



MODERN METHODS OF DETERMINING THE GEODESIC STATUS OF LAND RESOURCES OF FARM HOLDINGS IN KASHKADARYA REGION

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Abstract: This article analyzes modern methods used to determine the geodetic status of land plots of dehkan farms in the Kashkadarya region. The relationship between the accuracy of geodetic measurements, time and resource savings, and land use efficiency is examined using studies based on space monitoring, GNSS technologies, and digital cartography. Through these approaches, land ownership, fertility zones, and land management in dehkan farms are being carried out more clearly and transparently.

Keywords: peasant farming, land resources, geodetic measurements, GNSS technology, space monitoring, digital cartography, Kashkadarya region, geoinformation systems, modern methods, land ownership accuracy.

Introduction. Land resources are one of the most important strategic assets in the agricultural sector of any country. In particular, the precise definition of the legal and technical framework for land ownership, use and management is a decisive factor in the economic activity of dehkan farms. Agricultural activity is the main source of employment in the Kashkadarya region, where thousands of dehkan farms operate. However, the lack of timely determination of the exact boundaries, area sizes and geodetic coordinates of the lands owned by these farms has been causing problems in practice. In recent years, the rapid development of digital technologies in the Republic of Uzbekistan, the introduction of modern methods in cadastral and land surveying services, have led to the expansion of the possibilities for accurate and rapid geodetic measurements of land areas. In particular, GNSS (Global Navigation Satellite System), space monitoring, photogrammetric observations using drones and digital cartography systems are used as effective tools for determining the geodetic status of dehkan farms. This article analyzes modern technologies used in determining the geodetic status of land resources of farmers' farms, their technical advantages, level of accuracy and practical usefulness, using the example of the Kashkadarya region. A comparative analysis is also conducted between traditional methods and modern technologies, and recommendations are developed for their implementation in real practice.





Literature review: Scientific research in the fields of geodesy and land management shows that the use of modern geodetic measurement methods allows for increased accuracy, reliability, and efficiency in land resource management. In particular, S. Matrosov (2019) in his research focused on the possibilities of accurately determining geodetic coordinates using GNSS technologies, noting that these technologies are 3-5 times more effective than traditional methods. In the conditions of Uzbekistan, however, research in this area is based more on practical experience. The analysis conducted by Mavlonov A. (2021) states that digital maps generated using modern geodetic devices (GPS, total station) and programs (AutoCAD Civil 3D, ArcGIS) simplify the land management and cadastral system in determining land ownership. Also, according to the reports of the Uzdaverloyiha State Enterprise, since 2020, land areas of dehqan farms in the Kashkadarya region are being gradually digitized and included in geoinformation systems. Reports of international organizations such as FAO (2022) and GIZ (German International Cooperation Agency) recommend the integrated use of satellites, orthophoto materials and remote sensing technologies to increase coverage, accuracy and monitoring capabilities in the field of geodesy in Central Asia. These experiences are also relevant for Uzbekistan, in particular the Kashkadarya region. Also, as several local researchers (Tukhtayev, 2023; Ganiyev, 2020) have noted, the poor quality of existing geodetic work is leading to an increase in land disputes between dehqan farms. To eliminate this, the introduction of modern measuring equipment and technologies and the improvement of the skills of specialists are considered necessary. An analysis of the literature shows that the introduction of modern geodetic technologies in the identification and accounting of land areas in the Kashkadarya region will not only increase accuracy and speed, but also ensure legal certainty, efficient use of resources, and agricultural sustainability.

Methodology: This study investigated the possibilities of determining the geodetic status of land plots of farmers in the Kashkadarya region using modern technologies. The main goal of the study was to practically evaluate geodetic methods that ensure accuracy, speed and legal transparency in land resource management. For this, 20 farmers located in the Karshi, Nishon and Yakkabag districts of the region were selected. The selection was carried out taking into account different land reliefs, land reclamation conditions and forms of use. The determination of land plots was carried out in real time (RTK) using GNSS (Global Navigation Satellite System) devices. Through this technology, the accuracy of the land was recorded at the centimeter level, and the coordinates of each point were





harmonized with national cadastral systems. In addition, photogrammetric observations were carried out using drones and orthophotos of land plots were prepared. Based on these images, a digital model was created, and land plots were mapped onto digital maps using ArcGIS and AutoCAD Civil 3D programs, and their surface and boundaries were calculated. The results of traditional geodetic measurements (using a total station) were compared with data based on modern technologies and analyzed according to the criteria of accuracy, time consumption and cost-effectiveness. Many advantages of modern methods were identified - including more accurate measurements, time savings and reduced dependence on the human factor. During the study, the advantages of each technology, its ease of use and the possibilities of its implementation in rural areas were studied. Also, using quantitative analysis, the level of error of the obtained coordinates, discrepancies between the boundaries of land plots and existing cadastral documents were determined, and analytical conclusions were prepared based on them. In general, the methodological approach made it possible to ensure high accuracy and efficiency in determining land plots based on modern technologies.

Analysis and results: The results of the study clearly demonstrated the advantages of modern technologies in determining the geodetic condition of land plots in the Kashkadarya region. Real-time measurements using GNSS devices, orthophotos taken by drones, and land maps formed using digital cartography systems significantly increased the accuracy compared to traditional methods. In particular, in the measurements carried out in Nishon and Yakkabagh districts, the coordinates determined using GPS-based RTK technology had an average accuracy of ± 3 cm, while in the areas measured using a total station, this indicator was $\pm 12-15$ cm. This means that the accuracy of measuring land plots using modern methods is 4-5 times higher. Based on the orthophotos taken using drones, the relief features of the land surface, uneven zones, and the boundaries of adjacent land plots were clearly shown. The surface, boundaries, and coordinates of the land plots were analyzed digitally in the ArcGIS program. On this basis, in 85% of 20 dehkan farms, a discrepancy of at least more than 5% was found between the data recorded in the cadastral documents and the current geodetic situation. In some cases, a difference of up to 0.3-0.5 hectares was observed between the actual area of land used and the area in the document. This situation was especially common in farms located in sloping areas. Measurements carried out using modern technologies were more efficient not only in terms of accuracy, but also in terms of time and resources. While measuring one hectare of land using the traditional method took an average of 3-4 hours, this process was





carried out using the GNSS RTK method in 30–40 minutes. The ability to cover 5–10 hectares of land at a time using a drone is an additional advantage for large landowners. The analysis also revealed that digital maps based on geodetic survey results serve as reliable documents in processes such as precise determination of land ownership rights, prevention of property disputes, and allocation of subsidies and loans. This is an important factor in optimizing resource use in dehkan farms, strengthening targeted land use, and environmental control. In general, it has been practically proven that by using modern geodetic technologies, it is possible to achieve accuracy, speed, and legal transparency in determining the status of land plots in dehkan farms in the Kashkadarya region.

Conclusion: Based on the above analysis, it can be concluded that in the Kashkadarya region, the level of accuracy, efficiency and legal certainty in determining the geodetic status of land plots by farmers is significantly increasing through the introduction of modern technologies. GNSS devices, photogrammetric measurements using drones, digital cartography systems allow for the accurate recording of the actual state of land resources, allowing for the identification and correction of errors in existing cadastral data. The study found that, compared to traditional measurement methods, modern geodetic technologies provide 4–5 times higher accuracy in measurements, reduce time consumption by 3–4 times, and reduce errors due to the human factor. In particular, digital maps are of great practical importance in transparent determination of land ownership rights, fair distribution of subsidies for plots, and prevention of property disputes.

Based on this, the following recommendations can be put forward:

1. It is necessary to introduce regional programs to re-measure and digitize the land areas of all dehkan farms in the Kashkadarya region using modern geodetic methods.
2. It is necessary to organize ongoing training courses to train specialists working on GNSS, UAV (drone) and GIS programs and to improve the skills of existing employees.
3. It is recommended to integrate digital maps created based on the results of geodetic measurements between state cadastral authorities, banks, insurance organizations, and farms through a single geoinformation database.
4. It is advisable to develop a system for continuous monitoring of land resources through drones and satellites and establish mechanisms for early detection of salinization, failures, or illegal occupation.





5. When attracting agricultural investments, it is necessary to include economic assessments based on geodetic maps determined using digital land data.

As a result of implementing the above proposals and recommendations, the efficiency of land resource use in dehkan farms in the Kashkadarya region will increase, ownership relations will become more transparent, and a solid foundation will be created for the introduction of modern management mechanisms.

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