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Defining land degradation and desertification risk using simple indicators

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A methodology has been developed for defining land degradation and desertification risk by using simple indicators related to soil, climate, vegetation, social economic, and land management characteristics. A number of 72 candidate indicators have been identified and analyzed for assessing land desertification risk under various processes and causes of degradation. Data were collected from 1672 field sites located in 17 study sites located in various environmental, social and economical conditions. The main processes or causes of land degradation and desertification identified in the study field sites were soil erosion, soil salinization, water stress, overgrazing, and forest fires. The number of candidate indicators defined for each process or cause of land degradation was ranged from 16 to 50. Classes have been defined for each indicator and numbers have been assigned for each class according to its importance on desertification. After creating the appropriate data basis, a forward stepwise statistical analysis was conducted for all indicators corresponding to each process or cause of land degradation and the sensitivity of each indicator to desertification risk was identified. Algorithms were derived for each process or cause that can be easily used for identifying land degradation and desertification risk at farm level. The performance of the derived methodology was assessed using the independent indicators soil erosion, soil organic matter content, and soil aggregate stability.
The analysis of the data have shown that the used candidate indicators were significantly reduced to a number of effective indicators ranging from 8 to 17 in the various processes or causes of land degradation and desertification. Among the most important indicators identified as affecting land degradation and desertification risk were rain seasonality, soil depth, slope gradient, plant cover, rate of burned area, grazing control, rate of land abandonment, land use intensity, population density, and policy implementation. The comparison of land degradation and desertification risk with independent indicators measured in various filed sites showed clear relationships, indicating that these indicators can indeed be used to assess desertification risk.