Chapter 11
Forest Inventory:
Assessing Forest Resources for Sustaining Their Management – Contribution of Geospatial Technologies

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ABSTRACT

Forest resources management requires a variety of information related to social systems and to land and its supported resources and their dynamics (land cover, forest stocking, and growth). Such information is, by nature, spatio-temporal and scale dependent and its quality relay on costs for obtaining it. Geosciences and forest geomatics offer valuable methods for ensuring a good compromise between the quality of required information and its costs. This chapter will review and discuss the contribution of geoscience to forest and land inventory. After presentation of information needed and their acquisition methods, through traditional forest inventory, the chapter will focus on technologies aiming at forest resources characterization and assessment such as aerial photogrammetry, satellite imagery, LiDAR data.

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INTRODUCTION AND BACKGROUND

Forests contribute to provide ecosystem goods and services on which human communities depends, such as: biodiversity, carbon sequestration, regulation of water runoff (that ensure sustainable provision of water resources qualitatively and quantitatively), timber and non-timber products, as well as spiritual and cultural values (Johnston, Lindner, Parrotta, & Giessen, 2012). Forest ecosystems are then characterized by their multifunctionality which is expressed by the fact that forests may simultaneously contribute to the many requirements made by society to the main groups of functions organized and described in forest literature: production, option, regulation, information functions, or utility, realization, perception and protection (Cantiani, De Meo, Ferretti, & Paletto, 2010; Fernand, 1995; Paletto, Ferretti, Cantiani, & De Meo, 2012; Vos, 1996).

As the concept of multifunctional forestry become prerequisite, along with the changing perception of the relation men to nature, the raising environmental awareness (since the Rio de Janeiro Conference 1992) and the perspective of climate changes, forests and forest management around the world faces big issues (Farcy & Devillez, 2005; Johnston et al., 2012). Since then, forest management shifted from a model based mainly on wood and timber production to multipurpose planning with a lot of uncertainties (Cantiani et al., 2010; Hartikainen, Eyvindson, Miettinen, & Kangas, 2016).

Managing forest resources aims at maintaining the consumptive needs of society while caring for the integrity and function of ecological systems. Including, managing for wood production objectives, or promoting wildlife, fisheries, recreational dimension as well as other environmental and social services (Bettinger, Boston, Siry, & Grebner, 2009). According to Hartikainen et al. (2016), it could be simply described as the process that consists on selecting optimal harvest schedules including one or more treatment option(s) and their timing for forest stands (homogeneous sub-unit of the forest, with regards to tree species composition, and age); treatment options, within a stand, may include final felling (all trees harvesting) or thinning (harvesting a part of trees), planting new seedlings and tending them after a harvest has been carried out. With a multifucntionnality and sustainability perspectives, intensive forest management became necessary. Moreover, as human population expands, lands resources become scarce and the consumptive needs of society increase. Land planning become widely accepted as contributing to human well-being while maintaining ecosystems integrity and functions. Being a multidisciplinary process that involves multiple actors, land planning effectiveness depend on reliable, timely, and readily available information that is either quantitative or qualitative. It is a very data consumptive process needing accurate information on forest resources development (McCullagh & Nieuwenhuis, 2015). Within the scope of forest management, forest inventories remain the main tools used for obtaining information related to forest resources. Such information includes: biophysical context, natural resources (stands and its supported resources), and the predicted future forest conditions. Forest Inventory (FI) is then the foundation of forest planning and forest policy (Köhl, Magnussen, & Marchetti, 2006).

Within the scope of FI, gathering information on forest resources depends on the scale of interest, ranging from stand level to national or to global level, and on the forest evaluation objectives. Consequently, kind of information collected differ. Furthermore, FI have been reshaped in order to deal with the new trends of forest management such as multifunctionality, plurality and sustainability perspectives and moved forward to benefit from new advances related to data gathering tools, algorithms and statistical tools and other geosciences related techniques.

Further, beyond a long history of using aerial photography in forest inventory, the diversification of kinds and sources of remotely sensed data in addition to advances to image analysis, 'statistical' and

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