MONITORING OF ANTHROPOGENIC CHANGES IN DESERT VEGETATION

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Turkmenistan is a country of deserts. More then 90% of its terrotiry belongs to the Karakum desert. Adverse human activity (tree and shrub cutting, overgrazing, overirrigation etc.) is the main cause of land degradation (desertification) in Turkmenistan. Severely degraded lands occupy some 6% of its territory, moderately degraded lands I6%. (N.G. Kharin, G. S. Kalenov, V.A.Kurochkin, I993). Economic losses from desertification are given in Table I. Economic losses total 34.875.8 thou american dollar, that makes about 3% of the national income.

Desertification is a problem of global extent. As known more than I00 countries of the world have signed the International Convention to Combat Desertification (ICCD). National Action Programme to Combat Desertification (NAPCD) has been elaborated in Turkmenistan (A.G.Babaev, N.G.Kharin, I995). Now national institutions of many countries are developing an instrument of observance of the ICCD at national level.

NACCD in Turkmenistan includes the proposal on desertification monitoring. National Monitoring Centre (NMC) is to be established. NMC will summerize and process all information collected by monitoring stations located in many points of the country. According to the recommendations of the International Negotiating Committee for a Convention to Combat Desertification (INCD) monitoring must include the following data sets :

Minimum data sets

Climate variables : albedo, rainfall, air temperature, air humidity, wind velocity, dust storms,

Soil and water variables : ground water, major surfase waters, wind erosion, water erosion, soil salinization, waterlogging,

Vegetation variables : plant species composition, woody biomass, fod-

Table I

Annual economic losses from desertification in Turkmenistan

Name of losses	Sum thou american dollar
Direct losses (income foregone)	
A. Losses in animal production	I60.6
B. Losses in agricultural production	II27I3.7
Total A + B	II2874.3
Indirect losses	
C. Expences on rehabilitation od desert rangelands	I56780.0
D. Expences on rehabilitation of irrigated farm lands	64727.9
E. Expences on regeneration of forests	768.9
F. Expences on stabilization of moving sands	II724.7
Total C + D + E + F	23400I.5
TOTAL A + B + C + D + E + F	346875.8

der biomass, disappeared plant and animal species,

Land - use variables : land use system, land tenure system, change in land use, structure of sown areas, yield of major staple crops, composition and number of live - stock, animal pressure,

Socio - economic variables : human population, population changes, infant and adult mortality rates, length of life, human disease status, per capita income, income distribution, sources of income, market prices of key food stuffs, energy availability and prices.

Vegetation monitoring is based on ground observations and interpretation of space (or aerial) photos. Combination of ground observations and remote sensing could give the best results in study of anthropogenic changes in desert vegetation.

NMC will prepare small scale (I :2500000) desertification maps covering the whole territory of Turkmenistan. This map will register annual changes in desert ecosystems occured by the human impact. Above that maps of larger scales (I : I00000 - I : 500000) will cover the country where desertification process is especially intensive. Criteria for assessment of the vegetative cover degradation are given in Table 2.

The quality and quantity of information extracted from aerial and space photos depends on proper selection of spectral bands and seasons of photography. Our recommendations on this topic are given in Table 3. These recommendations are based on spectral reflectance study in the field.

Desert landscapes are characterized by low optical contrasts during the whole year. Spring is the best season of space photography in the desert. Phenological indicators of the optimal season are as follows :

I). The beginning of photography is marked by growth of Haloxylon persicum,

2). The end of growth of Carex physodes indicates the end of this period.

The second period of space (aerial) photography is confined to

Table 2

Criteria for assessment of the vegetative cover degradation

Assessment factors	Class limits		
	Slight	Moderate	Severe
I. Characteristics of plant communities	Climax or slightly changed communities	Long-existing secondary communities	Ephemeral secondary communities
2. Reduction in productivity, %	<30	30 - 70	>70
3. Reduction in composition of climax species,%	<25	25 - 50	>50
4. Reduction in plant cover,%	<25	25-50	>50

Table 3

Optimal seasons and spectral bands of aerial and space photography for vegetation monitoring in Turkmenistan

Regions	Seasons	Spectral bands, nm
Karakum desert	20.03 - 20.04	400 - 525 600 - 675
	20.09 - 30.I0	600 - 675
Foothill country	05.04 - 25.04	400 - 500 625 - 675
Agricultural oases	I5.05 - 30.05	600 - 650 700 - 800
	0I.I0 - 30,I0	500 - 550 700 - 800

autumn. The indicators are as follows :
I). Ripening of seeds of Haloxylon persicum indicates the beginning of the optimal period,
2). Fall of seeds of the same species indicates the end of this period.

Vegetation of foothill country is richer in plant composition and abandance, to be comperes with desert. The most contrast period of space photography in spring is marked by the following indicators:
I). The beginning-by flowering of Roemeria refracta,
2). The end-by drying up of Carex pachystylis.

Agricultural oases have cultural vegetation with dense cover because the land is irrigated. Under these conditions near infrared spectral band is more useful for interpretation of vegetation. Two optimal seasons of space photography have been selected - spring and autumn. The optimal spring period is marked by the following indicators :
I). The beginning - by milk stage of ripening of barley,
2). The end - by full ripening of wheat.

The autumn period is marked by the following indicators :
I). The beginning - by opening of cotton bolls,
2). The end - by leaf fall of Armeniaca vulgaris.

NMC will built up a database on desertification. Database on desertification has been developed by N. G. Kharin et al.(I990). It includes the following blocks :

Desertification causes (climatic criteria and anthropogenic factors including all aspects of human impact on desert environment).

Desertificarion status (Data on areas and intensity of land degradation, including soil degradation, water use, change of biodiversity etc).

Social and economic response (sanitary conditions, diseases, migration, length of life, birth rate, income, use of water, market prices on main food - stuff etc.).

Measures to combat desertification (land improvement, efficiency of realization of NAPCD, forecast of desertification).

All countries signed the ICCD will coordinate their activities on desertification monitoring. This coordination will include several levels : subregional (e.g. countries of Central Asia), regional (all countries of Asia), and global (all countries of the world affected by desertification). So our proposals giving in the paper could be used for development of a standard methodology of desertification monitoring.

Referencies.

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