Thus, I was shocked to read, in 1982, the reports of the World Parks Congress in Bali, where the need for protected areas was questioned and human concerns suddenly took center stage in conservation planning. Five years later the people-centered case for conservation was strongly featured in the Brundtland Report[1]. Since then, the sustainable development/use bandwagon has rolled merrily along, supported wholeheartedly by most of the major international conservation groups, politicians and lending institutions. Biology has taken a back seat to economics, and the needs and aspirations of people – an abundant, weedy species – are considered more important than the vital needs of all other species. Or, looking at it anthropocentrically, we are gratifying the present generation at the expense of future generations.

The radical shift away from protection and the uncritical embrace of sustainable development never made sense to me. But few have questioned the dominant paradigm[2,3]. Now, a multi-authored book has emerged that knocks the wheels off the sustainability bandwagon and reaffirms the fundamental values of protected areas in the fight to save biodiversity. *Last Stand* focuses on the tropical rain forests and argues that the recent emphasis on sustainable development has led to reduced protection of biodiversity. But the book is not a naive plea from a bunch of misanthropic preservationists. Rather, it is a well documented, mostly enlightening, and pragmatic treatment of the complex biological, socioeconomic, and cultural issues that make conservation in the tropics – indeed, anywhere – so difficult. The three editors and many of the authors are with Duke University's Nicholas School of the Environment. The book emerged from a 1993 workshop; it is a shame it took so long to get into print.

This is not a cheery book. Some 170 000 km^2 of rain forest are being lost every year. The World Conservation Union (IUCN) has called on nations to protect 10% of their lands, but there is no reason to believe that 10% protection will be biologically sufficient and many reasons to believe it is not[4]. Nevertheless, it seems unlikely that most countries will protect even 10%, and much of what is ostensibly 'protected' is being severely degraded by logging, road building, cattle grazing, hunting, agriculture, mining and other activities both within and adjacent to protected areas. Human populations continue to grow; indigenous cultural taboos and norms which sometimes protected forests are breaking down; social inequities, war, corruption, and greed abound; and few efforts of any kind (traditional protected areas or the new conservation and development projects) have truly saved rain forests.

But, curiously, the book is not hopelessly depressing. There seem to be the seeds here of a real solution. As noted in Chapter 2 by Terborgh and van Schaik, all the major forces of extinction can be minimized by a conservation strategy that emphasizes large, rigorously defended parks. Other chapters point out that representation of all ecosystem types is a good idea and that connectivity among reserves is important. But reserve selection and design receive scant attention in this book. Rather, most chapters address the issues of how to get land protected and how to keep it secure by keeping local people happy – or, encouraging them to seek employment in cities or other, already degraded habitats. The myth of indigenous peoples living in harmony with nature and carefully stewarding forest resources is thoroughly exploded – the more these people are exposed to outside influences, the more they want what everyone else has. As van Schaik, Terborgh, and Dugelby (Chapter 4) put it, 'native peoples are interested in pursuing economic development just as are people without tribal backgrounds. It would be unrealistic and unfair to expect otherwise.' MacKinnon (Chapter 3) describes how the Kayapo of eastern Amazonia earned approximately $33 million in 1988 alone by unsustainably logging mahogany in their indigenous reserve. The Brazilian government cannot afford to pay each Kapayo community $50 000 per month in requested compensation to stop logging. Case studies are presented in several chapters of conservation projects that have failed miserably or achieved a few of their goals. Some lessons have been learned, but true success stories are exceedingly rare.

All authors here agree that tropical forests can be conserved only if the opportunity costs (that is, lost opportunities to exploit forest resources) borne by local people are compensated in some way by the beneficiaries of conservation – the international community. Chapter 9, by Ferraro and Kramer, provides a fascinating account of compensation mechanisms and notes advantages and disadvantages of each approach. It is clear that investments in desirable activities (protection) and investments in undesirable activities (e.g. logging) must be made mutually exclusive, so that residents cannot accept compensation while continuing to degrade the forest. The authors favor economic incentives, including the negative incentive of strict law enforcement, but stress that the optimal solution will be case-specific. Van Schaik and Kramer conclude the book by summarizing four major principles: (1) protected areas, no matter how great their benefits to local communities or society generally, will always require active defense; (2) beneficiaries of protection who now receive benefits free of charge should be prepared to pay for protected areas; (3) effective solutions require the involvement of all stakeholders, including conservationists; and (4) although delegation of management to local communities should be encouraged, the role of the national government as the representative of the nation or international community must be maintained.

We simply must protect the rain forests and their biodiversity. As van Schaik and Kramer put it, 'protected areas are needed, not to satisfy some Western romantic ideal about paradisal nature unspoiled by humankind's uncouth hands but because a considerable number of species are vulnerable to extinction due to overexploitation or disturbance.' It is for these species, as well as future members of our own, that we must reinterpret sustainable development to include the rigorous protection of huge, wild landscapes.

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Why the Quaternary matters

Evolution and Ecology: The Pace of Life

by K.D. Bennett

Cambridge University Press, 1997.
$50.00/US$80.00 hbk, $16.95/
US$28.95 pbk (xviii + 241 pages)
ISBN 0 521 39028 1 / 0 521 39921 1

This book was written at least partly out of the author's sense of frustration about the mutual ignorance of Quaternary scientists, evolutionary biologists, and more traditional (pre-Quaternary) paleontologists. As a Quaternary scientist, I fully appreciate this frustration and the sense of disconnection between these disciplines. Perhaps this is because paleontologists working on Quaternary fossils must deal with all three camps. We deal mostly with extant species in our fossil assemblages, so we have natural connections with modern biology. Unfortunately, we find that most biologists are ignorant of the Quaternary fossil record. Likewise, we find that most bedrock paleontologists are also ignorant of the most recent of geological eras, and sometimes even disdainful of it. Quaternary sediments, to most paleontologists, are just the irritating overburden

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that must be scraped away to get at the 'real fossils' that lie below.

Bennett's task in this book is to explain why the Quaternary record is not only important to neontologists and paleontologists alike, but also that it is the one record that may well hold the answers to some of our most fundamental problems in ecology and evolution. He succeeds admirably in this explanation.

The book explains orbital forcing of climatic oscillations, laying the geologic foundation of sedimentary oscillations that can be linked with climatic oscillations on 20 000–100 000 year timescales throughout Earth history. In a review of late Cenozoic fossil records, Bennett demonstrates that biological communities are ephemeral, even in tropical regions, and that species react independently to environmental changes. The principal response to climate change during the Quaternary has been shifting distributional patterns. Individuals and populations do not respond in this way – only the species' ranges as a whole are altered. As such, we will probably never be able to observe the origination of a species; we will only be able to detect population increases and expansions into new regions.

For most species in the Quaternary fossil record, there is remarkably little evidence of evolutionary change. Examples discussed in the book show that species may exhibit three types of evolution: (1) stasis, (2) gradual change and (3) speciation by lineage splitting. Of these, stasis is the most frequent response to climatic oscillation during the Quaternary. Some natural selection has occurred, but there is no evidence that it accumulates over sufficiently long periods to bring about speciation. Much the same holds for extinction, which in the Quaternary has been mostly confined to anthropogenic influences during the past 12 000 years.

Bennett shows that the widely-held theory of long-term community stability is in fact quite false. Communities are not recurrent over geological timescales, simply because the species in those communities operate independently. One of my few disagreements with this book comes in this section of the book, where Bennett challenges the idea that species may track their environments and thereby avoid exposure to climate change. He confounds the fact that communities cannot react *en masse* to environmental change with the concept that species can react individually to such changes, citing examples from paleobotany. While plant species may not always track changing environments, the evidence from the fossil beetle record shows that at least this group (the most speciose group of organisms on the planet) has successfully tracked changing climates throughout the Quaternary[1,2]. The composition of fossil assemblages has changed through time, but the climatic conditions that are mutually acceptable to the species in those assemblages (their mutual climatic range) show that the environmental requirements of the individual species have remained fixed[3]. Furthermore, the fossil record shows that beetle species have managed to keep within their respective zones of suitable environment by shifting their distributions. Granted, beetles are more mobile and have higher reproductive rates than many other organisms, but it seems certain that the ability to track environments has not been restricted to the Coleoptera, or even just to the Insecta.

Bennett concludes by pointing out that some researchers have rejected use of the Quaternary fossil record as a model for evolution and ecology, because the range of climatic variation in the Pleistocene makes it atypical of Earth history. However, he argues that even the scale of climatic change seen in the Pleistocene does not appear to have evoked substantial biotic responses, particularly in the lower latitudes. To ignore the Quaternary means to ignore nearly all data available on the history of life at timescales from 10^3 to 10^5 years. These are the most meaningful timescales of all; within them the events that shape the biota take place.

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Evolution of social complexity

Evolution of Social Behaviour Patterns in Primates and Man

edited by W.G. Runciman, J. Maynard Smith and R.I.M. Dunbar

Oxford University Press, 1996.
$25.00 hbk (vi + 297 pages)
ISBN 0 19 726164 7

I have discovered a simple rule of refereeing. If the word 'patterns' is used, advise a rewrite: the word is usually so meaningless that it correlates strongly with vague thought. Occasionally my rule breaks down. Although 'Patterns' can be dropped from the title of this book with no loss of meaning, nevertheless, explicit ideas are, for the most part, clearly presented throughout (which they need to be, because there's no index). And while the breadth of the subject could have given us a scattershot of topics, we have a surprisingly cohesive series of chapters, from the ecology of non-human primate grouping through archaeology and the evolution of culture to language and how humans think.

The one difficult chapter was by Tooby and Cosmides. In it, they continue their argument that our 'cognitive machinery' is specially 'designed' (i.e. evolved through natural selection) to produce specific behaviours via specific psychological 'modules'. The argument that human behavior is adaptive and that its mechanisms have evolved through natural selection has been with us for a long time[1]. One of ethology's aims has from the start been to understand the mechanisms that produce adaptive behavior[2]. Witness, for instance, the studies of specific learning abilities that lead rats to associate illness with food[3]. Yet Cosmides and Tooby rarely refer to this earlier work, and I am therefore left wondering how much of what they say is new, especially as their inferences from the much-used Wason selection test have been strongly questioned[4].

A constant background to Cosmides and Tooby's arguments about adaptive psychological modules is the idea that the modules evolved in the Pleistocene hunter–gatherer 'environment of evolutionary adaptiveness'. Our ability to detect cheaters is one of their more famous modules. The means by which we induce cooperation is the one addressed here – where they appear to have rediscovered mutualistic cooperation[5]. Is it really the case that neither before nor after the Pleistocene hunter–gatherer environment was the ability to detect cheaters or to induce cooperation advantageous? Foley and Aiello argue (separately) in this book that the evolutionary groundwork for our complex abilities was being laid long before the appearance of *Homo*. Monkeys and apes detect cheating[6]; monkeys and many other birds and mammals cooperate[7], primates doing so in apparently complex ways[8], and being especially good at social, as opposed to environmental, calculations[9], precisely as Cosmides and Tooby argue humans are[10]; and Borgerhoff Mulder here argues that even the apparently culturally determined behavior of bride-wealth payment is not only explainable in terms of reproductive payoffs, but changes as conditions change in the second half of the 20th century. Why do we need Pleistocene hunting and gathering for our environment of evolutionary adaptiveness?

Perhaps more importantly, Cosmides and Tooby's argue strongly that the very specific modules (interpretable as rules) that they propose (e.g. cheater detection) have evolved through natural selection[10], without fully testing the possibility that the cheater detection rules could have been learnt, and