

THE LAND COVER CHANGES IN AGRICULTURALLY DEVELOPED DISTRICTS OF BELARUS

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The modern structure of land cover in agriculturally developed districts of Belarus has been studied on the example of Klieck and Niasviž Districts of Minsk Region. Based on cartographic materials, the structure of land cover in the research area at the beginning of the 20th century was recreated. The nature of the changes that have occurred has been determined, an analysis of the localization of forests in the 1930s and at the beginning of the 21st century has been carried out, then the possible reasons for these changes have been identified.

Keywords: land cover types; dynamics; GIS technologies; deforestation; agriculture.

ИЗМЕНЕНИЯ СТРУКТУРЫ ВИДОВ ЗЕМЕЛЬ СЕЛЬСКОХОЗЯЙСТВЕННО РАЗВИТЫХ РАЙОНОВ БЕЛАРУСИ

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Изучена современная структура видов земель сельскохозяйственно развитых районов Беларуси на примере Клецкого и Несвижского районов Минской области. По картографическим материалам воссоздана структура видов земель в исследуемых районах на начало XX века. Определен характер произошедших изменений, выполнен анализ локализации лесных земель в 1930-е и в начале XXI века, а также были определены возможные причины данных изменений.

Ключевые слова: виды земель; динамика; ГИС-технологии; сокращение площади лесов; сельское хозяйство.

ЗМЕНИ СТРУКТУРЫ ВІДАЎ ЗЯМЕЛЬ СЕЛЬСКАГАСПАДАРЧА РАЗВІТЫХ РАЁНАЎ БЕЛАРУСІ

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Вывучана сучасная структура відаў зямель сельскагаспадарча развітых раёнаў Беларусі на прыкладзе Клецкага і Нясвіжскага раёнаў Мінскай вобласці. Па картаграфічных матэрыялах адноўлена структура відаў зямель у доследных раёнах на пачатак XX стагоддзя. Вызначаны характар змен, якія адбыліся, выкананы аналіз лакалізацыі лясных зямель у 1930-я і ў пачатку XXI стагоддзя, а таксама былі вызначаны магчымыя прычыны дадзеных змен.

Ключавыя словы: віды зямель; дынаміка; ГІС-тэхналогіі; скарачэнне плошчы лясоў; сельская гаспадарка.

Periodically through history, cartography has been invigorated by shifts in environmental conception and advances in technology. An automated geographic information system (GIS) integrates data bases, mathematical analysis procedures, and graphical representation methods. Maps serve geographic information systems as a source of input data, a framework for spatial analysis and modeling, and an output medium. Cartography and geographic information systems influence each other, but mapping may get the best of the relation. GIS technology is transforming cartography by changing what gets mapped, what form maps take, who makes and uses maps, and how maps are used [1].

The land cover structure is formed as a result of the interaction of both natural and anthropogenic factors. Despite the relative stability of natural components (relief, vegetation, climate, etc.), the land cover structure tends to change due to economic activities, connected with the desire to use the land resources as intensively as possible.

In this study, it was decided to examine the change in structure for the most agriculturally developed districts in the south-west of Minsk Region (Klieck and Niasviž Districts) due to the good provision of cartographic materials, as well as historically similar land ownership (in both for a significant period of time economic activity was carried out by members of the most powerful magnate family of the Grand Duchy of Lithuania (the Radziwills).

Hereinafter inscriptions are developed according to Resolution of the State Committee of Land Resources, Geodesy and Cartography of the Republic of Belarus [2].

The main goal of this research was to study the land cover of Klieck and Niasviž Districts by using cartographic materials of the beginning of the 20th century followed by a comparison of obtained data with one at the beginning of the 21st century.

Thus, as a main source of the land cover structure at the beginning of the 20th century Polish topographic maps (WIG) at a scale of 1:100 000 published in 1931–1938 were used [3], while the same data in 2020 was taken from the Register of land resources of the Republic of Belarus [4].

At the same time, it should be noted that the categories of lands allocated on Polish topographic maps did not completely match with the current classification of land resources of the State Committee on Property of the Republic of Belarus. As a result, in order to compare the land cover changes, it was necessary to regroup some land types. Thus, the following groups of land coverage were selected for comparison (table):

When compiling any thematic map, it is especially important to develop a methodology for making a map, according to which thematic mapping will be carried out. So, the creation of the database and the subsequent visualization were carried out in the ArcGIS software products, where the scanned topographic maps were loaded. After the original cartographic materials were loaded, a new feature

class was created. Then the localization and type of land cover at the beginning of the 20th century were entered into the database at the stage of digitizing the materials.

Table – Regrouping of land cover types for comparison of the data

Dedicated categories for monitoring the land cover changes	Types of the land cover according to Polish topographic maps	Types of the land cover according to the Register of land resources of the Republic of Belarus
Water-covered area	Water-covered area	Water-covered area
Forests and bushes	Mixed forests, coniferous forests, deciduous forests, bushes	Forests, woody and bushy vegetation
Meadows and swamps	Meadows (including semi-wetland area)	Meadows, swamps
Residential area	Residential area	Common land, built-up area
Others	Cemeteries, gardens, others	Arable land, fallow land, permanent cropland, land under roads and other transport communications, disturbed land, unused land, others.

After completing the filling of the database, a comparison of the areas occupied by certain types of land cover in the 1930s and 2020 was made (figure 1).

Thus, in all types of land cover, except forests and bushes, the changes were similar:

- The water-covered area increased due to the construction of a large number of reservoirs and ponds on small rivers to supply water for agriculture from the 1950s to the 1970s;
- The residential area reduced (primarily because of the disappearance of a huge number of small rural inhabited localities which led to a denser settlement;
- The area covered with meadows and swamps shrank through their subsequent transformation for agricultural needs (for example, to arable land), or to forests and bushes (for instance, some meadows with shrubs were abandoned and after that woody and bushy vegetation became more widespread there);
- The area of other land cover increased on account of the need to expand arable land, and like in most countries, new cropland was converted primarily from tree-covered areas, but conversions from grassland and shrubland were also important [5].

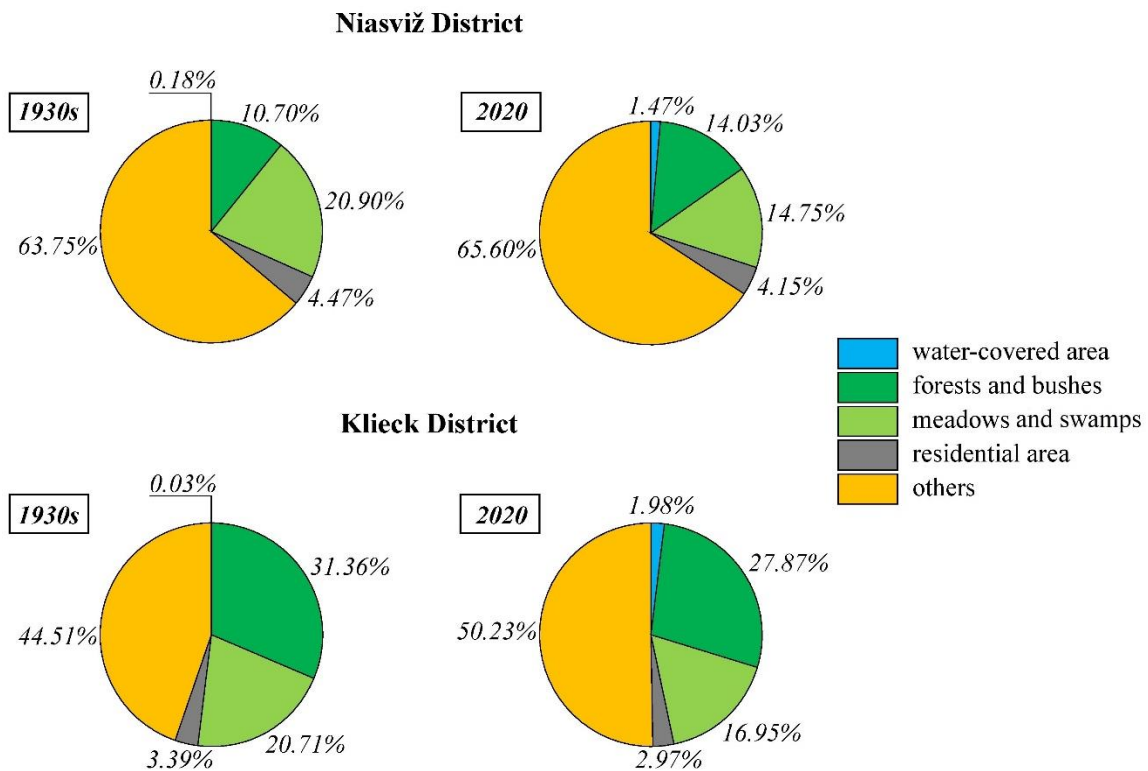


Figure 1 – Structure of land cover in Niasviž and Klieck Districts in the 1930s and 2020

The forest-covered area in the early 21st century compared to that in the 1930s increased by 3.33% in Niasviž District, while in Klieck District it fell by 3.49%. This difference could be explained by the very high development of Niasviž District so further deforestation was impossible without significant consequences for the environment and to the fact, that the most of poorest soils were occupied by forests and bushes; while in Klieck District there still were some places with fertile soils, which after the large-scale land amelioration in the southern part of the District were transformed to arable lands.

Also, there were some differences in the dynamics of changes in the forest area in different parts of the research districts, and in order to analyze this, a map of the dynamics of forest area changes was compiled at a scale of 1:200 000 (figure 2; is presented on a smaller scale). Thus, despite the tendency of an increase in the forest area in Niasviž District, the forest loss in the southwestern part was greater than the gain; while the tendency of a decrease in the forest area in Klieck District was not specific to the south-western and western parts of it.

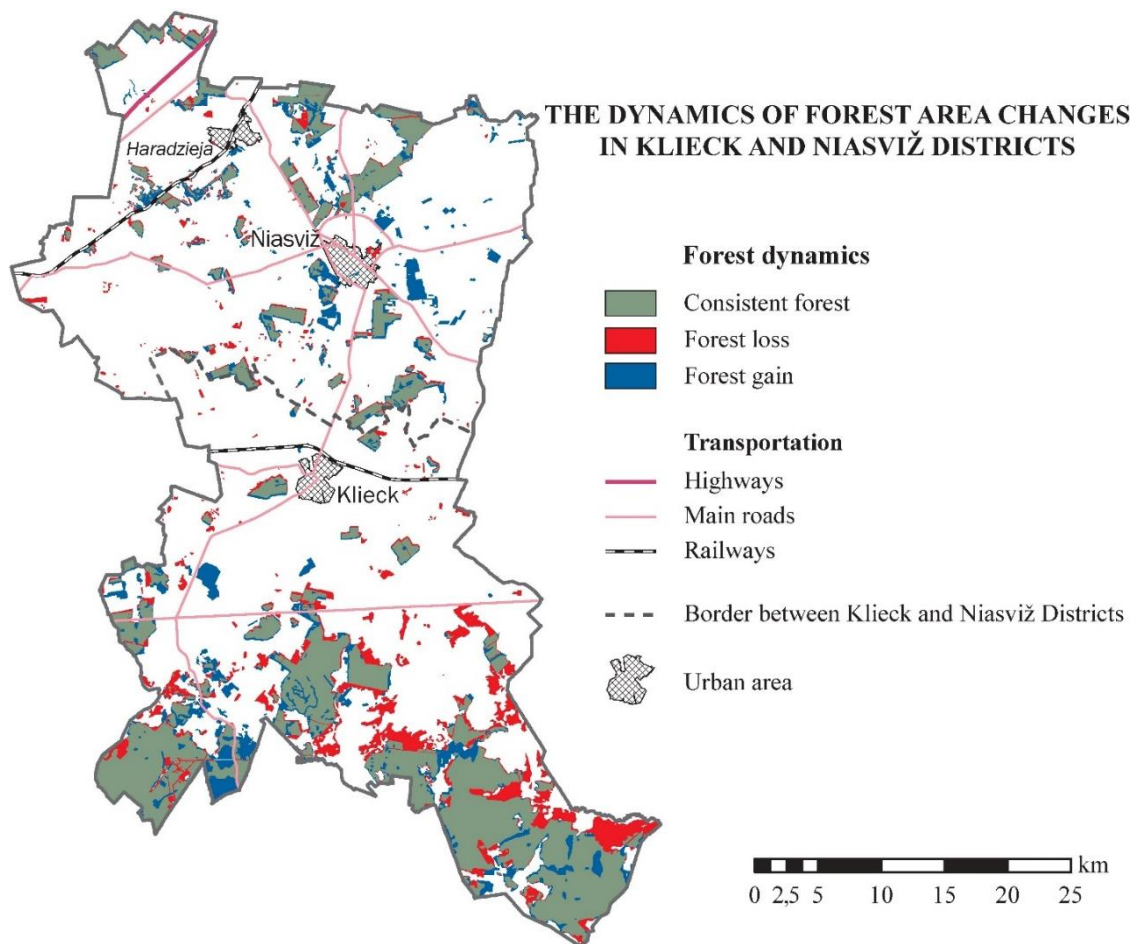


Figure 2 – The map of the dynamics of forest area changes in Klieck and Niasviž Districts

In this way, the land cover structure was not dramatically changed in the study area since the 1930s, which could be explained by the initially high level of land transformation. However, there were territorial differences caused by the diverse intensity of human activities as well as the natural prerequisites for agriculture.

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