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MAPPING AND TREATMENT OF LAND SUBJECT TO EROSION IN SEMIARID REGIONS

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Contents

Executive Summary

The purposes of the present project were:

1. The use of landscape-phytoindication method of evaluation and mapping of stony land subject to sheet erosion in Kazakstan.

2. Training Kazakstani specialists in the field of specific decoding of aerial photographs with a view to discovering areas affected by sheet erosion within Central Kazakstan Upland.

3. Jointly with Kazakstani specialists elaboration under field conditions a set of phytoindication and soil criteria for distinguishing sheet erosion on various types of soil forming rocks.

4. Jointly with Kazakstani specialists carring out a special large-scale (1:25,000) selective soil survey linked with a comprehensive geobotanical survey in a sample area of Central Kazakstan Upland, with the area of 17,500 ha.

5. Training Kazakstani specialists in the method of compiling a series of applied maps using G.I.S.:

a) in Kazakstan: on the basis of the computer hardware of the Laboratory of Geobotan Institute of Botany and Phytointroduction, the Academy of Sciences of Kazakstan;

b) in Israel: on the basis of the computer hardware of Soil Conservation and Drainage Division, Ministry of Agriculture of Israel.

6. Organization in Israel by the Ministry of Agriculture and by the Keren Kayemeth le Israel professional excursions for Kazakstani specialists with a view to teaching them the methods of stony land protection and management used in various regions of Israel.

7. The compilation of a map of sheet erosion and a map of soils conservation measures in the sample area of Central Kazakstan Upland on the basis of field material gathered by the use of the landscape-phytoindication mehtod and G.I.S.

8. Writing the methodology "Method of Mapping and Treatment of Stony Land Subject to Erosion in Semiarid Regions" with intent for use:

a) in Kazakstan;
b) in other semiarid regions of the world on the basis of the criteria being in accordance with local agroecological conditions and in the framework of the principles developed by the present project.

Research Objectives

There is an abundance of pastures on stony lands in the semiarid regions of the earth, including the hillocky areas of Central Kazakstan Upland (51 million ha). The overgrazing of Kazakstan's stony uplands in recent decades caused by continuous ploughing of the adjacent plains, has brought about an intensification of sheet erosion processes: over 60% of the stony lands in Kazakstan are affected by erosion. The acceleration of the sheet erosion processes has resulted in the disturbance of the natural soil cover and the reduction of soil fertility and fodder yield of pasture lands. The eroded pasture lands, in their turn, began to exert negative influence on the adjacent ploughed plains. In the meantime, modern experience in the evaluation of sheet erosion does not duly include pastures on the stony lands. This is why the problem of evaluation and mapping of the degree of sheet erosion of the stony lands with a view to their improvement and management has been and remains urgent. The present study is devoted to the solution of this problem.

The landscape-phytoindication method in combination with large-scale mapping was chosen as the basis for the evaluation of the stony lands disturbance due to sheet erosion. This method makes it possible to substitute the comprehensive soil survey usually carried out in such cases with a selected soil survey linked with a comprehensive special geobotanical survey.

The project has the following innovative aspects: to determine the degree of sheet erosion, stages of the vegetation cover development, the degree of pasture degradation, and the peculiarities of the life forms and types of plants root systems were taken into consideration in parallel with the generally accepted soil-geomorphological indicators. The said approach helped to define seven degrees of stony lands sheet erosion. Specific sets of measures have been developed for each degree of sheet erosion with a view to measures for land conservation and management of eroded soils. A principal scheme for the production of maps of eroded stony lands evaluation and management using G.I.S has been developed.

Project results are being used in special works carried out by the Institute of Botany and Phytointroduction Institute of the Academy of Sciences of Kazakstan in the frameworks of the following Kazakstan Goverment programs:

a) National Plan of Actions to Combat Desertification;
b) National Plan of Actions for Protection of Environment;
c) National Program of Natural Resources Management.

The project was supported, from Israel, by Keren Kayemeth le Israel, from Kazakstan, by Institute of Soil Science of Academy of Science and Ministry
of Ecolodgy and Bioresources.

Methods and Results

The data of the Project were collected on the base of landscape-phytoindication method. They are presented in the **"Method for Mapping and Treatment of Stony Land Subject to Erosion in Semiarid Regions"** (see Application).

Impact, Relevance and Technology Transfer

Perfomance of the project helped:
1. To organize analytical and computer processing of original material dealing with the actual ecosystem state of the Central Kazakstan Upland, the material being necessary for both ecological and applied programs of the Kazakstan;
2. To purchase by the Laboratory of Geobotany, Istitute of Botany and Phytointroduction, the Academy of Sciences of Kazakstan three PCs including "Pentium-100" computer with IDRISI-1,2 software and other US produced lincensed computer programs, computer peripherals, a copy machine and a fax modem.
3. To study three Kazakstani specialists to a set of modern measures of control for erosion on stony pastures, improvement and management of these pastures.
4. To study three Kazakstani specialists in Israel to the use of the G.I.S program intended to provide control for stony lands being used in agriculture.

Project Activities/Outputs. List of Meetings

1. 07.05.1995-17.05.1995, Kazakstan.
Visit of V.Kurepin and M.Shapiro (Israel) to Alma-Ata (Kazakstan) for signing a "Research Agreement between Goverment of Israel represented by Head of Department of Soil Conservation and Drainage of The Ministry of Agriculture of Israel and Institute of Botany and Phytointroduction of Kazakstan, National Academy of Sciences", and for conducting a preliminary stage of the Project.

2. 09.06.1996-07.07.1996, Kazakstan.
Visit of V.Kurepin, M.Shapiro and R.Zaidenberg (Israel) to Dzhezkazgan region (Nurtaldy sample area, Central Kazakstan Upland) for conducting a field stage of the Project together with Kazakstani specialists.

3. 05.05.1997-19.05.1997, Israel.
Visit of N.Ogar, E.Rachkovskaya and Y.Yevstifeev (Kazakstan) to Israel for training and study according to the following theme:

a) producting a series of applied maps on the basis of G.I.S-technology;
b) approaches and technologies used in Israel to prevent soil erosion;
c) measures of land conservation and management of stony pastures subjet to erosion in Israel;
d) approaches to irrigation and shallow drainage used in Israel in territories similar to Kazakstan;
e) a set of professional exertions to various parts of Israel, namely Galilee, Golan Heigts, Izrael Valley, hills and foothills of Judea and Samaria, The Cost Plain, The Central and North Negev, The Arava and The Dead Sea.

4. 09.11.1997-18.11.1997, Kazakstan.
Visit of V.Kurepin, M.Shapiro, R.Zaidenberg and T.Svoray (Israel) to Alma-Ata (Kazakstan) for accomplishment of the final stage of the Project.

Project Productivity

The project accomplished all of the goals cited in the Executive Summary.

Future Work

Proposals concerning the continuation of projects similar to the present one have been made by the leadership of the Academy of Sciences of Kazakstan and the Ministry of Ecology and Bioresources opf Kazakstan. An excursion to the Tien Shan foothills region for Israeli specialists participating in the present project was organized by the Ministry of Ecology and Bioresources jointly with the Institute of Botany and Phytointroduction, Academy of Sciences of Kazakstan, in November 1997. The purpose of the excursion consisted in reviewing the foolhills pasture lands affected by a severe erosion and the adjacent ploughed lands for which the problem of scientifically justified measures for fighting against sheet erosion is of utmost importance. One of the plots reviewed by the group during the excursion could be used as a sample area for a future joint poject.

Proposals concerning joint work on a similar theme was also received from the State Agrarian University of Georgia (Tbilisi, Georgia).

In the opinion of the Israeli side, further development and improvement of the landscape-phytoindication method would be promoted by the investigation of the semiarid Mediterranean regions affected by sheet erosion whose agroecological conditions are similar to those prevailing in Israel.

List of Publications

1. V.Kurepin, M.Shapiro, R.Zaidenberg, N.Ogar, Y.Rachkovskaya, Y.Yevstifeyev.
"Estimating and mapping of stony soil disturbance degree in Kazakstan" in Int.Conf."Problems of Antropogenic Soil Formation" issue, Moscow, Russia, 1997, p.130-134.
2. N.Ogar, Y.Rachkovskaya, V.Kurepin, O.Marinich, P.Sadvokasov.
"Changes in steppe vegetation biovariability under the effect of erosion process" in Int.Conf. "Eurasia steppes" issue, Orenburg, Russia, 1997, p.33-34.
3. V.Kurepin,N.Ogar, O.Marinich,Y.Rachkovskaya,P.Sad- vokasov, Y.Yevstifeyev, M.Shapiro, R.Zaidenberg.
" Mapping of natural dynamics of soils and vegetation at dry steppes of hilloky land". Is sent to Int.Conf. "Life of plants in the Central and South-Western Asia", Tashkent, Uzbekistan, 1998.
4. N.Ogar, V.Kurepin, Y.Rachkovskaya, R.Zaidenberg, M.Shapiro, Y.Yevstifeyev.
"Phytoindication method for evaluation of erosion disturbance of stony land in semiarid regions". Is sent to the Journal of the Academy of Science of Russia, Biology dept., Moscow, Russia, 1998.

List of Reports

1. N.Ogar. " Method for evaluation and mapping of erosion disturbance of stony land in semiarid regions of Kazakstan in order to elaborate measures for fighting against desertification". Report at the Republican Meeting organized by the Ministry of Ecology and Bioresources of the Republic of Kazakstan on the occasion of the World Day of Combating Desertification. 17.06.1997. Alma-Ata, Kazakstan.
2. N.Ogar. Results of the Project "Method for Mapping and Treatment of Stony Land Subject to Erosion in Semiarid Regions". Report at the Annual Session of the Biological Sciences Department, Academy of Sciences, the Republic of Kazakstan. 25.12.1997. Alma-Ata, Kazakstan.