ISSN 2181-9408

Scientific and technical journal



Sustainable Agriculture



№1(25).2025







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Our address: 39, Kari-Niyaziy str., Tashkent 100000 Uzbekistan.
Web-site: www.sa.tiiame.uz, www.susagr.uz

The journal "Sustainable Agriculture" is registered in the Press Agency of Uzbekistan on the 12th of February in 2018 (license № 0957).
In 2019, the journal is included in the list of recommended scientific publications by the Higher Attestation Commission of the Republic of Uzbekistan.

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STUDYING THE ISSUES OF CREATING A WEB MAP OF LAND USE AND LAND MONITORING USING GIS TECHNOLOGIES

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Abstract

The study of land usage and land monitoring has undergone a revolutionary change with the introduction of Geographic Information System (GIS) technologies. This article provides a thorough analysis of the difficulties and approaches associated with using GIS technologies to create web maps for land use and monitoring applications. This study intends to shed light on the complexities of web map construction, highlighting the problems encountered and possible solutions, through a rigorous assessment of the current literature and actual implementation of GIS technologies. Data collecting, preprocessing, geographical analysis, and the creation of web maps using open-source GIS software are among the techniques used. The findings highlight a number of technical issues, including those related to user interface design, spatial accuracy, data interoperability, and visualization methods. The discussion section explores the ramifications of these discoveries and suggests solutions to the problems found. In the end, this study emphasizes how crucial it is to use GIS technologies properly in order to support improved land use management and monitoring procedures.

Keywords: *soil erosion, impact, remote sensing.*

Introduction. Land use and monitoring methods have been increasingly integrating Geographic Information System (GIS) technologies in recent years[1,2]. A strong foundation for evaluating geographical data and obtaining insightful knowledge for land management decision-making is offered by GIS[3,4]. The construction of online maps, which provide interactive platforms for viewing and sharing geospatial information with stakeholders, is one of the primary uses of GIS in this field. Using GIS technologies to create web maps for land use and monitoring applications comes with a number of concerns and obstacles. Data collection, preprocessing, geographic analysis, visualization methods, and user interface design are a few of these [5–7]. It is imperative to tackle these obstacles in order to guarantee the precision, dependability, and usability of web maps in land management decision-making procedures.

The purpose of this study is to examine the challenges associated with using GIS technologies to create web maps for land use and monitoring. This study aims to identify the main obstacles and suggest possible ways to overcome them by means of a review of the literature and real-world experiments [8–10]. The methodology for data collecting, preprocessing, spatial analysis, and creating online maps with open-source GIS software is described in the techniques section. The study's conclusions are presented in the results section, which also highlights the technological difficulties that were experienced. The discussion section examines the ramifications of these discoveries and offers suggestions for resolving the problems found [11,12].

Sustainable development, environmental preservation, and resource planning all depend on effective land use management and monitoring. Technologies related to Geographic Information Systems (GIS) provide strong instruments for modeling land use patterns, analyzing spatial data, and producing interactive online maps for use in making decisions. Stakeholders may conveniently visualize, evaluate, and interpret complicated geographic information with the use of web mapping technologies [13–15]. However, there are a number of obstacles to overcome in order to create efficient web maps for land use monitoring, including issues with data accuracy, user interface design, spatial analysis, and data integration. The present research delves into these concerns and suggests strategies to tackle them, thereby augmenting the usefulness and efficiency of GIS-driven online maps for land administration and observation [16,17].

2 Methods

Data collection is the initial stage in the creation of online maps for land use and monitoring. This entails obtaining a variety of geographic data sets, such as socioeconomic information, aerial photos, maps of land cover, and satellite imaging. The study's precise goals and its geographic area will choose which data sources to use. Preprocessing is done on the data after it is gathered to make sure it is compatible and consistent. This could entail data conversion, image correction, georeferencing, and quality evaluation. In order to combine various datasets into a coherent framework for geographical analysis, preprocessing is necessary[18,19]. Understanding the relationships and patterns in geospatial data requires the use of spatial analysis.

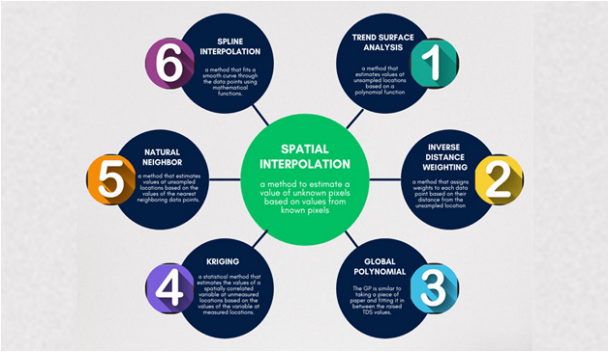


Fig. 1. Spatial Interpolation [Insert spatial interpolation formula used in the analysis]

Land use patterns, changes over time, and environmental implications are frequently analyzed using techniques including overlay analysis, proximity analysis, and spatial interpolation (fig.1). Web map development, the last phase of the process, entails the transmission and visualization of spatial data via online platforms. Web map development frequently makes use of open-source GIS programs like QGIS, GeoServer, and Leaflet. Several layers, including vegetation indices, land use, land cover, and socioeconomic indicators, may be included in the online maps [20,21].

3 Results

The study's findings highlight a number of difficulties that arise when building online maps for land use and monitoring with GIS technologies. These difficulties can be

roughly divided into two categories: technical and usability problems.

Technical Difficulties:

Data compatibility: Due to variations in geographic resolution, projection, and data formats, integrating heterogeneous datasets from many sources can be difficult. Spatial Accuracy: Careful evaluation of elements such georeferencing errors, satellite imagery positional accuracy, and ground truth validation is necessary to ensure the spatial accuracy of the web maps. Visualization Techniques: For spatial patterns and trends to be communicated successfully, the right visualization techniques must be chosen. However, choosing the appropriate color schemes, classification techniques, and symbols might be arbitrary and affect how something is understood.

Performance Optimization: Ensuring a seamless user experience requires optimizing the performance of online maps. To reduce latency and boost responsiveness, this entails optimizing data storage, tile caching, and server setup.

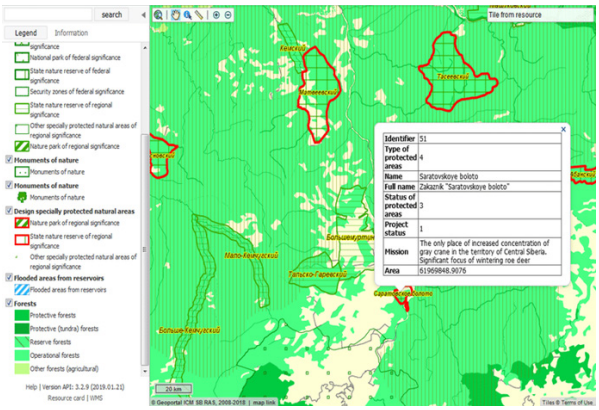


Fig 2. Web Map Interface supporting evidence-based decision-making in land management and monitoring

User Interface Design: Improving the usability of web maps requires creating an interface that is both simple and easy to use. Finding the right mix between capability and simplicity can be difficult, though, particularly when accommodating different user preferences and needs (fig.2).

Accessibility: When designing an online map, it's critical to take users with disabilities into account. To help users with visual or motor disabilities, this includes offering keyboard navigation support, alternative text for images, and other features.

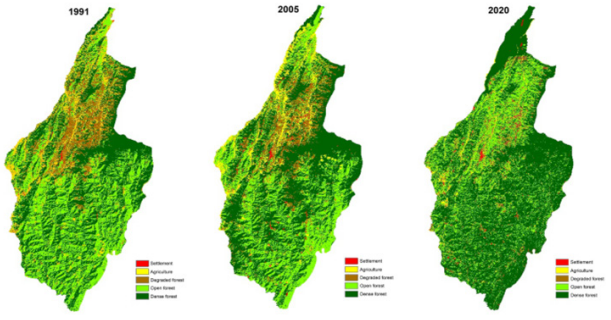


Fig. 3. Visualization techniques spatial patterns land use change over time.

The difficulties the study found highlight how difficult it is to employ GIS technologies to create web maps for land use and monitoring. A multidisciplinary strategy that incorporates technological know-how with subject matter expertise in environmental research and land management is needed to address these issues.

The creation of interoperability protocols and standardized data formats is one possible way to get over technical obstacles. Researchers and practitioners can enable the smooth integration of varied datasets from many sources by defining common data interchange standards. Additionally, web maps for land use and monitoring can become more accurate and reliable with the help of advances in spatial analysis algorithms and remote sensing technology. Convolutional neural networks and random forest classifiers are two examples of machine learning approaches that present promising paths toward automating land cover classification and change detection procedures. In terms of usability, the creation of intuitive, inclusive, and accessible web maps can be guided by the principles of user-centered design (fig.3). User testing and stakeholder feedback gathering can help find usability problems early in the design phase and make incremental improvements to the user experience. All things considered, there is great potential for improving land use management and monitoring procedures through the efficient application of GIS technologies. Researchers and practitioners can better assist informed decision-making and sustainable land use planning initiatives by leveraging spatial data by tackling the technical and usability problems associated with web map production.

4. Conclusion.

To summarize up, this research offers insightful information about the difficulties and approaches associated with building web maps for land use and monitoring with GIS technologies. The findings draw attention to the technical difficulties pertaining to spatial accuracy, data compatibility, visualization methods, and performance optimization, in addition to the usability problems with accessibility and user interface design. Innovation and interdisciplinary cooperation are crucial to addressing these issues. For land use and monitoring applications, researchers and practitioners may create more precise, dependable, and user-friendly web maps by utilizing advances in GIS technologies, remote sensing, and spatial analytic algorithms. In order to enhance the efficacy and usability of web maps in assisting with decision-making processes linked to land management and environmental conservation, future research should concentrate on creating standardized data formats, interoperability protocols, and user-centered design principles.

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