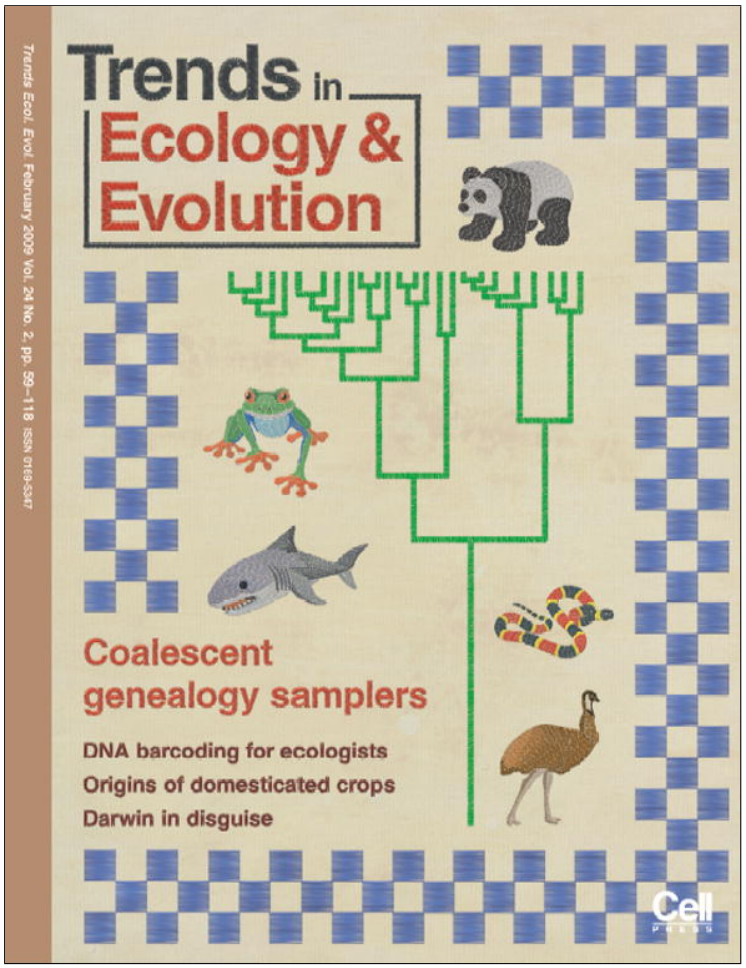

benefit to the squid, and that the squid's light organ enhances population growth rate in the bacteria. Thus, there appears to be a mutualism between the squid and the bacteria. But light emission is metabolically costly to the bacteria, and so we must ask, why not cheat? Game theory would address this question theoretically by introducing a cheater into a population and determining whether it could invade. In this system, however, the authors produce signal-negative and signal-blind mutants and introduce them into wild populations, and conclude that the system is maintained by kin selection. This study illustrates clearly that the intuitive explanations of signal honesty by Zahavi can be tested experimentally, and most elegantly so in this system. In addition, this chapter, along with David Haig's discussion of genomic imprinting and internal communication, are models of how basic evolutionary principles that have been developed mostly in the context of social communication in vertebrates and social insects can be fruitfully applied to a much wider spectrum of problems, even when the definition of 'communication' is broadened almost past recognition.

There are other gems in this volume; space only allows mentioning a few. Zuk and Tinghitella review studies of the evolution of silent male crickets in Hawaii. They address the expectation that sexual signals should evolve rapidly, but then wonder why there is not more evidence that this is the case. When theory is not supported by data, we usually suspect that there is some aspect of the phenomenon we do not truly understand. The authors suggest that the lack of rapid evolution of sexually selected traits might be one of those phenomena. Another discussion where some of our expectations are violated emerges in Hurst and Beynon's review of olfactory communication in rodents. It is now almost dogma that rodents and humans use MHC cues to choose better mates. But wild rodents also produce male urinary products (MUPs) whose effects might be confounded with MHC variation. MUPs seem to provide information useful in sex, kin and individual recognition as well as for assessing current social status, and might be far more important in communication in the wild than MHC cues have proven to be in laboratory-bred mice.

Finally, one of the most intriguing chapters is Crespi's review of psychosis and human communication. Citing data from evolutionary theory, neuroscience and genomics, he suggests that the psychosis which results from the conflict generated by both internal and external influences is an 'illness that made us human.' Crespi's words best sum this up: 'Balancing this conflict are the confluences of interest that emerge from genic cooperation, mother's love for child, and love of God – who, like our circle of kin created us in body and psyche and promises immortality, and who we serve to give life its meaning. In the beginning was the Word, and the Word was God – as are we, modern humans' (p. 243).

As the above quote illustrates, this is a book to stretch one's imagination of where and how animal communication concepts might apply. For the most part, it works. If one wants to be challenged to think outside of the box, this book represents a good exercise. But the reader should be advised that the book is not an introduction to, nor a prospectus on, the social behavior of communication. For that, the reader is referred to one of the standard texts [1,2].

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0169-5347/$ – see front matter
doi:10.1016/j.tree.2008.09.012 Available online 26 December 2008

Book Review

Sustainable complexity

Seeking Sustainability in an Age of Complexity by Graham Harris, Cambridge University Press, Cambridge, UK, 2007, £70.00 (hbk), £29.99 (pbk) (374 pages) ISBN 978-0-521-87349-9 (hbk), ISBN 978-0-521-69532-9 (pbk)

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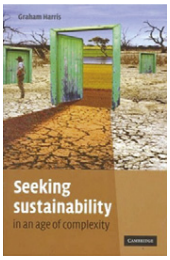

The ideas of complexity and sustainability have both become extremely popular over the last several decades, but until now no one has done a good job of putting them together. Graham Harris has done just that in this masterful piece of synthesis across an incredible range of ideas. He brings into the synthesis ideas about scaling, landscapes, uncertainty, values, management, governance, worldviews and much more. As one might imagine, the result is itself a pretty complex and dense read. But the style is straightforward and the book is very well researched. It bristles with insights gleaned from putting all these pieces together.

The paradigm of complex systems has radically altered the way we view the world, humanity's place in that world and, most importantly, the limits of humans' ability to understand and 'control' the world. Sustainability, as a goal for human presence in the world, thus has to take on a much more nuanced and 'complex' character. For example, the concepts of uncertainty, scale, precaution and resili-

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ence become key in talking about the sustainability of complex systems, and Harris fleshes out these ideas and relationships nicely. For example, he recognizes the scale dependence of resilience. Resilience at one scale can become counterproductive 'lock-in' at another. For example, our global society might be very resilient to change, but that is only sustainable relative to small changes in the external conditions. Peak oil and climate change are big changes in the external environment, and too much resilience at that scale can prevent needed adaptations and might be unsustainable.

What is needed to understand and manage these 'wickedly complex' problems is a new kind of science, what Harris calls 'Mode III' science. Mode III science is 'science that is done in the context of its application but which also influences the context and application through engagement in a contextual and recursive debate.' This kind of science is transdisciplinary, participatory, recursive and requires whole-systems thinking. It also needs to integrate the study of humans and the rest of nature and achieve a true 'consilience' across all the natural and social sciences and the humanities [1,2].

In the end, the book is a search for 'simplexity' defined as the 'emergence of large-scale simplicities as a direct consequence of different, but similar rules.' In the sea of complexity, why is there is any simplicity at all? How do we make sense of the world to achieve our goals? The final chapter on 'avoiding collapse' is Harris's attempt to glean policy prescriptions from the emerging science of complexity for achieving sustainability. These include providing the right incentives to reduce carbon emissions, restoring natural capital and ecosystem services, solving the institutional issues around adaptive management and providing more research dollars to solve all those wickedly complex problems. Although none of these prescriptions are particularly new, the link to complex systems makes them all the more compelling. The overall conclusion is that 'this is really a case for "stronger" sustainability: a more equitable arrangement of capitals and of stocks and flows throughout the interconnected biosphere and anthroposphere.' Ultimately, human ambitions have to operate within what Harris calls the 'envelope dynamics' of the system and 'human ambitions cannot override the workings of the planet on which we evolved.'

To avoid collapse, we certainly have to take these ideas more seriously. But Harris says little about the political dynamics and cultural evolution that might allow this to happen. The political and institutional constraints seem to be the limiting factors now, and they will be very difficult to overcome. In keeping with the ideas of complex, interconnected systems, we cannot just change one thing. We have to change worldviews, institutions and technologies simultaneously, while allowing for the inevitable cultural and political inertia and lock-in. On the other hand, as Peter Barnes [3] has pointed out, political seas do change and often change very quickly. The current economic crisis might provide just the shakeup needed to make significant changes in both how we view the world and how we manage it. We have to be ready with the right ideas and proposals when the time comes, and Harris provides a useful and timely synthesis of many of those ideas.

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Book Review

The phenotype in high dimensions

Evolutionary Genomics and Proteomics by Mark Pagel and Andrew Pomiankowski, Sinauer Associates, 2008.
US $54.95 pbk (295 pages) ISBN 978-0-87893-654-0

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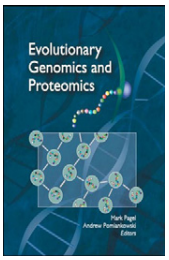

'We are learning the language in which God created life,' declared Bill Clinton when the first draft version of the human genome was presented in Washington in June 2000. At the time, a prominent German newspaper dedicated six full pages of its feuilleton to 0.1% of this genome sequence. Genomics has apparently permeated many areas of our culture. Certainly, one reason for this interest is that genomics promises to cure diseases more effectively than trial and error. Another reason, maybe less important but more culturally stimulating, is that it promises insights into our origins, at least of a secular variety. The sense that these insights are leading to 'a new kind of evolutionary analysis of organisms' led Mark Pagel and Andrew Pomiankowski to edit a volume that charts recent progress in the rapidly moving field of evolutionary genomics. 'In effect,' as they write in the first chapter, 'we wish to discover whether we can reveal a phenotypic biology in high-dimensional omics data.' Although we are probably as far from this goal as biomedicine is from abandoning its reliance on trial and error in curing diseases, genomic data have certainly allowed unprecedented insights into the evolutionary forces that have shaped genomes. In fact, one could argue that genome analysis has so far dealt

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