5th revised edition, β-version

Lecture Notes for the Module

"Monitoring of Forest Resources"

by

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October 2015

Preface

These lecture notes were compiled as supporting material to the lecture "Monitoring of Forest Resources" as delivered at the Faculty of Forest Sciences and Forest Ecology at Georg-August-Universität Göttingen. Selection of topics follows, therefore, largely the structure of that course. That does also mean that these lecture notes cover above all the topic of field based monitoring, touching only marginally on remote sensing techniques – which is the subject of other lectures for which other material is available.

These lecture notes started by my students Mr. Thzeng Yih Lam and Mr. Netra Bhandari during my lectures in winter semester 2004/2005, covering all subjects that had been lectured in that semester. Mr. Haijun Yang did a further review and Mr. Hendrik Heydecke did a thorough editorial check. They did a great job and I am very grateful to them for their efforts!

In the course of the years, various updates have been made, some topics added and some eliminated. Numerous students and research associates of the Chair of Forest Inventory and Remote Sensing at Göttingen University, and also many students taking the course contributed to this never-ending optimization work. Great thanks to all these two colleagues !

Of course, there may still be mistakes in the text. You are very much welcome and encouraged to explicitly search for them and let the authors know, so that we can continue gradually improving this learning material: any observations on structure, style, etc. of these lecture notes are very welcome!

This collection of materials is thought to accompany the lectures. I doubt that it can replace attending lectures and tutorials on a regular basis and / or reading further texts and articles, as recommended.

You may also wish to visit our "AWF Wiki", the first Wiki that deals specifically and comprehensively with the fields of forest mensuration, forest inventory and forest monitoring and which is globally intensively accessed in the meantime. The AWF Wiki has been established in 2009 at the Chair of Forest Inventory and Remote Sensing ("AWF" = Abteilung Waldinventur und Fernerkundung) as an initiative of Dr. Lutz Fehrmann: **http://wiki.awf.forst.uni-goettingen.de/wiki** (or search for „AWF Wiki" in any internet search machine).

I hope that this material proves useful and helps you getting even more interested in the exciting topic of monitoring techniques for forests and natural renewable resources.

Christoph Kleinn
and the team at the Chair of Forest Inventory and Remote Sensing
(= AWF = **A**bteilung **W**aldinventur und **F**ernerkundung)

Göttingen, October 2015

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1. Introduction

1.1 Background and objectives

It is well known that forests play an important role for biodiversity, for livelihoods and for local and national economies. Regardless of whether one looks at forests primarily as an ecosystem or as a resource – planning data is required for "informed decisions" in forest management, forest conservation and forest policies. In general, basic data and information are required when a renewable natural resource – such as forest –is to be managed sustainably. Eventually, there is quite some truth in the saying "If you cannot measure it you cannot manage it".

Forest inventory is the activity of data collection that helps generating the required information base of the forests within a defined area of interest. Commonly, forest inventories are organized as projects with a defined duration.

The term *forest monitoring* is used in a wider sense and does commonly embrace the observation and assessment of status and changes. Forest monitoring systems have a long-term character, are organized as programs and embrace repeated implementations of forest inventories.

Information requirements regarding forests are as manifold as are the interests in forests which may basically be viewed (1) as a resource (people-centered) and (2) as an ecosystem (nature-centered). Parties interested in information on forests are above all decision makers and researchers in forestry and related fields. Forest owners, forest managers and forest politicians are those who demand information about the forest resource, but also regional planners and the wood industry; and conservation biologists, ecologists and tourism managers may be interested in forest ecosystem information. Once the group of actually and potentially interested parties can clearly be identified, it is straightforward to plan an inventory according to their expressed needs and expectations. In some cases – and in particular in large area forest inventories - one needs to plan an inventory in a flexible manner so that many different potentially interested users are addressed – without yet knowing all of them and their needs exactly from the outset.

Experience of the past decades has shown that the expectations towards forest inventories are getting wider and wider. The traditional forest inventory that focuses only and exclusively on timber production is, of course, still in use in forest plantation companies where trees are very intensively managed much like agricultural crops. However, forests are more and more managed for multiple services and functions, which is also reflected in the range of topics that are addressed in forest inventories. In some regions, forest inventories have developed towards tree inventories including also non-forest lands, or even to comprehensive land use assessments.

These lecture notes shall give you an insight into forest inventory from an implementation point of view and also from a research point of view. The major part of the lecture and the lecture notes is on sampling and plot design, which is applied statistics. The principles of statistical sampling are not only relevant in the forest inventory context but in any other empirical discipline as well; it has largely to do with statistical methods of empirical research.

The lecture notes shall help you to understand the principles of forest inventories. You should be able to plan your own inventory in a methodologically sound manner and according to statistical principles. You should know how to write good inventory reports but also how to critically read inventory reports of others, and how to ask the right and relevant questions.

A most important point eventually is that you should never look at a forest monitoring exclusively from the mere technical point of view (on which we are actually focusing in this lecture!), but you should clearly recognize that forest monitoring does always serve a specific goal and is always embedded in decision processes, generating information in order to – in the ideal case – facilitate what is called informed decisions.