

space available to us and their duration exceeds the time endangered species can persist without our intervention?

Stevens is well known as a writer for the *New York Times's* weekly science section who covers a wide range of issues with rare insight and clarity. Why pick restoration as the subject for a first book? The practical difficulties, the political battles and, as the cover puts it, the "story of perseverance and tenacious human spirit" make a great read, of course. The subject matter lends itself to delightful illustrations. Crucially, the ecological issues are ones we cannot ignore. □

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Flaming nuisance?

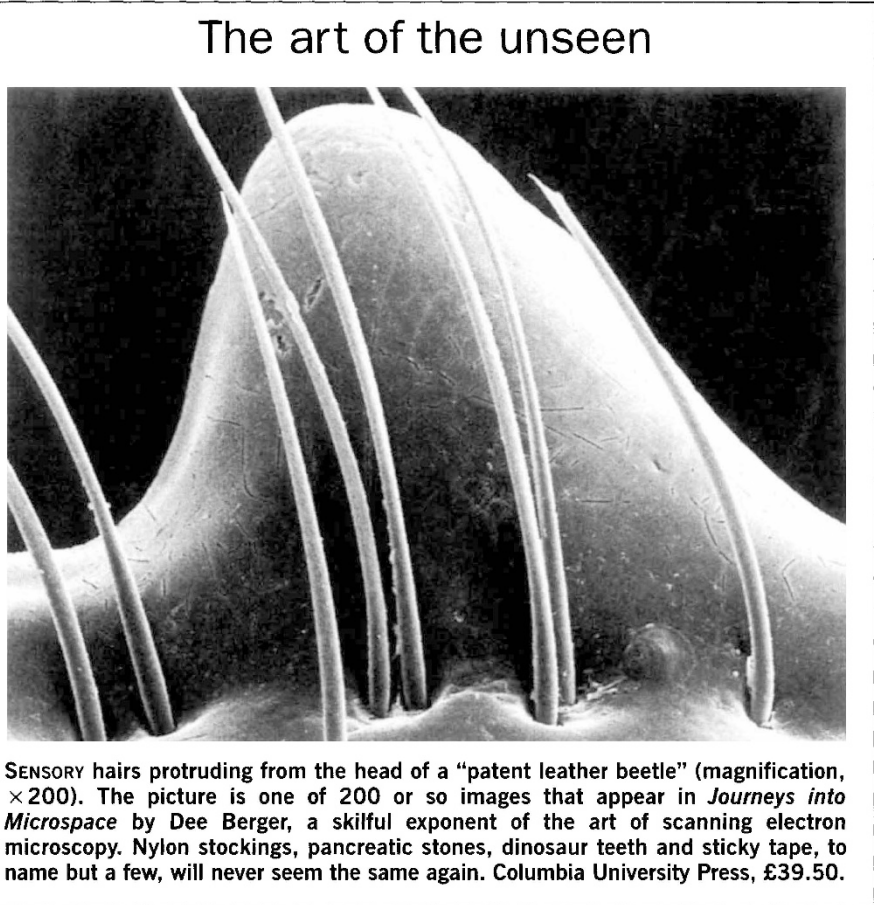
Peter D. Moore

The Ecology of Fire. By Robert J. Whelan. Cambridge University Press: 1995. Pp. 346. £42.50, \$79.95 (hbk); £15.95, \$27.95 (pbk).

THERE can be no doubt that fire is catastrophic, but can it also be constructive? As children we are taught to avoid it, but as ecologists we need to learn how to understand it, how to control it and perhaps even how to use it; such is the message of this book.

Fire has undoubtedly played an important part in the evolution of life on Earth, long before our species began using it for social, gastronomic and hunting purposes. The traces of burned plant fragments in sedimentary rocks dating back to the Devonian period, some 360–410 million years ago, have even been used to trace the oxygen content of the Earth's atmosphere. Both the individual species and the communities that today occupy the world's fire-prone areas have therefore evolved and assembled themselves under its influence and selective direction. From the thick insulating bark of *Eucalyptus* trees to the burrowing proclivities of chaparral mammals and the evasive behavioural tactics of Australian woylies, the range of techniques that species have evolved and adopted to tolerate fire have been set out in this account. The 'Bambi' image of stampeding herds of vertebrates fleeing before fire is not in favour with fire scientists, for animals often use a more subtle approach and double-back through gaps to pass behind the fire-front.

The dynamics of whole populations provides a documentation of benefits of fires in many habitats. Fire following fruit maturation, for example, may release



SENSORY hairs protruding from the head of a "patent leather beetle" (magnification, $\times 200$). The picture is one of 200 or so images that appear in *Journeys into Microspace* by Dee Berger, a skilful exponent of the art of scanning electron microscopy. Nylon stockings, pancreatic stones, dinosaur teeth and sticky tape, to name but a few, will never seem the same again. Columbia University Press, £39.50.

seeds for germination that would otherwise have been eaten by insects or birds, so post-germination survivorship is often greater on burned sites. But post-fire habitats offer rich pickings to wandering herbivores, as the canny Mesolithic pyromaniac hunters of northern Europe were well aware, so new shoots in burnt-over areas may be intensively grazed. This can lead to some animal populations being favoured by fire; and having considered the responses of vegetation to periodic combustion, Robert Whelan also looks at the impact of fire on animals.

A major problem is that so much evidence about the impact of fire is anecdotal. This can be overcome in part by experimentation, which can easily be applied to plants by burning areas at different intensities and observing vegetative recovery and subsequent seed germination. But such work with animals, especially vertebrates, would quite reasonably be frowned upon. Sound information on the mortality inflicted on large herbivores by fire is therefore still scarce. Among invertebrates, results cited vary from an almost total kill in a forest fire to about 90 per cent survival by flight for savanna grasshoppers.

The book provides a thorough analysis of the ecology of fire, illustrating principles from a wide range of fire-affected habitats, including boreal forest, Mediterranean-climate chaparral

and savanna grassland. Europeans may be disappointed at the poor representation of the oceanic western heaths and moorlands in the text, and this is particularly apparent in the final chapter on fire and management. Here we find what should be the climax of the book, an explanation of how we can use this powerful tool to manipulate ecosystems for habitat management and wildlife conservation, but the attitude conveyed by the few pages devoted to this subject still seems to view fire as a danger to be avoided rather than an ally to be exploited. The main emphasis of the chapter is on hazard reduction by periodic burning in American forests, and this is certainly an important topic that demands attention. An account of the historical development of fire policies and the disastrous mistakes made (as at Yellowstone National Park) would have been appropriate here to illustrate the dangers of over-protectionist attitudes. But we also need more on the positive side of fire management, and where better to turn than the British grouse moors with their long history of fire management? Some conversations with Scottish muir-burners would have turned this otherwise admirable text into a more rounded work. □

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