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GEOINFORMATION MODELING OF SELECTION OF LAND PLOTS FOR NON-AGRICULTURAL USE

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Some objects pose an increased environmental risk due to their impact on the surrounding areas, so their location must take into account different requirements and data for the study area. In order to optimize the work on the rational use of land resources, it is necessary to integrate different data and use them comprehensively, and automate the sequence of actions through models.

The work aims to develop geoinformation models for automated selection of areas for non-agricultural use.

This study describes the structuring of the general algorithm for establishing the necessary and impossible locations of objects and their limitations through a functional model. The model of site selection is generally common, i.e.: it is necessary to determine the desired location and exclude areas with restrictions, but for each object, it is necessary to set restrictions based on the environment. The article analyses the requirements for the selection of areas for two types of facilities: filling station and disposal tip. Geoinformation models of a selection of non-agricultural land plots for the placement of certain objects have been developed and implemented.

The results of the work can be used in community planning to form spatial decisions on the use of non-agricultural facilities.

The prospect of further research is to develop an automated decision-making unit for planning the location of non-agricultural facilities in communities.

Key words: geoinformation modeling, model, selection of territories, geoimage.

Introduction. In the process of life, humanity, even unwillingly, is still the cause of increasing the negative impact on the environment. Some sites pose an increased environmental risk due to their impact on the surrounding areas. The location of such objects must take into account a variety of requirements and this requires the collection of a large amount of spatial and attributive data on the study area. To optimize the work on the rational use of land resources, it is necessary to integrate disparate data and use them comprehensively, and the sequence of actions to automate through models. Thus, there is a task in creating a geoinformation model that can support the selection of land plots for non-agricultural use.

Analysis of recent research and publications. The development of a problem of creating systems for automation support of decision was covered in papers [1-3]. The research [1] presented the GIS approach to identify changes in land use and soil cover is presented. The study [2] describes the use of GIS for decision-making for land allocation planning to implement urban public projects. The article [3] reflects the approach to the formation of spatial decisions on land use and identifies a set of data needed for planning land management measures for the formation of spatial decisions on land use.

The issue of using geoinformation for ecology and natural resources has been and is the subject of study by many scientists [4-6]. The paper [4] analyzed the use of modelling and structuring data to develop a cadastre of natural healing resources. The study [5] describes the design of the location of objects of the Danger Category IV on the example of filling stations using three-dimensional modelling. The article [6] considers a spatial model of rational use of erosion-hazardous lands is presented.

However, the considered works do not address the issue of automated selection of areas suitable for the location of dangerous objects.

The purpose and objectives of the study. The work aims to develop geoinformation models for automated selection of areas for non-agricultural use.

To achieve this goal, the task was set as follows: to build models to justify the selection of areas to determine the location of environmentally hazardous objects, taking into account favourable and unfavourable factors.

Research methodology. When selecting areas for non-agricultural use, a geoinformation modelling approach is used, which provides the interaction of spatial data from attributive to the study of land use and related objects. In geoinformation modelling, the tools of geoinformation analysis were used: proximity analysis, construction of buffer zones and layering. A Unified Modelling Language (UML) was chosen for model development. The implementation was carried out in the ArcGIS software.

Presentation of the main research material. Finding the best location for non-agricultural facilities is a land management task with many criteria. For optimal selection of areas for non-agricultural use, it is necessary to take into account the needs of both users and agriculture, as well as environmental requirements. All these requirements require the processing of both attributive and spatial data, the processing of which can provide geographic information systems.For the effective implementation of such a system, it is necessary to collect a sufficient amount of data and accumulate them in a single system, the basis of which is a database of geospatial data [4].

There are many factors to consider when choosing a plot of land for any site, as you need to find the optimal area. In this point can highlight the opposite sides: these are areas that are suitable for location, on the one hand; and these are areas where accommodation will be inappropriate due to restrictions, on the other hand. To describe the process, a functional model was constructed through a UML activity diagram (Fig. 1).

The initial element of the model is the selection of a suitable site, which determines for what purpose the search will be carried out. The next stage contains two parallel processes: determining the desired location and identifying unsuitable areas. To find the desired location, the find for the best locations is determined by how much the position can vary from the desired location through the construction of

buffer zones, which in turn provides a definition of a suitable area. To determine unsuitable areas, normative documents are studied, requirements are set for the location of the object and its possible impact on the adjacent territories, and unfavorable objects are searched. Buffer zones are defined around these objects to prevent exposure and areas where the required facility cannot be located are identified. At the final stage, a thematic map is built, taking into account the possible and desired location of the selected object.

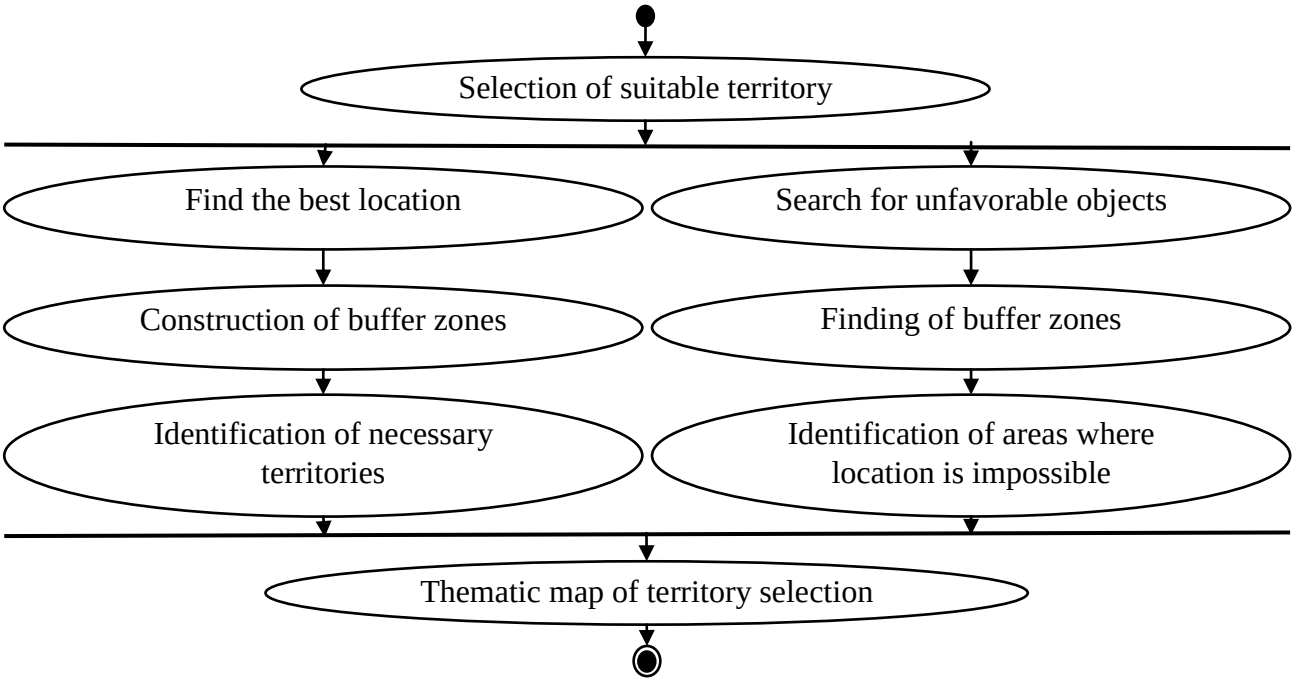


Fig.1. Functional model of selecting for areas

To implement the model, Model Builder in the ArcGIS software is selected. Model Builder allows to build geoprocessing workflows as a model that combines input and tools, while the output data of one tool can be input data to another.

The development of a geoinformation model of land selection in this study was carried out on the example the filling station and disposal tip.

To select the areas under the filling station, it has been determined that it is impossible and dangerous to place it near some objects. The model for determining the zones of impossible location for filling stations was developed in ArcGIS Model Builder and presented in Fig. 2 (Block No. 1).

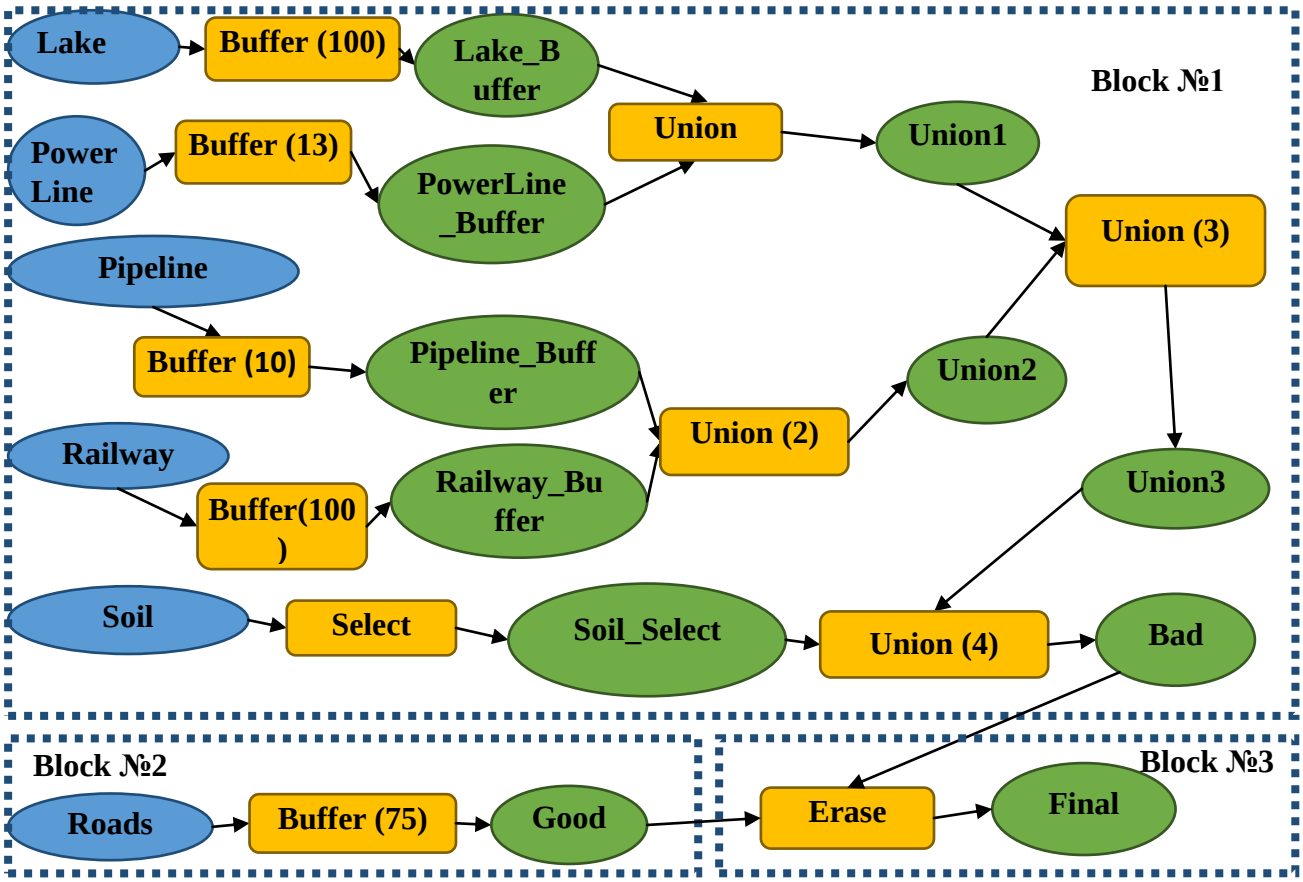
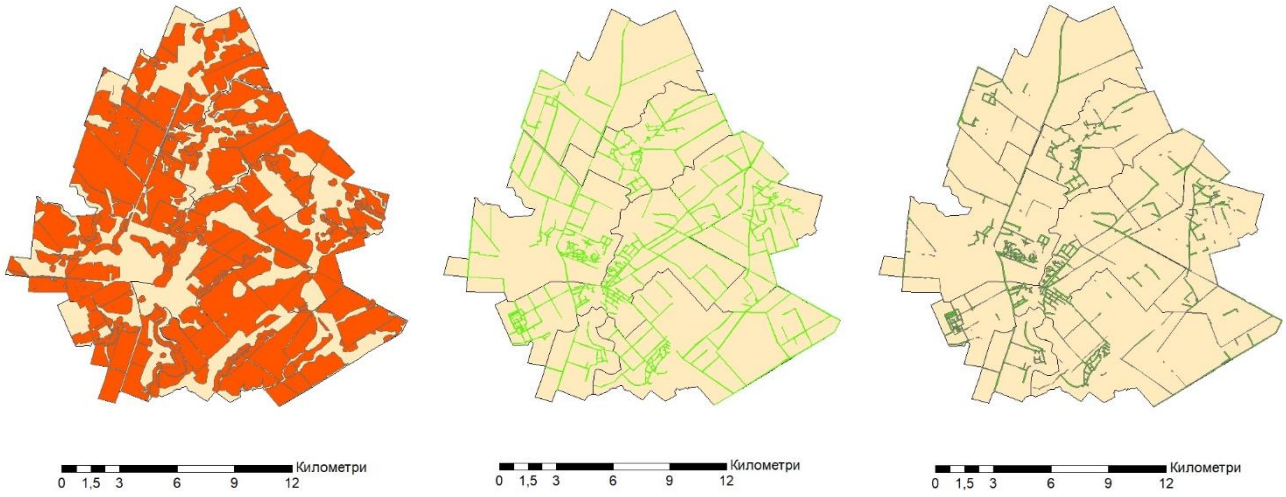


Fig.2. Model of defining territories for filling station location

In this model, the list of initial data is marked in blue, the processing modules in yellow, and the processing results in green. The model identifies and performs the installation of buffer zones: powerline - 13 m, lakes - 100 m, pipeline - 10 m and railway - not less than 100 m [7]. To build these zones, the BUFFER module is used with the setting of its width parameter (for clarity in the model, the values are indicated in parentheses). It is forbidden to locate filling station on particularly valuable soils, so the SELECT function selects areas with particularly valuable soils to exclude them from further consideration of the territory for which the placement of environmentally hazardous facilities is possible. Next, a combination of thematic layers through the module "Union" resulting in areas where the location of the filling station is impossible (Fig. 3 a)

The next step is to build a part of the model that selects the desired location of the filling station: near the roads (Fig. 2, block №2). The result is illustrated in Fig. 3 b.



a *b* *c*

Legend: Hrebinka territorial community
desired location; impossible location; possible location

Fig. 3. Thematic maps of the research territory: a - the territory of the impossible location of the filling station, b - the territory of the desired location of the filling station, c - the territory of the possible location of the filling station.

To create the final thematic map of the area, it is necessary to combine the resulting images from two blocks: Blok No. 1 and Block No.2. For this purpose, the function ‘erasure’ is selected excluding from the desired areas of the impossible location (Fig. 2, Block No. 3). The result is shown in Fig. 3c.

The model for disposal tip is built on a similar principle but based on other criteria. The model is divided into blocks: Block №1 – definition of zones of impossible location, Block №2 – select of the desired location, Block №3 – combination of conditions and creation of the resulting image. In the first side we add the necessary initial data and we construct buffers (road_Buffer200, Power_line_Buffer30, Lake2000_Buffer, Settlements_Buffer 500), we exclude especially valuable soils through the Select module and union the received data in one layer “no recommended” The model is presented in Fig. 4, and thematic maps on which restrictions concerning disposal tip are given are given in fig. 5a and the possible location in Figure 5.b.

In the studied territorial community, the location of the disposal tip is impossibledue toplots without the impact of restrictions have insufficient area.

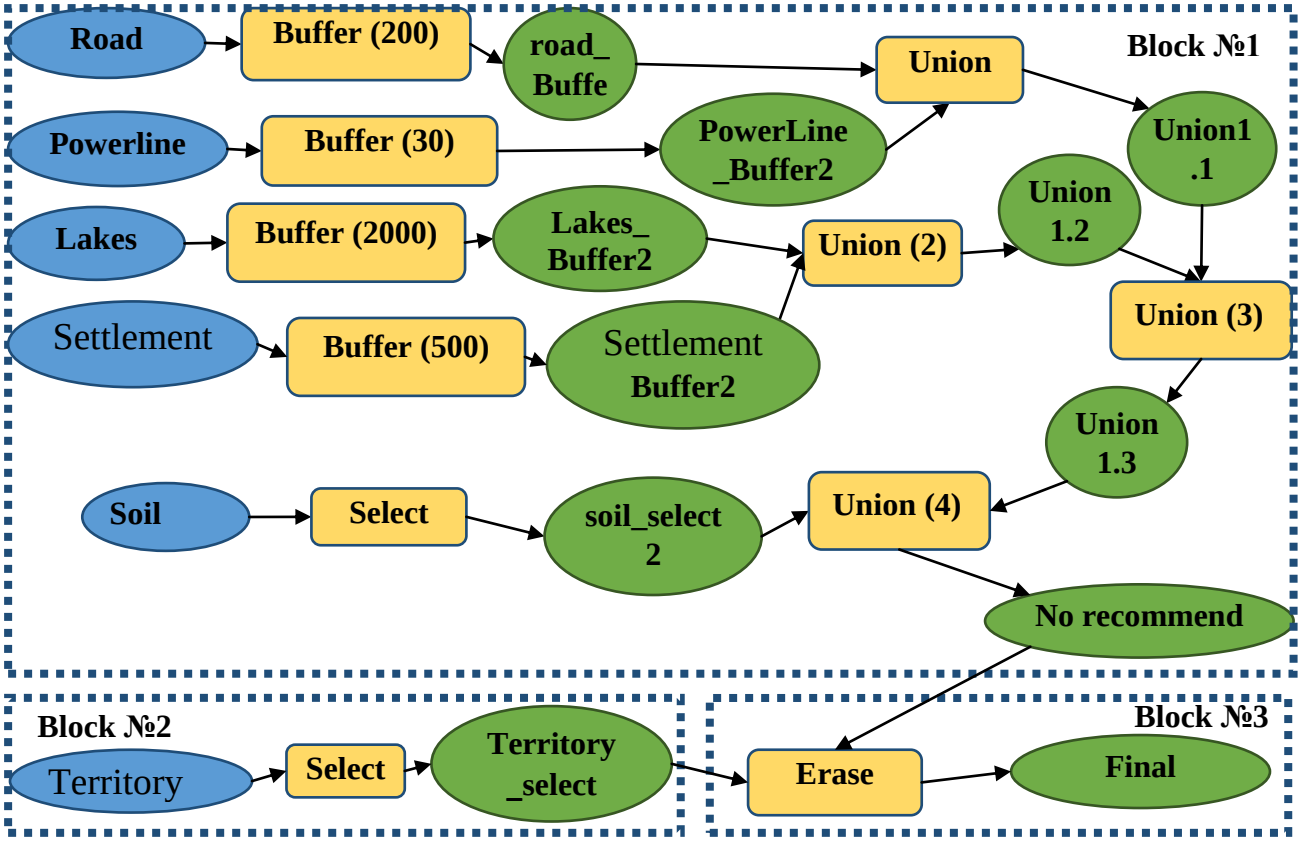
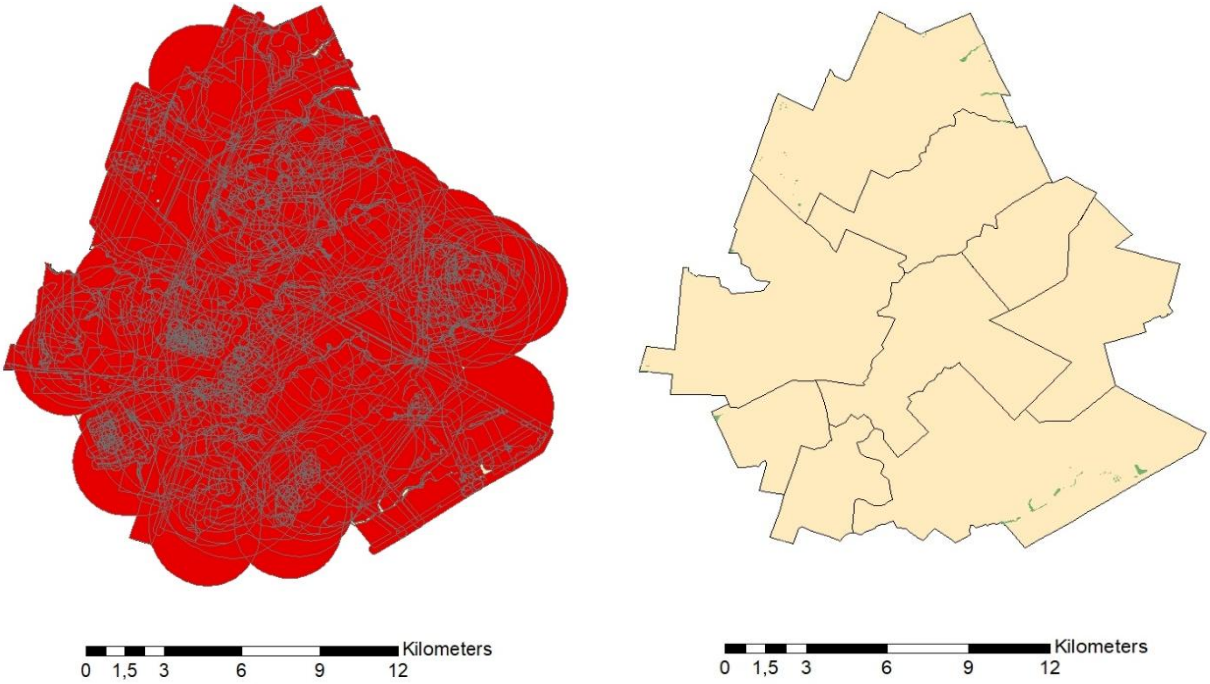


Fig. 4. Model of defining territories for the location of disposal tips



a *b*

Legend: Hrebinka territorial community; impossible location; possible location

Fig. 5. Thematic maps of the community: a - the territory of the impossible location of the disposal tips, b - the possible location of the disposal tips

Conclusions. The developed functional model of selection of land plots for non-agricultural use is generally common: it is necessary to determine the desired location and exclude restricted areas, but for each object it is necessary to take into account the environment and set restrictions. Developed geoinformation models of geoimaging allow accelerating the analysis of spatial data to justify decisions on the selection of land plots filling station and disposal tip.The results of the work can be used to automate the selection of land plots for for these objects.

The prospect of further research is to develop an automated decision-making unit for planning the location of non-agricultural facilities in communities.

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ГЕОІНФОРМАЦІЙНЕ МОДЕЛЮВАННЯ ПІДБОРУ ЗЕМЕЛЬНИХ ДІЛЯНОК НЕСІЛЬСЬКОГОСПОДАРСЬКОГО ВИКОРИСТАННЯ

Деякі об’єкти становлять підвищену екологічну небезпеку через їх вплив на прилеглі території, а отже при їх розташуванні необхідно врахувати різні вимоги та дані щодо досліджуваної території. Задля оптимізації робіт з раціонального використання земельних ресурсів необхідно інтегрувати різнорідні дані та використовувати їх комплексно, а послідовність виконання дій автоматизувати через моделі.

Метою роботи є розробка геоінформаційних моделей для автоматизації підбору земельних ділянок під несільськогосподарське використання.

Дане дослідження описує структурування загального алгоритму встановлення територій необхідного та неможливого розташування об’єктів та їх обмежень через функціональну модель.Модель підбору територій загалом є спільною, тобто необхідно визначити бажане розташування та

виключити території з обмеженнями, однак для кожного об'єкту необхідно за нормативами встановлювати обмеження з урахуванням оточення. В статті наведено аналіз вимог до вибору територій для двох типів об'єктів: АЗС та полігонів побутових відходів. Розроблено та реалізовано геоінформаційні моделі вибору земельних ділянок для розміщення визначених об'єктів.

Результати роботи можуть бути використані при плануванні територій громад для формування просторових рішень щодо використання розташування об'єктів несільськогосподарського використання.

Перспектива подальших досліджень полягає в розробці автоматизованого блоку прийняття рішення щодо планування розміщення об'єктів несільськогосподарського використання на території громад.

Ключові слова. геоінформаційне моделювання, модель, підбір територій, геозображення.

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ГЕОИНФОРМАЦИОННОЕ МОДЕЛИРОВАНИЕ ПОДБОРА ЗЕМЕЛЬНЫХ УЧАСТКОВ НЕСЕЛЬСКОХОЗЯЙСТВЕННОГО ИСПОЛЬЗОВАНИЯ

Некоторые объекты представляют повышенную экологическую опасность из-за их влияния на прилегающие территории, а следовательно, при их расположении необходимо учесть различные требования и данные относительно исследуемой территории. Для оптимизации работ по оптимальному использованию земельных ресурсов необходимо интегрировать разнородные данные и использовать их в комплексе, а последовательность выполнения действий автоматизировать через модели.

Целью работы является разработка геоинформационных моделей для автоматизации подбора земельного участка под несельскохозяйственное использование.

Данное исследование описывает структурирование общего алгоритма установления территорий необходимого и невозможного расположения

объектов и ограничений через функциональную модель. Модель подбора территорий в общем является общей, то есть необходимо определить желаемое расположение и исключить территории с ограничениями, однако для каждого объекта необходимо по нормативам устанавливать ограничения с учетом окружения. В статье представлен анализ требований к выбору территорий для двух типов объектов: АЗС и полигонов бытовых отходов. Разработаны и реализованы геоинформационные модели выбора земельных участков для размещения определенных объектов.

Результаты работы могут использоваться при планировании территорий общин для формирования пространственных решений по использованию расположения объектов несельскохозяйственного использования.

Перспектива дальнейших исследований заключается в разработке автоматизированного блока принятия решения о планировании размещения объектов несельскохозяйственного использования на территории общин.

Ключевые слова: геоинформационное моделирование, модель, подбор территорий, геоизображение.