



## **World Conference on Agricultural and Earth Sciences**

Hosted Online from Istanbul, Turkey

Date: 20<sup>th</sup> September, 2026

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### **METHODOLOGICAL FRAMEWORK FOR THE COMPREHENSIVE ASSESSMENT OF DEHKAN FARM LANDS BASED ON THE INTEGRATION OF REMOTE SENSING AND LAND-CADASTRE DATA**

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#### **Abstract**

This conference paper proposes a contour-oriented methodological framework for the comprehensive assessment of dehkan farm lands through the integration of remote sensing, land-cadastre, soil, irrigation and official statistical data. The concept of “dehkan farm lands” is used here to denote small household-operated agricultural parcels that make a major contribution to food production in Uzbekistan. The proposed framework was developed with Beshariq district of the Fergana Region as an applied example. The approach relies on parcel boundaries as the basic spatial unit and combines satellite-derived indicators of vegetation, moisture and surface conditions with auxiliary cadastral and environmental attributes. A weighted Comprehensive Assessment Index (CAI) is then calculated after normalization of the indicators and determination of weights by the Analytic Hierarchy Process (AHP). The study demonstrates that the integration of multi-source data at parcel level creates a more policy-relevant monitoring product than the use of a single vegetation index alone. The methodology is designed for routine land monitoring, prioritization of field inspection, identification of problematic parcels, and preparation of spatially explicit management recommendations.

**Keywords:** dehkan farm, land cadastre, remote sensing, GIS, parcel-based assessment, AHP, Comprehensive Assessment Index, land monitoring, Beshariq district.



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### **Introduction**

The rational use of agricultural land requires regular observation of both quantitative and qualitative land conditions. In small-parcel farming systems, traditional field inspection remains important, but it is costly and time-consuming when the number of parcels is large and monitoring must be repeated frequently. For this reason, the role of remote sensing in land assessment has expanded rapidly during the last decade. Open satellite systems such as Sentinel-2 and Landsat 8/9 enable repeated observation of vegetation vigor, moisture conditions, thermal anomalies and surface disturbance, while cadastral data provide legally defined parcel boundaries that connect biophysical information with land tenure and land-use attributes.

International practice increasingly moves from generalized district-level analysis to parcel-based monitoring. The European Union Area Monitoring System (AMS) is a representative example of how remote sensing is linked to parcel geometry for agricultural supervision and policy implementation. Similar ideas can be seen in the USDA Cropland Data Layer, in FAO WaPOR applications, and in GIS-based multi-criteria agricultural land assessment studies. These experiences show that the analytical value of satellite data rises substantially when they are combined with administratively meaningful boundaries and with contextual variables such as soil, irrigation, and production information.

The relevance of such an approach is particularly high in Beshariq district. According to official district statistics, agriculture, forestry and fisheries output reached 2.9 trillion UZS in 2024, and 58.5% of agricultural output in January–September 2024 was produced by dehqan and household farms. Under these conditions, parcel-level monitoring is not merely an academic exercise; it is directly related to land management, support measures, risk identification and sustainable production planning. The aim of this paper is therefore to formulate



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an integrated methodological model for the comprehensive assessment of dehkan farm lands using remote sensing and land-cadaastre data.

### 1. Data blocks and the integration principle

In the proposed framework, the cadastral parcel is the basic spatial unit. This is a critical methodological decision because it allows remote sensing results to be interpreted not only as pixel values, but as parcel-specific land-condition indicators connected to legal and managerial attributes. The framework uses a multi-source database composed of: (1) remote sensing imagery; (2) cadastral parcel boundaries and land-use attributes; (3) soil and irrigation characteristics; and (4) auxiliary official statistics for contextual interpretation and validation. Sentinel-2 Level-2A imagery is preferred for parcel-level work because its 10 m spatial resolution is better suited to small agricultural plots than Landsat's 30 m resolution, while Landsat remains highly useful for long-term historical analysis. The soil and irrigation block may include soil texture, salinity, bonitet, organic matter, groundwater depth, distance to irrigation infrastructure and water supply characteristics. The cadastral block includes parcel ID, land-use category, ownership or use status, parcel area, and if available, crop information or production specialization. The statistics block is not used to assign direct parcel values when only aggregated district-level numbers are available; instead, it is used to characterize the economic importance of dehkan farming and to support the interpretation of parcel-level monitoring outputs.



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Table 1. Main data blocks used in the integrated assessment

| Data block          | Typical variables                                                | Methodological role                                                         |
|---------------------|------------------------------------------------------------------|-----------------------------------------------------------------------------|
| Remote sensing      | NDVI, NDMI, SAVI, BSI, LST, valid-pixel share                    | Primary biophysical evidence on vegetation, moisture and surface conditions |
| Land cadastre       | Parcel boundary, land-use type, parcel area, parcel ID           | Core spatial unit linking biophysical data with legally defined land units  |
| Soil and irrigation | Texture, salinity, bonitet, irrigation access, groundwater depth | Contextual variables explaining spatial heterogeneity of parcel performance |
| Official statistics | Production output, producer-category shares, crop structure      | Background information for interpretation and policy relevance              |

Source: compiled by the author.

## 2. Assessment indicators and normalization

A reliable comprehensive assessment should not depend on a single index. NDVI remains the baseline indicator for vegetation vigor and photosynthetic activity, but its interpretive power decreases when biomass is very high or when sparse vegetation is affected by a strong soil background. Therefore, NDVI should be complemented by NDMI for vegetation and near-surface moisture conditions, SAVI for sparse vegetation and exposed soil environments, BSI for bare or degraded surfaces, and, where possible, LST for thermal stress. These variables reflect different but related dimensions of parcel condition and together provide a more robust picture of agricultural land quality than any one metric alone.

Because the selected indicators differ in units and physical meaning, they must be transformed into dimensionless comparable values before aggregation. For benefit-type indicators, where higher values correspond to better conditions, min–max normalization can be used. For cost-type indicators, where higher values



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indicate degradation or stress, reverse normalization is applied. The selection of reference minima and maxima should be based on the observed distribution in the study area and, where possible, on expert knowledge and field evidence. Such normalization not only improves comparability, but also makes the final composite index easier to interpret and communicate.

The choice of weights has an important influence on the content of the final result. In agricultural land assessment, AHP is one of the most common methods for determining weights because it combines expert judgement with a transparent pairwise-comparison matrix and a consistency check. In the proposed model, the indicators are grouped into five blocks: vegetation and phenology, moisture and water stress, soil and degradation, cadastral suitability, and production/management context. The final weights should be calibrated through expert consultation and, if possible, validated against field observations or independent reference data.

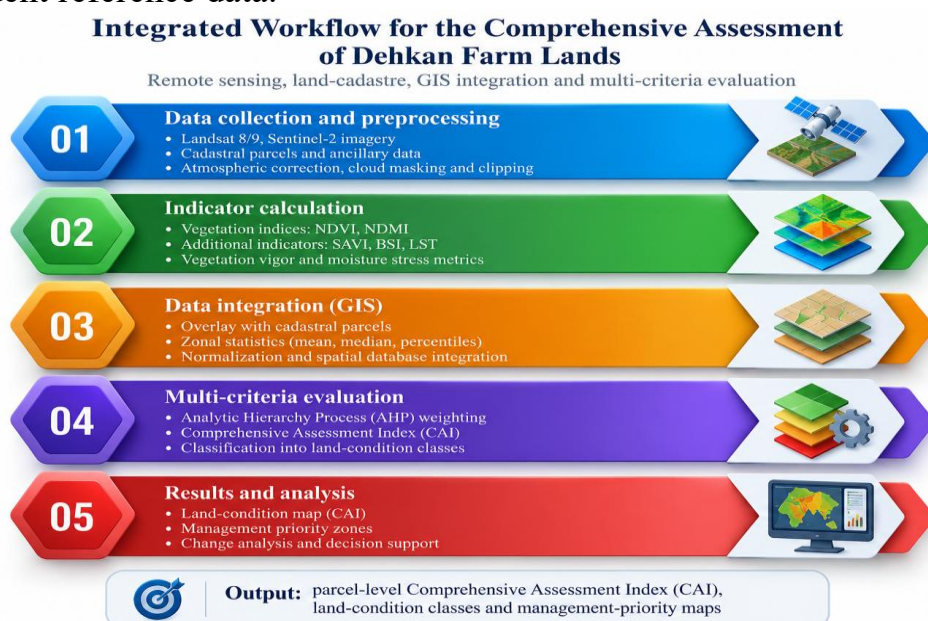


Figure 1. Infographic workflow for comprehensive assessment of dehkan farm lands  
Source: author's elaboration.



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### 3. Formation of the Comprehensive Assessment Index

After normalization and weighting, the Comprehensive Assessment Index (CAI) is calculated as a weighted linear combination of the selected indicators. In conceptual form,  $CAI = \sum(w_i \cdot x_i)$ , where  $x_i$  is the normalized value of the  $i$ -th indicator and  $w_i$  is the corresponding weight. The interpretation of the index can be organized into five classes: 0.80–1.00 very high condition; 0.60–0.80 high condition; 0.40–0.60 moderate condition; 0.20–0.40 low condition; and 0.00–0.20 very low condition. These class limits are initial methodological thresholds and should be locally calibrated on the basis of field knowledge and validation data.

The principal advantage of the CAI is that it prevents over-simplified conclusions based solely on NDVI. A parcel may have relatively high greenness but still suffer from moisture stress, irrigation constraints, thermal anomalies or cadastral mismatches. Conversely, a parcel with only moderate greenness may be in an acceptable condition when water regime and soil conditions are stable. Hence, the composite approach captures the multidimensional nature of land condition and converts heterogeneous information into a unified decision-support metric. Once the CAI is assigned to cadastral parcels, the outputs can be used to generate monitoring maps, lists of problematic parcels and priority zones for field inspection and management intervention.

### 4. Cartographic outputs and management priority zoning

Integrated assessment becomes especially valuable when analytical results are transformed into thematic maps. Cartographic outputs make it possible to identify spatial patterns of land condition, to distinguish relatively stable agricultural zones from problematic areas, and to communicate results clearly to non-specialist decision-makers. A management-priority map is a logical derivative of



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the CAI because it translates assessment classes into operational zones such as sustainable development, support, monitoring, improvement and urgent restoration. Such a map does not replace detailed field diagnosis, but it provides a practical spatial framework for the allocation of monitoring and management resources.

### Management Priority Map of Dehkan Farm Lands in Beshariq District

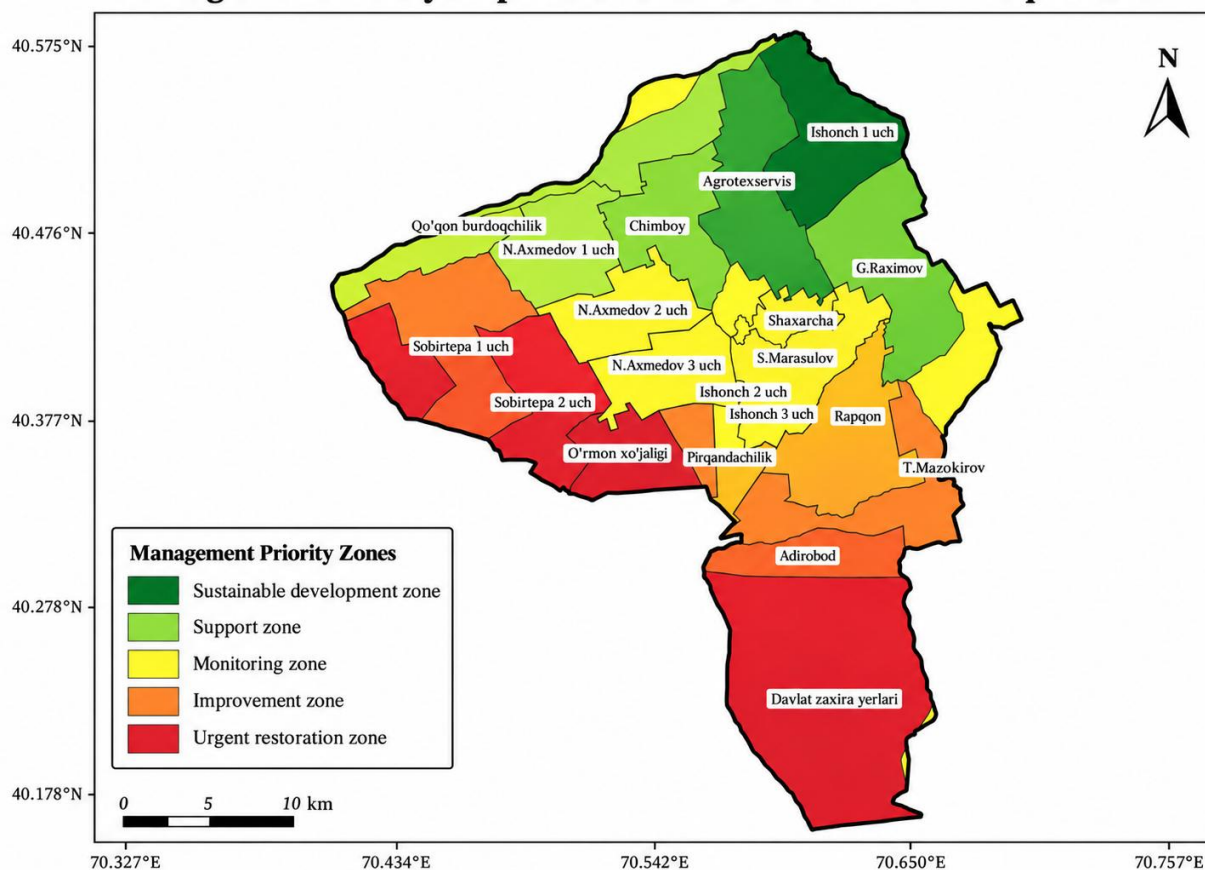


Figure 2. Management priority map of dehkan farm lands in Beshariq district  
Source: author's cartographic elaboration based on integrated assessment results.



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### **Discussion**

The scientific contribution of the proposed framework lies in the strict linkage between remote sensing indicators and cadastral parcels, as well as in the integration of biophysical, cadastral and contextual data. This shifts the analysis from a generic image-processing exercise to an operational land-monitoring tool. The framework is particularly suitable for environments where agricultural parcels are small, heterogeneous and subject to differentiated management conditions. It also supports digital reporting at parcel level, which is important for land administration and for the modernization of state land monitoring.

Nevertheless, several methodological limitations must be acknowledged. First, if parcels are very small, even Sentinel-2 pixels may still contain mixed signals from roads, channels, courtyards or neighboring crops. Second, the quality and currency of cadastral geometries strongly affect the reliability of parcel statistics. Third, district-level statistics cannot be mechanically disaggregated to parcels and therefore should be used primarily as interpretive context, not as direct parcel attributes. Finally, any weighting scheme is partly expert-dependent, which makes systematic validation indispensable.

### **Conclusion**

1. Integrating satellite imagery with cadastral parcels, soil, irrigation and contextual statistics substantially improves the analytical value of dehkan land monitoring.
2. The use of cadastral parcels as the assessment unit connects remote sensing indicators directly with legally and managerially meaningful land objects.
3. A composite index organized around vegetation, moisture, soil-degradation, cadastral suitability and management context blocks overcomes the limitations of single-index assessment.



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4. AHP-based weighting, normalization to a 0–1 interval and five-level classification provide a practical methodological basis for routine monitoring and management prioritization.
  5. For Beshariq district, class thresholds and weights should be treated as initial methodological parameters to be calibrated by field observations and independent validation.

## References

1. European Commission. CAP paying agencies: Area Monitoring System (AMS). Agriculture and Rural Development. URL: [https://agriculture.ec.europa.eu/common-agricultural-policy/financing-cap/area-monitoring-system\\_en](https://agriculture.ec.europa.eu/common-agricultural-policy/financing-cap/area-monitoring-system_en).
2. USDA National Agricultural Statistics Service. Cropland Data Layer: technical information and FAQs. URL: [https://www.nass.usda.gov/Research\\_and\\_Science/Cropland/Release/](https://www.nass.usda.gov/Research_and_Science/Cropland/Release/).
3. Food and Agriculture Organization of the United Nations. WaPOR data: remote sensing for water productivity. URL: <https://www.fao.org/in-action/remote-sensing-for-water-productivity/en/>.
4. Fergana Regional Department of Statistics. Statistical bulletin of Beshariq district for January–September 2024. Fergana, 2024.
5. Fergana Regional Department of Statistics. Agriculture, forestry and fisheries output in Beshariq district. 14.04.2025.
6. Shaloo, Bisht H., Jain R., Singh R.P. Cropland suitability assessment using multi-criteria evaluation techniques and geospatial technology: a review. The Indian Journal of Agricultural Sciences.



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7. Yalew S.G., van Griensven A., van der Zaag P. AgriSuit: a web-based GIS-MCDA framework for agricultural land suitability assessment. Computers and Electronics in Agriculture.
  8. Zolekar R.B., Bhagat V.S. Multi-criteria land suitability analysis for agriculture in hilly zone: remote sensing and GIS approach. Computers and Electronics in Agriculture.