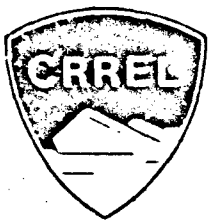


Draft Translation 635
July 1977

WORLD SOIL MAP AT THE SCALE 1:10,000,000

V.A. Kovda and Ye.V. Lobova

CORPS OF ENGINEERS, U.S. ARMY
COLD REGIONS RESEARCH AND ENGINEERING LABORATORY
HANOVER, NEW HAMPSHIRE

Unclassified

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER Draft Translation 635	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) WORLD SOIL MAP AT THE SCALE 1:10000000		5. TYPE OF REPORT & PERIOD COVERED 6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) V.A. Kovda and E.V. Lobova		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS U.S. Army Cold Regions Research and Engineering Laboratory Hanover, New Hampshire		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS		12. REPORT DATE July 1977 13. NUMBER OF PAGES 7
14. MONITORING AGENCY NAME & ADDRESS(if different from Controlling Office)		15. SECURITY CLASS. (of this report) 15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

Approved for public release; distribution unlimited.

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

MAPS
SOIL FORMATION
CRYOZENIC SOILS
CLIMATIC FACTORS

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This map reflects laws governing the distribution of different soil types over the globe.

DD FORM 1 JAN 73 1473 EDITION OF 1 NOV 65 IS OBSOLETE

Unclassified

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

DRAFT TRANSLATION 635

(6)

ENGLISH TITLE: WORLD SOIL MAP AT THE SCALE 1:10000000

FOREIGN TITLE: (POCHVENNAIA KARTA MIRA V MASSHTABE 1:10000000)

(12) 14p.

(10) AUTHOR: V.A. Kovda and V.V. Lobova (Ya.)

(11) Jul 77

(21) SOURCE: Moscow, International Congress of Soil Science 1974, vol. 8, p. 20-26. (USSR) v8 p20-26 1974.

CRREL BIBLIOGRAPHY ACCESSIONING NO.: 31-283

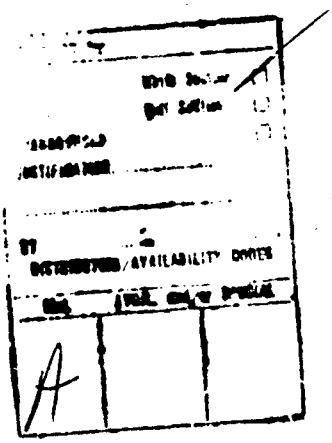
(14) CRREL-TL-635

Translated by U.S. Joint Publication Research Service for U.S. Army Cold Regions Research and Engineering Laboratory, 1977, 7p.

NOTICE

The contents of this publication have been translated as presented in the original text. No attempt has been made to verify the accuracy of any statement contained herein. This translation is published with a minimum of copy editing and graphics preparation in order to expedite the dissemination of information. Requests for additional copies of this document should be addressed to the Defense Documentation Center, Cameron Station, Alexandria, Virginia 22314.

037100 1B



EXPLANATORY MATERIAL PRESENTED FOR WORLD SOIL MAP

Moscow SOILS OF THE WORLD, INT CONGRESS OF SOIL SCIENCE in Russian 1974
Vol 8 pp 20-26

[Article by V. A. Kovda and Ye. V. Lobova,* Institute of Agronomy and Soil Science, AS USSR: "Soil Map of the World on a Scale of 1:10,000,000"]

[Text] The compilation of a world soil map which reflects the laws of distribution of the various soils on the earth is a task which has been accomplished at various times, employing various scales and with varying degrees of accuracy depending on the status and development of information (Table I).

TABLE I Number of Soil Symbols on World Maps

Editors and Compilers	Year of Publication	Scale	Number of Symbols
V. V. Dokuchayev	1889	chart	11
K. D. Glinka	1906	chart	19
K. D. Glinka	1927	1:82,000,000	15
L. I. Prasolov	1937	1:50,000,000	32
I. P. Gerasimov			
Coauthors			
M. A. Glazovskaya, Ye. V. Lobova	1956	1:50,000,000	51
N.N. Rozov, V.M. Fridland	1957	1:75,000,000	44
Z.Yu. Shokal'skaya, Ye. N. Rudneva			
A. A. Yerokhina			
Guy Smith (U.S.)	1960	chart	11
Yu. Tomashevskiy (Poland)	1960	chart	15
N. Florea (Romania)	1964	chart	
R. Ganssen (FRG)	1965	1:80,000,000	98
I. P. Gerasimov and ccauthors (Phys Geog Atlas of the World)	1964	1:60,000,000	95
V.A. Kovda, Ye. V. Lobova and coauthors (IAP [Soil Institute] AS USSR, MGU [Moscow State U])	1974	1:10,000,000	295

*Editor-in-chief V. A. Kovda. Responsible editor Ye V. Lobova. Compilers: V.D. Vasil'yevskay, G. V. Dobrovol'skiy, L. A. Dorokhov, V. A. Kovda, Ye. V. Lobova, N. B. Myakina, B. G. Rozanov, N. N. Rozov, Ye. M. Samoylova, M. N. Stroganova.

The world soil map on a scale of 1:10,000,000, as presented, was compiled on the basis of the contemporary national classifications and medium- and small-scale soil maps. The soil map, as presented, was developed on evolutionary genetic and ecologically genetic principles. The map legend was therefore compiled and is read in several aspects. The most common representatives groups are as follows:

I--Soil formations which are based on the energetics of soil development, i.e. the intensiveness of the weathering associated with climatic and biological factors. The description of the formations includes the overall character of the vegetation, the types of clay formation, the humus formation and the chief soil processes.

II--The evolutionary genetic (stage) soil groups are separated into formation limits; they reflect the stages of soil development.

III--The soil phases conform to both the broad general characteristics within the limits of the formations and to the regional objective influences. The phases combine various soil types with several common symbols.

Analysis of the soil cover of the continents and large regions resulted in the designation of the following 12 formations on the map:

I--Formation [1] of cryogenic neutral and low-acid and saturated soils of the Arctic wastes. Weathering is primarily physical. There is no neosynthesis of clays. The chief processes are frost weathering, permafrost differentiation of the skeleton material, accumulation of fulvous organic matter and ferrous development.

II--Formation[2] of cryogenic subacid and acid tundra soils. Fulvous, drifting humus. Intensive physical and light chemical weathering. Weak neosynthesis of clays. Accumulation of hydroacids of iron and aluminum. Chief processes: cryogenic mass and moisture exchange, gleying and horizontal surface permafrost eluviation.

III--Formation[2] of acid highly frozen or permafrost taiga soils. Light weathering. Hydromicaceous loams. Chief processes: Humus and peat accumulation, swamping, podzolization, gleying and cryogenesis. Boreal cold climate.

IV--Formation[3] of acid and slightly acid forest soils. Weathering of medium intensity. Weak neosynthesis of soils in podzol soils and considerable in brown forest soils. Humus fulvous, drifting, slightly polymerized. Chief processes: podzolization, loess formation, gleying. Boreal moderately cold climate.

V--Formation[4] of neutral or alkaline steppe soils. Humus largely polymerized and closely linked with the mineral portion. Light weathering. Clays of the loam-montmorillonitic group. Chief processes: humus accumulation, ancient and modern carbonization, salt accumulation in the arid regions. Subboreal moderately warm climate.

VI--Formation[5] of neutral and slightly alkaline dry subtropical soils. Weathering of light intensiveness with retention of the primary mineral resources. Modern and residual carbonization. Chief processes: rubefaction, slight polymerization of humus, accumulation of carbonates, varying degrees of salinity. The products of the weathering do not deviate from the structure of soils. Vegetation--dry forests, makvis soil, barren steppes.

VII--Formation [6] of ferrosialic acids and more rarely neutral, moist subtropical soils. Weathering of medium intensity with retention of primary mineral resources. Clay formation encompasses a considerable portion of the structure. No saline accumulation in the larger portion. Chief processes: negligible humus formation with relatively little migration of weathering products. The effect of the residual tropical soil formation is widespread. It is difficult to distinguish the modern soil levels from the older ones. The vegetation consists of extensively cut subtropical forests and brushwood steppes.

VIII--Formation [7] of slightly acid and neutral soils of the dry tropics. Weathering of medium intensity. Humus is ulmicfulvous. No free aluminum. Clays are of the loam-montmorillonitic type. Iron is linked with the clays. Chief processes: slight humus accumulation and clay formation to a small cross-sectional depth. Ferrous development. Occurrence of carbonates. Vegetation is forest savannas and savannas.

IX--Formation [8] of ferrous acid soils under rainy tropical forests and secondary savannas. Humus very mobile, bright and nonpolymerized. Weathering intensive with hydrolisis of the primary minerals, accumulation of hydroacids of aluminum and iron, and neosynthesis of kaolinite. The products of the weathering deviate from the soil structure. Chief processes: erosion and drifting of the foundations, iron and silica. Relative accumulation of gibbsite. "Relative" and "absolute" accumulation of iron. Secondary hydromorphism. Frequent insufficiency of mineral resources. Accumulation of thick weathering crusts.

X--Formation[9] of carbonate saline arid soils. Slight weathering. Intensive gangue effect. Chief processes: carbonization, gypsum accumulation, ferrous development (under dehydration), salt accumulation. Eolian processes are extensively developed.

XI--Formation [10] of volcanic, relatively young soils in periodically regenerating sediments from ashes, tuff and lava. There is a prevalent geochemical loss of drifting weathering and soil formation products. Chief processes: considerable humus accumulation, desiliconization, partial erosion of foundations, neosynthesis of amorphous allophanides and crystallized clay minerals. Soils extend through various climatic zones, which affects the heterogeneity of their characteristics, their leaching and their saturation.

Formation[11] of salty and alkaline soils of the primarily arid and semiarid climate of various thermal zones; this formation is associated with

accumulated and constantly accumulating plains and outcroppings of ancient salty rocks. There is a characteristic modern and recent action of mineralized ground and surface waters. The secondary minerals are extremely diverse because the soil-forming rock is very heterogeneous and the zonal status of the soils encompasses a wide range. In the arid regions there is a prevalence of mineral groups of the loam and montmorillonitic types. Chief processes: accumulation and migration of various salts and formation of solonetz solonchaks and takyrs. Redistribution of residual salts.

The concept of stage development of soils (V. A. Kovda) warrants designating in the legend and on the map the chief growth stages in the development of soil from young to mature. Thus, we distinguish hydromorphous and semihydromorphous soils, paleohydromorphous soils (with traces of residiual hydromorphism) and then relatively young automorphous soils (nonautomorphous) and the oldest soils--paleoautomorphous soils.

The principles we have examined for soil grouping in the map legend respecting formations and stages are based on general objective laws. However, for understanding the reasons for the formation of the soil types, their specific characteristics and their actual distribution on the continents, it would be useful to distinguish the soil phases within the formations.

The phase groupings combine the various soil types with several common characteristics. For example, the steppe soils (the chernozems, the chesnut brown soils and the V formations) are grouped according to three phases: subcontinental European, continental--East European, and strictly continental --Siberian. We know that the chernozems and chesnut brown soils of these phases differ both in salinity and carbonate structure and in extent, type of humus and structure of humus levels. However, within each phase the characteristics are monotypic. The phase differences are determined by the differences in the hydrothermal regime and in some regions also by the paleogeography of the country. Thus, the Mongolian arid soils are nonsaline while the same soils in Central Asia and Kazakhstan are saline; this is due not only to the hydrothermal regime but also to the paleogeography of the locality and the residual salification from the soil-forming rock.

Assigned to a special group[12] are the soils of the mountain regions which include diverse climatic zones and phases. These are regions with a predominance of geochemical loss, erosion and denudation and with slipping of the weathering products and soils along the slopes. The intensiveness of the weathering differs for the vertical zones. The soils are usually detrital. The soil cover is fragmentary. There is considerable exposure effect. On the high-mountain plateaus and on the lowlands between the mountains the soil formation is of a specific character.

In addition to the soils of the mountain regions and the soils combined in a formation, the soil map of the world shows the following three soil groups: 1) ancient soils and crusts which have survived as relics (for example: pelitic soils, laterites and also crusts formed at various times--calcareous and gypseous), 2) undeveloped soils on various rocks, and 3) eolian sands of diverse origin.

In the work on the map the authors tried to carry out the following principles; 1) rational generalization of the existing legends on various soil maps, 2) indicative and accurate (vis-a-vis the scale) representation of the chief and characteristic feature of the world's soils, 3) recording of the natural and agricultural characteristics of the territory, 4) classification of the soils according to their history origin and characteristics. Moreover, the characteristics of the soils must not be examined in arbitrary fashion but must be analyzed as results of the history of complex processes which take place under the overall action of the elements of the geographic environment as evolved in this way: characteristics-->processes-->factors (Gerasimov, Kovda, Ober).

The 1956 and 1964 soil maps of the world and the maps of Africa (1963), Asia (1971) and America (1971) reflected the modern views on the evolution of soils, the zonal distribution and the resulting characteristics of the soils, and the laws governing their development and expansion. They also reflected the successes achieved by the soil scientists of various countries in the concrete study of many soils. The scientists compiled a more detailed classification and produced a description of the most important soil types: the podzol, steppe, desert and tropic soils. Genetic reasons were set forth for the expansion of salty, blended, hydromorphous, gypseous and cultivated soils and the expansion of calcareous, gypseous and lateritic crusts was shown, as were the combination of soils. A great deal of factual information was supplied.

The study of the world's soils and the generalization of the knowledge on the subject have become a tradition of several generations of soil scientists and we regard our work as only a stage in this general process of perception of the world.

Bibliography

I. P. Gerasimov. "The Contemporary Dokuchayev Approach to Soil Classification and its Applications to the Soil Maps of the USSR and the World," POCHVOVEDENIYE [Soil Science], 1964, No 6.

V. A. Kovda and Ye. V. Lobova. "A Soil Map of Asia on a Scale of 1:6,00,000," GUGK [Main Administration of Geodesy and Cartography], Moscow, 1971.

"An Atlas of Physical Geography (FGAM), GUGK, Moscow, 1964.

G. Aubert. "Les Sols Tropicaux VIIIe Congr. Int. de la Sc. des Sols," VI, 1964.

Ph. Duchaufour. "Precis de Pedologie." Masson et Cie, Paris, 1970.

R. Dudal. [English] "Approach to Soil Classification," FAO, Rome, 1968.

R. Dudal. [English] "About the Legend for the FAO/UNESCO Soil Map of the World." Bull. ISSS, 1969a, N 34.

J. L. D'Hoore. "La Carte des Sols d'Afrique," Lagos, 1964.

C. F. Marbout. [English] "Soils of the United States. Atlas of American Agriculture," VIII, 1935.

R. W. Simonson. [English] "General Soil Map of the United States on a Scale of 1:5,000,000," VIIIth Int Congress of Soils, Sc. VI, 1964.

C. G. Stephens. [English] "Soil Map of Australia," Adelaide, 1960.

[English] "World Soil Resources. Reports." FAO/UNESCO, Rome, 1961-1972, NNI-39.

"Soil Map of Canada." Soil Research Institute, 1970.

Summary

The compilation of a soil map of the world is a task which has been accomplished at various times and with varying degrees of accuracy depending on the development of information.

The world soil map on a scale of 1:10,000,000 as presented was compiled on the basis of present-day national classifications and medium- and small-scale soil maps. The world soil map was compiled on evolutionary genetic and ecological genetic principles. In accordance with these principles the map legend distinguishes the following type groups:

I--Geochemical soil formations which are determined by the energetics of soil formation and the chief soil processes.

II--The evolutionary genetic (stage) soil groups which differ according to soil development in the lowlands from young hydromorphous to the more mature soils.

II--The soil phases, which combine various types of soils with several common symbols. The soil characteristics of each phase were analyzed from the standpoint of the bioclimatic and paleogeographic factors of soil formation.

The map as presented on ten sheets is multicolored and contains 295 parts for soil outlines and 70 nonscale symbols indicating the heterogeneity of the soil cover.

FOOTNOTES

1. V. D. Vasil'yevskaya.

2. For the materials of Ye. N. Ivanova, N. A. Nogina and others--G. V. Dobrovol'skiy, N. N. Rozov and M. N. Stroganova.

3. G. V. Dobrovol'skiy, M. N. Stroganova.

4. Ye. V. Lobova, N. N. Rozov, Ye. M. Samoylova.

5. L. A. Dorokhov, Ye. V. Lobova, Ye. M. Samoylova.

6. Ye. V. Lobova.

7. V. A. Kovda. Materials of CCTA, FAO, Orstom, UNESCO.

8. A. A. Kovda, Ye. V. Lobova, B. G. Rozanov. Materials of CCTA.

9. Ye. V. Lobova.

10. V. A. Kovda, B. G. Rozanov.

11. V. A. Kovda.

12. V. A. Kovda.