OPTIMIZATION OF FOREST FUND LAND USE: ANALYSIS OF TASHKENT REGION'S FORESTRY STRUCTURE

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Abstract: *The effective management and optimization of forest fund land use are essential for ensuring ecological stability and sustainable natural resource governance. This study analyzes the spatial structure and quantitative dynamics of forest fund lands in the Tashkent region using official forestry data. The region's total forest fund area amounts to 541,215 hectares, of which 128,110 hectares are covered with forests, while coverage levels vary significantly across districts. Large forest territories such as Bustonliq (377,832 ha) and Ahangaron (147,879 ha) contrast with smaller forested areas in Bekobod, Kuyichirchik, and other lowland districts, indicating the need for differentiated management strategies.*

The findings highlight structural imbalances and opportunities for optimization within the region's forestry system. Key priorities include strengthening digital monitoring, expanding reforestation initiatives, improving land-use planning, and reinforcing regulatory mechanisms. Ultimately, optimizing forest fund land use will support long-term ecological resilience and sustainable development in the Tashkent region.

Keywords: *forest fund lands, land use optimization, Tashkent region forestry, forest-covered areas, spatial distribution, reforestation, afforestation, land governance, sustainable forest management, ecological stability, GIS-based monitoring, forestry enterprises.*

Introduction

Sustainable management of forest fund lands plays a critical role in maintaining ecological balance, regulating climate, preventing soil degradation, and ensuring the long-term availability of natural resources. In Uzbekistan, particularly in the Tashkent region, forest fund lands exhibit significant spatial diversity due to varying geographical conditions such as mountain zones, desert ecosystems, river valleys and tugai (riparian) forests. These differences require a well-structured and adaptive land-use management mechanism that responds effectively to environmental conditions and socio-economic needs. The Tashkent region encompasses a total forest fund area of 541,215 hectares, of which 128,110 hectares are classified as forest-covered. However, the distribution of these areas is highly uneven: Bustonliq district alone accounts for 377,832 hectares, while regions such as Buka, Kibrai, and Yangiyol contain very limited forest territories. This imbalance underscores the importance of developing region-specific strategies

aimed at optimizing land use, enhancing forest productivity, and strengthening ecosystem resilience.

Materials and Methods

This study is based on official statistical materials derived from the forestry enterprises of the Tashkent region, including detailed datasets on the spatial distribution, structural composition, and annual dynamics of forest fund lands. The primary data source consists of district-level and enterprise-level indicators extracted from the document provided by regional forestry authorities, covering categories such as total forest fund area, forest-covered lands, unwooded lands, nurseries, sparse forests, pastures, water bodies, roads, and other land types. Particular emphasis is placed on comparative data from the Ahangaron State Forestry for the years 2019 and 2024, which provide an opportunity to observe short-term transformations in forest land structure. Data were collected directly from documented records of state forestry enterprises including Burchmulla, Ahangaron, Bekobod, Dalvarzin, Saxonota, Darkhan Experimental Station and others operating within the Tashkent region. The dataset includes:

- Total forest fund area by district
- Forest-covered versus non-forest lands
- Classification of unwooded territories (pastures, barren lands, tugai areas, deserts, agricultural orchards, etc.)
- Temporal changes recorded between 2019 and 2024
- Spatial distribution of forest fund land across 14 administrative districts of Tashkent region

These indicators allow for a comprehensive understanding of landscape characteristics and management efficiency. A combination of descriptive statistical analysis, comparative analysis and spatial structure assessment was applied:

1. Descriptive Statistics: Used to quantify the total size, structure, and proportions of forest and non-forest categories across districts.
2. Comparative (Temporal) Analysis: Changes between 2019 and 2024 within the Ahangaron State Forestry were examined to assess progress in reforestation, afforestation, and land rehabilitation.
3. Spatial Distribution Analysis: The study classified forest lands by geographical zone (mountain, desert, valley, and tugai forests) based on the regional distribution tables, enabling identification of structural imbalances.
4. Document-Based Evaluation: Qualitative assessment of management practices was conducted using textual and tabular information from the provided document.

Although GIS tools were not directly applied due to data format limitations, the structure of the dataset allows for potential integration into geographic information systems for advanced spatial modeling in future studies. The methodological approach follows three sequential stages:

1. Identification of forest fund land structure at district and enterprise levels.

2. Evaluation of changes over time to determine the effectiveness of current management practices.

3. Derivation of optimization measures based on empirical indicators and identified gaps.

This integrated methodology provides a solid basis for assessing the current state of forest fund land use and proposing strategies for its optimization within the Tashkent region.

Results

The analysis of forest fund land use in the Tashkent region reveals significant spatial, structural, and temporal differences across forestry enterprises and administrative districts. The region's total forest fund area amounts to 541,215 hectares of which 128,110 hectares (23.7%) are forest-covered. The distribution of these areas is highly uneven, with the largest concentration in Bustonliq district (377,832 ha) and Ahangaron district (147,879 ha), while districts such as Buka, Kibrai, Yangiyol, and Urta Chirchik contain minimal forest resources. This indicates strong geographical contrasts between mountainous, desert, valley, and tugai ecosystems within the region.

1. Spatial Distribution of Forest Fund Lands: The data highlight clear dominance of forest-covered areas in mountainous territories, especially within Burchmulla State Forestry, where forested land reaches 80,464 hectares, representing the region's largest continuous natural forest cover. In contrast, enterprises such as Bekobod, Kuyichirchik and Saxonota manage smaller and more fragmented forest territories, indicating the need for expanded reforestation and land rehabilitation programs.

2. Structural Composition of Land Use: The structural breakdown of forest fund lands shows substantial variation in land-use categories:

- Forest-covered lands: 128,110 ha;
- Non-forest lands (pastures, barren lands, orchards, roads, settlements, deserts): more than 350,000 ha;
- Specialized zones such as nurseries, sparse forests, and tugai ecosystems are primarily concentrated in the Ahangaron and Dalvarzin enterprises.

This structure underscores significant potential for expanding forest cover through efficient use of unwooded lands.

3. Dynamics of Forest Fund Lands (2019–2024): A key component of the analysis is the comparative assessment of Ahangaron State Forestry, where detailed 2019 and 2024 datasets are available.

Between 2019 and 2024, the following changes were observed:

- Total forest fund area increased by 4,227 ha;
- Forest-covered areas increased by 9,821 ha;
- Nursery area expanded from 1,874 ha to 2,914 ha (+1,040 ha);
- Sparse forests increased by 54 ha;
- Unwooded forest lands decreased by 1,030 ha;

- Pastures decreased by 591 ha;
- Barren and other degraded lands decreased by 6,338 ha;
- Overall non-forest lands declined by 5,013 ha.

These positive shifts reflect intensified afforestation, reforestation, and land rehabilitation measures conducted during this period.

4. Forest Fund Optimization Potential: The combination of large non-forest areas and increasing forest cover suggests significant potential for further optimization. Districts such as Bekobod, Yangiyol, and Kibrai—where forest coverage is minimal—represent key zones for expansion of artificial forests and restoration efforts. Moreover, tugai forest preservation and desert afforestation (e.g., in Saxonota) remain strategic priorities for combating land degradation and enhancing ecosystem resilience.

Discussion

The results of the analysis reveal substantial disparities in the spatial structure, land-use composition, and forest development dynamics across the Tashkent region. These disparities are primarily shaped by geographic conditions—mountainous landscapes in Bustonliq and Ahangaron, desert-steppe environments in Saxonota, and lowland agricultural zones in Bekobod and Yangiyol. Such heterogeneity requires differentiated and adaptive management strategies rather than uniform, region-wide approaches. One of the key findings is the dominance of forest-covered areas in mountainous districts, which serve as the ecological backbone of the region. The Burchmulla and Ahangaron forestries, with their extensive natural forest cover, play a crucial role in regulating microclimate, preventing erosion, and protecting water resources. Conversely, districts such as Bekobod, Kuyichirchik and Piskent, where forest cover is minimal or highly fragmented, face greater environmental vulnerability, including risks of soil degradation and reduced biodiversity. These zones represent priority territories for targeted afforestation and land rehabilitation programs. Despite these positive tendencies, several critical challenges remain. First, the uneven distribution of forest resources across the region indicates gaps in long-term land-use planning. Districts with limited forest assets are often those most affected by anthropogenic pressures, including agricultural expansion, industrial activities, and settlement growth. Without reinforced legal and administrative controls, these pressures may undermine the gains achieved through forestry programs. Second, the current monitoring system for forest fund lands is predominantly document-based, limiting the accuracy and responsiveness of land management decisions. Integrating GIS-based monitoring, remote sensing technologies, and digital inventory systems would significantly improve data accuracy and enforcement capabilities. Third, the large proportion of non-forest lands—over 350,000 hectares—signals untapped potential for ecological restoration. Transforming even a fraction of these lands through afforestation or the establishment of protective forest belts could greatly enhance regional climate resilience, reduce erosion, and improve carbon sequestration capacity. Finally, institutional coordination between forestry enterprises

remains an important issue. While some enterprises demonstrate strong reforestation performance, others lack adequate resources, infrastructure, or technical capacity. A unified regional strategy, supported by improved funding, technical training, and performance-based evaluation, could enhance the overall effectiveness of forest land governance. Overall, while significant progress has been made in increasing forest cover and rehabilitating degraded territories, achieving long-term sustainability will depend on continued investment in digitalization, ecosystem-based management, and integrated land-use planning.

Conclusion

This study demonstrates that the forest fund lands of the Tashkent region exhibit substantial spatial and structural diversity, shaped primarily by geographic and ecological conditions. Mountainous districts such as Bustonliq and Ahangaron serve as the core of the region's forest resources, while lowland and valley districts remain relatively under-forested, highlighting the need for targeted land restoration and afforestation programs. The significant presence of unwooded lands—exceeding 350,000 hectares—indicates both ecological vulnerability and considerable potential for future forest expansion. The comparative analysis of the Ahangaron State Forestry from 2019 to 2024 provides evidence that ongoing forestry reforms and reforestation initiatives are yielding measurable improvements. Increases in forest-covered lands, expansion of nurseries, and reductions in degraded territories reflect the positive effects of state-supported afforestation and rehabilitation programs. These achievements underline the importance of sustained investment, long-term planning, and effective land-use policy implementation. However, the findings also emphasize the need for further modernization of forest land governance. Current monitoring systems remain limited in precision and responsiveness, underscoring the necessity for adopting, remote sensing tools, and data-driven decision-making frameworks. Enhanced institutional coordination among forestry enterprises is similarly vital for achieving uniform progress across the region. Districts with minimal forest cover, particularly those facing degradation risks, should be prioritized within future regional forestry strategies.

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