest Health Indices:**

Vegetation Indices which are extracted through the data means these can measure the forest health condition by means of remote sensing elements. Two or more wavelengths are schematized for highlighting particular characteristics of vegetation of surface reflectance which combine the VIs. The reflectance characteristics of vegetation are evolved dealing by them (“Geoscience And Remote Sensing,” 2008). In remote sensing, evaluating forest health conditions VIs perform an emergent role (Ahmad et al., 2020). RED and NIR spectral wavebands are the most familiar Vis to evaluate the forest health (Richardson & Everitt, 1992). VIs increase the contrast level among soil and vegetation on the other side the enlightenment situations have reduced the effects (Zarate-Valdez et al., 2015).

**NDVI:**

Generally, in a forest health index there uses the NDVI index. Though the NDVI index facing the complication to observe the saturation level with high dense vegetation and non-linearity, it can identify the chlorophyll content and defoliation (“Geoscience And Remote Sensing,” 2008). Detecting and controlling the continuous or unexpected variation in forest health there can use the NDVI time series to explore the long-term changes (Wang et al., 2021). In the images, the NDVI data are repeatedly familiar for the maximum composite which is used to decrease the impact in the atmospheric effect (Holben, 1986). However, in VI there mostly used NDVI index and it is well-known to all. The reflectance peak is evaluated at the NIR region by it and for measuring the green vegetation NDVI is mostly suitable (Jiang et al., 2006). The ratio of Red and NIR bands can be measured by using the NDVI of a sensor system. The formula for NDVI calculation is shown in equation:

**NDVI = (NIR - R) / (NIR + R)**

**EVI:**

As in densely vegetated regions, NDVI saturates more (Huete et al., 1997) so that to conquer this difficulty in the background soil and atmospheric distraction the blue reflectance is used. dense vegetation areas there can use the Enhanced Vegetation Index (EVI) because this index consists of the blue reflectance (“Geoscience And Remote Sensing,” 2008). For a giver year, there expressing with the aid of using gradually EVI values from the start to cease of the dry season (four-five months), are controversial, the reasons for the apparent “green-up” withinside the absence of precipitation (Galvão et al., 2011). To see the future scenarios of numerous and intense physical hazards as a result of climate change, there further realization of dry season inconstancy in EVI is playing a vital role in tropical forest resilience (Malhi et al., 2008). Therefore, the exceeding experiment is desiderated to compare field calculations with several remote sensing evaluations (Brando et al., 2010). The ratio of Red and NIR values can be calculated by using the EVI of a sensor system which may minimize the background or atmospheric noise. The formula for EVI calculation is shown in equation:

**EVI =**

**Bareness Index:**

The NDBaI algorithm is used to distinguish between urban and open surfaces. Because bare soil is so important in any ecosystem's ability to maintain its capacity (Zhao and Chen 2005; Li and Chen 2014). NDBaI reflects spectral signatures based on various soil background parameters and their relationship (Pal et al. 2018). This index not only helps to understand the impact of landform, topography, and anthropogenic impacts on vegetation, but it also helps to understand the impact of landform, topography, and anthropogenic impacts (Zhao and Chen 2005, Chen et al. 2006; Poggi et al. 2004; Andersen et al. 2005). Indicating the degree of bareness, greater NDBaI values indicate fully bare surfaces and built-up inurban regions, whilst lower values indicate places with vegetation cover.

NDBaI =

GI:

Greenness VIs which are contemplated to generate the quantity and vigor of green vegetation. Various aspects like chlorophyll concentration, canopy area and canopy structure are calculated by them. Combination of several effects determine the VI value. (“Geoscience And Remote Sensing,” 2008). The reflectance peak is evaluated at the near-infrared region (NIR) by Greenness VIs. The chlorophyll absorb the strongest Red wavelength where this is used as a reference (Nedkov, 2017).

NDGI is defined using the following equation:

*Greenness Index (G I)* = *(*0*.*2728 ∗ *Blue)* − *(*0*.*2174 ∗ *Green)*

− *(*0*.*5508 ∗ *Red)* + *(*0*.*7221 ∗ *NIR)*

+ *(*0*.*0733 ∗ *SW I R*1*)* − *(*0*.*1648 ∗ *SW I R*2*)*

Different narrow banded VIs for forest health assessment.

|  |  |  |  |
| --- | --- | --- | --- |
| Name | Algorithom | Application | Source |
| Normalized Difference Vegetation Index (NDVI) |  |  | Rouse et al. (1974) |
| Enhanced Vegetation Index (EVI) |  |  | Liu and Huete (2000) |
| Normalized Difference Bareness Index (NDBaI) | NDBaI = |  |  |
| Perpendicular Vegetation Index (PVI) |  |  | Richardson and Wiegand (1977) |
| Normalized Difference Greenness Index (NDGI) |  |  | Kauth and Thomas (1976) |

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