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Silim Zeki

Handbook of Operations Research in Natural Resources

Andrés Weintraub | Carlos Romero
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HANDBOOK OF OPERATIONS RESEARCH IN NATURAL RESOURCES

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HANDBOOK OF OPERATIONS RESEARCH IN NATURAL RESOURCES

Edited by

Andres Weintraub
University of Chile, Santiago, Chile

Carlos Romero
Technical University of Madrid, Spain

Trond Bjørndal
CEMARE, University of Portsmouth, UK

Rafael Epstein
University of Chile, Santiago, Chile

with the collaboration of

Jaime Miranda
Diego Portales University, Santiago, Chile

Andres Weintraub
University of Chile
Santiago, Chile

Carlos Romero
Technical University of Madrid
Madrid, Spain

Trond Bjørndal
CEMARE, University of Portsmouth
Portsmouth, United Kingdom

Rafael Epstein
University of Chile
Santiago, Chile

Series Editor:
Fred Hillier
Stanford University
Stanford, CA, USA

With the collaboration of:
Jaime Miranda
Diego Portales University,
Santiago, Chile

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Contributing Authors

Christopher Alford

University of Queensland
c.alford@smi.uq.edu.au

Ragnar Arnason

University of Iceland
ragnara@hi.is

Manuel Arriaza

Andalusian Institute of Agricultural,
Fisheries and Food Research
manuel.arriaza.ext@juntadeandalucia.es

Frank Asche

University of Stavanger
frank.asche@tn.his.no

Enrique Ballester

Technical University of Valencia
eballe@esp.upv.es

Julio Berbel

University of Córdoba
berbel@uco.es

Pete Bettinger

University of Georgia
pbettinger@forestry.uga.edu

Trond Bjørndal

University of Portsmouth
t.bjorndal@imperial.ac.uk

Houcine Boughanmi

Sultan Qaboos University
boughanh@squ.edu.om

Marcus Brazil

University of Melbourne
brazil@unimelb.edu.au

Joseph Buongiorno

University of Wisconsin
jbuongio@wisc.edu

Jeroen Buysse

Ghent University
J.Buysse@UGent.be

Louis Caccetta

Curtin University of Technology
caccetta@cs.curtin.edu.au

Alejandro Caparrós

Spanish Council for Scientific
Research (CSIC), Spain
acaparros@ieg.csic.es

Rodrigo Caro

University of Chile
rcaro@dii.uchile.cl

Carmen Castrodeza

University of Valladolid
ccch@eco.uva.es

Emilio Cerdá

University Complutense of Madrid
ecerdate@ccee.ucm.es

Richard L. Church

University of California at Santa
Barbara
church@geog.ucsb.edu

Roberto Cominetti

University of Chile
rcominet@dim.uchile.cl

Jon M. Conrad

Cornell University
jmc16@cornell.edu

Luis Diaz-Balteiro

Technical University of Madrid
luis.diaz.balteiro@upm.es

Rafael Epstein

University of Chile
repstein@dii.uchile.cl

Bruno Fernagut

Centre for Agricultural Economics
bruno.fernagut@ilvo.vlaanderen.be

José A. Gómez-Limón

University of Valladolid
limon@iaf.uva.es

Daniel V. Gordon

University of Calgary
dgordon@ucalgary.ca

Eldon A Gunn

Dalhousie University
eldon.gunn@dal.ca

Robert Haight

North Central Research Station
rhaight@fs.fed.us

Olivier Harmignie

Université Catholique de Louvain
harmignie@ecru.ucl.ac.be

Kiyotada Hayashi

National Agricultural Research
Center
hayashi@affrc.go.jp

Bruno Henry de Frahan

Université Catholique de Louvain
henrydefrahan@ecru.ucl.ac.be

John Hof

Rocky Mountain Research Station
johnhof@comcast.net

Ruud Huirne

Wageningen University
Ruud.Huirne@wur.nl

Lynn Huntsinger

University of California
(Berkeley)
buckaroo@nature.berkeley.edu

Veijo Kaitala

University of Helsinki
veijo.kaitala@hut.fi

Jenny Karlsson

Linköping University
jekar@mai.liu.se

Mark Kuchta

School of Mines
mkuchta@mines.edu

Daniel E. Lane

University of Ottawa
dlane@uottawa.ca

Ludwig Lauwers

Centre for Agricultural Economics
ludwig.lauwers@ilvo.vlaanderen.be

David H. Lee

University of Melbourne
dhlee@bigpond.net.au

Marko Lindroos

University of Helsinki
marko.lindroos@helsinki.fi

Peter Lohmander

Department of Forest Economics
peter.lohmander@sekon.slu.se

Hamish Marshall

New Zealand Forest Research
Institute Ltd.
Hamish.Marshall@ensisjv.com

David L. Martell

University of Toronto
martell@smokey.forestry.utoronto.ca

Michael Martinez

Colorado School of Mines
michael.martinez@usafa.af.mil

Miranda Meuwissen

Wageningen University
miranda.meuwissen@wur.nl

Gordon Munro

University of Portsmouth
munro@econ.ubc.ca

Glen Murphy

Oregon State University
Glen.Murphy@orst.edu

Alan T. Murray

Ohio State University
amurray@geography.ohio-state.edu

Alexandra M. Newman

Colorado School of Mines
anewman@mines.edu

Linda Nøstbakken

Cornell University
linda.nostbakken@nhh.no

Sean Pascoe

University of Portsmouth
sean.pascoe@csiro.au

John Sessions

Oregon State University
john.sessions@oregonstate.edu

Teresa Peña

University of Valladolid
maitepe@eco.uva.es

Richard B. Standiford

University of California (Berkeley)
standifo@nature.berkeley.edu

Philippe Polomé

Université Catholique de Louvain
polome@ecru.ucl.ac.be

Diana Tingley

University of Portsmouth
diana.tingley@port.ac.uk

Ronald Raunikaar

University of Wisconsin
raunikaar@students.wisc.edu

Marcel Van Asseldonk

Wageningen University
marcel.vanasseldonk@wur.nl

Carlos Romero

Technical University of Madrid,
carlos.romero@upm.es

Guido Van Huylenbroeck

Ghent University
Guido.VanHuylenbroeck@UGent.be

Mikael Rönnqvist

The Forestry Research Institute
of Sweden
mikael.ronnqvist@nhh.no

Jef Van Meensel

Centre for Agricultural Economics
jef.vanmeensel@ilvo.vlaanderen.be

Jaime San Martín

University of Chile
jsanmart@dim.uchile.cl

Andres Weintraub

University of Chile
aweintra@dii.uchile.cl

Pablo Santibañez

University of Chile, Santiago
psantiba@dii.uchile.cl

Slim Zekri

Sultan Qaboos University
slim@squ.edu.om

Preface

Operations Research/Management Science (OR/MS) approaches have helped people for the last 40 years or so, to understand the complex functioning of the systems based upon natural resources, as well as to manage this type of systems in an efficient way. The areas usually viewed within the natural resources field are: agriculture, fisheries, forestry, mining and water resources.

Even though, the above areas are usually viewed as separate fields of study, there are clear links and relations between them. In fact, all of them share the common problem of allocating scarcity along time in an optimal manner. The scale of time or length of the planning horizon is very different. Thus, we have almost a continuous renewal in the case of the fisheries, periodic cycles in the case of agriculture and forestry (ranging from some few months in the case of a horticultural crop to more than a century for some forest species), and enormous periods of time much beyond the human perception in the case of mining resources. But in all the cases, the key matter is to obtain an efficient use of the resource along its planning horizon.

Another element of connection among the different natural resources is due to the interaction between the use of the resource, and the environmental impact caused by its extraction or harvest. This type of interaction implies additional complexities in the underlying decision-making process, making the use of OR/MS tools especially relevant.

The above views are corroborated by the massive use of quantitative approaches in the management of natural resources. It can be said that this broad field was one of the first where the OR/MS discipline was successfully applied.

The papers presented correspond to invitations made to the specialists we considered the most distinguished in each area, and we are extremely satisfied with the positive response we obtained from them. In defining the subject matters, we tried to cover comprehensively the most relevant topics in each area, from the application point of view, as well as consideration of the operations research techniques involved. In particular, we wished to highlight the successes of the OR approach to deal with problems, which involves a conceptual view of problems, modelling of complex realities, and development of algorithms for problems increasingly difficult to solve. Issues of large scale, uncertainty, multiple objectives appear increasingly in these decision processes. Also, we view the integration in multidisciplinary approaches, where specialists in the specific areas need to interact with operations research specialist, and the need to incorporate information technologies for implementations is also present.

The set of papers compiled in this volume attempts to provide readers with significant OR/MS contributions in each one of the applied areas previously defined. In this way, we hope to encourage the use of quantitative techniques in order to manage the use of the different natural resources efficiently from an economic as well as an environmental point of view.

The papers are divided by area of application: agriculture, fisheries, forestry and mining.