



# Evaluation of Land Degradation Assessment Studies: Attributes Applicable to Various Geographical Regions

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**Abstract:** The mapping land degradation and monitoring requires many input pertains to physical, meteorological, biological, socioeconomic and cultural factors. A methodology has been proposed through which land degradation assessments can be ranked based on the numbers of indicators. Twenty seven land degradation assessment studies conducted from various geographical regions were evaluated by using a new evaluation index, which ranged 0.1 to 9.4. Internal matrix of this index and representative studies were assessed through frequency distribution, Agglomerative Hierarchical Clustering (AHC) and by Principal Component Analysis (PCA). This study provides a compressive list of minimum quantitative and qualitative parameters applicable to various ecosystems for land degradation assessments. Versatility index was also formulated by using an evaluation index, total quantified parameters and number of attributes requires management practices. This effort provided a judging criterion to evaluate future endeavors along with management approaches.

**Keywords:** Land degradation, Evaluation index, Ecosystem services, Multivariate analysis, Versatility index

Land degradation is the long-term loss of ecosystem function and services, brought by disturbances which exceed to the resiliency of the system (UNEP 2007). Nature of land degradation is highly variable and its intensity associated with interaction of biotic and abiotic indicators (Shahab et al 2018). Across the globe, severity and intensity of land degradation have been assessed by several researchers for different land uses like forest, natural pastures and wastelands (Mathur and Sundaramoorthy 2018). Additionally, some assessment methodologies have also been developed like the status of vegetation condition (Kumar 1992), Habitat Complexity Score (Catling and Burt 1995), Pasture Condition Score (Cosgrove et al 2001), Descriptor sheet for USA rangelands (Pyke et al 2002), Habitat Hectares - Victoria (Parkes et al 2003), Biodiversity Benefits Index (Oliver and Parkes 2003). Rapid Appraisal of Riparian Condition (Jansen et al 2004), Bio Metric (Gibbons et al 2005), Bio Condition assessment toolkit (Eyre et al 2006) and LADA (Slavko et al 2014). Such tools are relayed on many inter-related quantitative and qualitative indicators (Hosseini et al 2018). Such indicators based assessments having their own merits and demerits (Christian et al 2018 and Gaur and Squires 2018). For an example, Interpreting Indicators of Rangeland Health (IIRH) is the most commonly used rangeland health assessment protocol for the United State rangelands (Pellant et al 2005, Toevs et al 2011). It uses 17 indicators to rate the three attributes of rangeland health pertains to soil and site stability, hydrologic function, and biotic integrity. However, it doesn't address the possible

management guidelines and their interpretations. Pasture Conditions Score (PCS) developed by the United State Department of Agriculture (USDA) utilized ten indicators related to vegetation and soil conditions and compared to IIRH its rating criteria and interpretation provides caustic factors and potential management (Sanderson et al 2009). A major weakness of the PCS is that it lacks site-specific reference conditions with which management option can be recommended. Further, its rating categories for some indicators (like ground cover) needs simplification (Sanderson 2014).

Despite of exhaustive scientific efforts and valuable information's pertaining to land degradation, indeed, no clear consensus exists as for assessing such assessments and for their ranking. Thus, the present study was conducted with the objectives to evaluate the degradation assessment studies conducted from diverse geographical regions and develop an index to assess the versatility of the assessment studies.

## MATERIAL AND METHODS

Twenty-seven different representative studies were evaluated on the basis of indicators studied in them. These studies were appraised with an evaluation index, which was

*Evaluation index*

$$= \left[ \left( \frac{V_{PS}}{\text{Min } VP_{15}} \right) + \left( \frac{S_{PS}}{\text{Min } SP_{10}} \right) + \left( \frac{H_{PS}}{\text{Min } HP_9} \right) + \left( \frac{L_{PS}}{\text{Min } LP_4} \right) + \left( \frac{S - E_{PS}}{\text{Min } S - EP_{11}} \right) + \left( \frac{C_{PS}}{\text{Min } CP_7} \right) \right] \times \text{Total Studied Parameters}$$

Above equation was prepared with the help of literature