Landscape Planning as a Basis for Sustainable Development of a Region (Simferopol Region and the Town of Simferopol, Republic of the Crimea Taken as an Example)

E A Petlukova¹, V A Tabunshchik², M G Zelentsova³

¹Taurida Academy, V.I. Vernadsky Crimean Federal University, Vernadsky Avenue,4, Simferopol, Republic of Crimea 295007, Russia, a post graduate student, Department of Physical Geography, Oceanology and Landscape Study
²Taurida Academy, V.I. Vernadsky Crimean Federal University, Vernadsky Avenue,4, Simferopol, Republic of Crimea, 295007, Russia, a post graduate student, Department of Physical Geography, Oceanology and Landscape Study.
³Taurida Academy, V.I. Vernadsky Crimean Federal University, Vernadsky Avenue,4, Simferopol, Republic of Crimea, an associate professor, Theory and practice of translation Department

E-mail: petlukova@mail.ru, tabunshchyk@ya.ru, poisk0808@list.ru

Abstract. This research deals with the theoretical principles of landscape planning. The possibility for applying geographical information systems (GIS) to carry out landscape planning on different levels has been studied. Geographical informational systems (GIS) can be used on every stage of planning work and they provide processing and analyzing a great amount of spatial data about natural components, submission and dissemination of the results by plotting the maps, their typing as well as distributing over on-line resources. The chart of landscape planning with its application has been worked out. The main stages of the research include: spade-work, preliminary (data collection and information storage, alongside with cartographic, informational, statistical data), examining the territory and its environment, considering the landscape features of the territory. Geographic information system data can help to make up landscape planning of the territory of Simferopol region and the town of Simferopol of the Republic of the Crimea. During this stage of landscape planning a set of maps i.e. maps of natural and economic landscape subsystems, adverse natural processes, ecological network, landscape and ecological restrictions has been plotted. By reference to all maps for the territory of Simferopol region, the map for landscape planning as well as functional zoning of territory have been worked out. According to the received data, measures against adverse processes have been planned.

1. Introduction
In the last decades there appeared a strong tendency to increase the load on landscapes that results in the change of their functional qualities. It is necessary to search solutions for sustainable development enabling to preserve functional potential of the natural landscapes, harmonious development of anthropogenic systems. Landscape planning is considered to be one of the tools for such development.
The territory of Simferopol region and the town of Simferopol is an administrative and economic center of the Republic of Crimea. Having high landscape potential this region endures the greatest loads on natural landscapes. In most cases this problem is solved formally by creating individual elements of ecological framework as well as by introducing restrictions on local levels. Yet this task can be solved only by employing a complex approach which takes into consideration landscape integral properties.

The purpose of this research is to work out the algorithm of landscape planning of administrative region and make up the landscape planning map of Simferopol region and of the town of Simferopol. It is the first time that the landscape planning for this territory has been carried out.

2. Materials and methods
There are a great number of scientific works devoted to studying and working out the theory and methodology of landscape planning. Degorski M.[1], Dulias R. [2], Janescakov E. [3] studied the problems of landscape planning and nature conservation in Poland; Rudenko Z. and co-authors [4] applied the system of landscape planning tools for the purpose of sustainable development of Ukrainian territory; Drozdo A.V. [5], Antipov A. and Semenov Yu. [6], Antipov A. and Vorobyov V. [7], Semenov Yu. And Lysanova G. [8], Semenov Yu. [9] worked out and used the theory and methodology of landscape planning in Russia in practice; Von Haaren and co-authors [10-11], Artmann and co-authors [12] developed and applied the theory of landscape planning in Germany. Also, landscape planning is actively used in other countries – the USA [13, 14, 15], the Netherlands [16, 17], Italy [18, 19] and so on. Landscape planning is known to be actively developed in the Crimea. For the last years the methods of landscape planning have been applied in many parts of the Crimean Peninsula [20, 21, 22].

This article uses the following basic methods such as: geo-information, mathematical modeling, literary and analytical, comparative-geographical, cartometry, cartographic, historical and others.

Landscape planning is carried out with the help of Geographic Information Systems (GIS).GIS territories turn out to be a very effective instrument in fulfilling landscape planning and functional zoning. They provide the integrity of hierarchical levels and landscape planning stages and give the possibility to work with a huge amount of input data like HD photos, open geodata, Landsat photos, database, digital relief models, cartographic materials, archive and statistical data.

GIS are used at each stage of planning and provide processing and analysis of a greater volume of input spatial data about nature components. They represent and disseminate the results by making up maps and their dissemination over on-line resources.

The main GIS functions in landscape planning are as follows:
- Carrying out spatial reference and the change of coordinates.
- Data vectorizing.
- Aerial photo interpreting, photos processing by SRTM.
- The possibility to create geo-data base powered by different informational sources: cartographic, statistical, etc.
- Detailed landscape analysis: component testing, natural and economic subsystem analysis, sustainability analysis, transformation, etc.
- The territory analysis to define the natural peculiarities, socio-economic and geo-ecological problems of it.
- To be able to carry out quick lythe calculations and in a quality manner by modules: computation of morpho-metric indices of relief, the study of waterways, getting the data about solar radiation, etc.
- To compute most accurately the areas of objects with further mathematical calculations.
- To estimate and analyze the landscape territories for nature protection activity, etc.

There are two groups of tasks to be fulfilled in landscape planning by using GIS:
To conduct landscape planning. This group includes the data and the results received during landscape planning stages.

To get landscape plans ready for users – a set of tasks conducted at the final stage of landscape planning.

The chart shows the methods of applying landscape planning for different objects aided by GIS (fig.1).

**Figure 1.** Landscape planning methods with GIS [21, 22, 23].

At the first stage the analysis of information on natural and economic subsystems of natural landscapes of the region is being carried out. The landscape structure of the territory is studied in three basic constituents aided by all materials collected.

- Landscape and ecological constituent.
- Functional and assessing.
- Landscape and ecological restriction zones.

The set of data aided by GIS tools, is a basis for maps of landscape planning.

3. Results and discussion

Having studied the physic-geographical features of the territory based on cartographic material (landscape component maps; landscape maps; topographic maps), cosmic photos, basic materials and statistical data, using GIS, we have got a set of maps: a modern landscape map (natural and economic subsystem), ecological network map; ecological condition map and a map of landscape and ecological restrictions. A landscape planning map for Simferopol region territory has been made up, taking into account all the maps obtained, functional zonation of a territory having been accomplished (fig.2)

Landscape planning map shows the main objects of economic system of Simferopol region territory.

In landscape planning the ecological network has been worked out in detail – (i.e. Eco centers and Eco corridors to provide ecological stability limited mainly at present because of the territories of high ecological value are separated, small in area and quite sensitive to forcing. Picking out the margins are to be thoroughly corrected further, taking into account more extended planning scale.

Special attention should be paid to conservation and reforestation of landscapes measures. Such steps with other advantages result in increasing water resources, the lack of which restrains the economic development of Crimea. The promising objects of Specially Protected Natural Territories should be set up on the preserved forest-steppe areas.

In the process of planning one should keep in mind the number of environmental geo-systems. Their enlargement due to projecting the network of new protective forestation, observing sanitary-protective zones and buffer zones as well as establishing “green” zones is planned.
The above-mentioned measures to project environmental forming geo-systems are closely connected with those which are directed against adverse processes.

Figure 2. Landscape planning of Simferopol region and the town of Simferopol.

There are territories where coastal-line strengthening and drainage works as well as forest plantations should be carried out to prevent landslides and avalanches. The territory must be protected from technogenic flooding, slopes erosion and destruction and their overloading.
As most territory of the studied region is characterized by adverse processes, it is necessary that the following measures should be taken such as: anti-erosional, to eliminate linear erosion and plane wash-out; land restoration, anti-landslides measures, and tree felling control.

To turn the territory of Simferopol region into stable area of sustainable development a number of measures are proposed, landscape planning taken into account:

- Introduction of control system over natural resource management aided by landscape planning, ecological expertise, audit.
- To increase the number of environmental geo-systems, which are to occupy up to 30% of region’s territory due to restoration and conservation measures and increasing forest protective forestation.
- Measures on conservation and restoration of natural landscapes.
- To define the zones of landscape – ecological restrictions and its controlling; Specially Protected Natural Territories, buffer zones of water conservation zones and etc.; applying landscape approach in determining the zones with special regime of nature use.
- Measures against negative processes (anti-erosion and landslides, land restoration).
- Introduction and application of the principles of contouring, adaptive farming.
- To organize ecological network of territories, its detailed working out by experts, increasing the number of protected objects, expanding the network of eco-centers and eco-corridors.

4. Conclusion
Conserving the balance between natural and economic landscape constituents, its sustainable development must be a priority task in taking administrative decisions for the region to improve and function normally. The results of landscape planning must be taken into account in territorial planning of Simferopol region and the town of Simferopol, in making up and changing the plans of settlements. The data obtained are used in stabilizing the adverse natural and anthropogenic negative processes measures. Recommendations received as a result of territory’ landscape planning regulate the ecological framework of the territory.

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