



BOOK REVIEW

Decision Making in Natural Resource Management: A Structured Adaptive Approach. Michael J. Conroy and James T. Peterson, 2013. Wiley-Blackwell, Oxford, UK. 456 pp. \$99.95 paperback. ISBN: 978-0-470-67174-0.

Natural resource management involves making decisions that integrate ecological, social, economic, and political aspects, among others. Often, decision makers take an ad-hoc approach in evaluating choices because of the complex, multi-dimensional nature of natural resource problems. This lack of structure in decision making often results in a less than rigorous process that may not be inclusive of all stakeholders, transparent, or defensible. The quality and durability of decisions can be improved by using a more structured approach. Drs. Conroy and Peterson have relied on their accumulated personal experiences in solving natural resource problems using the principles of Structured Decision Making (SDM) and Adaptive Management to help produce *Decision Making in Natural Resource Management: A Structured Adaptive Approach*. The authors enrich the book with their insights and experiences from facilitating >20 applied decision problems. The book presents a structured approach to decision making in natural resources that begins by developing a problem statement and then uses a values-based approach that identifies objectives, specifies decision alternatives, uses analytical methods of decision analysis to identify an action that best achieves the objective(s), and addresses the issue of uncertainty and incorporates feedback from monitoring programs via adaptive management.

The book clearly articulates why decision makers should use a structured approach to decision making, defines the elements of SDM, and then focuses much of the book on the many quantitative approaches for modeling decision influence. The quantitative focus of the book on decision science is what sets this book apart from a recent SDM book by Gregory et al. (2012), making Conroy and Peterson's book more useful to students, scientists, practitioners, and decision analysts. This is not to say that less quantitative folks should shy away from the book; to the contrary, I believe that exposure to the tools for decision making and analysis is a very important component to fully appreciating and understanding SDM. However, those less mathematically inclined may find some chapters to be a challenge. This well-written book has no shortage of rich, accessible material and its technical level should not prevent wide readership.

Perhaps 1 area missing from the book is a chapter focused on the history and technical origins of SDM. Despite this omission, the authors successfully demonstrate the well-supported foundations of decision-theoretic methods and the value of their application in a structured approach. The authors state that 1 of their goals in writing the book was to attempt to change the attitudes of managers who often choose alternatives based on what they perceive as the least

risky option, as a way of hedging their bets against uncertain outcomes. The authors succeed in introducing readers to how uncertainty can be explicitly recognized and formally incorporated into decision making. This recognition, coupled with a clear approach for how to solve problems with multiple competing objectives should put managers on the path to better decision making. Additionally, I found that the authors placed appropriate emphasis throughout the book on the role of science in informing decision making and the common problem of confounding values (e.g., objectives) with science (e.g., data or information). Recognizing this distinction and understanding that natural resource management is fundamentally a values-based endeavor should also help managers make better decisions.

The 10 chapters are organized into 3 primary sections plus a collection of technical appendices, beginning with Part I: An Introduction to Decision Making. This part contains 4 chapters that provide an introduction to the value and limitations of the structured approach to decision making, how to deal with uncertainty in decision making, identifying objectives, and working with stakeholders. Part II of the book (Tools for Decision Making and Analysis) discusses how to construct decision models and how to use data to inform decision making. This part includes 4 chapters, including basic and advanced statistical ideas and terminology, modeling the influence of decisions, how to identify and reduce uncertainty in decision making, and methods for making optimal decisions (i.e., optimization). Part III: Applications, includes case studies and lessons learned, and the 2 chapters in this part provide valuable lessons that the authors have learned through their personal experiences in conducting SDM workshops. Part IV, the final section, includes 5 technical appendices, providing detailed background on probability, statistical distributions, methods for statistical estimation, approaches to multi-model inference, mathematical approaches to optimization, a guide to software, details regarding the electronic companion to the book, and an impressively comprehensive glossary of terms used in the book.

The book includes a student companion website with additional resources including all tables in PDF format and all figures in the book provided as Microsoft PowerPoint slides. Although labeled as the student companion, these resources will be particularly valuable to instructors. Even more useful to students is a Google site providing numerous worked examples and their accompanying documents and materials in various electronic formats. This site also provides an introduction to basic computing using R, R code and data for all boxed examples in the book, background exercises in probability and distributions, parameter estimation, building predictive models, Bayesian basics, and simulation modeling. I found both electronic companions to be extremely useful resources for students, instructors, and practitioners.

Decision Making in Natural Resource Management: A Structured Adaptive Approach is a welcome arrival, and can serve as an excellent textbook for a graduate-level seminar in decision making for natural resources. In fact, I have been searching for this very book for the last 2 years, and will use it in my graduate-level course in Structured Decision Making for Natural Resources. This book is an extremely valuable contribution to decision making as it delves into the analytical approaches in enough detail to allow readers to analyze their own decision problems. I highly recommend this book to resource managers, scientists, students, and anyone who faces difficult, complex, or uncertain decisions

that would benefit from adopting a structured approach to decision making.

LITERATURE CITED

Gregory, R., L. Failing, M. Harstone, G. Long, T. McDaniels, and D. Ohlson. 2012. Structured decision making: a practical guide to environmental management choices. Wiley-Blackwell, Oxford, United Kingdom.

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