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Forest resource management based on GIS and Remote Sensing: Analysis from the Legislation and Scopus database

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Abstract: This paper explores the challenges and strategies for managing forest fires, with a focus on the role of human activity in causing and exacerbating wildfires. It highlights the significant damage caused by fires to forests, agricultural lands, and ecosystems, as well as the associated risks to human lives and livelihoods. The study also discusses the importance of preventive measures and effective fire management in forestry practices to mitigate the impacts of fires. Furthermore, the paper reviews recent trends in fire-related research and technological advancements, such as remote sensing and GIS, in monitoring and managing forest fires. The paper concludes by emphasizing the need for integrated strategies that address both prevention and response to forest fires.
Keywords: Forest fires, human activity, fire prevention, forestry management, GIS, remote sensing, ecosystem protection, soil erosion, wildfire monitoring.

Introduction

In the world and its various regions, the comprehensive analysis of forest land conditions based on the use of remote sensing data and geographic information systems (GIS) for digital and efficient management of forest resources is taking a leading position [1]. Modern remote sensing and GIS technologies are being used for geospatial analysis of forest management areas, determining the boundaries of forest plots, identifying plant species, creating and controlling their long-term data bases, and developing innovative methods [2], [3]. In this regard, taking into account the natural, socio-economic, and other agroecological conditions of our country's forest management areas, attention is being paid to the plant species in forest management lands and the decline in their numbers due to the consequences of forest fires, based on GIS technologies and remote sensing data [4], [5].

Legislative Analysis

In the Republic of Uzbekistan, the government-approved decrees and decisions implement measures related to the development of the economy and forestry, particularly comprehensive actions to determine the geographical locations of various plant land areas, and certain results have been achieved. The "New Uzbekistan Development Strategy for 2022-2026" includes important tasks, such as "entering data from the state monitoring electronic database into a unified geographic information database." In the implementation of these tasks, including improving the placement system of forestry crops, scientific research is being conducted on developing methods of using modern remote sensing and geographic information system (GIS) technologies [6].

The Presidential Decree of the Republic of Uzbekistan on May 11, 2017, PF-5041 on the establishment of the State Forestry Committee of Uzbekistan, PF-5349 dated February 19, 2018, on measures to further improve the field of information technology and communications, PF-6061 dated September 7, 2020, on the improvement of land accounting and the state cadastre system, the Presidential Decree PQ-2966 dated May 11, 2017, on the establishment of the State Forestry Committee's activities, the Law of the Republic of Uzbekistan O'RQ-409 dated September 21, 2016, on "Protection and Use of Plant Life," the Law of the Republic of Uzbekistan O'RQ-475 dated April 16, 2018, amending and supplementing the "Forests" Law, the Cabinet of Ministers' Decision No. 66 on February 16, 2005, on "State Control over Land Use and Protection" and related regulations, and the approval of other regulatory legal documents related to this activity, are contributing to the implementation of these tasks.

Globally, significant achievements are being made in the study of ecological and technological processes and the technogenic impacts on them [7], [8]. At the same time, remote sensing methods are becoming more complex and gaining importance. The study of forest objects is one of the areas that require remote sensing techniques. In forest areas, the presence of wild fauna poses risks to studying the area, and road and other expenses create several obstacles to deep study of the forest. The solution to this issue could be the use of remote sensing [9], [10].

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An analysis of scientific literature related to the field indicates that the methods of geospatial analysis for studying forest plant degradation using remote sensing have been examined in various scientific research works published in the Scopus database. The search was conducted using keywords such as "Remote sensing," "GIS," "Forest," and "Management." The results were then analyzed.

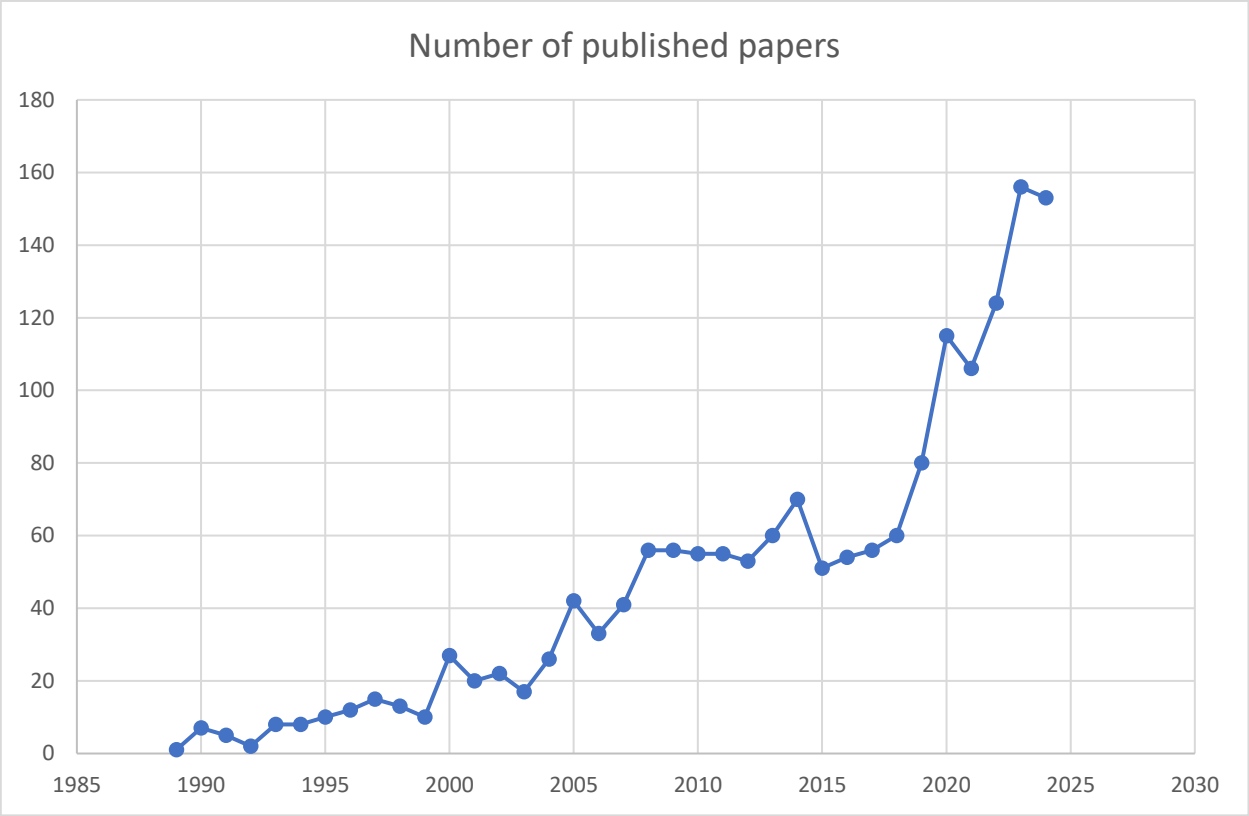

Figure 1. Number of articles published in the Scopus database from 1990 to 2025.

Conclusion

Among the many sources of threats to forests, fire is often considered the most dangerous. This danger is a real threat both to the forest area and to the adjacent population. Every year, thousands of people lose their homes due to forest fires, and hundreds of people die in these unfortunate events; additionally, tens of thousands of livestock perish. Fire destroys agricultural crops and leads to soil erosion, which in the long term may be even more catastrophic than the previously described unfortunate events. If the soil becomes infertile after a fire and heavy rain moistens it, large mudslides or landslides may occur.

According to calculations, every year:

- 10 to 15 million hectares of boreal or temperate forests burn.
- 20 to 40 million hectares of tropical rainforests burn.
- 500 to 1,000 million hectares of tropical and subtropical savannas, forest steppes, and open forests burn.

More than 90% of these fires are caused by human activities. Therefore, preventing and controlling fires should be a top priority in forestry activities.

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