Malenkov R. RESEARCH PALEOLANDSCAPE WOOD-STEPPE OF A PART RIGHT COAST OF DNIEPER WITH USE OF LANDSCAPE METHODS

In the given material is executed attempt to show opportunities, which open for paleolandscapes, young science, which part of the researchers considers (counts) as a direction paleogeography, under condition of its synthesis with modern sciences about landscapes. For demonstration some results of research of landscapes more, which existed in limits wood-steppes of a part the right coast of Dnieper. Research have made with use of the modified techniques of reconstruction of an ancient nature (landscapes), which approved on kaikad paleogeography a stage of late pleistocene. This stage on natural conditions: to a climate (in an optimum stage), soil and vegetative cover, within the limits of researched territory was similar on modern and can present pleistocene as a whole. It (he) began of 175 thousand years back and proceeded of 60 thousand years.

Also in the given material the urgency of a problem of development sciences about paleolandscapes is briefly considered, as independent science, the previous researches on the given subject are analysed, the purpose of research and his (its) some results is stated.

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CTRONIC LANDSCAPE-HISTORICAL ATLAS MOSCOW REGION: METHODOLOGY AND EXPERIENCE OF ITS CREATION

Summary: Landscape-historical atlas generalizes the results of multiyear field landscape-historical and archeological investigation. The objects of large-scale expedition works were main landscapes of Moscow region, as natural and natural-anthropogenic complexes with world famous cultural-historical places (Moscow Kremlin, Borodino, Gorki, Kolomenskoe, Zaricino, etc.)

Three hierarchical level of mapping and analysis of objects within Moscow region are represented in atlas. 1. Moscow region - Small scale (1:1 000 000 - 1:2 500 000). 2. Large districts and Moscow city - Middle scale 1:50-100 000. 3. Mostly detail scale 1:5 000 - 1:10 000 - for key sites.

Electronic atlas consists of natural, historical and application blocks for each
hierarchical levels. The kernel of the natural block means landscape maps. Historical block consists of the maps of landscapes restored for different temporal stages, archeological and historical maps. These maps reflect history of settling and mastering of Moscow region. The large part of maps has been worked out on the landscape base. Application block (assessing and forecasting) contains maps of cultural historical landscapes, outstanding sites, excursion maps, functional zoning, maps for monitoring, etc.

Such atlas is created for performance and exploration of anthropogenic landscape genesis processes due to sets of maps and for decision of modern ecological problems.

Introduction. The Electronic Landscape-Historical Atlas of Moscow region is a combination of a traditional atlas and geographical informational system (GIS), and has two main foundations. The first is a traditional set cartographical maps, collected for specific purposes by certain methodological principles. The second is a GIS with large data bases. The landscape-historical atlas generalizes the results of long-term field landscape historical and archeological investigations, as well as the materials of field, expedition, and office studies, archival data. These are maps (modern, authorial, and archival), verbal descriptions, and tables. The history of man’s mastering of landscapes and the consequences of the interaction dynamics of society and nature in Moscow region are shown in this atlas. Research has been conducted at the Department of Landscape Study and Physical Geography of Geographical Faculty of Moscow State University since the 1970s.

The main goal of the atlas is the investigation of the human impact on landscapes in space and time and the elaboration of methods for anthropogenic landscape genesis’ research. From the initial stage of the formation of society, people have lived in close interaction with nature and concrete landscapes. However, unreasonable actions lead to ecological conflicts, and such conflicts are a great problem for human survival. The investigation of man’s impact on the environment and nature is a key topic of modern science. Traces of these problems were typical for the study area from the initial stage of landscape mastering. For example, in the Bronze Age, over-pasturization of pigs was the cause of deforestation of floodlands in central Russia. In the Iron Age, the development of slash-burn clearing for ploughed fields resulted in secondary aspen and birch forest development. Therefore, spatial and retrospective analysis and mapping are very important for determining the peculiarities of the results of the mutual man-nature influence process, and the historical approach and use of GIS technology are necessary for studying land use changes.

Geographical Scope and Scaling. Natural, man-transformed, and cultural landscapes are shown in the Atlas. The key sites of large-scale field research were natural and natural-anthropogenic landscapes of Moscow region at the world famous cultural-historical places: Moscow Kremlin, Borodino, Gorki Leninskie, Kolomenskoe, Zaricino, the neighborhoods of ancient towns Radonezh and Zvenigorod, Porech’e, Pavlovskay Sloboda, etc. All these key sites have historical importance, a large diversity of natural conditions with a full set of landscape complexes of different hierarchical levels, which are typical for the forest zone of the
Russian plain. These places have been implicated in various economic activities, such as agriculture, forestry, industry, hydropower station, recreation, transport, and others in different historical periods. Therefore, the Atlas shows interesting natural and anthropogenic landscapes, unique historical and archeological monuments, all factors of economical and cultural human activity in concrete landscape conditions.

Three hierarchical levels of mapping and analysis of objects in Moscow region are represented in the atlas.

1. Moscow region, small scale (1:1 000 000 -1:2 500 000). Physical and geographical regions and districts are shown on the landscape map.

2. Large districts of Moscow region, middle scale (1:50-100 000). The physical and geographical localities ("urochisches" in Russian) are shown on the landscape map.

3. Detailed scale (1:5 000 -1:10 000). For key plots (urochisches and suburochisches on the landscape map). For some key sites (neighborhoods of historical and archeological monuments), the scale 1: 2000 was used.

The problems of contour adjustment and results comparison (common for the whole atlas, especially for historical maps, created in different time with various accuracy) are decided based on the landscape.

Methodology. Long standing conjugate landscape and historical investigation, including mapping and reconstruction of natural-territorial complexes, land use, and ecological problems in Moscow region have provided for the special research methods. Natural properties of landscapes have been found. These properties, in some respect, have determined the way of settling and economical mastering of Moscow landscapes. The detailed scheme of the process of anthropogenic landscape genesis for central Russia has been established, and the main stages of the transformation of the landscapes have been specified by the use of historic and diachronic data. The basis of land use analysis and discovery of the first natural-economical system is the reconstruction (by archeological data) of types and methods of land use, as well as paleoreconstruction of initial environment. Such reconstruction is worked out by landscape-edaphic methods, including the hydrotopic estimation of territories. Soil is the component and product of landscape functioning. In the past, paleopedological data is the basis for the paleoreconstruction of land cover and land use. The buried and old arable soils were investigated and diagnostic signs of economical actions were determined. The exploration of soil structure and the combination of layers by means of pedology and paleobotany make it is possible to localize concrete ancient tenures (settlements, arable lands, forests, and meadows). The other interesting method is place-name analysis. Toponymy (place-name study) and landscape-lexicographical analysis provide a look into the history of the landscape. The distribution of place-name data by natural complexes shows their connection with the landscape and land use features. Therefore, the evolution of interrelations between man and landscapes was studied through identifying the regular transformations of landscape structures. In long-settled territories, natural changes and different types of land use brought about such transformations.

Structure of the Atlas. The electronic atlas consists of natural, historical, and application blocks for each hierarchical level. The kernels of the natural block are
landscape map characteristics of natural-territorial complexes, drawings, and descriptions of soil profiles, etc. The fundamental concept of landscape unity and the conjunction of its components allow the derivation of component maps. The historical block consists of the landscape maps that were restored for different temporal stages, archeological, and historical maps. These maps reflect the history of settling and landscape changes in Moscow region. The majority of the maps has been worked out on the basis of landscape. The application block (assessing and forecasting) contains maps needed for solving specific tasks. These are maps of cultural historical landscapes, outstanding sites, excursion maps, functional zoning, and maps for monitoring. The atlas includes a huge mass of literary data and authorial descriptions on the nature and history of Moscow region. There are complex illustrations of landscapes and their components, historical notes, sets of explanatory photos, and reproductions.

**Some Practice and Examples of Atlas Usage**

The landscape-historical atlas of Moscow region is regional (by territorial coverage) and thematic (by content). Its destination is multitudinous. Some blocks may be used in scientific, referential, tutorial, and tourist aims. First, however, it is used in scientific explorations, especially for investigations of land-use dynamics. The use of GIS technology and automatic overlap maps enable more accurate calculation and deductions. The location of the modeling region in the central part of the Russian plain make it possible to extrapolate the established results for the main part of this huge plain.

**Example 1. Ascertainment of the landscape-ecological preconditions of Moscow origin**

Data of the atlas regarding landscape and history help to determine the main stages of the interaction of man with nature. Moreover, detailed field investigation is the basis of our atlas. Obtaining and manipulation of expedition data with large-scale mapping are the most important, laborious, and time-consuming part of atlas creation. However, this work makes it possible to obtain reliable conclusions. For instance, the natural reasons of the origin of Moscow certain places have been identified through comprehensive research of natural territorial complex features.

A diversity of landscape conditions in the territory of Moscow is mainly caused by features of a lithogenous basis (geological constitution and relief) and distinctions of a local climate of landscapes. Moscow is located on a joint of three physical-geographical provinces. Nine primary landscapes are discharged in the territory of modern Moscow, the majority of which reaches far of Moscow limits. Eight of them practically converge in the central part of city, which is a unique fact of that area. There is not a similar neighborhood with such quantity and diverse properties of landscapes anywhere else in the Moscow region, or at the center of the Russian plain. Valley landscapes were stretched through all of Moscow from the northwest on a southeast dividing its territory into two nearly equal parts. These landscapes were basic dispersal routes in Moscow. In all times it was possible to find fields, congenial for conducting facilities here. The floodplain and terraces with pine wood and low valley outwash plain occupy the greatest areas and reach 1 - 3 km of width. More floodplain was complicated by numerous dead river channels by
downturned and meandering lakes. Conditions of humidification varied also in the
dependence of character of a surface (flat or gently sloping-wavy), lithological
structure alluvial deposits (the sand or loam): alongside a normal degree of
humidification. There were the wet and damp localities and even swamps, as, for
example, Sukino bog existed for a long time.

The main distinctive feature of floodplain localities is a raised substratum
fertility because of constant receipt of nutrient materials of floodwaters. Therefore,
bottomland forests with rich underwood and rich terraneous cover: oak woods, lime-

oak woods, and elm woods, and black alder thickets grew on bog fields. The
floodplain NTC is the most dynamic complex of the area. There were always more
open places (wood glades) here. All this, in combination with a direct affinity of
water, attracted settlers (first, cattle-breeders in the end of Neolithic (late Stone Age)
and Bronze Age) to these areas. Apparently the specific woods used for cattle
breeding and the primary pasture for pigs has began. However, the beginning of
floodplain deforestation has been caused by the pasturizing of cattle in one place for a
long period of time.

Over-flood river terraces (first and second) and low valley outwash plain (third
over-flood-plain terrace) are combined mainly of the sandy, low-powered loam and
loam-sandy sediments. Pinewoods on podzolic and derno-podzolic soils were
distributed here. The woods became richer and more diverse (deciduous forests with
broad-grass elements in herb layer) on the areas with heavy mechanical structure of
soils. Near-river shallow bottom valley networks promoted good drainage. Therefore,
despite the poverty of substratum, these localities were optimal at the first stages for
employment by slash-burn agriculture. There was an abundance of animals in these
localities, thus they were perfect hunting lands.

The value of life of the first settlers could have depended on rather small and
sloping primary slopes of valleys engaged by lime-tree forests on cold expositions
and oak woods on warm ones. Vegetation began on slopes of warm expositions
earlier than on other localities. Therefore, these places were the better agricultural
sites for that term. The lime-tree forests with radical slopes have served as the basis
of development of honey gathering.

Example 2. Investigation of land use dynamics.
Land-use dynamics is investigated on key sites. One of the key sites (the Pavlovskaya
Sloboda area) of large-scale studies is situated 25 km to west of Moscow. It is located
in the ecotone zone of three landscape regions and two physical geographical
provinces. The landscape structure of the area has been analyzed in detail. The main
stages of development have been identified, as well as the present-day human impact
and the degree of anthropogenic transformation for the dominant types of landscapes.
The changing of land use of this area since the second part of the 17th century has
been researched by means of old map investigation. We established maps for 4
historical time periods: 1767 (map of general chronometry, scale 1:84000), 1860
(military-topographic map of the Moscow province, scale 1:42000), 1920 (map of the
Zvenigorodsky district, scale 1:84000), and 1960 (modern topographic map, scale
1:10 000). Accurate localization of maps using GIS technology allows us to
superimpose these different scale cartographical original sources. Such standard GIS
operation as Geoprocessing Union and Intersect helped us to make a conjuncted analysis of natural conditions and the historical situation. Overlays of landscape and historical maps has shown land use of each natural unit (natural-territorial complex), and changing of this land use during the past 300 years. Shares (in percent) of area, occupied by define types of land use for 4 historical moments have been calculated and shown on the diagram. Furthermore, the changing in share of dominant landscapes in main land use type has been defined for the same historical moment.

Our investigation has elicited clear-cut determination of land use (especially for agricultural land use) in some types of landscapes. Land use structure essentially correlates with landscape structure. Mainly during the last 300 years there were little to no changes in land use structure. General modification of landscape structure has been in the 17th-18th centuries (Nizovtsev et al. 2001).

3. Extreme natural phenomena

It is impossible to determine the trends of landscape natural development and their man-made evolution without the reconstruction of climatic fluctuations. Investigations of climate changes for historical periods are the most productive. There are not only proxy-data, but also documented records on climatic fluctuation and extreme phenomena. For central Russia, the most documented period is the latest millennium, when the first records on climate have appeared in the chronicles. Therefore, the history of instrumental meteorological observation has continued for nearly 150 years. The main method of past climate and landscape investigation is all-round analysis of chronic data including the following: data of tree-ring studies and carbon-data, spores and pollen analysis data, and others. These are important methods for the registration of unusual natural phenomena, such as storms, eclipses, droughts, floods, which have become regular since the second half of the 10th century. All important climatic events were written in chronicles because they strongly influenced the functioning, rhythmic, and dynamics of landscapes and determine both the economical and historical development of Russia. The processing of literature and chronical data gives us data of unusual natural events for each year. We use not only direct climate and meteorological remarks and characteristics (hot or cold, wet or dry and so on), but also descriptions of unusual natural events and indirect data (on water-floods, bad harvest, hunger years, epidemics, and others). The result of our investigation is documented in a Board classification in the form of a table of annual records of uncommon weather events in the second millennium or the table of Extreme nature phenomena (Marchenko et al. 2001). The table is of importance to the creation of our atlas.

The common scheme of climate dynamics in Moscow can be performed in such a manner. The main distinguishing features are 1) the existence of two main periods: the climate optimum in the 8th-13th century, 2) the little ice age from the 14th century to the middle of the 19th century, and 3) the modern warming of climate since the first half of 19th century. In the 10th-12th centuries, old Russian agriculture suffered from drought. However, severe droughts, cold winters, and rainy summers frequently led to hunger. In the 10th century and the first quarter of the 12th century, the frequency of catastrophic natural events was minimal. From the 13th century, extreme phenomena became more frequent, both severe and soft winters, and dry
summers. This change, and the worsening of climate conditions led to bad harvests
and starvation during the next 17 years. The chronicles give us a clear idea of the
increasing of instability of atmosphere processes and cyclone activity intensification.
These events led to an increase in the frequency of floods, more moisturizing, and to
a decrease of temperature. The records in the chronicles also document frost in
summer, which killed the crops.

The transitional period of the 13th-14th century was the period of contrasts, as it
was the forerunner of the little ice age. It had the next character features – increasing
of intrayear variability of weather, increasing of moistening, harsh fluctuation
wetting, and warming from year to year. We can see in the table very often warm and
severe winter, rainy, and dry summer. For the 14th century, we can see an increase in
the quantity of severe winters and at the same time warm winters, rainy and dry
summer. Seasonal contrast increased, on the background of cooling, and it was the
time of contrasts and sharp cooling. We can trace an increasing quantity of extreme
natural events in the 13th-14th centuries. The period since the 15th century to the 19th
century (little ice age) is characterized by an increasing quantity of unusual natural
phenomena, forcing of intrayear fluctuations, and the vegetative period was reduced.
Cyclonic activity forced sharply and the pluvial period alternated with dry years.
However, bad harvests and famines in general were caused by severe winters and
long heavy rains.

The Russian chronicals document sharp cooling in last third of the 16th century.
That led to serious economical shocks, and the end of 16th century was the period of
strong political and economical crisis in the Russian State (oprichnina and Livon
Wars by Ivan IV), with the bad climate conditions (high humidity, low temperature).
Therefore, many Russian villages died, and large villages became small, and the
forests, bushes, meadows, and bogs became larger.

It is generally accepted that the little ice age was not entirely cold; it was more
a set of shorter cold and normal periods. We can see that the little ice period was
broken into two parts by warm periods of the 16th century. The 15th century was a
very cold time. There were 150 extreme natural events. The weather was different –
dry periods changed by wet and cold. Snow cover in Moscow in 1445 was more then
two meters and there were great frosts. The 16th century was characterized by high
humidity, which expressed also in the enlarging of lake quantity. The story of
Moscow as a marshy and swampy region with many navigable small rivers is based
on this period. Many villages, located near rivers disappeared.

It is interesting that at the beginning of little ice age the process of mastering of
areas between rivers began. This process had economic and natural causes. Village
had been founded on higher positions, and the culmination of the little ice period was
from the 16th century (1650) to the 17th century (1701), when we can see maximal
frequency of severe winter and frosts in summer. We can read that crops could not
even mature in some years and farmers dried rye with the help of fire. The large
range of temperature fluctuation testified about great instability of climate and
significant regional differentiation. This illustrates the great importance of circulation
processes in climate formation.
In summary, cold and wet conditions were observed in the 12th century, in the second part of 16th century, at the beginning of 17th century, and in the middle of the 18th century. Cold and dry conditions were observed in the 13th and 17th centuries, in the second part of 18th century, and the first part of 19th century. Warm and dry conditions were observed in the 9th, 10th, 14th centuries, and in the middle of the 17th and first part of the 19th centuries.

**Example 4. Education and museum affairs**

It is very important to familiarize people at large with history of ecological problems and to use the new data and the results of scientific work in education. We have the opportunity to spread the knowledge of this experience through teaching in schools and universities. Some parts of the electronic atlas are shown in the lessons of Russian geography and Moscow studies, on special excursions for pupils and during field practice. The main objects of landscape-historical excursion sand practice are landscape-historical complexes as unity of archeological or historical monuments and their natural environment. Scientists of different specializations take part and geographical, historical, ecological, architectural, and design phenomena are learned, mapping and home-tasks are carried out. We make such excursions in outstanding and well-known places, having a long history of man and nature interaction, well-preserved historical and archeological monuments, and remnants of different types of land use. For example, the museum and refuge "Kolomenskoe" and "Zaricino," "Kuskovo," and "Bitca" etc. There are special touristic maps in our atlas. The routes of landscape-historical excursion and the objects for demonstration are marked on these maps. Also, students use the materials of the atlas, when they make their training and scientific works and when create other map themselves. Students have made some parts of the atlas, and some of these details seen in Marchenko and Nizovtsev 2003.

**Conclusion.** The electronic atlas represented here is a new type of atlas, showing landscapes, history, and changes for Moscow region. Such an atlas is created for the performance and exploration of anthropogenic landscape genesis processes caused by sets of maps. In this atlas, the main stages of land use and human impact in Moscow region are traced from the upper (Paleolithic) Old Stone Age, beginning from equilibrium system "man-nature" with appropriate economic throw producing economic with different forms of agriculture to modern significant anthropogenic transformation of landscapes. The main features for different periods and natural complexes are described. The atlas does not only display the location of different objects (natural, historical, and cultural) in different times. Moreover, the causes of various settlement systems and land-use peculiarities, stages of development, and the arising ecological problems have been apparent because of this set of landscape and historical maps.

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ВПЛИВ ЕРОЗІЇ І ГРУНТУ НА СТАН АГРОЛАНДШАФТІВ БІБРСЬКО-ПЕРЕМИШЛЯНСЬКОГО ОПІЛЛЯ

Запропоновано антропогенні ландшафти Бібрсько-Перемишлянського горбогір’я відносити до класу агроландшафтів. Встановлено негативні наслідки ерозії для грунтів Опілля. Ерозія досягає критичних меж і є загрозою деградації агроландшафту.


Ландшафтна структура досліджуваного району має наступні особливості: близько 60% площі займають місцевості горбогірних масивів з середніми абсолютно висотами 350-400 м. Горби складені крейдовими відкладами (мергелями і пісковиками), на яких залежать неогенові піски, пісковики і вапняки. Поверхня горбів перекрита антропогеновими лесовими породами.