

USE OF REMOTE SENSING FOR ASSESSMENT AND MAPPING DESERTIFICATION ON A REGIONAL LEVEL

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Abstract

Desertification maps on their scales are divided into four classes : large scale (1 : 100,000 and larger), medium scale (1 : 250,000-1 : 500,000), small scale (1 : 1,000,000-1:2,500,000), very smallscale (1:5,000,000 and smaller).

Desertification maps contain information on types of land degradation, desertification classes, desertification aspects and other criteria dealing with assessment of land degradation. A set of desertification criteria has been developed on the basis of regional approach for Central Asia. They include quantitative data on biological productivity, wind and water erosion, soil salinization, human pressure on environment etc.

Methodology of mapping includes field study, photo interpretation of aerial and space photos, reconnaissance from helicopter and literature survey. Combination of these methods depends upon map scale and general specification of project.

Methodology was tested in Central Asia, Mongolia, Libya and Mali.

Key words : Desertification, Vegetation, Erosion, Land use/cover, Photo interpretation.

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UN Convention to Combat Desertification (CCD) considers desertification as a process of global dimension (United Nations Convention, 1994). More than 100 countries of the world with population of 250 million are affected by desertification. CCD promotes several new approaches in desertification control. Creation of a system of desertification monitoring at

national, regional and global levels is a part of these activities. Use of new technologies, in particular remote sensing and GIS could provide politicians, decision makers and planners with operative information on desertification status within countries and regions.

Our practical experience includes use of remote sensing for thematic mapping in Central Asia, Mongolia, Libya and Mali (N.G.Kharin et al., 1991, N.G.Kharin, 1991, N.G.Kharin et al., 1994).

Various concepts and methodologies are used for assessment and mapping desertification. Desertification maps (maps of land degradation) can be compiled at different scales (large, medium, small and very small). Criteria for the assessment of desertification could be regional, subregional, national and local. Above that, in different regions desertification process has its own features depending on physical environment and socio - economic conditions. Is it possible to develop a standard methodology for the assessment and mapping desertification ?

Our practical activity on desertification mapping testifies to the possibility of realization of this idea on a regional level.

Classification of desertification maps. The main types of land degradation are the following : degradation of the vegetative cover, wind and water erosion, salinization of irrigated farmlands, soil crusting and compaction, technogenic desertification, zoogenic desertification. In Central Asia to them belong : waterlogging of desert rangelands and soil salinization due to drop of the Aral Sea level.

Maps of land degradation are divided into four classes depending upon their scales :

- large scale maps (1 : 100 000 and larger)
- medium scale maps (1 : 250 000 - 1 : 500 000)
- small scale maps (1 : 1000 000 - 1 : 2500 000)
- very small scale maps (1 : 5000 000 and smaller)

Zero level of assessment. Different scales of rating can be used by the assessment of desertification :

Possible scales of assessment				
Without changes	Slight	Moderate	Severe	Very severe
Zero level	Slight	Moderate	Severe	
	Slight	Moderate	Severe	

Five point rating is used when a zero level is unknown and a status of desert environment at definite time is taken as a zero level. Four point rating is used when a zero level is known. The three point rating could be used when reliable data on a zero level are absent, the map scale is very small and the territory to be mapped is very large.

Desertification criteria. A set of criteria was used by the assessment of desertification conducted by the author in Central Asia. These criteria could be used as a basis for further development of the assessment methods in desertification study in other countries of Asia.

Table 2
Criteria for the assessment of desertification

S c a l e s			
Large	Medium	Small	Very small

Degradation of the vegetative cover

Change of species composition, plant cover, loss of biological productivity in absolute figures	Change of dominants and subdominants, plant cover, loss of biological productivity in absolute figures	Change of dominants, dynamics of plant communities, plant cover, loss of biological productivities, %	Dynamics of plant cover, loss of biological productivity, %, per cent of nude soil
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Wind erosion

Sod cover, %, ratio of shrub and herb cover, area covered with barchans and deflation hollows, volume of soil blown out, MT/year	Per cent of area covered with moving sands, per cent of area covered with vegetation, volume of soil blown out, MT/year	Per cent of area covered with moving sands, per cent of area covered with vegetation	Per cent of area covered with moving sands
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Water erosion

Type of erosion, number of gullies per 1 km, loss of top soil, cm, depth of gullies	Type of erosion, loss of top soil, %, per cent of area covered with gullies, vegetative cover, %	Type of erosion, per cent of eroded area, vegetative cover, %	Type of erosion, per cent of eroded area
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Salinization of irrigated farmlands

Type of salinization, dense residue, g/l, toxic salt content, location of salt layers in soil profile, new soil formations, loss of yield of agricultural crops MT/ha, seasonal salt accumulation MT/ha	Type of salinization, dense residue g/l, toxic salt content, loss of yield of agricultural crops MT/ha,	Type of salinization, dense residue g/l, loss of yield of agricultural crops, %	Type of salinization, loss of yield of agricultural crops, %

Methodology of mapping could vary depending on the map scale. Sources of information are given in table 3. Panchromatic photos were used by desertification study in Central Asian deserts because of the higher optical contrast of landscape features in the visible spectral band. False colour and infrared films gave better results by interpretation of cultural landscapes and vegetation of river valleys. NDVI was used by desertification study in Mali.

Table 3

Map scales	Sources of information						
	Field survey work	Selected field work	Aerial photos	Space photos	Thematic maps	Literature	Reconnaissance from helicopter
Large	+		+				
Medium		+	+	+	+		+
Small		+		+	+	+	+
Very small				+	+	+	+

Desertification monitoring. Decision makers and managers need information on dryland status in each country. The transfer of information from sectorial sources to decision makers is a continuing ongoing process. The problem can be solved by application of remote sensing and other modern technologies.

To realize this idea a Desertification Monitoring Network (DMN) should be established. Countries signed the CCD will set up National Monitoring Centres (NMC). For example, National Action Programme to Combat Desertification in Turkmenistan (1996) envisages setting up NMC which will be responsible for collection, processing and distribution of information about land degradation. Remote sensing will play an important role in activity of NMC. Desertification maps will be compiled annually on the basis of low resolution imagery. High resolution space photos will also be used for mapping selective key areas.

DMC will function if a standard methodology is developed. The main guidelines of this methodology should include :

- Criteria of assessment
- Standard scale of maps
- Standard format and content of reports
- Standard data sets
- Standard hardware and software
- Standard format of database.

A methodology proposed by N.G. Kharin et al (1990) could be used as a basis for setting up NMC in countries of Asia. These NMCs will function in the frame of joint DMN.

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