

Preface

Hemispherical photography (HP) is a field-based, remote-sensing approach for acquiring a permanent record of observations from which the light regime and biophysical structure within a forest canopy can be characterized. It is a technique that has seen increasing use, as evidenced from the published literature, in part because of the increasing need to gather information for quantifying and monitoring the status, health, composition, and structure of forested ecosystems as well as the light regime in forest stands. It has been difficult for prospective users to gather information about the theoretical concepts and about how HP can be acquired and processed, because this information has been fragmented and dispersed across a variety of publication media. To date, a single, definitive reference source has not been available. As a result, a book is needed that describes the theory, methods, and applications of HP for acquiring forest biophysical measurements. The purpose of the present volume is to address the information void that exists in this field.

HP is applicable to many fields in forestry, including ecology (e.g., light, moisture and nutrient distribution, plant diversity, seedling regeneration), inventory (e.g., growth and yield, stand dynamics), hydrology (e.g., snowpack, precipitation applications, flooding, stream temperature), and biophysical parameter estimation (e.g., leaf area index, leaf area duration, openness), to name a few. The information that is extracted from hemispherical photographs provides a useful complement to information that is gathered by standard inventory methods, and HP also supplies a series of biophysical measurements that would otherwise be challenging to acquire. For example, variables such as wood volume, biomass, canopy gap distribution, sapwood area, and leaf area can be derived from hemispherical photographs. The other application of high interest is the ability to characterize the solar radiation regime with measures such as gap fraction and fraction of diffuse and direct radiation.

Although most of the earlier work in HP was done with analog film and single-lens reflex cameras, the advent of digital photography has made it easier to acquire photographs, a development that has been accompanied by new digital camera systems and data acquisition opportunities. The availability of software programs that can readily process large numbers of individual photographs has

further amplified the adoption of digital technology. These advances have driven increasing demands for knowledge about the theory and equipment of HP and about the methods for acquiring, processing, and analysis. This book has been designed to meet these information needs by compiling information from established researchers into a single source that will be of value to a broad range of users, including academics, senior undergraduate and graduate students, natural resource professionals, and researchers.

This book presents practical information about three domains of HP: (1) theory and concepts; (2) equipment and methods for field data acquisition and image processing; and (3) applications. The first section of the book is an introduction to HP and the fundamental elements of forest structure and light interactions within the forest canopy. The second section provides practical information about the equipment and procedures for procuring and processing the photographs. Example applications using HP in forestry and natural resource assessment are described in the third section. The book concludes with a discussion about modeling tools and future directions for this rapidly growing field.

It has taken several years to bring this book from its inception to completion, a period far longer than initially anticipated. We have greatly appreciated the patience and persistence of the international group of contributors and reviewers. It was particularly challenging to design a structure for the book that would be of most value to our target readers and to organize the topics within that structure. It is our hope that we have produced a volume that will meet the information needs of those who are interested in using HP in forested environments.

Sherbrooke, Canada
Edmonton, Canada

Richard A. Fournier
Ronald J. Hall

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Fournier, R.A.; Hall, R.J. (Eds.)

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