

Book reviews

RESTORING PARADISE: RETHINKING AND REBUILDING NATURE IN HAWAI‘I

By Robert J. Cabin

2013. Published by University of Hawai‘i Press, Honolulu.

236 pp. + 13 colour plates.

Paperback, US\$24.99, ISBN 9780822836931.

The native ecosystems of Hawai‘i have been severely degraded by the introduction of herbivorous mammals and a myriad of invasive plant species. Left unmanaged, most natural areas would continue along a trajectory towards domination by non-native species; however, several projects have undertaken the daunting task of ecological restoration, four of which are the subject of *Restoring Paradise* by Robert Cabin: Hakalau Forest National Wildlife Refuge; Hawai‘i Volcanoes National Park; the Auwahi dryland forest, Maui and Limahuli Garden and Preserve, Kaua‘i. After an introductory section discussing the setting and factors that have contributed to so much of the degradation and extinction of Hawai‘i’s native biota, Cabin outlines two different views of restoration in two central sections of the book: *ad hoc*, trial-and-error approaches versus the careful application of science to direct restoration. The time-tested methods of fence construction, ungulate removal, weed control, and replanting native species with the help of numerous volunteers and community support are presented in marked contrast to inconsistent applications of science in guiding restoration, and illustrated by some of the author’s unsuccessful research. The book is largely presented as a non-technical first-person account of travels and meetings with key personalities driving restoration projects. The philosophies of restoration practitioners are embedded in passages from interviews. Setbacks, obstacles, logistical constraints, and successes are narrated in between as Cabin revisits each of the restoration sites. The utility of science in restoration is frequently questioned by the author and sometimes abandoned by practitioners in favour of a ‘let-nature-take-its-course’ approach.

Efforts in Hawai‘i associated with ungulate control such as fence construction and maintenance, and hunting often represent the most expensive aspect of restoration because they occur in patches continuously surrounded by vast areas with extraordinarily prolific and abundant non-native ungulates. The chapter about Hawai‘i Volcanoes National Park presents a good overall perspective of the number of animals and effort required to create the largest area where feral goats had been removed from any island until it was surpassed by the Galápagos island of Santiago, Ecuador, in 2005 (Chynoweth *et al.* 2013). However, a reader might get the mistaken impression that ungulate control within restoration areas consists of the removal of a small number of animals within a relatively short period of time. For example, Cabin reported a grand total of 171 cattle and 112 feral pigs removed from two management units of Hakalau Forest National Wildlife Refuge during 1989–92, when in fact, more than 1400 feral pigs had been removed from eight

management units within the refuge between 1988 and 2004 (Hess *et al.* 2006).

The application of science to restoration or lack thereof, is a recurring theme throughout the book. Cabin frequently points out how scientific approaches to restoration have been limited by logistical constraints or replaced by trial-and-error, which he compares to ‘intelligent tinkering’ also the title of Cabin’s 2011 book about bridging the gap between science and practice (Cabin 2011). The divide between researchers and on-the-ground managers is also repeatedly asserted in *Restoring Paradise*. Such a narrow view, however, ignores the volumes of science that have contributed to a comprehensive understanding of natural history and community and ecosystem ecology in Hawai‘i, thus providing a fundamental rationale for restoration (Ziegler 2002). The ecosystem-altering effects of non-native species are also now well understood, and restoration projects pay dividends as they demonstrate the potential for recovering landscape-scale ecosystem functions, as in the case of soil hydraulic properties at Auwahi (Perkins *et al.* 2012). Moreover, several widely-applied aspects of efficient restoration programs have been developed through formal scientific research, such as the Judas Goat technique to control ungulates (Taylor and Katahira 1988) and techniques to germinate seeds of native plants (Kildisheva *et al.* 2013). The ultimate scientific test of restoration projects in Hawai‘i will be the measureable prevention of native species’ extinction over time.

The third and final part of the book titled ‘Herding cats with leaf blowers’ dwells on attitudes and philosophical questions involving restoration, such as ecological purity and the intentional introduction of non-native species for biological control purposes, or as surrogates for extinct native species. The final chapter in part 3, ‘Nature Is Dead. Long Live Nature!’ is an essay reprinted from *American Scientist* which examines the role of intervention to preserve pieces of nature in a world that is overwhelmingly influenced by human activity. Indeed, Hawai‘i provides good examples of all these issues to consider for young professionals who may be interested in a career in restoration ecology. Understanding the limitations of science to address issues surrounding societal values that Cabin raises may also contribute to the formulation of more useful scientific questions for those who have not yet had the opportunity to participate in restoration projects. *Restoring Paradise* may be most appropriate for upper-level undergraduate students or beginning graduate students to survey this speciality and appreciate the challenges, conflicts, and complexities they can expect to encounter in this field of work. The book might not interest many researchers in Hawai‘i, however, who may already have a more nuanced knowledge of specific sites, restoration strategies, and approaches for employing science in restoration.

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A FIELD GUIDE TO THE FRESHWATER FISHES OF WESTERN AUSTRALIA'S PILBARA PROVINCE

By D. L. Morgan, M. G. Allen, S. J. Beatty, B. C. Ebner, and J. J. Keleher

2014. Published by Murdoch University, Murdoch, WA.
Paperback, AU\$10, ISBN 9781921877131.

The Pilbara Province of Western Australia embraces the Mid West, Gascoyne and Pilbara regions of far north-western Australia. It covers an area of more than 500 000 km², includes Western Australia's highest mountains, the Hamersley Range (1200 m above mean sea level), and has some of Earth's oldest geological formations dating back more than 4 billion years. Summers are hot (>40°C) and winters warm (25–30°C), with an annual rainfall of less than 400 mm. As a result, most rivers flow only intermittently. The Pilbara Province is one of five major drainages in Western Australia and, despite its size, has only 16 species of freshwater fish. Nine of these are endemic. Three are subterranean blind cave species. In addition, the Pilbara has several diadromous species—fish that move between marine and fresh waters. Four non-Australian species of freshwater fish have been introduced into the Pilbara and have established populations. This includes the Mozambique Tilapia (*Oreochromis mossambicus*) listed as 'noxious' due to its size and potential threat to native species as a predator.

As is typical of much of Western Australia, knowledge of the Pilbara's freshwater fauna is recent. The first endemic to be described, the Deep or Murchison River Hardyhead (*Craterocephalus cuneiceps*) was only described in 1944. This was followed in 1945 by the description the Blind Gudgeon (*Milyeringa veritas*), Australia's first known true cave fish. At least three endemics remain to be described; two plotosid catfish and a bony bream.

The emphasis in this field guide is on the Pilbara's inland freshwater fishes. Thus, in addition to species restricted to freshwater habitats, diadromous species that penetrate inland waters such as the Mangrove Jack (*Lutjanus argentimaculatus*) and Bull Shark (*Carcharhinus leucas*) are also considered. A description is given for each species, supplemented by an easy-to-follow key and an excellent glossary, along with a brief

account of distribution, biology, and conservation status. Six species are listed as threatened. This includes the three species of cave fish (rare or likely to become extinct), the Bull Shark and Indian Short-finned Eel (*Anguilla bicolor*) (near threatened), and the Freshwater Sawfish (*Pristis pristis*) (critically endangered). The undescribed Robe River Tandan (*Neosilurus* sp.) is likely to be listed as mining activities affect river flows and waterhole permanency in the Robe River catchment.

Anyone with an interest in Australia's unique biota will find this guide to the freshwater fishes of the Pilbara fascinating and disturbing. I was fascinated because I have long been a fan of freshwater fish and delighted in the evolutionary history of the Pilbara's fishes implicitly described by David Morgan and his colleagues at Murdoch University. I found it disturbing because a unique and special assemblage of species that has evolved and persisted in one of the continent's harshest and most unforgiving environments is now threatened by activities taking place in a blink of ecological time. Pastoralism, with its attendant degradation of land and water, and mining date only to the 19th Century, yet their impacts are pervasive, irreversible and accelerating. Mining, by disrupting aquifers and lowering water tables threatens the entire subterranean biota—not only fish, but invertebrates. Despite these effects politicians in Western Australia along with mining and agricultural interests plead for an intensification of the use the freshwaters of north-western Australia. In their eyes, these waters are 'wasted' because they are not used by industry. Their call is to make northern Australia a 'food bowl' for Asia and to 'drought proof' Western Australia by diverting and impounding water that now flows to the sea thereby sustaining freshwater, subterranean, estuarine, and marine ecosystems. In my opinion, whatever the Australian economy gains in jobs and profits from such actions pales to insignificance when compared with what will be lost in natural ecosystems and the extinction of species. Whatever is gained will be short-term, the losses are permanent, but that is the story of the European colonisation of Australia.

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OBSERVATION AND ECOLOGY: BROADENING THE SCOPE OF SCIENCE TO UNDERSTAND A COMPLEX WORLD

By Rafe Sagarin and Anibal Pauchard
2012. Published by Island Press, Washington, D.C.
213 pp. + xiv.
Paperback, US\$30, ISBN 9781597268264.

Sagarin and Pauchard take readers on a wild romp from the molecular to the global; through the days of lyrical, anthropogenic species descriptions and literary, alcohol-fuelled chicken/egg musings about ecology; past statistical fallbacks, pitfalls and promising developments; and over debates on the philosophy of science, finally concluding that the field of ecology would be better served by more observational studies and fewer manipulative experiments.

Sagarin and Pauchard define observation-based ecology as 'ecology that relies on observations of systems that have not been manipulated for scientific purposes' and compares that with academic ecology which they posit as a process whereby observations suggest theories from which well-defined hypotheses can be formed and tested, either using computer models or in experimental treatments. The premise of their book is that the former is the only way to understand and to potentially solve the large-scale ecological disruptions we face with issues such as invasive species, global extinctions, climate change and ocean acidification. They argue that observational ecology will require a return to the skills and knowledge of great natural historians, which will be enhanced by technology that allows observation at both finer and coarser scales and from different viewpoints. They also make a compelling case that ecology should be inclusive of a social component. That is, it should embrace local and traditional knowledge holders, engage citizen scientists and educators, and work within the policy-making institutions of governments.

In Part I of the book, Sagarin and Pauchard review the cyclical history of observational approaches to ecology. They discuss its origins in natural history, the speculative questions borne of observations in the early 20th century, and the attraction and power of experiments to test ecological theory. While experimental studies dominated ecology from the 1950s, more recently the pendulum is swinging and a greater proportion of studies found in top journals are based on observations rather than experiments.

The 'hows' of observation in ecology are addressed in Part II of the book with one chapter devoted to human senses and a second devoted to the ways technology has expanded our ability

to observe through advances in remote sensing, microscopy, and the use of animal observers. Sagarin and Pauchard also discuss common potential pitfalls inherent in the unexamined application of technology such as cost, the enormous volume of data collected, the globally unequal availability of technology, and the tendency to draw spurious conclusions if generalisations are made outside of a strong natural history context. Part II of the book concludes by considering non-academic ecological observers, and suggests that traditional, local and accidental ecological knowledge holders can be invaluable sources of information, ideas and data.

A third section of the book tackles challenges in observational approaches to ecology. The authors identify the flood of data created by new technologies, as well as the paucity of data for some questions as concurrent problems. Sagarin and Pauchard suggest four areas of focus to address these issues. The first is to identify useful data; they suggest that data need good resolution at spatial, temporal and taxonomic scales. Second, they identify the importance of long-term datasets and storage; whether in collections, or in long-term monitoring programs. Networks of ecological observers and observations are praised as solutions to acquiring the data and expertise to understand large-scale issues, but the authors note that these networks are lacking in some parts of the world. Lastly, they discuss the challenges posed by analysis of non-normally distributed and qualitative ecological data, and laud advances in multivariate statistical methods and Bayesian approaches as these facilitate interpretation of the sorts of data collected in observational studies.

In Part III, Sagarin and Pauchard also take on the loaded question 'is observation scientific?'. Here they discuss the primacy of strong inference in late 20th century ecology, but also provide numerous examples of discoveries made because of non-random or serendipitous events. They also consider criticisms of observation-based science and present cogent counter-arguments, concluding that observations *must* be a part of scientific understanding.

The final section of the book suggests all the ways that observational ecology should be applied in the public sphere, citing policy-making, education, citizen-science and advocacy as among the arenas where the stories and emotional responses that come from first hand observers (as opposed to from theoretical, jargon-filled scientific articles) could sway opinions and change outcomes. The text is enthusiastic, broad, inclusive and optimistic. At the end of the journey, readers will want to go outside to observe—and then hopefully they will return inspired to contribute to solutions for our most vexing ecological problems.

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THE GEEK MANIFESTO: WHY SCIENCE MATTERS

By Mark Henderson

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Mark Henderson is a London based journalist and editor who has become a regular commentator on science in all forms of the press. He was the Science Editor of *The Times* where he built his reputation as the most respected and best connected journalist in the field. He is Head of Communications at the Wellcome Trust, a large biomedical research charity. He was awarded the European Best Cancer Reporter Prize and the Royal Statistical Society Prize for statistical excellence in journalism and other awards from the Medical Journalists' Association. He is without doubt well positioned to author this book.

This book is a call to arms for the geeks of the world who are characterised within as those of us, particularly scientists, who believe experimental methods, randomised quantitative trials and truthful data interpretation provide the evidence that must be called upon for decision making. If you believe these things and they are your creed then you are one of Mark Henderson's geeks. He aims to raise the awareness of good science and its methodology while highlighting how the politicians and lobbyists abuse, cherry-pick and outright lie about the scientific evidence, to misinform and to pursue their own agendas. He also aims to applaud the geeks that hold these evidence-abusers to account and encourage more geeks to fight back.

Mark Henderson uses his background to draw well known examples of the misuse of scientific evidence and its principles to further political and economic positions. He exposes the fraudulent claims of chiropractors, alternative medicine (e.g. homeopathy) and the selective misuse of scientific evidence by politicians about issues such as stem cell research, abortion and genetically modified organisms. These and similar examples are explained at length and provide the backbone of Henderson's thesis, upon which he builds by highlighting the most prominent cases and their protagonists, including the part played by the geeks (us) in bringing the truth into focus.

The book is divided into ten chapters, which discuss *why science matters* and the misuse of evidence in the media, politics, economics, education, the justice system, healthcare and the environment. All of these areas are well treated and none is glossed over. While you may think that the audience being addressed is geeks (and it does address geeks) the book is also reaching out to politicians, it is begging to be read by them so they can understand how they stand to benefit by adopting an understanding of scientific method and an evidence-based approach to testing their ideas. By addressing this book to the geeks the author quickly engages this core audience then keeps the facts, disturbing as they are, rolling along and continually reminding us that we must keep the 'bastards' honest.

Strengths and weaknesses: the strength is in the breadth of examples exposed by the author that the politicians and

lobbyists use to keep their untested opinions and misrepresented facts in the forefront of decision making. The author juxtaposes their muddled waters with the clarity of evidence-based facts. Henderson shows us how evidence-abuse is used to dance around the truth and how politicians selectively ignore evidence that does not agree with policy. All while reminding the geeks to keep watch over them and to yell loudly from the lofty heights of Internet blogs and tweets to illuminate the truth: this is his call to arms. The only weakness of the book that I detected was the use of the same tactics that the book decries to support the nuclear industry. However, the author freely admits that he expects geeks to question him, because this is something we do well.

About this point in a book review I generally ask, has the book aided the understanding of the discipline? And the answer is yes, it has done this in spades. The aim of the book was to inform and engage geeks (and others) into how the scientific method is misused by some and used by the geeks (and others) to hold the decrees of government and other decision makers up to the light of testing and evidence. It has done this so efficiently that copies of the book have been bought by a benefactor and supplied to all politicians in Britain and Australia. Let us all hope that they actually read it.

Beyond being a good read this book reminds us that the scientific method of testing hypotheses with well designed science that leads to results interpreted with a degree of confidence is the foundation of science. It is not a textbook on scientific method; it is a call to arms and an instruction book for those unfamiliar with the principles of testing and the unbiased reporting of the results. It could fit into the extended reading lists in many fields including journalism and communication. All conservation biology administrators and decision makers must read it.

The level of research for this book is indeed deep. While much of it came from the day-to-day experiences of an environmental journalist and editor at *The Times*, all these things would have been revisited and checked and then updated with the relevant literature. It is a well researched and thought-out book.

The writing throughout is clear and accessible and the explanations of scientific methods are straightforward. Anyone who can read *The Times* newspaper can read this text. The chapters are well organised, not too long and studded with subheadings, which enabled me to put the book down and pick it up again easily. It comes with an index and a thorough list of references/notes, documented clearly at the end. These references will facilitate detailed follow-up if that is what the reader desires.

I strongly recommend this book to the readers of *Pacific Conservation Biology* as a good read and a guide to understanding how and why science and reason are thrown out by governments, lobbyists and the unscrupulous among us and it provides the manifesto necessary for science and reason to fight back.

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