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The IIASA-LUC Project Georeferenced Database of the Former U.S.S.R. Volume 4: Vegetation.

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Abstract

The IIASA/LUC georeferenced database for the former U.S.S.R. was created within the framework of the project "Modeling Land Use and Land Cover Changes in Europe and Northern Asia" (LUC). For Russia, essential information on relief, soil, vegetation, land cover and use, etc., for routine environmental analysis was lacking when the LUC project started developing the database. In addition, the environmental data on the former U.S.S.R. which were available, occurred in formats (papers, tables, etc.) that in general could not be used with modern information technology, and in particular in model building. In creating the LUC project database, we have established a threefold task:

1) to obtain the relevant information for the LUC project modeling exercises;
2) to develop data which is applicable to modern information technology;
3) to contribute a series of digital databases which could be applied for a number of other specific analyses by the national and international scientific community.

In defining the tasks it was agreed to create a set of digital databases which could be handled by geographic information systems (GIS). The full set of georeferenced digital databases was combined into the LUC project's GIS, using ARC/INFO. However, each individual item (physiography, soil, vegetation, etc.) was created as a separate digital database, allowing each item to be used independently, according to users' needs.

The complete series of the unique georeferenced digital databases for the territory of the former U.S.S.R. is described in the IIASA/LUC volumes:

Volume 1: Physiography (landforms, slope conditions, elevations).
Volume 2: Soil.
Volume 3: Soil degradation status (Russia).
Volume 4: Vegetation.
Volume 5: Land categories.

Volume 6: Agricultural regionalization.

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Special thanks should be also extended to many others scientists and practical specialists who have provided essential data from all over the country for inventory of vegetation and thus made the map compilation possible.

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Introduction

Vegetation is one of the main components of the Earth's surface. There was number of reasons to include it in the project on "Modeling Land-Use and Land-Cover Changes in Europe and Northern Asia" (LUC-project) database. Vegetation is listed in an internationally recognized concept (4) of land which is defined as "*An area of the Earth's solid surface, the characteristics of which embrace all reasonably stable, or predictably cyclic, attributes of the biosphere vertically above or below this area, including those of the atmosphere, the soil and underlying geology, the hydrology, the plant and animal populations, and the results of past and present human activity*".

The plant population has various roles to perform in land-use and land-cover analysis. Natural and artificial vegetation, as the main element of the geobiophysical state of the Earth's surface, plays the principal role in the land-cover concept[1]. The area has been covered by natural vegetation on the Earth's surface differs from 100% (unused land) to at least 20% in the case of intensive agricultural (cropland) areas. As source of wood and herbs, vegetation is the principal component of different land-use practices. It also seems to be the most dynamic component on the Earth's surface, which is particularly sensitive to climate change. In fact, vegetation provides parameters for different specific models like climate circulation (surface roughness, albedo), geochemical cycles (carbon stock, gas emissions) land productivity

[1] Land cover is the geobiophysical state of the Earth's surface shaped by, and relevant to, various kinds of land use and other human activities. (Fischer, et. al., 1995).

(biomass) and many other extremely important characteristics for land-use/cover modeling.

However it should be pointed out, that currently a huge knowledge on present vegetation of the FSU, which is accumulated insight the country, is not accessible. This well known fact can be only partly explained by language constrain. Basically, the problem deals with the lack of international convention on the vegetation classification, variety of definitions, paper format of data storage, etc.

There are few internationally sound efforts to fill this gap. For example the IGBP-DIS Global 1-km Land-Cover project is primarily relying on NOAA AVHRR[2] data. As far as vegetation is concerned, it will be represented besides seventeen broad land-cover classes.

Being aware of these efforts, the LUC-project has contacted with the research groups charged with harmonizing land-use and land-cover classifications. It has helped to establish characteristics of vegetation aiming to be consistent with and useful to the international research community.

The objective of this paper is to introduce the georeferenced digital database on vegetation of the FSU. This volume describes the sources and methodology, which were applied elaborating the database, provides basic attribute definitions and poses technical specification for user.

The authors hope that this innovative digital georeferenced database will be widely used by scientific community in various practical researches. It also will be valuable for educational and other purposes. However the complexity of the initial materials might cause difficulties in using the database in a very complete way. Thus all users comments will be welcomed serving the aim to improve the database output.

[2] National Oceanic and Atmospheric Administration Advanced Very High Resolution Radiometer.

The sources and procedure of the database compilation

Several sources of data were exploited for the database compilation. Mostly, vegetation characteristic (attributive data) came from the legend of the map of vegetation of the FSU (11) and explanatory text. The descriptive characteristics contained in these materials were converted into quantitative ones. However, data which could be derived from the map legend did not fully fit neither the LUC-project goals nor others studies tasks. Therefore an additional set of attributes was distinguished. This data was taken from various articles and reference literature.

The map of vegetation of the FSU is the newest document accumulating both theoretical and practical research in the field of geobotanical mapping of the country. It has been compiled (4) on the basis of regional geobotanical and cartographic materials collected over the last 10-15 years (Baikal-Amur railway region, Amur river basin, European part of the USSR, Caucasus, the southern-west Siberia, Kazakhstan, etc.).

The map is designed to reflect actual vegetation, which is characterized by natural plant communities and their anthropogenic modifications. Potential vegetation is shown for agricultural land with the exception of oases.

Special attention is paid to a structure and dynamics of vegetation. The structure of vegetation reflects a regular combination of plant communities, represented by phytocoenoses and phytocoenochores at different levels of the biosphere aggregation: sub-planetary, regional and topological. Two types of vegetation dynamics, natural and anthropogenic are considered. Using ecological-dynamic sequences in floodplains shows natural vegetation dynamics. Anthropogenic vegetation dynamics is mainly illustrated by terms of primary and secondary vegetation.

A plant species composition (dominant, associated and differentiated species), the relationships between different groups of flora forms, and the formation of plant communities determine topological peculiarities of vegetation.

Ecological-phytocoenotical classification of vegetation has been used.

The higher taxa of the classification is identified by ecobiomorphes of plant communities and latitudinal geographical elements of flora. It allows many types of

vegetation on a large scale to be interpreted (tundra, desert, savanna, etc.). The subzonal subdivision of vegetation has been distinguished on morphological features of communities (stratification, density, etc.), visual composition of communities, their development rhythm, combined with the composition of ecobiomorphes in co-dominant sinusium criteria. The regional botanical-geographical categories are mainly based upon different floristical composition of communities and interrelation of longitudinal elements of flora. Floristical features define the lower taxon. In this case the composition of dominant species or their groups is taken into account to reflect phytocoenotical and ecological-geographical peculiarities of plant communities.

The geometric data was taken from the original map. Mapping units were redrawn on stable material and manually digitized. After entering into the GIS, further processing was done such as changes of projection and scale. The digitized polygons were corrected according to information on coastal lines, water bodies and rivers obtained from the Digital Charts of the World at the scale 1:1M (3). Mapping unit codes were entered in the database and linked to the corresponding polygon labels in the GIS ARC/INFO.

Description of the database attributes

The thematic specific is described by the list of attributes and their definitions. In general form the list of attributes is represented in Table 1.

Table 1. The list of vegetation attributes

No.	Item	Value
1	Community types	1. Dominant communities 2. Associated communities 3. Anthropogenic variants of communities 4. Regional-paleogeographical variants of communities 5. Geographically substituted species and variants
2	Community	
3	Percentage of polygon area	
4	Edaphic variants of communities	
5	Origin, age of communities	1. Primary 2. Secondary
6	Vegetation architecture*	1. Mosses 2. Low shrubs 3. Shrubs 4. Forest 5. Sparse forest 6. Grasses
7	Stratification (layering) of communities	
8	Communities	
9	Species composition in community	
10	Distribution pattern in community	1. Dominants or edificators 2. Codominants 3. Differentiating species or groups of species
11	Type of leaves*	1. Dark coniferous 2. Light coniferous 3. Small-leaved 4. Broad-leaved
12	Phenology*	1. Deciduous 2. Evergreen
13	Albedo*	

* Extended attributes derived from literature sources

Definition of the vegetation attributes

1. Dominant plant communities - are those which prevail in a given mapping unit.

2. Associated plant communities - are those which accompany the dominant ones and are included in the name of a given mapping unit. The area is less than for the dominant plant community.

3. Anthropogenic variants - plant communities of anthopogenic origin. Some types of modified plant communities of anthropogenic origin are considered (including those on agricultural lands): birch and aspen forests, which have appeared for a short period of time, meadow and shrub communities, etc. Anthropogenic dynamics makes it possible to gain an insight into the concept of primary and secondary vegetation. The latter is divided into communities appearing over a long and short periods of time. The database contains the percentage of every anthropogenic variant in any polygon.

4. Regional-paleogeographical variants - plant communities, in which recent or paleogeographical plant interrelations are given to show botanical-geographical boundaries. Besides, there are also stands comprising of relict and endemic plant species. Their percentage within a mapping unit of any variant is indicated.

5. Geographical vicariads - cartographic units to reflect heterogeneity of topological vegetation composition, stipulated by topo-lithological conditions.

   The main categories have been stipulated by climatic and topo-lithological conditions.

6. Edaphic variant of communities - plant communities caused by peculiar features of the habitat (excessive moistening, soil texture, soil salinity, carbonate content, etc.).

7. Mosses - a type of higher spore plants constituted of thallophytes or trunk and leaves.

8. Lichens - lower symbiotic plants, the thallus of which is composed of mycelium and one-celled or colonial algae.

9. Low shrubs - small perennial plants (coppice) with lignified shoots of 5-60 cm high.

10. Shrubs - perennial woody plants of 0.8-6 m high, with trunk diameters up to 7 cm, and having in the adult state no basic trunk.

11. Forest - areas, covered by trees, with trunk diameters of more than 7 cm and a closed canopy of more than 40%.

12. Sparse forest - areas, covered by forest trees with trunk diameters of more than 7 cm and a closed canopy of less than 40%.

13. Grass - life form of annual, biennial and perennial plants with one or several overground non-lignified stalks. Tall herbaceous vegetation is the plant of 80 cm high. Middle herbaceous vegetation - plants of 30 cm high. Low herbaceous vegetation - plants of 10 cm high.

    Tall herbaceous vegetation - *Pranqos pabularia, Ferula uchistanica, F.kokanica, Polygonum coriarium, Ligularia macrophylla, Dactylis glomerata, Bromopsisi inermis, Phleum phleoides*, etc.

    Middle herbaceous vegetation - *Phlomis oreophila, Polygonum nitens, P.hissaricum, Poa pratensis, Pheum phleoides, species Geranium, Allium*, etc.

    Low herbaceous vegetation includes - *Lagotis korolkowii, Geranium saxativle, Allium fedschenkoanum, Festuca alaica, Puccinellia subspicata, Kobresia stenocarpa, K.humilis, K.capilliformis, K.myosureoides, K.smirnovii, Carex melanantha, Alchemilla sibirica*, etc.

14. Stratification (layering) of community - amount of layers in a community. Phytocoenoses are divided in clearly expressed layers or horizons of their above-and underground parts.

15. Dominant species - species abundant in plant communities. Dominants are plant species, which prevail, in larger amounts within the community.

16. Codominants (associated) - plant species, which determine specific communities, are represented by a lesser amount as compared to dominant plants within a definite layer.

17. Differentiating species are those occupying definite geographical areas or differentiated by ecological specific patterns. They help to identify the ecological-geographical peculiarity of vegetation under mapping.

18. Dark coniferous - *spruce, fir, Pinus (cembra) sibirica* forest prevail.

19. Light coniferous - predominant *pine, larch*, etc.

20. Small-leafed - tree species of mesophytic type, which are green in summer, such as different species of *birch* and *aspen.*

21. Broad-leaved - mesophytes: *oak, hornbeam, elm, linden, ashtree*, etc.

22. Albedo - ratio between reflectivity and solar radiation.

Technical specification

General information

Database composes two parts of information, which are associated with a type of vegetation and with a polygon content. The correspondence between vegetation types and polygons data can be found in polygon attribute table (Table 1). It is assumed that few polygons could have the same vegetation type, but there could be only one vegetation type for a single polygon.

Item for a polygon unique number is named by CONTOUR in all data files; item for the main vegetation type has been labeled by CLASS. Relations between files of two parts of database can be found by using these two fields - CONTOUR and CLASS.

Some attributes are described by a character string and have been coded. The code could be used to look up a character value in another table, so code item for each attribute has the same name in all tables (attribute and lookup tables). Some items are repeated in tables for easiest using. A procedure, which merges a few tables, uses a common item.

Files structure includes table names, items names, items description, items types (B - boolean, I - integer, C - character types) and references to look up tables.

Table 2. Structure of polygon attribute table.

Attribute description	*Table name*	*Item name*	*Item type*	*Look up tables*
	SVEGET.PAT			
Standard polygon attributes		AREA		
		PERIMETER		
		SVEGET#		
Unique polygon number		SVEGET-ID	I	

Aggregation of vegetation		VLAD_CLASS		
Unique polygon number (the same as SVEGET_ID)		CONTOUR	B	
Vegetation type code		CLASS	I	VEG

Description of vegetation types

Each vegetation type is characterized by following information:

- geographycal units (table VEG) which is subdivided into 4 layers:
- the name of vegetation type (table VEG);
- albedo (table VEG);
- the list of geographical vicariads, if exists (table VEG3). The lack of records in table VEG3 for some vegetation types, means the absent of geographical vicariads.

This information is available when using code of vegetation type (item CLASS). The relation between vegetation type (item CLASS) and geographical vicariads (item SUBCL) is one-to-many or no matches.

The vegetation type and its geographical vicariads (items CLASS and SUBCL) is characterized by:

- the list and description of dominant and associated communities (table ASSOC);
- the list and description of species compositions (table VIDCLASS);
- the list of dominant, codominant and differentiating species (tables DOMIN, SODOMIN, DIFFER).
- This information can be related by using both keys CLASS and SUBCL.

The vegetation type and its geographical vicariads can have only one dominant community (table ASSOC, item ASS_ROLE is equal 1). It might have few associated communities (table ASSOC, item ASS_ROLE is equal 2).

The lack of records for some vegetation type and its geographical vicariads in the tables ASSOC (records with the item ASS_ROLE = 2), DOMIN, SODOMIN, DIFFER means the absent of corresponding attributes.

Relation between vegetation type and its geographical vicariads and associated communities (table ASSOC, ASS_ROLE=2), dominant (table DOMIN), codominant (table SODOMIN), differentiating species (table DIFFER) and species compositions (table VIDCLASS) is one-to-many.

Table 3. The list of geographical units combinations (part of the table VEG, items TITLE1, TITLE2, TITLE3, TITLE4):

	TITLE1	*TITLE2*	*TITLE3*	*TITLE4*
1	Polar desert			
2	Tundra	Plain tundra	Arctic tundra	
3	Tundra	Plain tundra	Northern tundra	
4	Tundra	Plain tundra	Southern tundra	
5	Tundra	Alpine tundra		
6	High mountain vegetation (carpet-like meadows, umbelliferous plants, cushion plant formation, elfin and open woodlands)			
7	Dark and light coniferous, broad-leaved forests, open woodlands	Plain forests	Boreal forests and open woodlands	Pre-tundra open woodlands
8	Dark and light coniferous, broad-leaved forests, open woodlands	Plain forests	Boreal forests and open woodlands	North-taiga forests
9	Dark and light coniferous, broad-leaved forests, open woodlands	Plain forests	Boreal forests and open woodlands	Middle-taiga forests
10	Dark and light coniferous, broad-leaved forests, open woodlands	Plain forests	Boreal forests and open woodlands	South-taiga forests
11	Dark and light coniferous, broad-leaved forests, open woodlands	Plain forests	Boreal forests and open woodlands	Subtaiga forests
12	Dark and light coniferous, broad-leaved forests, open woodlands	Plain forests	Steppe forests	
13	Dark and light coniferous, broad-leaved forests, open woodlands	Mountain forests	Boreal forests and open woodlands	Subgoltsy (tundra belt above the timberline) open woodlands
14	Dark and light coniferous, broad-leaved forests, open woodlands	Mountain forests	Boreal forests and open woodlands	Mountain taiga forests
15	Dark and light coniferous, broad-leaved forests, open woodlands	Mountain forests	Dark coniferous forests outside boreal belt	
16	Broad-leaved forests	Plain forests		
17	Broad-leaved forests	Piedmont and mountain forests		
18	Steppes and secondary communities	Plain steppes	Meadow steppes and steppe meadows	

	TITLE1	*TITLE2*	*TITLE3*	*TITLE4*
19	Steppes and secondary communities	Plain steppes	Typical	
20	Steppes and secondary communities	Plain steppes	Desertified steppes	
21	Steppes and secondary communities	Piedmont and mountain steppes		
22	Steppes and secondary communities	High mountain steppes		
23	Deserts	Plain desert	Northern deserts	
24	Deserts	Plain desert	Central deserts	
25	Deserts	Plain desert	Southern deserts	
26	Deserts	Piedmont and mountain deserts		
27	Deserts	High mountain deserts		
28	Communities with ephemere-ephemeroidal cover (savannoides)	Piedmont and mountain		
29	Open woodlands and mountain xerophytic steppe vegetation (phryganoides)	Mountain		
30	Bogs			
31	Shrubbery vegetation			
32	Halophytic vegetation			
33	Ecologo-dynamic sequences of alluvial communities, secondary (antropogenic) meadows and agricultural areas			
34	Production communities and agricultural lands			
35	Bare solonchakous (salt) lakes			
36	Others			

Files structure

Table 4. Part describing vegetation types and geographical vicariads.

Attribute description	*Table name*	*Item name*	*Item type*	*Look up tables*
	VEG			
Geographic units code		TITLE1	I	
Geographic units name		NAME1	C	
Geographic units code		TITLE2	I	
Geographic units name		NAME2	C	
Geographic units code		TITLE3	I	
Geographic units name		NAME3	C	
Geographic units code		TITLE4	I	
Geographic units name		NAME4	C	
Vegetation type code (the same as in PAT item CLASS, the same as in all files of the first part of the database)		**CLASS**	I	
Vegetation type name		NAME	C	
Albedo		ALBEDO	N	
The list of geographical vicariads	**VEG3**			look up table
Vegetation type code (the same as in PAT item CLASS, the same as in all files of the first part of the database)		**CLASS**	I	VEG
Code describing the geographical vicariads		**SUBCL**	I	
Geographical vicariads name		NAME_ SUBCL	C	
The list of communities	**ASSOC**			
Vegetation type code (the same as in PAT item CLASS, the same as in all files of the first part of the database)		**CLASS**	I	VEG
Geographical vicariads codes		**SUBCL**	I	VEG3
Association role 1 - dominant community 2 - associated community		ASS_ROLE	I	
Code describing the community (the list of values is in the table ASSCODE)		ASS_ID	I	ASSCODE
Community name (the same as in the table ASSCODE)		ASS_NAME	C	ASSCODE
Code describing an age of the community (the list of values is in the table		ASS_AGE_ID	I	ASS_AGE

ASS_AGE)				
Attribute description	***Table name***	***Item name***	***Item type***	***Look up tables***
Community age (the same as in the table ASS_AGE)		ASS_AGE	C	ASS_AGE
Code describing the architecture of a vegetation (the list of values is in the table ARH_VEG)		ARH_VEG_ID	I	ARH_VEG
Vegetation architecture (the same as in the table ARH_VEG)		ARH_VEG	C	ARH_VEG
Number of layers of the community		ASS_YRUS	I	
The List of community codes and names	ASSCODE			look up table
Community code (used in the table ASSOC)		ASS_ID	I	
Community name (used in the table ASSOC)		ASS_NAME	C	
Community age codes and names	ASS_AGE		I	look up table
Community age code (used in the table ASSOC)		ASS_AGE_ID	C	
Community age (used in the table ASSOC)		ASS_AGE		
The list of vegetation architecture codes and names	ARH_VEG			look up table
Vegetation architecture code (used in the table ASSOC)		ARH_VEG_ID	I	
Vegetation architecture (used in the table ASSOC)		ARH_VEG	C	
Species composition of community	**VID CLASS**			
Vegetation type code (the same as in the PAT item CLASS, the same as in all files of the first part of the database)		**CLASS**	I	VEG
Geographical vicariads codes (the list of Values is in the table VEG3)		**SUBCL**	I	VEG3
Species composition code (the list of values is in the VIDCODE)		VID_ID	I	VIDCODE
Species composition name (the same as in the table VIDCODE)		VID_NAME	C	VIDCODE
Code of leaves types (the list of values is in the table CODE_LEAF)		LEAF_ID	I	CODE_ LEAF
Types of leaves (the same as in the table CODE_LEAF)		LEAF	C	CODE_ LEAF
Phenology code (the list of values is in		FENOLOG_ID	I	CODE_

the table CODE_FENOLOG)				FENOLOG

Attribute description	*Table name*	*Item name*	*Item type*	*Look up tables*
Phenology name (the same as in the table CODE_FENOLOG)		FENOLOG	C	CODE_ FENOLOG
The list of species composition codes and names	VIDCODE			look up table
Species composition code (used in the table VIDCLASS)		VID_ID	I	
Species composition name (used in the table VIDCLASS)		VID_NAME	C	
The list of leaf types codes and names	CODE_ LEAF			look up table
Code of leaves types (used in the table VIDCODE)		LEAF_ID	I	
Types of leaves (used in the table VIDCODE)		LEAF	C	
The list of phenology codes and names	CODE_ FENOLOG			look up table
Phenology code (used in the table VIDCLASS)		FENOLOG_ID	I	
Phenology name (used in the VIDCLASS)		FENOLOG	C	
The list of dominant species	**DOMIN**			
Vegetation type code (the same as in the PAT item CLASS, the same as in all files of the first part of the database)		**CLASS**	I	VEG
Geographical vicariads code (the same as in the VEG3)		**SUBCL**	I	VEG3
Dominant community name		DOMIN	C	
The list codominants	**SODOMIN**			
Vegetation type code (the same as in the PAT item CLASS, the same as in all files of the first part of the database)		**CLASS**	I	VEG
Geographical vicariads code (the same as in the VEG3)		**SUBCL**	I	VEG3
Codominants name		SODOMIN	C	
Differentiating species	**DIFFER**			
Vegetation type code (the same as in the PAT item CLASS, the same as in all files of the first part of the database)		**CLASS**	I	VEG

Geographical vicariads code (the same as in the VEG3)		**SUBCL**	I	VEG3
Differentiating species name		DIFFER	C	

Description of polygons

This part of the database includes information on vegetation communities by each polygon. It includes:

- main vegetation type (SVEGET.PAT);
- geographical vicariads (table SUBCLASS);
- regional paleographical variants (table MIX);
- edaphic variants (table ADAF);
- antropogenic variants (table ANTROP).

The lack of records for some polygons in tables SUBCLASS, MIX, ADAF, ANTROP means the absent of geographical vicariads, regional paleographical variants, edaphic variants or antropogenic variants.

The relation between polygon description and vegetation type description (two parts of vegetation database) can be achieved by using Polygon Attribute Table (item CLASS) and table SUBCLASS (items CLASS, SUBCL).

The relations between attribute table and tables SUBCLASS, MIX, ADAF, ANTROP can be reached by using unique polygon number (item CONTOUR). These relations are one-to- many or no matches.

Table 5. The list of attributes associated with polygons.

Attributes description	*Table name*	*Item name*	*Item type*	*Look up tables*
Geographical vicariads	**SUB CLASS**			
Unique polygon number (the same as in the PAT item CONTOUR)		CONTOUR	B	
Vegetation type code (the same as in the PAT item CLASS, the same as in all files of the first part of the database)		CLASS	I	
Geographical vicariads code (see table VEG3 including definition of each geographical vicariads)		SUBCL	I	
Percent of area covered by geographical vicariads in a polygon		SUBPR	I	
Regional paleogeographical variants	**MIX**			
Unique number of the polygon (the same as in the PAT item CONTOUR)		CONTOUR	B	
Code describing the regional paleogeographical variants (the list of values for this item is in the table CODE_MIX)		MIX_ID	I	CODE_ MIX
Code describing the aggregation of regional paleogeographical variants (the list of values for this item is in the table CODE_MIX0)		MIX0_ID	I	CODE_ MIX0
Name of regional paleogeographical variants (the same as in the table CODE_MIX)		MIX	C	CODE_ MIX
Name of aggregation of regional paleogeographical variants		MIX0	C	CODE_ MIX0
Percent of area covered by regional paleogeographical variants		MIX_PR	I	
The list of regional paleographical variants	CODE_ MIX			look up table
Code describing the aggregation of regional paleogeographical variants (the same as in the table MIX)		MIX_ID	I	
Name of regional paleogeographical variants (the same as in table MIX)		MIX	C	
The list of aggregated regional paleogeographical variants	CODE_ MIX0			look up table
Regional paleogeographical variants - code (the same as in the table MIX)		MIX0_ID		

Attributes description	*Table name*	*Item name*	*Item type*	*Look up tables*
Name of aggregated regional paleogeographical variants		MIX0		
Edaphic variants of associations	**ADAF**			
Unique polygon number (the same as in the PAT item CONTOUR)		CONTOUR	B	
Code describing the edaphic variants (the list of values for this item is in the table CODE_ADAF)		ADAF_ID	I	CODE_ ADAF
Name of edaphic variants		ADAF	C	CODE_ ADAF
Percent of area covered by edaphic variants		ADAF_PR	I	
The list of edaphic variants	CODE_ ADAF			look up table
Code describing the edaphic variants (the same as in the table ADAF)		ADAF_ID	I	
Name of edaphic variants		ADAF	C	
Anthropogenic variants	**ANTROP**			
Unique polygon number (the same as in the PAT item CONTOUR)		CONTOUR	B	
Code describing the anthropogenic variants (list of values for this item is in the table CODE_ANTROP)		ANTROP_ ID	I	CODE_ ANTROP
Name of anthropogenic variants		ANTROP	C	CODE_ ANTROP
Percent of area covered by anthropogenic variants in a poligon		ANTROP_ PR	I	
The list of antropogenic variants	CODE_ ANTROP			Look up table
Code describing the anthropogenic variants (used in the table ANTROP)		ANTROP_ ID	I	
Name of anthropogenic variants (used in the ANTROP)		ANTROP	C	

Table 6. The list of attributes linked with a polygon (without codes and contents of look up tables).

	Attributes	*Table name*	*Item name*	*Item type*	*Look up tables*
0	Unique polygon number (the same as SVEGET_ID)	SVEGET.PAT	CONTOUR	B	
1.1	Vegetation type code	SVEGET.PAT	CLASS	I	VEG
	VEGETATION TYPE DESCRIPTION				
1.2	Geographic units description (4 layers)	VEG	TITLE1,TITLE2, TITLE3,TITLE4	I	
1.3	Vegetation type name	VEG	NAME	C	
1.4	Albedo	VEG	ALBEDO	N	
1.5	Geographical vicariads list	VEG3	NAME_SUBCL	C	look up table
	INFORMATION LINKED WITH VEGETATION TYPE AND GEOGRAPHICAL VICARIADS				
1.6	Dominant community (ASS_ROLE=1)	ASSOC	ASS_NAME	C	ASSCODE
1.6.1	Community age	ASSOC	ASS_AGE	C	ASS_AGE
1.6.2	Vegetation architecture	ASSOC	ARH_VEG	C	ARH_VEG
1.6.3	Number of layers of the community	ASSOC	ASS_YRUS	I	
1.7	Associated communities (ASS_ROLE=2)	ASSOC	ASS_NAME	C	ASSCODE
1.7.1	Community age	ASSOC	ASS_AGE	C	ASS_AGE
1.7.2	Vegetation architecture	ASSOC	ARH_VEG	C	ARH_VEG
1.7.3	Number of layers of the community	ASSOC	ASS_YRUS	I	
1.8	Species composition of community	VIDCLASS	VID_NAME	C	VIDCODE
1.8.1	Types of leaves	VIDCLASS	LEAF	C	CODE_LEAF
1.8.2	Phenology name	VIDCLASS	FENOLOG	C	CODE_FENOLOG
1.9	Dominant species	DOMIN	DOMIN	C	

1.10	Codominants species	SODOMIN	SODOMIN	C	
	Attributes	***Table name***	***Item name***	***Item type***	***Look up tables***
1.11	Differentiating species	DIFFER	DIFFER	C	
	INFORMATION FOR EACH MAP POLYGON				
2.1.1	Geographical vicariads	SUBCLASS	SUBCL	I	
2.1.2	Percent of area covered by geographical vicariades in a polygon	SUBCLASS	SUBPR	I	
2.2.1	Regional paleogeographical variants	MIX	MIX	C	CODE_ MIX
2.2.2	Aggregation of regional paleogeographical variants	MIX	MIX0	C	CODE_ MIX0
2.2.3	Percent of area covered by regional paleogeographical variants in a polygon	MIX	MIX_PR	I	
2.3.1	Edaphic variants of communitiess	ADAF	ADAF	C	CODE_ ADAF
2.3.2	Percent of area covered by edaphic variants in poligon	ADAF	ADAF_PR	I	
2.4.1	Anthropogenic variants	ANTROP	ANTROP	C	CODE_ ANTROP
2.4.2	Percent of area covered by anthropogenic variants in a polygon	ANTROP	ANTROP_ PR	I	

Figure 1. The scheme of the files relation.

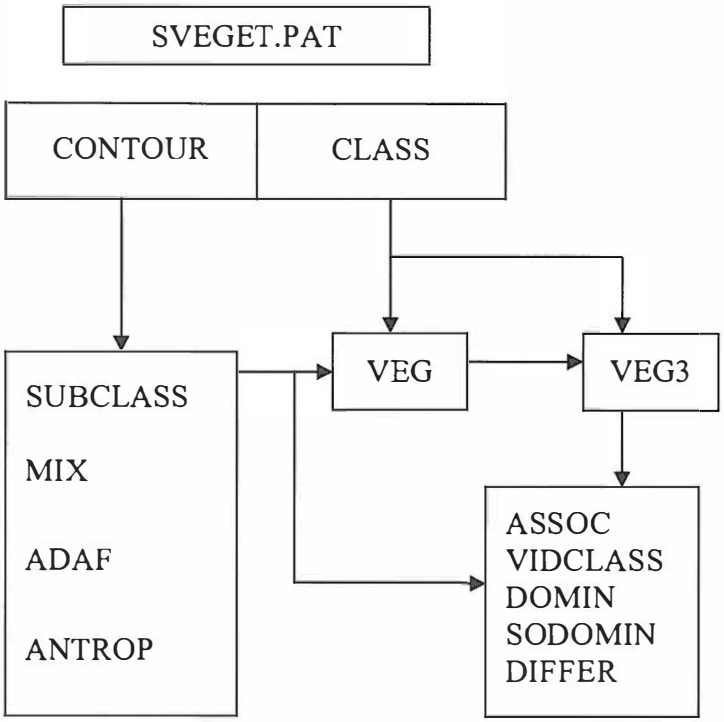
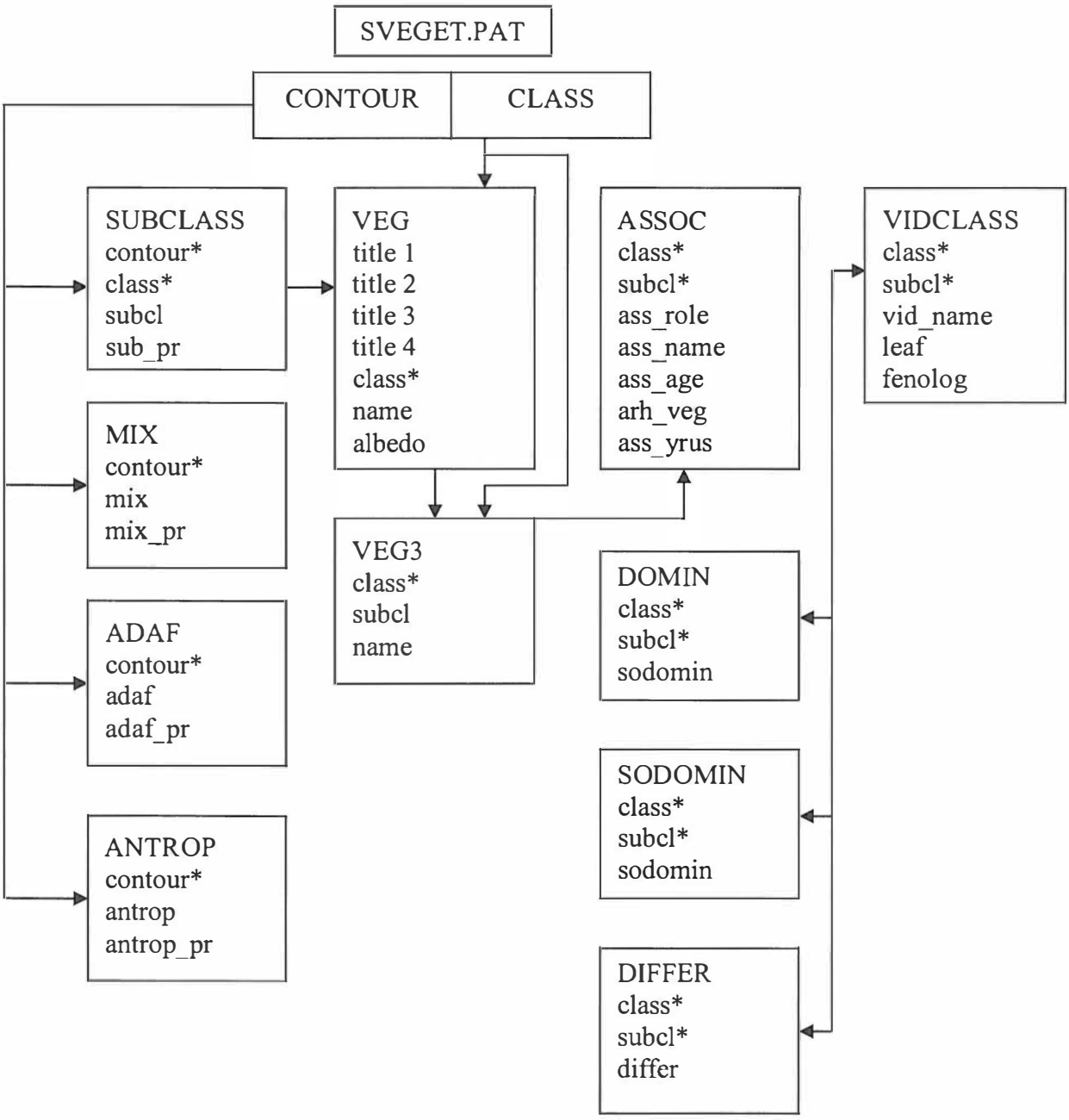


Figure 2. The scheme of files relation with main items (without codes, look up tables)



* key items

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Appendix I.

THE LEGEND OF THE MAP OF VEGETATION OF THE U.S.S.R. AT SCALE 1:4 M

POLAR DESERTS

1. Open (unclosed) aggregations of lichen (*Pertusaria. Ochrolechia*), moss (*Ditrichum flexicaule, Bryum, Pohlia*) and arctic species of flowering plants

TUNDRA

- ***Plain tundra***
- ***Arctic tundra***

2. Grass-moss and low bush-grass-moss

- ***Northern tundra***

3. Grass-moss and low bush-moss with *Carex ensifolia ssp.arctisibirica*, species: *Betula, Salix glauca, S.lanata*

4. Low bush-moss (*Dryas punctata, Cassiope tetragone*, species *Aulacomnium, Tomenthypnum nitens, Hylocomium splendens* var. *alaskanum* with *Betula exilis, Salix pulchra, S.lanata*)

5. Small willow stand (*Salix glauca, S.reptans*)

6. Cotton grass and moss (species *Aulacomnium, Hylocomium splendens* var.*alaskanum, Eriophorum vaginatum*)

- ***Southern tundra***

7. Shrubbery grass-low bush-moss

8. Low bush-cotton grass-moss (*Ledum decumbens, Eriophorum vaginatum*, species: *Sphagnum, Aulacomnium*) together with *Betula exilis, Salix pulchra*, in some places *Duschekia fruticosa*

- ***Alpine tundra***

9. Open (unclosed) aggregations of crustaceous and foliose lichen (species: *Rhizocarpon, Lecanora,Lecidea, Umbilicaria, Gyrophora*), moss (species *Rhacomitrium*), arctic-alpine species of flowering plants

10. Low bush-moss, grass-low bush-moss and lichen (*Novosieversia glacialis*, species *Dryas*)

11. Low bush-lichen and low bush-moss in combination with shrubs and sparse vegetation among rock streams

HIGH MOUNTAIN VEGETATION

(carpet-like meadows, umbelliferous plants, cushion plant formation, elfin and open woodlands)

12. Sparse communities of subnival plants, scree and rock vegetation

13. Herb and carpet-like (alpine) meadows in combination with communities of shrubs (*Rhododendron caucasicum*) and sparse scree and rock vegetation

14. Herb (*Geranium saxatile, Lagotis korolkowii, Festuca alaica*) and short grass meadows in combination with communities of mountain cryoxerophytes

15. Elfin and open woodlands (subalpine)

16. Herb (middle grass) meadows and umbelliferous plants

17. Sedge, *(Cobresia apline)*, herb (short grass) meadows

18. Cushion plant formation of herbs, semi-shrubs and shrubs

DARK AND LIGHT CONIFEROUS, BROAD-LEAVED FORESTS, OPEN WOODLANDS

- ***Plain forests***
- ***Boreal forests and open woodlands***
- ***Pre-tundra open woodlands***

19. Birch forest (*Betula czerepanovii* with *Pinus sylvestris, Picea obovata*) with short grass-low bush and spruce cover

20. Spruce forest (*Picea obovata*) with mosaic low shrub-spruce cover, including

21. Larch forest with low-bush-lichen-grass cover

- ***North-taiga forests***

22. Spruce sparse forest (*Betula nana*) with low bush-lichen-grass undergrowth

23. Larch-spruce-cedar sparse forest (*Pinus sibirica, Picea obovata, Larix sibirica*) with low bush-lichen cover

24. Pine sparse forest with low bush-grass-lichen cover

25. Larch sparse forest with low bush-moss and low bush-lichen cover

- ***Middle-taiga forests***

26. Spruce and fir-spruce forest with low bush-spruce and short grass cover

27. Spruce-cedar and cedar-spruce forest (*Pinus sibirica, Picea obovata*) with grass-low bush-spruce cover

28. Pine forest with low bush-spruce and lichen cover

29. Larch forest

- ***South-taiga forests***

30. Spruce, fir-spruce and spruce-fir forest with mosaic grass-low bush and grass-spruce cover

31. Cedar-spruce-fir forest (*Abies sibirica, Picea obovata, Pinus sibi- rica*) with mosaic short grass-spruce cover

32. Pine (*Pinus sylvestris*) and larch-pine forest with grass-spruce and low bush-lichen-spruce cover

33. Larch (*Larix gmelinii*) and pine-larch forest with low bush-grass cover

- **Sub-taiga forests**

34. Dark coniferous forest with admixture of broad-leaved one (undergrowth and cover of nemorose species), broad-leaved and dark coniferous forest

35. Pine forest (*Pinus sylvestris*) with grass cover, frequently forest with pine and meadow-steppe species (southern bor)

36. Larch forest (*Larix gmelinii*) with *Quercut mongolica, Betula davurica* and other grass species

37. Aspen-birch forest (*Populus tremula, Betula pendula*) with grass cover (*Tilia cordata*) predominated in Pre-Ural region, birch-aspen forest with nemorose species in the region of Kuznetsk Alatau

- ***Steppe forests***

38. Pine forest (*Pinus sylvestris*) with steppe grass cover

39. Aspen-birch and birch-aspen forest with steppe grass cover

- ***Mountain forests***

- ***Boreal forests and open woodlands***

- ***Subgoltsy (tundra belt above the timberline) open woodlands***

40. Dark coniferous forest with low bush-moss-lichen cover

41. Larch forest with low-bush-moss-lichen cover

42. Communities with *Pinus putila* in combination with larch open woodland and tundra

- ***Mountain taiga forests***

43. Cedar-spruce and fir-spruce forest

44. Spruce-fir and cedar-fir forest with grass-low bush cover

45. Cedar and fir-cedar forest (*Pinus sibirica, Abies sibirica , Larix sibirica, Picea obovata*) with low bush-short grass-spruce cover

46. Spruce-fir, cedar-fir, fir-spruce forest with nemorose elements

47. Pine forest (*Pinus sylvestris*)

48. Larch forest

49. Birch forest (*Betula lanata*) with high grass cover

- ***Dark coniferous forests outside boreal belt***

50. Spruce, fir and beech-fir forest (*Picea abies, Abies alba, Fagus sylvatica*), in some places *Pinus cembra , P. mugo, Lonicera nigra*

51. Spruce-fir forest (*Abies nordmanniana, Picea orientalis*) frequently with *Fagus orientalis*

52. Spruce, fir-spruce, aspen-spruce forest in combination with meadows and steppes

53. Pine forest

- ***Broad-leaved forests***
- ***Plain forests***

54. Beech forest (*Fagus sylvatica*) frequently with *Quercus petraea, Carpinus betulus, Acer pseudoplatanus*
55. Oak-hornbeam, hornmeam forest (*Carpinus betulus, Quercus robur*) with *Acer pseudoplatanus, Cerasus aviumm*
56. Oak forest
57. Pine-broad-leaved forest with boreal types in the cover
58. Lime-tree and oak forest
59. Cedar and broad-leaved forest (*Quercus mongolica,Tilia taquetii, Pinus koraiensis*) with ferns and high grasses

- **Piedmont and mountain forests**

60. Beech forest
61. Oak and hornbeam-oak forest
62. Broad-leaved and oak forest
63. Polydominant moist broad-leaved forest
64. Cedar-broad leaved forest (*Quercus mongolica, Betula costata, Pinus koraiensis*) high grassy
65. Walnut and apple-tree forest (*Juglans regia, Malus sieversii*) and walnut-maple forest (*Acer turkestanica, A.semenovii*) in combination with ephemeroids and high grasses in light forests and shrubwoods

STEPPES AND SECONDARY COMMUNITIES

- ***Plain steppes***
- ***Meadow steppes and steppe meadows***

66. Herb-grass and grass-herb (*Festuca valesiaca*, species: *Stipa, Bromopsis, Carex, Helictotrichon, Phleum, Poa, Filifolium sibiricum mesophyye* and xeromesophyte herbs) meadow steppe and steppe meadows in combination with forests (forest-steppe)

- ***Typical***

67. Herb (xeromesophytic herbs) and bunchgrass steppe
68. Herb (mesoxerophytic herbs), bunchgrass and bunchgrass herbs
69. Northern dry bunchgrass and rootstock (rhizome) grasses
70. Southern dry xerophytic herbs and bunchgrasses

- ***Desertified steppes***

71. Northern semi-shrub and bunchgrass steppe
72. Southern semi-shrub and bunchgrass steppe

- **Piedmont and mountain steppes**

73. Meadow and herb-bunchgrass steppe (*Festuca valesiaca*, species: *Stipa, Helictotrichon, Carex, Phleum, mesophytes, xerophytes* and *petrophytes*)

74. Shrub communities (species: *Caragana, Amygdalus, Spiraea, Rosa*) in combination with meadow steppes

75. Herb-bunchgrass and bunchgrasses (species: *Stipa, Koeleriam Festuca valesiaca, mesoxerophytes* and petrophytes) in combination with shrubs

76. Shrubs (*Colophaca soongorica, Caragana pygmaea*) and bunchgrasses (*Stipa capillata, Festuca valesiaca*) in combination with petrophytes

77. Short bunchgrasses (*Agropyron cristatum, Stipa krylovii*)

78. Half-shrub-bunchgrass desertified and desert steppes

79. Ephemeroid-bunchgrasses (*Festuca valesiaca, Bothriochloa ischaemum*, species: *Artemisia, Stipa*, ephemeroids)

- ***High mountain steppes***

80. Mountain xerophytic-bunchgrasses (*Festuca musbelica, Stipa trichoides, Cousinia pannosa*, species *Acantholimon*)

81. Cryophytic herbs and bunchgrasses (*Phlomis oreophila, Ligularia alpigena, Festuca musbelica, F.olgae, Helictotrichon tianschanicum*), in some places with admixture of dwarf-pine wood *Juniperus pseudosabina*

82. Steppes covered by cushion plant formations and brunchgrasses

DESERTS

- ***Plain desert***

- ***Northern deserts***

83. Sagebrush among grasses (*Stipa sareptana*, etc.) in complex with sagebrush and saltwort

84. Saltwort in complex with halophytic sagebrush

85. Meadow grass (*Agropyron fragile*), sandy-sagebrush, meadow-psammophytic shrubs

- **Central deserts**

86. Saltwort in complex with sagebrush

87. Sagebrush with *Haloxylon aphyllum, Artemisia terrae-albae* and *Salsola orientalis*

88. Sandy sagebrush (*Ceratoides papposa*), sammophytic shrubs (species *öalligonum*) with *Haloxylon persium, H.aphyllum*

- **Southern deserts**

89. Saltwort (*Salsola gemmascens, S.orientalis, Anabasis salsa*) in complex with sand sagebrush (*Artemisia kemrudica*)

90. Sagebrush

91. Black-saxaul woodland *Haloxylon aphyllum*, *Salsola orientalis* with *Artemisia kemrudica*

92. Sedge (*Carex physodes*), psammophytic (species: *Calligonum, Ephedra strobilacea, Salsola arbuscula*) shrubs and *Haloxylon*

93. Sedge (*Carex physodes*) - sandy sagebrush and psammophytic shrubs (species: *Calligonum, Ammodendron conollyi, Salsola arbuscula, Ephedra strobilacea*)

- ***Piedmont and mountain deserts***

94. Young and thalloid plants

95. Ephemeroid-sagebrush

96 Ephemeroid-saltwort (*Salsola nodulosa, S.ericoides, S.dendroides, Poa bulbosa, Catabrosella humilis*) and ephemeroid-sagebrush (*Artemisia szowitziana, Poa bulbosa, Catabrosella humilis*)

97. Ephemeroid-feather grass-sagebrush

98. Ephemeroid-psammophytic shrubs (*Haloxylon persicum, Calligonum leucocladum, C.setosum,Astragalus paucijugus, Carex physodes, Poa bulbosa*)

99. Ephemeroid-psammophytic shrubs

100. Dwarf semi-shrubs together with grasses

- ***High mountain deserts***

101. Dwarf semi-shrubs and grass-dwarf semi-shrubs (*Ceratoides papposa, Stipa orientalis, S.glareosa*)

COMMUNITIES WITH EPHEMERE-EPHEMEROIDAL COVER (SAVANNOIDES)

- ***Piedmont and mountain***

102. Mesophytic open woodlands and dwarf shrubs (*Acer turkestanicum, Juniperus seravschanica*, species: *Cotoneaster, Rosa, Lonisera*) with high-grass cover (*Prangos pabularia, Polygonum coriarium, Dactylis glomerata*)

103. Xeromesophytic open woodlands and dwarf shrubs with high-grass cover (*Elytrigia trichophora, Hordeum bulbosum*)

104. Xerophytic open woodlands, dwarf shrubs and dwarf semishrubs with short grass cover (*Poa bulbosa, Carex pachystylis*), in some places high grasses

105. Short grasses and dwarf semishrub-short grasses (*Poa bulbosa, Carex pachystylis,species of Bromus, Artemisia, xerophytic herbs*)

OPEN WOODLANDS AND MOUNTAIN XEROPHYTIC STEPPE VEGETATION (PHRYGANOIDES)

- ***Piedmont and mountain***

106. Juniper open woodland (*Juniperus turkestanica, J.semiglobosa*) with meadow-steppe cover (*Festuca valesiaca, species Stipa, Helictotrichon, Bromopsis, Geranium*) in admixture with mountain xerophytes in combination with steppes and shrub communities

107. Juniper open woodland (*Juniperus polycarpos, J.foetidissima*) with mountain xerophytic steppe cover (*Festuca valesiaca*, species: *Stipa, Acantholimon, Onobrychis, Astragalus*)

108. Juniper open woodland (*Festuca valesiaca, Elytrigia trichophora*, species: *Artemisia, Stipa, Acantholimon, Astracantha*) with ephemeroid-mountain xerophytic steppe cover

109. Mountain xerophytic steppe communities

- ***Bogs***

110. Grass and hypnum grass bogs

111. Grass-sub-shrub-lichen-moss complex polygonal bogs

112. Grass-sub-shrub-lichen-moss palsa bogs

113. Grass-hypnum-sphagnum with ridge-pool aapa

114. Hepatic-lichen-sphagnum high bog with ridge-pools

115. Sphagnum highland bogs with ridge-pools

116. Grass-sphagnum and sub-shrub-grass-sphagnum transitional bogs

117. Wooded swampy fens

- ***Shrubbery vegetation***

118. Shrub communities

- ***Halophytic vegetation***

119. Herb and grass halophytic meadows

120. Ecological sequences of perennial and annual saltworts, halophytic grasses, halophytic semi-shrubs, halophytic shrubs in combination with bare solonchaks

ECOLOGO-DYNAMIC SEQUENCES OF ALLUVIAL COMMUNITIES, SECONDARY (ANTHROPOGENIC) MEADOWS AND AGRICULTURAL AREAS

121. Meadow-bog-shrub sequence with an admixture of willow stand and yernik tundra

122. Sor (*Arctophila fulva, Agrostis stolonifera*), meadow (*Carex aquatilis, Calamagrostis langsdorfii*), small leaved (*Betula pendula*), coniferous sequence

123. Shrub-coniferous sequence

124. Shrub-small leaved (*Populus suaveolens, Chosenia arbutifolia*), coniferous (*Larix gmelinii, Picea obovata*) sequence

125. Shrub-broad leaved-coniferous sequence

126. Shrub-broad leaved forest sequence

127. Shrub-small leaved forest sequence (*Betula pendula, Populus tremula, P.nigra, P.alba*)

128. Halophytic meadow-tugai sequence

129. Shrub-small leaved forests and steppe meadows sequence

130. Meadow sequence

131. Reed brakes in plavni (long time flooded areas with *Phragmites* in river deltas and bottomlands) and lake kettle depressions

132. Reed brakes and halophytic grass meadows in combination with halophytic communities on solonetz soils and solonchaks

PRODUCTION COMMUNITIES AND AGRICULTURAL LANDS

133. Agricultural lands on drained bogs

134. Agricultural lands of old irrigation

BARE SOLONCHAKOUS (SALT) LAKES

135. Bare salt lakes

OTHERS

136. Glaciers

137. Polygons (islands), without color on map, marked as litoral vegetation.