Forest Dynamic Processes and Management Paradigms in Forest Ecosystems

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Yayıncılık

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İÇİNDEKİLER

CHAPTER 1

Unmanned Aerial Vehicle (UAV) Applications in Forestry:
A Review of Technologies, Methods, and Application Areas 2
Ender BUĞDAY

CHAPTER 2

Digital Transformation in Forest Management: AI-Driven Forest
Inventory, Growth Modelling and Decision Support 16
Aydın KAHRİMAN

CHAPTER 3

Web-Based Integration Systems in Forestry:
Linking Forest Dynamics Monitoring to Adaptive Management 41
Taha Yasin HATAY

CHAPTER 4

Multipurpose Native Species in Eastern Black Sea Agroforestry:
Functional Roles and Sustainable Use..... 70
İbrahim TURNA
Fahrettin ATAR

CHAPTER 5

Age-Related Variation in Morphological Characteristics and
Seedling Quality of Ginkgo biloba L. 89
Fahrettin ATAR
Ali BAYRAKTAR

CHAPTER 6

Agroforestry Systems and Traditional Rural Land-Use
Patterns in the Eastern Black Sea Region.....107
İbrahim TURNA
Fahrettin ATAR

CHAPTER 7

Spatial and Temporal Analysis of Forest Disturbance Using Landsat Time
Series and the LandTrendr Algorithm: A Case Study of Muğla.....127
Mehmet Serdar ORUÇ
Osman Salih YILMAZ

FOREWORD

Forest ecosystems are of great importance for the conservation of biological diversity, the mitigation of the effects of climate change, the regulation of the carbon cycle, and the sustainable use of natural resources. However, climate change, shifts in land use, and various natural and human-induced pressures necessitate a better understanding of the dynamic processes in forests and the continuous development of management approaches.

This book, titled *''Forest Dynamic Processes and Management Paradigms in Forest Ecosystems''*, examines current scientific approaches to the monitoring, assessment, and sustainable management of forest ecosystems from various perspectives. The book covers a range of topics, including web-based integration systems, unmanned aerial vehicles (UAVs), artificial intelligence-supported forest inventory and decision support systems, spatial and temporal analysis of forest disturbance using LandTrendr, agroforestry practices, the functions of native plant species, and the morphological characteristics of *Ginkgo biloba L.*a species significant both for its medicinal and aromatic properties and for its landscape value.

Digital technologies and artificial intelligence applications offer significant opportunities for monitoring forest resources, identifying changes, and basing management decisions on scientific data. However, traditional land-use practices, local ecological conditions, and the characteristics of plant species are also fundamental components of sustainable forestry. The chapters in this book bring together technological advancements with ecological knowledge and practices to offer an interdisciplinary approach to forest management.

This work is intended to contribute to academics, graduate students, forestry experts, and practitioners working in the field of natural resource management. I would like to thank all the chapter authors and reviewers who contributed to the preparation of this book, and I hope that this work will contribute to a better understanding of forest ecosystems and the development of sustainable management approaches.

Prof. Dr. Erhan ÇALIŞKAN

Editor

CHAPTER 1

UNMANNED AERIAL VEHICLE (UAV) APPLICATIONS IN FORESTRY: A REVIEW OF TECHNOLOGIES, METHODS, AND APPLICATION AREAS

Ender BUĞDAY[1]

1. INTRODUCTION

In recent years, unmanned aerial vehicles (UAVs) have become indispensable tools in a wide range of applications, driven by rapid advances in remote sensing and geospatial technologies. The forestry sector has also been profoundly affected by this transformation, with UAV technologies increasingly adopted as an effective means of overcoming the time and cost constraints associated with conventional ground surveys and aerial photography (Zhang & Zhu, 2023). UAV platforms offer distinctive solutions to various forestry challenges through flexible mission planning, the ability to collect high-spatial-resolution data, and relatively low operating costs.

Forest road network planning and design are particularly important in countries with rugged terrain, such as Türkiye. The extent and quality of forest roads directly affect the efficiency of timber harvesting operations, wildfire response capability, and the provision of recreational services. Natural hazards such as landslides, meanwhile, rank among the major threats to both infrastructure and ecosystems in forested areas. UAVs offer valuable capabilities for addressing these complex problems by generating accurate digital terrain models, integrating with machine learning algorithms, and supplying data to geographic information system (GIS)-based decision-support systems.

Buğday (2018b) conducted one of the early comprehensive studies examining opportunities to use UAV technology in forest road construction, demonstrating its potential in forest engineering. In subsequent years, the

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