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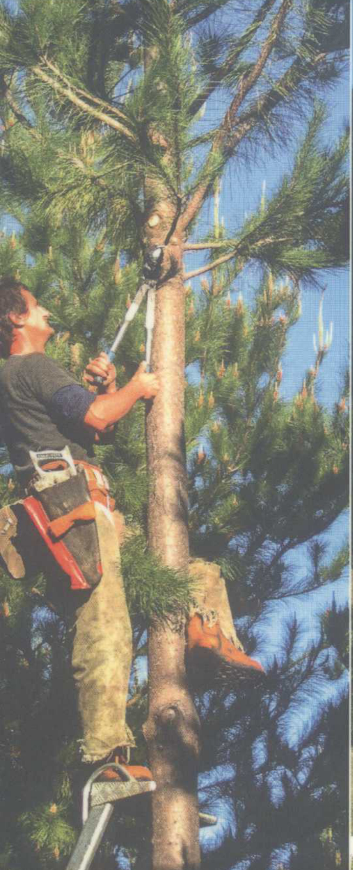
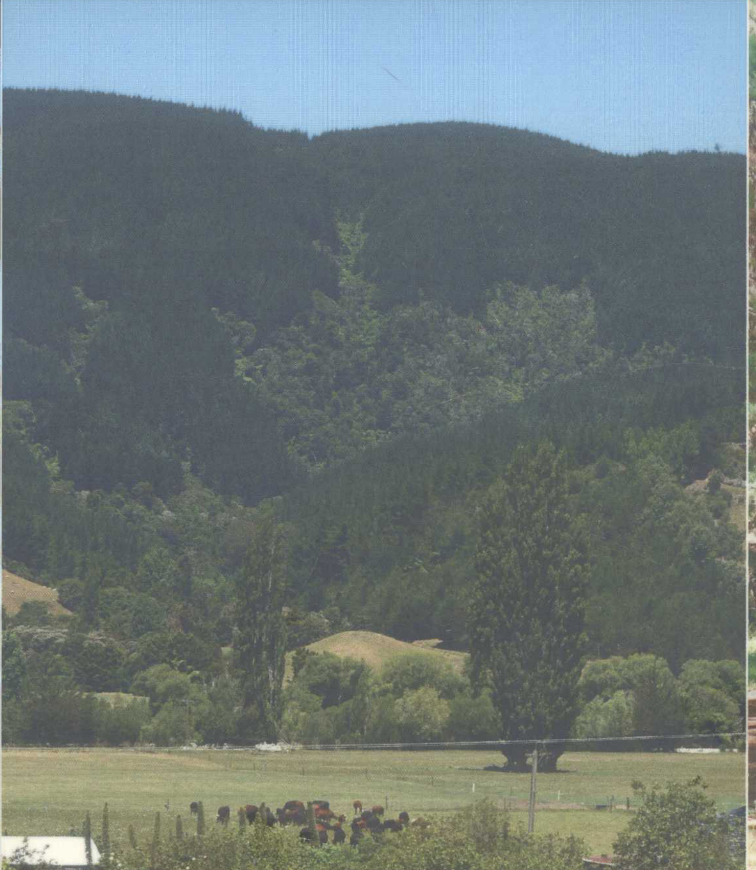
170

Sustainable management of *Pinus radiata* plantations





Sustainable management of *Pinus radiata* plantations

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by
Donald J. Mead

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS
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Cover photos:
Left: High pruning of radiata pine, New Zealand (P. Wilks)
Centre: A combination of radiata pine plantations, other introduced trees, native areas and farming create attractive landscapes in New Zealand; the farming is on the better soils (D. Mead)
Right: Recreation in a mature radiata pine plantation near Nelson, New Zealand (D. Mead)

Foreword

Growing societal demand for forest products and services require an increase in efforts to establish new forests. Where appropriate, intensively managed forest plantations can supply local and global markets with wood while contributing significantly to rural and industrial development. One of the most successful forest plantation species is *Pinus radiata* – radiata pine.

FAO recognizes the need to back up any significant tree-planting with a deep understanding of all aspects of the species being planted. In 1960, FAO published a major review of radiata pine, written by C.W. Scott, which presented the state of knowledge at that time. After more than 50 years, FAO is pleased to present a comprehensive update of knowledge on radiata pine. While this new publication, by Dr Donald Mead, covers many aspects of the species – its discovery and domestication, site requirements, limitations, wood properties and end-uses, and its social and environmental roles – its focus is on the principles and practices of growing radiata pine sustainably. It also looks ahead to emerging challenges facing plantation forest management, such as the effects of climate change, new diseases and other threats, and how to manage plantation forests to meet changing product needs and societal demands. Thus, this book is relevant and helpful for growers of other tree species, and should also provide valuable insights to forestry students and a wide range of other people interested in forestry.

Globally, there are just over 4 million ha of radiata pine plantations, mainly in Australia, Chile, New Zealand and Spain, making this species the most widely planted introduced conifer. As a plantation species, radiata pine has been a spectacular success, becoming the basis of strong wood-using industries in those countries and producing about 60 million cubic metres of wood per year. Even so, radiata pine provides only slightly more than four percent of the output of all planted forests.

Dr Mead, a New Zealander, has been involved in forestry research and teaching about radiata pine for more than 50 years. He wanted FAO to publish this review of radiata pine management as a means to ensuring its wide dissemination. For FAO, this publication is a way of educating professionals and others on the importance of long-term sustainable plantation forest management based on a profound knowledge of the biology, silviculture and use of a species. I congratulate Dr Mead for this outstanding contribution to global knowledge on plantation forest management and recommend the work to the global forestry community.

Eduardo Rojas-Briales
Assistant Director-General
FAO Forestry Department

Acknowledgements

This book has endured a long gestation. My sincere thanks go to the many people who provided information over the years. In particular, I thank Peter Lavery and Gonzalo Paredes, who were instrumental in providing the impetus for this book in the early years. Gonzalo supported the writing of this book until his health prevented him from being actively involved in the last few months.

I also sincerely thank Alvaro Sotomayor, Rowland Burdon, Euan Mason, Lisa Langer, Mike Carson, Eric Appleton, Robin Trewin, Piers Maclaren, Jose Prado, Tat Smith and Philip West, all of whom reviewed parts of this book. Rowland Burdon actively cooperated by providing background information on radiata pine history and status; he has been involved with a book on the domestication of the species. Jim Carle provided insightful comments on the entire book based on his wide experience with FAO and as a forest manager. Walter Kollert is also thanked for his support after Jim Carle retired. Rosamund Arthur assisted by reading the manuscript from a non-forester's viewpoint. I thank the editorial staff at FAO – Giulia Muir, Alastair Sarre and Patricia Tendi – and designer Roberto Cenciarelli for their excellent work.

Financial support for this project was provided by the New Zealand Forestry Corporation, the University of Canterbury and Lincoln University, the latter two by way of study leave.

Dedication

This book is dedicated to Dr Gonzalo Paredes Veloso, who died at Valdivia, Chile, in October 2012. Gonzalo was a forest engineer who did his PhD in forest economics at Corvallis, Oregon, United States of America, from 1984 to 1986. He was Dean of the Faculty of Forestry and Natural Resources, Universidad Austral de Chile in Valdivia, for two periods of his career, and for a time he was the Vice Chancellor of Finance and Administrative Support. He was a major leader in the development of the Chilean radiata pine simulator and actively supported forestry research in Chile. Between 1997 and 2000 he was director of Instituto Forestal, the Chilean government forest research organization.

Gonzalo, an academic leader and a critical thinker, was a strong supporter of this book project. He was a dedicated family man and a good friend to many, including the author.

Acronyms and abbreviations

B	boron
BA	basal area
C	carbon
Ca	calcium
CAI	current annual increment
CO^2	carbon dioxide
CSIRO	Commonwealth Scientific and Industrial Research Organisation (Australia)
Cu	copper
D	diameter
dbh	diameter at breast height
DCF	discounted cash flow
DDC	diameter of the defect core in the centre of a pruned log
DOO	diameter over occlusion
DOS	maximum stem diameter over branch stubs after pruning
DRIS	Diagnosis and Recommendation Integrated System
FAO	Food and Agriculture Organization of the United Nations
Fe	iron
FRI	Forest Research Institute (New Zealand), now Scion
FSC	Forest Stewardship Council
G	genetic gain
H	tree height
h2	broad-sense heritability broad-sense heritability
INFOR	Instituto Forestal (Chile)
IRR	internal rate of return
LAI	leaf area index
LEV	land expectation value
LiDAR	light detection and ranging
LSW	log sweep
MAI	mean annual increment since establishment
Mg	magnesium
Mn	manganese
MoE	modulus of elasticity
N	nitrogen
n	stocking
NPW	net present worth
P	phosphorus
PEFC	Programme for the Endorsement of Forest Certification
PMAI	periodic mean annual increment
RD	relative density
REDD+	reducing emissions from deforestation and forest degradation
S	sulphur
SI	site index
V	variance
Zn	zinc

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