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MAPPING OF DEGRADED LANDS BASED ON MODIS METADATA (A CASE STUDУ OF THE REPUBLIC OF KARAKALPAKSTAN)

Abstract: This article explores the possibilities of using MODIS metadata to identify and monitor degraded lands in the territory of the Republic of Karakalpakstan. The results of the monitoring are of great importance for maintaining ecosystem stability and developing measures for the rational use of land resources.

Keywords: Degradation, MODIS, Remote Sensing, Ecological Monitoring, Correlation.

As a result of land degradation, environmental problems take on a number of negative impacts, particularly developing very intensively in arid regions. Due to the Aral Sea crisis, soil salinization, erosion, sand encroachment, and a reduction in vegetation cover have been observed in the territory of the Republic of Karakalpakstan. To systematically study and monitor this problem, remote sensing technologies—particularly the use of MODIS (Moderate Resolution Imaging Spectroradiometer) data—represent an effective solution.

In the mapping process, QGIS 3.28 software was used, and NDVI and EVI analyses were carried out, as a result of which degraded areas were identified

(Figure 1). The correlation coefficient levels of the districts of the Republic of Karakalpakstan were determined using the Spearman method. According to the table, the degradation levels in Khojayli and Amudarya districts are significantly higher compared to other districts, whereas the indicators of improved lands are considerably better in the Muynak and Kegeyli districts (Table 1).

Table 1

The levels are presented as determined using the Spearman correlation coefficient calculation method

Districts of the Republic of Karakalpakstan	Temperature °C	Precipitation (mm)	Degraded lands %	Restored lands %
Amudarya	4	14	13	3
Beruniy	3	12	9	6
Qonlikol	13	6	8	7
Qaraozek	7	5	6	8
Kegeyli	11	3	1	13
Qongirot	10	4	2	12
Muynaq	14	1	3	14
Nukus	8	9	4	11
Takhtakupir	5	7	5	10
Tortkol	1	8	11	9
Khojayli	6	13	14	1
Chimbay	12	2	7	4
Shumanay	9	10	12	2
Ellikkala	2	11	10	5

Table 2

Spearman correlation coefficient

Indices	Temperature °C	Precipitation (mm)	Degraded lands %	Restored lands %
Temperature °C	1			
Precipitation (mm)	0,055944	1		
Degraded lands %	-0,46154	0,307692	1	
Restored lands %	0,475524	0,083916	-0,75524	1

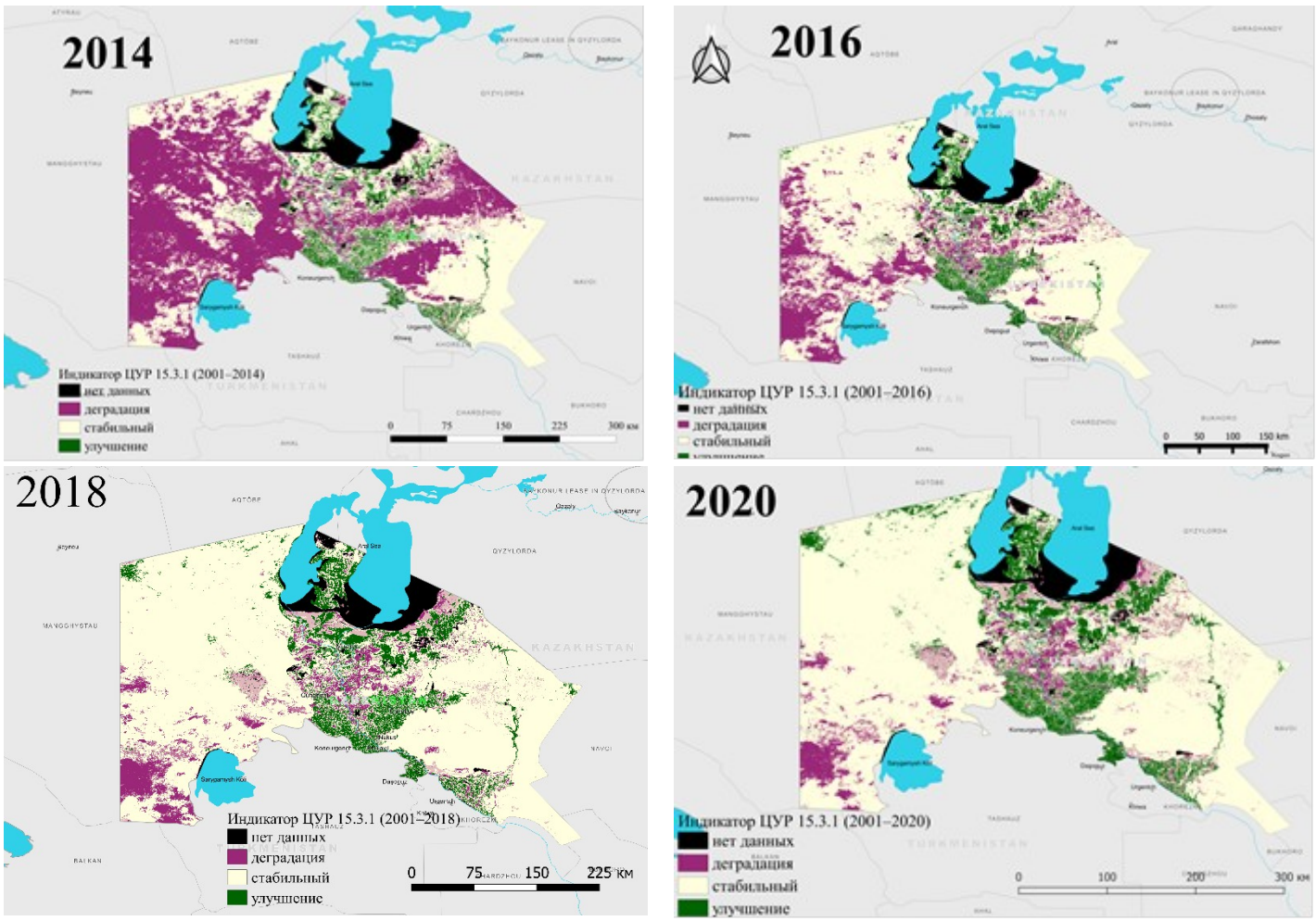

Fig 1. Map Showing Degraded Areas in the Republic of Karakalpakstan

The results obtained indicate the following:

The results showed that in 2014, due to high precipitation and elevated air temperatures, the level of soil salinization increased significantly. During the period from 2016 to 2018, environmental problems decreased or land conditions were improved through drainage irrigation and crop rotation practices. By 2020, the NDVI values had reached a relatively high level, and lands previously classified as unsuitable for use were reclassified into irrigated and arable land categories.

Recommendations for monitoring land degradation and improving land conditions in the Republic of Karakalpakstan include the following:

- the use of MODIS data, which enables effective identification and monitoring of degraded lands in the territory of Karakalpakstan;

- strengthening land reclamation (melioration) measures in degraded areas;
- establishing artificial forest plantations and applying bioremediation methods;
- integrating remote sensing results with local environmental programs.

In conclusion, the mapping of degraded lands in the Republic of Karakalpakstan using MODIS metadata at two-year intervals demonstrates that the implementation of the above-mentioned recommendations and effective land improvement measures can help prevent land degradation across the entire territory of Uzbekistan and enable the reintegration of previously unusable lands into productive use.

I consider the use of geoinformation technologies to be highly beneficial for assessing the dynamics of land degradation and for the systematic study of environmental problems.

References

1. Reymov P.R., Khudaybergenov Ya.G., Kannazarov Z.U, Amandurdiyev D.У “Use of geoinformation technologies in determining soil salinity”, Экономика и социум, №4(119) 2024.

2. R. Boymurodov, M. Matchanov, Q. Tajiyev, D. Amandurdiyev, A. Mansourian, A. Ashurov, “Monitoring land use and land cover (LULC) in the Khorezm oasis using the Esri Sentinel-2 Land Cover Explorer database”, E3S Web of Conferences 590, 04001 (2024), https://doi.org/10.1051/e3sconf/202459004001

3. Матчанов М., Абдиреймов С., Сейткасимова А., Турсынов М., Амандурдиев Д. “Ўрмон ёнғинларини гат ва сунъий йўлдошлардан олинган геотасвирлари орқали ўрганиш масалалари”, Xorazm Ma’mun akademiyasi axborotnomasi, 2023-3/1.

4. Худайбергенов, ЯГ; Реймов, ПР; Тайров, БС; Канназаров, ЗУ;“Картографирование и мониторинг озер дельты Амударьи с использованием дистанционного зондирования, и ГИС Технологий”,

Экономика и социум,12 (115) -1,1511-1516,2023, ООО «Институт управления и социально-экономического развития».

5. Реймов П. Р. и др. НЕКОТОРЫЕ ВОПРОСЫ ГЕОИНФОРМАЦИОННОГО ОБЕСПЕЧЕНИЯ АГРОКЛИМАТИЧЕСКОГО РАЙОНИРОВАНИЯ ПРИАРАЛЬЯ С УЧЕТОМ ГЕОЭКОЛОГИЧЕСКИХ ОСОБЕННОСТЕЙ //Таҳрир ҳайъати.

6. Metternicht G. I., Zinck J. A. Remote sensing of soil salinity: potentials and constraints //Remote sensing of environment. – 2003. – Т. 85. – №. 1. – С. 1-20.

7. Corwin D. L. Climate change impacts on soil salinity in agricultural areas //European Journal of Soil Science. – 2021. – Т. 72. – №. 2. – С. 842-862.

8. Ivushkin K. et al. Global mapping of soil salinity change //Remote sensing of environment. – 2019. – Т. 231. – С. 111260.

9. Prăvălie, Remus, et al. "A unifying modelling of multiple land degradation pathways in Europe." *Nature Communications* 15.1 (2024): 3862.

10. Prăvălie, R., Borrelli, P., Panagos, P., Ballabio, C., Lugato, E., Chappell, A., ... & Birsan, M. V. (2024). A unifying modelling of multiple land degradation pathways in Europe. *Nature Communications*, *15*(1), 3862.

11.NASA MODIS Data Products: Overview and Applications. https://modis.gsfc.nasa.gov