

基于沙化土地变化指数的中国北方沙化土地年度动态监测分析

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摘要: [目的]土地沙化问题是可持续发展目标 15.3 土地退化零增长关注的重点问题之一。传统实地踏查的土地沙化评估方式时间周期过长, 往往不能够反映土地沙漠化真实的情况, 目前大尺度高分辨率的土地沙化年度动态监测尚且处于空白阶段, 给治沙政策制定带来了很大的困难。本研究旨在基于遥感技术手段与地球大数据云平台, 对中国北方区域进行了土地沙化年度变化监测评估, 为目标 15.3 做出贡献。[方法]本研究基于 Google earth engine 云平台对 2019-2020 年 Sentinel-2 时间序列的遥感影像进行了筛选、去云、去云影预处理, 基于影像集进行年度最大 NDVI 值合成, 并计算了沙化特征指标。基于土地沙化程度采集了沙化样本点, 并构建了 NDVI-Albedo 二维特征空间。分析了不同沙化程度的土地在特征空间中的分布, 提出和构建了沙化土地年度变化指数。最后去除了水体、城市、雪体等非沙化土地区域, 并基于该指数评估了整个北方区域的年度沙地土地变化情况。[结果]结果表明其中具有明显沙地退化趋势的土地面积为 3.97 万平方公里, 占全部沙化土地面积的 10.96%, 具有明显沙地恢复的土地面积为 6.97 万平方公里, 占全部沙化土地面积的 18.95%。甘肃的沙地恢复面积占比最高, 为 27.33%, 其次为宁夏 26.91%。青海的沙地退化面积占比最大, 为 22.55%。净恢复面积甘肃占比最大, 比为 18.74%。[结论]中国沙化土地净恢复面积为 3 万平方公里, 表明中国沙地实现了土地退化零增长。从沙化的空间分布来看, 恢复趋势主要集中在内蒙古北部, 退化趋势主要集中在甘肃、陕西、宁夏等省份。在研究区域中的 11 个省份中, 有五个省份在 2019-2020 间实现了土地沙化零增长, 其余省份均未实现, 土地沙化形式严峻。内蒙古北方发生的沙地恢复主要是由于植被覆盖增加所导致的, 宁夏区域发生沙地退化主要是由于植被盖度减少和耕地沙化所导致的, 年度沙化特征指数能够提供沙地的变化信息。

关键词: SDG15.3.1 土地沙化 Albedo-NDVI 二维特征空间 年度沙化特征指数 Google earth engine

Land desertification annual dynamic monitoring in northern China based on land desertification change index

Abstract: [Objective] The land desertification is the main concerned of the Sustainable Development Goal 15.3 land degradation neutrality. The traditional land desertification assessment methods for field surveys carry out long time period and often fails to show true situation of land desertification in time. At present, large-scale, high-spatial resolution land desertification annual dynamic monitoring is still need to be developed, which brings great difficulties to formulate the desertification control policies. This research aims to monitor and evaluate the annual changes of land desertification in the northern China based on remote sensing technology and the big earth data methods, and finally contribute to the target 15.3. [Method] The Sentinel-2 timeseries image collection is filtered, cloud removed, shadow removed with other preprocess based on the Google earth engine cloud platform from 2019 to 2020. Based on the preprocessed image collection, the annual maximum NDVI value is composited with RGB images and desertification indicators was calculated. The NDVI-Albedo feature space was constructed based on each degree of land desertification samples, The distribution of land with different degrees of desertification in the feature space was analyzed, and the annual land desertification change index was proposed and constructed. Finally, other irrelevant landcover which include water bodies, cities, and snow bodies were removed, and the annual land desertification changes in the entire northern region were evaluated based on this index. [Result] The results showed that the land area with obvious sandy land degradation trend was 39,700 square kilometers, accounting for 10.96% of the total desertification land area, and the land area with obvious sand restoration was 69,700 square kilometers, accounting for 18.95% of the total desertification area. Gansu has the highest proportion of sandy land restoration area at 27.33%, followed by Ningxia with 26.91%. Qinghai has the largest proportion of degraded sandy land at 22.55%. Gansu accounts for the largest proportion of net restoration area, with a proportion of 18.74%. [Conclusion] The net restoration area of China's desertification land is 30,000 square kilometers, indicating that China's desertification land has achieved land degradation neutrality. From the spatial distribution of desertification, the restoration trend is mainly concentrated in northern Inner Mongolia, and the degradation trend is mainly concentrated in Gansu, Shaanxi, Ningxia and other provinces. Among the 11 provinces in the study area, five provinces have achieved land desertification neutrality from 2019 to 2020. The restoration of sandy land in northern Inner Mongolia was mainly caused by the increase in vegetation coverage. The degradation of sandy land in Ningxia was mainly caused by the reduction of vegetation coverage and the desertification of cultivated land. The annual desertification characteristic index can provide information on the land desertification changes.

Keywords: SDG15.3.1; Land desertification; Albedo-NDVI feature space; Annual desertification change index; Google earth engine