forests

Editorial

Mapping and Monitoring Forest Cover

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Citation: Congalton, R.G. Mapping and Monitoring Forest Cover. *Forests* **2021**, *12*, 1184. https://doi.org/10.3390/f12091184

Received: 24 August 2021
Accepted: 27 August 2021
Published: 1 September 2021

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Our Earth consists of approximately 70 percent water and 30 percent land. Of the land, approximately 31 percent is forested. Forests provide incredible benefits to all the living creatures on Earth. They provide a diverse ecosystem that is home to countless species of plants and animals. Forests are incredibly diverse—from the boreal forests in the north to the tropical forests of the Amazon, from the pine plantations of New Zealand to the mixed deciduous forests of the northeastern United States and the coniferous forests of Europe, and everywhere in between. Forests are used by humans as a source of heat, building materials, paper, and food. Forests also provide an invaluable place for recreation. Finally, they provide a place for storing carbon and for releasing oxygen. Clearly, forests must be mapped and monitored so that we can effectively manage our forests for a sustainable future.

The use of remotely sensed imagery and other geospatial technologies holds the key to our effective mapping and monitoring of our forests. While collecting samples of ground data is still important for the development and validation of this mapping and monitoring, remote sensing provides a total enumeration of the entire Earth on a repeated basis. Remotely sensed imagery can be collected at a variety of spatial, spectral, and temporal resolutions. Satellites in orbit above the Earth collect imagery continuously and revisit the same spot at regular intervals (every 16 days, every 3 days, twice a day). These satellites tend to have sensors that range from just the visible portions of the electromagnetic spectrum into the near and middle infrared, and some even collect thermal data. The spatial resolution tends to be coarse to moderate (1 km to 30 m), but newer sensors have achieved higher spatial resolutions (10 m to 50 cm). Aircraft can fly over an area repeatedly in a day or over any desired period and can include very high spatial resolution digital cameras or other sensors. Most recently, unmanned aerial systems (UAS) can be used to acquire imagery repeatedly at very high spatial resolutions (a few cms) by flying very low to the ground. Advances in computer processing and algorithms for converting the raw remotely sensed imagery into forest maps or other land cover maps have improved greatly over the last 30 years and continue to do so. The combination of the right imagery with the best processing allows remote sensing scientists to map and monitor our forests far better than we have ever been able to in the past.

This Special Issue comprises six papers that clearly demonstrate the power of using remotely sensed imagery to map and monitor our forests. These papers represent a wide range of examples and emphasize the importance of spatial, spectral, and temporal resolutions provided by a variety of remotely sensed imagery. The paper by Guo et al. [1] demonstrates the benefits of using moderate-resolution imagery to monitor forest change over time and for a large area. The papers by Aljahdali et al. [2] and Jallat et al. [3] emphasize specific critical forest types (mangrove and juniper forests) that are especially important to map and monitor to maintain these niche ecosystems. The paper regarding large juniper forests also introduces the concept of carbon sequestration, which is particularly important to our environment today [3]. The final three papers deal with higher spatial resolution remotely sensed imagery [4–6]. The paper by Ganz et al. [4] demonstrates the benefits of having a detailed forest map of a German forest created from high spatial resolution imagery. They then introduce the concept of comparing or relating what can be determined on the detailed map created from the remotely sensed imagery with their forest inventory data collected on the ground. The paper by Lister et al. [5] continues this important theme. This review paper provides a discussion of the efficiencies that the United States Forest Service employs by combining the National Forest Inventory and Analysis (FIA) data and remote sensing [5]. Many experiences and suggestions provided by this paper can help other countries to more effectively and efficiently map and monitor their forests. The final paper by Gu et al. [6] brings the analysis of forests down to the individual tree level. This paper reports on efforts using a UAS to collect imagery that can be used to delineate individual tree crowns and emphasizes some of the computer processing and algorithm developments that have made such techniques possible [6].

Funding: This research received no external funding.

Conflicts of Interest: The author declares no conflict of interest.

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