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## CATASTROPHIC THINKING

David Sepkoski

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*Catastrophic Thinking: Extinction and the Value of Diversity from Darwin to the Anthropocene*

David Sepkoski

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*Catastrophic Thinking* is a story about how ideas about extinction motivate considerations about biodiversity. David Sepkoski has written a history of the 'extinction imaginary', the immense variety of cultural ideas and expectations surrounding what has happened and what could (catastrophically) happen to life on Earth. As he skilfully argues, this has enabled 'Western culture's imaginary' more broadly to seamlessly connect present ecological worries with narratives about 'deep time', from the earliest discovery of extinction to the contemporary claim, now taken to be self-evident, that biodiversity conservation is a good thing.

Sepkoski's monograph historicizes biodiversity through the lens of extinction, suggesting that our concept of biodiversity is the product of the 200-hundred-year entanglement of scientific and popularized notions of extinction. *Catastrophic Thinking* tells us how conservation biologists read the palaeobiologists' accounts of the deep past and, as a result, came to see diversity as a good threatened by causes as diverse as meteorites and human action. Changes in popular thought (identified in US and, to a lesser extent, UK popular media) play an important role in his narrative. Sepkoski's new book adds a cultural dimension to the history of palaeobiology he previously narrated in his (Sepkoski [2012]). He includes in this new work not only the history of scientific insights and their cross-disciplinary entanglements, but also how works of popularized science and reflections on the history of civilization have been key in shaping the ability of the public and scientists to imagine different futures.

The book proceeds chronologically, through the development of scientific and popular understandings of extinction, catastrophe, and crisis. We begin with the initial scientific uptake of the very idea of extinction, which interpreted the disappearance of living forms as part of the debate between catastrophists and uniformitarians in the history of geology (chap. 1). This is the ground upon which Darwin's theory of evolution is constructed, where extinction is marshalled as one of the conditions for the Victorian sense of both organic progress (by the replacement of older, less-adapted forms) and social progress (by the colonial replacement of less-adapted civilizations; see chap. 2). The early twentieth century sees a fruitful, if relatively bleak, exchange between modernist authors and cultural critics obsessed with a narrative of societal, cultural, and racial decline and palaeontologists who, precisely during this same period, begin to turn their attention to extinction as a phenomenon potentially explicable by orthogenetic degeneration, a kind of channelling of evolutionary change in potentially non-adaptive directions (chap. 3).

Chapters 4 to 6 move us closer to the present, beginning at the height of the Cold War, with the preoccupation with nuclear warfare and the development of fears concerning human extinction and overpopulation (chap. 4). Ecological worries about dynamics and interconnectedness move seamlessly, in this context, into arguments about the fate of the human species. Once again, this provides fertile intellectual and cultural ground (as a sort of 'preadaptation', in Sepkoski's words; p. 86) for the development, over the ensuing several decades, of theories of the rapid extinction of the dinosaurs by an asteroid impact, as well as a broader understanding of the concept of 'mass extinction' more generally (chap. 5). Finally, the book closes with a discussion of the 'sixth mass extinction', the biodiversity crisis, and climate change, where Sepkoski deftly argues that—whatever might be its empirical merits—the idea of a sixth mass extinction can only be comprehended as the result of the steady process of refinement of precisely the extinction imaginary that the book has traced (chap. 6). A brief epilogue looks to the future, and includes a particularly illuminating discussion of recent efforts to expand the idea of 'biodiversity' toward 'biocultural diversity'—a change, Sepkoski notes, that may herald yet another shift in the constellation of values that have animated conservation over the latter half of the twentieth century.

As this too-brief summary already makes clear, the book's central argument turns on what we might call a 'feedback loop' between, on the one hand, scientific work on catastrophe, geology, and extinction, and on the other, the cultural ideas surrounding catastrophic events, from contemporary concerns surrounding the loss of diversity as an inherent socio-cultural harm to the nuclear annihilation threatened by the Cold War. The book is at its best when it is articulating the precise ways that this feedback loop operates—in one case, by virtue of the very same scientists modelling both the extinction of the dinosaurs by climatic disruption after an asteroid impact and also the potential after-effects of a nuclear winter.

This goal is accomplished most successfully for the dinosaur extinction case, and for early twentieth-century 'Modernism' or the 'Age of Catastrophe', when popular worries about cultural decadence and degeneracy were paralleled in biological and anthropological research. The cases for significant cross-pollination in debates surrounding extinction in the Victorian era (chap. 2) and in contemporary work on biodiversity (chap. 6) are perhaps less convincing: while we can track in detail the scientific and cultural changes taking place in both circumstances, there is an absence of 'smoking gun'-style evidence to show precisely that transmission was taking place. But read in the light of how many smoking guns can indeed be found in other periods, this is a relatively minor criticism.

Of particular interest to a philosophical audience, the book engages with a number of issues surrounding the role of values in science, or even with social construction. Sepkoski is at pains to note that while we are undeniably in a biodiversity crisis, whether or not we are in a 'sixth mass extinction' is a much more complex matter and one that appears to have been driven to an important degree by social and cultural value judgements. Even more pointedly, he gestures at how these same social and cultural values might have influenced not only public-facing presentations, like discussions of a 'sixth mass extinction', but also presentations of the science itself, with the debate over punctuated equilibrium forming an especially compelling example. Conspicuously rather absent in these discussions over public value judgements, in contrast, is the impact of the early environmental movement.

Sepkoski's book does what a good history of scientific neologisms should do: it points to concrete events, publications, and people to explain the rise and spread of ideas (of catastrophe, biodiversity, and extinction), yet it also successfully de-centres them: the trauma of WWI 'did not create the culture of doom and catastrophe' (p. 92), as can be seen in the pessimistic cultural commentaries and literary writings that preceded the war; the atomic threat is not the cause of catastrophism, as we see it in fictional works well before; the 1986 National Forum on Biodiversity is the birthplace of the 'biodiversity' neologism and thus played an important role in the term's spread into mass culture, yet the recognition of the value of diversity was thanks to both scientific and cultural changes throughout the twentieth century. This de-centring of simplistic causal stories creates rich and interwoven narratives, where concepts appear and are transformed as stratigraphic accumulations and disruptions.

De-centring these simple narratives is important for how we understand all of these concepts. Sepkoski shows how, in order to understand the success of biodiversity (and, we would also add, its limits), we cannot only look at the history of conservation biology and ecology. Sepkoski manages to tell a story of biodiversity with a thorough discussion of conservation coming only late in the book (chap. 6). Instead, he uses a wider lens to explain biodiversity's success, with insights from other disciplines (most prominently, palaeobiology), as well as changes in the larger cultural context. The biodiversity movement in the late 1980s and the proponents of the concept of a sixth mass extinction in the 1990s used understandings of 'extinction' that had been developed by palaeontologists in the previous decades in their work on diversification. Concerned scientists used the notion of extinction to explain the biodiversity catastrophe of the present through mass extinction events in the geological past. For Sepkoski, looking at the history of palaeontology and its relation to the biodiversity movement 'is central to understanding how and why biological diversity became a topic of such central concern when it did' (p. 267).

If this proposition may not be surprising to some, what may be more pressing for philosophers of science is that this knowledge transfer from palaeontology to conservation biology is far from unproblematic, particularly concerning whether the 'sixth mass extinction' is an appropriate label for our current loss of biodiversity. While some palaeontologists were part of the biodiversity movement themselves, it remains 'a somewhat complicated story', Sepkoski argues (pp. 269–74). Key figures, like Dave Raup, remain sceptical about the employment of the analogy between the past and the present—particularly the use of the background extinction rate, a thorny quantity to calculate in palaeontology—as an unproblematic point of comparison to assess the severity of today's decline in biodiversity. Here, Sepkoski explains the difference in how we might interpret the relevant data, once again through the different values and attitudes of conservationists and palaeontologists: the former professional group deals in the here and now, where political and public support, as well as scientific evidence, is necessary for conservation

action; while palaeontologists, Sepkoski writes, 'are conservative by nature' and will shy away from grand extrapolations and moral claims. This interconnection nicely demonstrates Sepkoski's potential contribution to the values in science literature.

This intertwining of science and values sets Sepkoski apart from some philosophical analyses of the uniqueness of conservation biology as a value-driven enterprise. Here, David Takacs, widely cited in the philosophical literature as providing key sociological and historical insights into the concept of biodiversity, comes in for particular criticism. Takacs ([1996], p. 106) sets up biodiversity's multiplicity of meanings in a 'dialectical' fashion, arguing that there is, on the one hand, 'biodiversity, the notional totality of life on this planet, and *biodiversity*, the term biologists have concocted as an approximation for that totality: a scientized synonym for *nature*, imbued with the values biologists cherish'. Takacs's approach to the hybridity of values and facts, according to Sepkoski, is problematic because it establishes a 'false dichotomy' between subjective and objective views of scientists, where the conservation ambition of the discipline of conservation biology is the main reason for the influx of values in an otherwise value-free science worthy of social respectability. For Sepkoski, values, as well as cultural, social, and political contexts, are the bread and butter of science, which cannot exist in a vacuum.

Another attack that Sepkoski launches on Takacs concerns the issue of biodiversity's seeming multiplicity of meanings. Perhaps Takacs's main contribution is taken to be that biodiversity is an ambiguous concept, with no consensus definition. Takacs interviewed key scientists studying biodiversity, illustrating the multiple and often contradictory definitions that they gave of the concept that unites the field of conservation biology. Sepkoski takes issue with Takacs's choice 'to interrogate a nebulous concept to begin with' (p. 249), and claims that Takacs's argument appears to be circular, further illuminating the layered entanglements of science and how his book departs from Takacs's approach:

The point is that if we set out by defining our categories in a way that does not distinguish between philosophical, personal, political, and empirical values and beliefs, we should not be surprised if we cannot disentangle them in our results. This is, in many ways, the approach the book you are reading has taken; it might well have been titled *The Idea of Extinction*, since it explicitly and intentionally seeks to understand the ways in which scientific discussions have been imbricated with cultural, political, and personal values. The difference, of course, is that I see this entanglement as essential to understanding how science works, rather than as a corruption of something that ought to be 'pure'. (p. 249)

Overall, Sepkoski's book offers a fascinating look into the history of extinction and biodiversity, and the complex web of scientific and cultural factors that have shaped our understanding of the deep past and our fate as a species. It is worth noting that his emphasis on the inescapable value-ladenness of biodiversity may not sit well with all philosophers of science, especially those working on the normative aspects of biodiversity. Sepkoski's wide lens has managed to capture biodiversity as a relatively stable and consistent phenomenon (pp. 249–50), while discussion in the philosophy of conservation biology has been centred around its apparent conceptual uncertainty, leading some to argue for deflationist or eliminativist alternatives. By de-centring biodiversity from a conservation context, Sepkoski brings to the table a much-needed perspective: 'biodiversity' cannot be simply eliminated, as it is supported not only by scientific consensus (or lack thereof), but by a knotty weave of cultural fears and hopes that shape our attitudes and actions towards the natural and social world.

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