БЕЛОРУССКИЙ ГОСУДАРСТВЕННЫЙ УНИВЕРСИТЕТ /
BELARUSIAN STATE UNIVERSITY

УТВЕРЖДАЮ / APPROVED

Ректор Белорусского
государственного университета/
Rector of Belarusian State University

А.Д.Король /Andrei D.Karol

29.11.2024

Регистрационный Registration № 1930/m.

ГИС ДЛЯ УПРАВЛЕНИЯ ЗЕМЕЛЬНЫМИ РЕСУРСАМИ / GIS FOR LAND RESOURCE MANAGEMENT

Учебная программа учреждения образования по учебной дисциплине для специальности:
The program of the educational institution of the discipline for the speciality:

7-06-0532-03 Землеустройство, кадастры, геодезия и геоматика /
7-06-0532-03 Land Management, Cadastres, Geodesy and Geomatics

Профилизация / Profilization:
Управление геоданными с помощью интеллектуальных систем /
Geodata management using intelligent systems

2024

Учебная программа составлена на основе ОСВО 7-06 0532-03-2023 по специальности 7-06-0532-03 Землеустройство, кадастры, геодезия и геоматика, примерного учебного плана № 7 06-05-011/пр. от 18.01.2023, учебного плана № М 47а-5.7-157/уч. от 29.03.2024

СОСТАВИТЕЛЬ:
Д.М.Курлович, доцент кафедры почвоведения и геоинформационных систем Белорусского государственного университета, кандидат географических наук, доцент

РЕЦЕНЗЕНТ:
В.А.Сипач, заместитель начальника отдела № 14 «Разработки технологий обработки и применения данных дистанционного зондирования Земли» Научно-инженерного республиканского унитарного предприятия «Геоинформационные системы»

РЕКОМЕНДОВАНА К УТВЕРЖДЕНИЮ:
Кафедрой почвоведения и геоинформационных систем
(протокол № 5 от 21.11.2024);

Научно-методическим советом БГУ
(протокол № 4 от 28.11.2024)

Заведующий кафедрой _____ А.Н.Червань

ПОЯСНИТЕЛЬНАЯ ЗАПИСКА

Цели и задачи учебной дисциплины

Цель учебной дисциплины – формирование знаний, умений и навыков в области использования ГИС для управления земельными ресурсами.

В рамках поставленной цели **задачи учебной дисциплины** состоят в следующем:

1) освоение базового понятийно-терминологического аппарата, методики использования ГИС в управлении земельными ресурсами;

2) формирование навыков выполнения типовых операций по использованию данных дистанционного зондирования, результатов инструментальных наземных съемок и планово-картографических материалов для целей ГИС-картографирования земель и их управления.

Место учебной дисциплины в системе подготовки специалиста с углубленным высшим образованием. Учебная дисциплина относится **к модулю** «Геоинформационный анализ геоданных / Geoinformation analysis of geodata» компонента учреждения образования.

Учебная программа составлена с учетом межпредметных связей и программ по дисциплинам «Функциональный анализ программного ГИС-обеспечения», Технологии автоматизированной обработки геоданных», «Имитационное и прогнозное моделирование данных в ГИС».

Требования к компетенциям

Освоение учебной дисциплины «ГИС для управления земельными ресурсами» должно обеспечить формирование следующей **специализированной компетенции:**

СК. Применять географические информационные системы и данные дистанционного зондирования Земли для решения исследовательских и инновационных задач в управлении земельными ресурсами.

В результате изучения учебной дисциплины студент магистратуры должен:

знать: базовый понятийно-терминологический аппарат использования ГИС в управлении земельными ресурсами, основные источники данных, используемые для целей ГИС-картографирования земель, принципы типовых операций по использованию данных дистанционного зондирования, результатов инструментальных наземных съемок и планово-картографических материалов для целей ГИС-картографирования земель и их управления;

уметь: проектировать и создавать базы геоданных земельно-кадастрового содержания, выполнять визуальное и автоматизированное дешифрирование видов земель по данным дистанционного зондирования, обрабатывать результаты наземной инструментальной съемки земельных участков и конвертировать их в ГИС, создавать планы границ земельных участков в ГИС по материалам наземной инструментальной съемки и планово-картографическим материалам, выполнять

автоматическую векторизацию рельефа на основе планово-картографического материала; выполнять компоновку и дизайн земельно-кадастровых карт в ГИС;

иметь навык: владения методикой картографирования и управления земельными ресурсами на основе различных источников данных в среде ГИС.

Структура учебной дисциплины

Дисциплина изучается во 2 семестре. Всего на изучение учебной дисциплины «ГИС для управления земельными ресурсами» отведено:

– в очной форме получения углубленного высшего образования: 100 часов, в том числе 48 аудиторных часов, из них: лекции – 14 часов, лабораторные занятия – 24 часа, внеаудиторный контроль УСР – 10 часов.

Трудоемкость учебной дисциплины составляет 3 зачетные единицы.

Форма промежуточной аттестации – дифференцированный зачет.

EXPLANATORY NOTE

Aim and tasks of the discipline

The aim of the discipline is to form knowledge, skills and abilities in the field of using GIS for land resource management.

Tasks of the discipline:

1. mastering of basic conceptual and terminological apparatus, methods of using GIS in land resource management;

2. formation of skills to perform typical operations on the use of remote sensing data, results of geodetic surveys and cartographic materials for the purposes of GIS-mapping of land and their management.

Place of the academic discipline in the system of training a specialist with advanced higher education.

The academic discipline is part of the module «Geoinformation analysis of geodata».

Connections with other academic disciplines: «GIS software functionality», «Technologies for automated data processing», «Simulation and predictive data modeling in GIS».

Requirements for competences

Mastering of the academic discipline «GIS for land resource management» should provide the formation of the following special competences*:*

SC. To apply geographic information systems and remote sensing data to solve research and innovation tasks in land resource management.

As a result of mastering the academic discipline, the student is expected to:

know: basic conceptual and terminological apparatus for the using of GIS in land resources management, main data sources used for GIS mapping of land, principles of typical operations for the using of remotely sensed data, results of geodetic surveys and cartographic materials for the purposes of GIS mapping of land and its management.

be able to: design and create geodatabases of land cadastral content, perform visual and automated interpretation of land types based on remotely sensed data, process the results of geodetic survey of land plots and convert them into GIS, create plans of boundaries of land plots in GIS based on geodetic survey and cartographic materials, perform layout and design of land cadastral maps in GIS.

have skills in: mastering the methodology of land resource mapping and management based on various data sources in GIS.

Structure of the academic discipline

The discipline is studied in the 2 semester. In total for the study of the discipline GIS for land resource management is allocated:

– for full-time higher education – 100 hours, including 48 in-class hours, of them: lectures – 14 hours, laboratory classes – 24 hours, , extracurricular control of controlled self-study – 10 hours.

Form of certification – differentiated end-of-term test.

CONTENT OF THE STUDY MATERIAL

Topic 1. Basics of GIS for Land Resource Management

Basics of GIS-mapping of land resources. The major sources of data for the purposes of GIS-mapping of land resources. Formation and development of GIS-methods of mapping of land resources. The market of software for GIS-mapping of land resources. GIS-mapping of land resources in the Republic of Belarus: land-information system of the Republic of Belarus, automated system of the state land cadaster, land management.

Topic 2. Land Resource Management Based on Remote Sensing Data

Remote sensing data used for the purposes of land resource management: spatial resolution, spectral resolution, radiometric resolution, temporal resolution. Data processing: radiometric correction, topographic correction, atmospheric correction. Data processing levels. Ways and methods of image classification. Visual image classification. Automated image classification.

Topic 3. Land Resource Management Based on Geodetic Surveys and Global Navigation Satellite Systems

Main geodetic surveys used for land resource management. Global Navigation Satellite Systems. Main geodetic instruments. Technology and methodology of geodetic surveys. Stages of carrying out activities to establish and restore the boundaries of land parcels. Conversion of the results of geodetic surveys into GIS. Process of creation and editing of digital land-cadastral maps in GIS based on geodetic surveys and global navigation satellite systems.

Topic 4. Land Resource Management Based on Cartographic Materials

Stages of GIS-mapping of lands based on cartographic materials. Creation of the "Soil" layer of the geodatabase of the land-information system of the Republic of Belarus. Creation of digital elevation models. Creation of maps for the boundaries of land parcels.

Topic 5. Land Resource Management Based on Vector Data. Layout of land-cadastral maps.

General recommendations for mapping. The main elements of a map. Stages of design and layout of the map in GIS. External and internal factors of cartographic design. Using vector data for land resource management. Special features of design and symbolization of land-cadastral maps using GIS in the Republic of Belarus.

TEACHING AND METHODOLOGICAL MAP OF THE DISCIPLINE

Full-time form of higher education with the use of distance learning technologies (DLT)

Title of section, topic	Title of section, topic	In-class hours					Independent work	Form of control
		Lectures	Practical classes	Seminar classes	Laboratory classes	Other		
1	2	3	4	5	6	7	8	9
	Total for the discipline	**14**			**24**		**10**	
1	Basics of GIS for Land Resource Management	4			4			electronic test, written reports on laboratory work
2	Land Resource Management Based on Remote Sensing Data	4			8		10	electronic test, written reports on laboratory work and self-study
3	Land Resource Management Based on Geodetic Surveys and Global Navigation Satellite Systems	2			4			electronic test, written reports on laboratory work
4	Land Resource Management Based on Cartographic Materials	2			4			electronic test, written reports on laboratory work
5	Land Resource Management Based on Vector Data. Layout of land-cadastral maps.	2			4			electronic test, written reports on laboratory work

INFORMATION AND METHODOLOGICAL PART

List of basic literature

1. Kurlovich, D. M. GIS for Land Resource Management: coursebook / D. M. Kurlovich. – Minsk : BSU, 2024. – 190 p.

List of additional literature

1. Bolstad, P. GIS fundamentals: a first text on geographic information systems. GIS fundamentals / P. Bolstad. – Acton, MA White Bear Lake, Minnesota: XanEdu, 2016. – 764 p.

2. DeMers, M.N. Fundamentals of geographic information systems / M.N. DeMers. – Hoboken, NJ: Wiley, 2009.

3. Geographic Information Science for Land Resource Management. – Scrivener Publishing LLC, 2021. – 408 p.

4. Geospatial Technologies in Land Resources Mapping, Monitoring and Management. Editors: G. P. Obi Reddy, S. K. Singh. - Springer Cham, 2018 . – 638 p.

5. Kasthuri Thilagam, V. Role of remote sensing and GIS in land resource inventory-a review / V. Kasthuri Thilagam, R. Sivasamy // Agricultural reviews. – 2013. – Vol. 34. – №. 3.

6. Kumar, N. Applications of remote sensing and GIS in natural resource management / N. Kumar, S. S. Yamaç, A. Velmurugan // Journal of the Andaman Science Association. – 2015. – Vol. 20. – №. 1. – P. 1-6.

7. Kumar, S. Application of remote sensing and GIS in land resource management / S. Kumar, N. Khan // Journal of Geography and Cartography. – 2021. – Vol. 4. – №. 2. – P. 78-81.

8. Pirimov, J.J. Modern Geographic Information Systems in Land Resource Management / J.J. Pirimov // Academic Journal of Digital Economics and Stability. – 2021. – Vol. 8. – P. 66-69.

9. Ralphs, M.P. GIS in Land and Property Management / M.P. Ralphs, P. Wyatt. – London: Taylor & Francis, 2003. – 416 p.

10. Shekhar, S. Encyclopedia of GIS / S. Shekhar. – New York, NY: Springer Berlin Heidelberg, 2017.

11. Tripp, G.C. ArcGIS Pro 2.x Cookbook / G.C. Tripp, G.T. Corbin. – Birmingham – Mumbai: Packt Publishing, 2018.

12. Wise, S. GIS Fundamentals, Second Edition / S. Wise. – Boca Raton: CRC Press, 2014.

13. Xiao, N. GIS Algorithms: Theory and Applications for Geographic Information Science & Technology. GIS Algorithms / N. Xiao. – 1 Oliver's Yard, 55 City Road London EC1Y 1SP: SAGE Publications, 2016.

List of recommended diagnostic tools and methodology for final mark formation

The object of diagnostics of students' competences is the knowledge and skills acquired as a result of studying the academic discipline. Identification of students' learning achievements is carried out by means of current and interim certification.

The following means of current certification can be used to diagnose competences: electronic test, written reports on laboratory work and self-study.

The form of interim certification in the discipline GIS for land resource management in accordance with the curriculum is differentiated end-of-term test.

A rating system of the student knowledge is used for the final mark formation, which makes it possible to trace and evaluate the dynamics within the process of achieving learning objectives. The rating system stipulates the use of weighting coefficients for current and interim certification of students in the academic discipline.

The final mark formation in the course of control measures for current certification (approximate weighting coefficients determining the contribution of current certification to the mark for passing interim certification) includes:

- electronic test – 40 %;
- written reports on laboratory work and self-study – 60 %;

The final mark for the discipline is calculated on the basis of the mark of current certification (rating system of knowledge) — 40 % and differentiated end-of-term test mark — 60 %.

Approximate list of assignments for controlled self-study

Topic 2. Land Resource Management Based on Remote Sensing Data. (10p.)
Automated Classification of Land Classes Using Multizone Satellite Images.
Form of control – written report.

Approximate list of laboratory classes

1. Creation a Geodatabase (on an Example of the Geodatabase of Land Informational System of the Republic of Belarus)
2. Creating a Geodatabase Topology (on an Example of the Geodatabase of Land Informational System of the Republic of Belarus)
3. Visual Interpretation of Land Types and Subtypes of the Geodatabase of Land Informational System of the Republic of Belarus Based on Aerial Photography Materials
4. Creation of Plans of Boundaries of Land Plots in GIS Based on Geodetic Surveys
5. Creation of Plans of Boundaries of Land Plots of Gardening Communities Using Cartographic Materials

Description of innovative approaches and methods for teaching the discipline

When organizing the educational process, a project-based learning approach is used, which entails the following:

- mastering students' skills of planning, self-organization and cooperation relevant for both educational and professional activities, including the creation of one's own product;
- acquiring skills to solve research, creative, social, business and communication problems.

Methodological recommendations for the organization of independent work

When studying the discipline GIS for land resource management it is recommended to use the following forms of independent work:

- search (selection) and review of literature and electronic sources on an individually specified problem of the academic discipline;
- fulfilment of homework;
- study of the material submitted for independent work;
- preparation for laboratory classes;
- research work;
- preparation for participation in conferences and competitions.

The effectiveness of students' independent work is checked during the current and final control of knowledge. The rating system is used for general assessment of the quality of students' mastering of the study material.

Approximate list of questions for differentiated end-of-term test

1. Basics of GIS-mapping of land resources. The major sources of data for the purposes of GIS-mapping of land resources.
2. Formation and development of GIS-methods of mapping of land resources.
3. The market of software for GIS-mapping of land resources.
4. GIS-mapping of land resources in the Republic of Belarus: land-information system of the Republic of Belarus, automated system of the state land cadaster, land management.
5. Remote sensing data used for the purposes of land resource management: spatial resolution, spectral resolution, radiometric resolution, temporal resolution.
6. Data processing: radiometric correction, topographic correction, atmospheric correction. Data processing levels.
7. Ways and methods of image classification. Visual image classification.
8. Automated image classification.
9. Main geodetic surveys used for land resource management. Global Navigation Satellite Systems. Main geodetic instruments.
10. Technology and methodology of geodetic surveys.

11. Stages of carrying out activities to establish and restore the boundaries of land parcels. Conversion of the results of geodetic surveys into GIS.

12. Process of creation and editing of digital land-cadastral maps in GIS based on geodetic surveys and global navigation satellite systems.

13. Stages of GIS-mapping of lands based on cartographic materials.

14. Creation of the “Soil” layer of the geodatabase of the land-information system of the Republic of Belarus.

15. Creation of digital elevation models.

16. Creation of maps for the boundaries of land parcels.

17. General recommendations for mapping. The main elements of a map.

18. Stages of design and layout of the map in GIS. External and internal factors of cartographic design.

19. Using vector data for land resource management.

20. Special features of design and symbolization of land-cadastral maps using GIS in the Republic of Belarus.

ПРОТОКОЛ СОГЛАСОВАНИЯ УЧЕБНОЙ ПРОГРАММЫ УО

Название дисциплины, с которой требуется согласование	Название кафедры	Предложения об изменениях в содержании учебной программы по изучаемой учебной дисциплине	Решение, принятое кафедрой, разработавшей учебную программу (с указанием даты и номера протокола)
дисциплина не требует согласования			

Заведующий кафедрой почвоведения и
геоинформационных систем
к. с.-х. н., доцент _____ А.Н.Червань

21.11.2024

ДОПОЛНЕНИЯ И ИЗМЕНЕНИЯ К УЧЕБНОЙ ПРОГРАММЕ ПО ИЗУЧАЕМОЙ УЧЕБНОЙ ДИСЦИПЛИНЕ

на 2025/2026 учебный год

№№ пп	Дополнения и изменения	Основание

Учебная программа пересмотрена и одобрена на заседании кафедры (протокол № от г.)

Заведующий кафедрой
к. с.-х. н., доцент _____ А.Н. Червань
(подпись)

УТВЕРЖДАЮ
Декан факультета
к. г. н., доцент _____ Е.Г. Кольмакова
(подпись)