Brief information about the project

Name of the project	AP26199673 "Environmental assessment of technogenic soil contamination in Almaty city using GIS technologies"
Relevance	The relevance of the study is determined by the unfavorable environmental situation in Kazakhstani cities caused by technogenic factors such as the growth of motor transport, utilities, energy sector, and waste disposal. Almaty is the largest metropolis of Kazakhstan (population 2,264.5 thousand, area 683 km²), representing a vulnerable techno-ecosystem that has lost its self-recovery capacity. Global changes (aridization, greenhouse effect, pollution, soil degradation) are especially evident in urbanized areas, intensifying ecological risks for soil, air, water, and biota. In the city, the concentration of heavy metals and toxicants in soils is increasing. Therefore, the development of modern ecological monitoring methods, the creation of an updated series of thematic maps, and the preparation of scientifically substantiated recommendations for sustainable urban development are of particular importance. Since previous research was fragmentary, a comprehensive assessment of Almaty's soil ecological condition is a highly relevant scientific task.
Purpose	To assess the ecological state of soils in Almaty city, determine the degree of technogenic transformation, develop a mathematical model of urbanized contaminated areas, provide forecast directions with ecological zoning, and create a series of thematic maps using GIS technologies.
Objectives	1. Study the current ecological condition of urban soils in Almaty under conditions of territorial expansion and population growth to achieve sustainable development indicators. 2. Develop a series of soil contamination maps for heavy metals using GIS technologies. 3. Develop a predictive mathematical model of urban soil contamination in Almaty through the application of mathematical analysis.
Expected and achieved results	Quantitative and qualitative characteristics of the project include determining the level of soil contamination in Almaty with heavy metals, identifying the main sources of pollution, conducting an ecological assessment of soil condition, creating soil contamination maps for heavy metals, and ecological zoning of the city's territory based on the obtained results. On the basis of the collected data, a predictive mathematical model of urban soil contamination in Almaty will be developed, along with recommendations for reducing soil pollution and improving soil quality. Project outcomes: 1. – Publication of 3 (three) articles and/or reviews in peer-reviewed scientific journals indexed in the *Science Citation Index Expanded* database of Web of Science and/or having a CiteScore percentile of at least 50 in the Scopus database; • 1 patent for an invention (including a positive decision); • 2 (two) articles or reviews in peer-reviewed domestic or foreign journals recommended by the Committee for Quality Assurance

	in Education and Science (MES RK); One article must be in the *multidisciplinary* category (practical interdisciplinary application) addressing tasks of enterprises in Kazakhstan's real sector; • or at least 2 (two) articles and/or reviews in peer-reviewed journals indexed in the *Science Citation Index Expanded* and included in the 1st or 2nd quartile by impact factor in Web of Science and/or with a CiteScore percentile of at least 65 in Scopus; • as well as at least 2 (two) articles or reviews in peer-reviewed foreign or domestic journals recommended by the Committee for Quality Assurance. One article must belong to the *multidisciplinary* category and include project-design documentation prepared in accordance with the ESKD. The article will indicate the project's registration number, title, and grant funding as the source. 2. Publication of monographs, books, or book chapters in foreign and/or Kazakhstani publishers is not planned. 3. As a result of the project, 1 (one) Doctor of Philosophy (PhD) will be trained (the dissertation topic will correspond to the project's subject). 4. Participation in international scientific conferences and seminars to disseminate project results among potential users and the scientific community. 5. Other direct and indirect results of the project with their qualitative and quantitative characteristics.
Research team members with their identifiers (Scopus Author ID, Researcher ID, ORCID, if available) and links to relevant profiles	1. Mukhanova Gulzhanat Amangeldikyzy – Project Leader, Candidate of Biological Sciences, Associate Professor. Hirsch index – 3, ResearcherID: A-9814-2015, ORCID: 0000-0002-3683-6622, Scopus Author ID: 55067113400. 2. Aktymbaeva Aliya Sagyndykovna – Candidate of Geographical Sciences, Associate Professor. h-index = 8, Web of Science h-index = 2, ResearcherID: N-9777-2014, ORCID: 0000-0003-1269-4356, Scopus Author ID: 55916649100. 3. Bazarbayeva Tursynkul Amankeldievna – Candidate of Geographical Sciences, Associate Professor. Hirsch index – 5, ResearcherID: CEH-3380-2022, ORCID: 0000-0001-8775-1234, Scopus Author ID: 56784399000. 4. Shimshikov Batyrgeldy Erdenovich – Candidate of Biological Sciences, Associate Professor. Hirsch index – 2, ResearcherID: A-9814-2015, ORCID: 0000-0002-3683-6622, Scopus Author ID: 55067113400. 5. Tukenova Zulfiya Aydunovna – Candidate of Biological Sciences, Associate Professor. Scopus h-index = 2, ORCID: 0000-0002-9919-6220, Scopus Author ID: 56951094300. 6. Tusupova Bayan Khalelovna – Candidate of Technical Sciences, Senior Lecturer. ORCID: 0000-0002-7246-0685, Scopus Author ID: 57189002642. 7. Temirbekov Almas Nurlanovich – PhD, Associate Professor. Scopus h-index = 5, Web of Science h-index = 2, ResearcherID:

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List of publications with links to them	-
Patents	-