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CARTOGRAPHIC METHOD APPLICATION IN
FOREST RESOURCES STUDY AND PROTECTION

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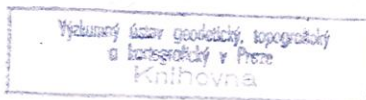
Forest is one of the important components of natural environment, providing the balance of biosphere, and it is the main part of the natural resource complex, providing society with timber and wood products.

The problem of environment protection and mainly large forest tracts has become the most important problem of present times.

At this stage of national economy development the scientific base of forestry is being developed not only with the aim of reproduction and improvement of forests, but taking into account their protective, water-conservation, antierosion and climate-regulative properties.

Rational use of forest resources, the more so on the planning base, is impossible without their prompt and reliable inventory.

From the start of the Soviet power and establishment of the public ownership of all lands, the socialist character of the national economy had required the nation-wide inventory of all the forest resources, and organization of their planned and integrated use. That is why, just after the Decree on Land (November 8, 1917), the Decree on Forests (May 27, 1918) followed, which laid down the foundation for planned forest management and the Decree of High Geodetic Board establishment (March 23, 1919) intended for the study of the territory of this country, as far as topography is concerned, and compiling and drawing up the cartographic materials for the effective exploitation of natural resources.



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The above Decrees, signed by V.I. Lenin, served as the basis for development of the principal branches of national economy, and particularly the Soviet cartography, including forest mapping.

In the USSR, forest maps have become necessary and obligatory means for organizing and planning forest management and forest industries on all governmental levels.

Forest physical plans and maps are extremely various, as for their assignment and contents, which reflects the multiple importance of forests in environment and human activities.

The most detailed and widely employed forest maps are the stand maps resulting from the forest inventory, these maps show National forest land distribution by land classes and within that, the forests as classified by predominant species and the classes (young, middle-aged, approaching maturity, mature and old-growth stands).

The forest stand maps are the main cartographic materials for solving forestry problems within the forest district and its parts. Therefore, the maps show the shape of all forest compartments and subcompartments with the main characteristics of each separate forest stand expressed symbolically by means of special formula.

As a rule forest stand plans are made photomechanically. With this method, from the charts of forest survey compiled on the base of photoplans of land organization, large scale topographic maps or terrestrial geodetic and survey activities, negatives reduced to the needed scale, are made. From the negatives copies are produced on photo paper or design paper. Copies are then assembled in certain order. Forest stand plans serve as the main background matter for compilation of the rest types of forest maps.

Forest schematic maps of forest enterprises as users of forest land are widely spread as well. On the maps the predominance of one or other tree species is shown with the distribution by the area occupied and timber volume indication. Such maps permit planning the location of forest logging enterprises, the delineation of wood bases, and the marking the direction of wood transport ways; they are used when planning big forest industrial complexes and transport network development.

The Schematic fire protection maps resulting from the ground survey are of great importance for the national economy. Such maps are the basic materials for planning and accomplishment of fire protection measures in the particular forest stands as well as for activity of the various forest fire inspection services.

Along with the increasing importance of forest for human society the diversity of the subject maps also increases. There is ^{no} generally approved classification of forest maps, but now it is quite possible, however, to classify all existing forest maps into two big categories: first, forest biological maps, which include maps of forest types, wood species distribution, phenological, forest pathological and many others; and second, forest economical maps, including forest exploitation, forest management and wood transportation maps, etc.

The maps of forest types indicate distribution of forest area by site conditions. On the maps of tree species their ranges are shown. On the phenological maps, with the help of isolines (isophens), dates of tree species development phases, namely foliage formation, flowering, seed maturing etc., are shown.

Forest pathological maps show location of forest areas attacked or damaged by pests and diseases. These maps are compiled as result of forest pathological survey carried out by All-Union Forest Inventory Amalgamation "Lesproject".

Forest management maps are being compiled in the process of forest organization activities and are used when planning and carrying out forestry projects in forest districts and enterprises.

Fire protection management maps, maps of forest health condition and forecast maps of future forests are relevant to the same category. The forecast maps of future forest should be specially noted. For the forest industries dealing with the renewable resources with comparatively long regeneration cycle (tens of years) forecasts are of vital importance.

The forecast maps basing on the forest survey and organization data illustrate long-term cycle from establishment of good quality, and high-productive forest stands of various predestination to their harvesting and further end-use of products with regard to the improvement of the total productivity of the earth byosphere.

The category of forest management maps includes the special type of cartographic materials, being compiled, when planning the recreation forest management. At present times in the USSR there are over 14 million hectares of recreational forest area (national forest parks, green belts, etc.). These forest maps contain full information about scenery and sanitary value of recreation forests, and the planned measures for tending and improvement of landscapes and forest stands are indicated there with special symbols.

On the forest exploitation maps the characteristics of timber resources are shown which is quite necessary for planning of forest industry enterprises and running them.

Wood transportation maps show logging roads and other transport ways (floating rivers and highways), as well as goods traffic.

The forest industries maps show location of forest industrial complexes for timber harvesting and processing as well

as their timber resources.

The other type of maps show minor forest uses without tree cutting, that is hunting, resin-tapping, medicinal herb harvesting. These maps are usually being made by delineation of ranges and with use of symbols on the basis of wildlife management data.

The above brief list doesn't comprehend all possible alternatives of forest maps based on forest survey and management materials.

Many forest maps are difficult to apply properly to one or other type. For example, map of forest reclamation area showing network of drainage ditches and bilge mains, forest fire protection map, nature protection forest maps, etc.

In the prospect along with the forest maps of forestry and forest industrial importance there will be requirement to compile maps of economical and protective character.

Maps, which characterize the productivity of forests, are of great importance now. These maps should be regarded as specific type of biological forest maps.

The first comprehensive map of the countries forests showing predominant species was compiled in 1955 on the scale 1:2500000 and named "Map of the USSR Forests". The creation of the map was based on the detailed study of the forests.

The work over comprehensive map of the USSR forests in such a large scale was considerably facilitated by availability of regional forest maps of studied forest stands and air survey data covering the whole territory of the USSR.

Forest cartography in the country is being improved at present times as well.

Lately great changes have taken place in the technology of

forest map compiling.

Wide introduction of air survey data enabled passing over to the compilation of specified photo sketches by means of photogrammetrical procession of airphotographs, which become the topographic base for forest organization charts and consequently for maps of forest stands. As a result the need for labour-consuming and expensive ground geodetical basing was excluded.

Since 1946 permanent improvement of technology for application of air survey data made it possible not only to lessen labourconsuming nature of survey and geodetic operations but considerably raise the accuracy of forest stand delineation into homogeneous parts and also the accuracy of determination of forest stand evaluation indices with length reduction of ground evaluation lines.

In 1954 so named colour spectrazonal air photography was first used in the USSR. Since then coloured spectrazonal photographs have been used in forestry for forest management organizing purposes. With the use of coloured images the accuracy of forest stand delination into homogeneous sites - that is separate stands (subcompartments) has become higher. Besides in the early sixties the technology of simultaneous survey with two different cameras on board of airplane was developed. The first 100-mm topographic camera using panchromatic small-scale film (1:20000 - 1:35000) was used to obtain high quality materials for forest mapping. Comparatively small quantity of small-scale gyrostabilized airphotographs simplifies their photogrammetric processing, increases the accuracy of forest map compiling.

The second 200-mm camera using colour spectrazonal film (scale 1:10000 to 1:17500), was used to obtain colour spectrazonal airphotographs format of 30 by 30 for forest evaluation and inventory operations.

Air survey with two cameras considerably increased the

accuracy of forest map compiling, and served as a base for development of a new method for obtaining forest information-analitical and measuring interpretation of colour spectra - zonal airphotographs.

At present air survey for forest management purposes is performed annually on the area of 650 000km² of which 50-60% area photographed onto the colour spectrazonal film.

Colour spectrazonal photographs allow more accurate interpretation of compartment boundaries, and determination of species composition and the cathegories of forest and agricultural lands with resultant increase in the accuracy of data as far as the structure of forest fund areas and the total forest exploitation stock are concerned.

Application of colour spectrazonal photographs in forest organization and management allowed to solve the problem of changing on the considerable part of the managed area of labour-consuming evaluation with analitical and measuring interpretation of air photographs while maintaining the prescribed accuracy and quality of forest management organizing operations.

The similar forest inventory technology is developed and being introduced into the practice in the increasingly exploited mountaneous tayga forests.

The process of analitical and measuring interpretation of air photographs of forests under mountain conditions is complicated by a number of factors: different relative elevations different scale of image within the air photographs illumination of slopes with various aspects. At present we have developed the majority of methodical questions on accounting of the mentioned factors, affecting interpritation accuracy of mountain forests and compilation of good quality cartographic material.

The analitical and measuring methods for air photographs interpretation are being applied also with the I and the II

class of forest inventory organization for high intensity management.

We developed the special method on rational combination of ground evaluation works with analytical and measuring interpretation of the air photographs.

The application of analytical and measuring methods of interpretation not only permits to increase the quality of forest inventory, but considerably reduce the labour consumption.

The practice showed that when applying the interpretation methods it is possible, without increasing the staff number to considerably enlarge the annual forest organization work which in turn increases the rate and area of the forest inventarization with compiling more detailed and accurate forest maps.

The use of the materials of selective large-scale photography on the scale 1:500 to 1:2000 taken from the helicopter as the addition to the main work flights, opens high potentialities for prompt forest data obtaining. The promising technique is detection of outbreaks (infestations) of the most dangerous forest pests such as Siberian moth (*Dendrolimus sibiricus*), pine moth (*Dendrolimus pini*) and long-horned beetle (*Cerambycidae*) and assessment of the damage by means of colour spectrazonal air photographs. It enables to identify four degrees of damage including initial stage of invasion with the subsequent compiling of maps for localization and eradication of infestation niduses.

At present the complex of the studies and experimental work is being carried out on the application of the spectrazonal photographs taken from the different altitudes and on the automation of the forest interpretation.

The purpose of these activities is to increase the role of air survey materials in the study and assessment of forest resources of our country and to make high-accuracy forest maps and improve their quality.



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