

## Georgina Mace (1953-2020)

### Conservation scientist who built an evidence base for the Red List of threatened species

Georgina Mace was an influential conservationist who was pivotal in helping to shape both the International Union for Conservation of Nature (IUCN) Red List of threatened species and the Millennium Ecosystem Assessment, two cornerstones of modern ecology and conservation. Among the sharpest minds of her generation, she championed analytical rigour and multi-disciplinary approaches to solving real-world problems.

The IUCN's Red List of threatened species is the most comprehensive inventory of the global conservation status of plant and animal species. Throughout her career Georgina, who has died aged 67, worked on documenting declining biodiversity and developing tools to implement science-based policies to address this loss. Prior to the changes she introduced, the Red List was based on nominations from experts rather than data, raising issues of accuracy and confidence. The new criteria she developed helped to standardise assessments. To this day, the Red List Index, based on the Red List of threatened species, remains the most known, trusted and used indicator for global biodiversity monitoring.

Georgina was born in London in 1953. She studied Zoology at the University of Liverpool before moving to the University of Sussex in the 1970s, where John Maynard Smith was pioneering quantitative approaches to evolutionary ecology. Her PhD research, a comparative study on small mammals supervised by Paul Harvey, tested these approaches in the field. Her first post-doctoral position was at the Smithsonian Institution in Washington DC, where she had the opportunity to research the impact of inbreeding on captive animals at the US National Zoological Park and other zoological collections.

She returned to the UK as a research fellow in comparative biology at the University of Newcastle upon Tyne before joining the Institute of Zoology in London, the research arm of the Zoological Society of London. She would remain there for 23 years, becoming the director from 2000 to 2006. At the Institute, Georgina continued her work on the genetic management of zoological collections and small populations, assessing the conservation status of a number of species (including the Western lowland gorilla) and exploring the use of reproductive technology in endangered species breeding programmes. She became increasingly interested in the concepts of population viability, extinction risk and priority-setting for conservation. In 1991 this led her, together with Russell Lande, to question existing IUCN categories of threats and associated criteria, which she perceived as

largely subjective, suggesting instead to redefine categories in terms of the probability of extinction within a specific time period and to use standardised criteria based on population biology theory (such as, eg, total effective population size, population trend over the past five years or observed/projected habitat loss). During the following years, Georgina refined her thinking around categories and criteria, introducing, among other things, the new non-threatened categories. This work ultimately defined the IUCN categories of threats and associated criteria as we now know them.

In 2006 she moved to become director of the NERC Centre for Population Biology at Imperial College London, where she expanded her research focus to include the definition of biodiversity targets, the relationship between biodiversity and ecosystem services, and assessing species' vulnerability to climate change. As founding director of the Centre for Biodiversity and Environment Research at University College London from 2012, she developed a new interest in natural capital accounting, that is, the process of calculating the total stocks and flows of natural resources and services in a given ecosystem or region. Her blending of economics and ecological theory to define a risk register for natural capital, for example, helped provide an effective means to focus future monitoring and data gathering, but also helped build common understanding of priorities across disciplines.

Her recent research and involvement with various national committees and organizations are likely to shape UK environmental management for years to come. For example, as a member of the Committee on Climate Change, which advises the government, Georgina steered its analysis on the natural environment for major progress reports on adapting to climate change in England and Scotland, and she was a pivotal member of the team preparing the third landmark assessment of UK climate risk, due to be published next year.

Georgina helped to bridge the gaps between experts focussing on different aspects of biodiversity, specifically genetics, population ecology and macroecology. She also demonstrated the importance of engaging with different disciplines (climate scientists, economists, social scientists) for theoretical and applied breakthroughs. Her career is one of a true unifier: she excelled in building consensus, a key step towards securing the incorporation of scientific evidence into policy. In addition to her work on the Red List, she was coordinating lead author for biodiversity on the widely-regarded Millennium Ecosystem Assessment, a UN initiative launched in 2001. She supported the technical development of measures for the Convention on Biological Diversity (CBD) 2010 biodiversity target, developed methodology for the UK National Ecosystem Assessment, and, most recently, acted as overall Review Editor for the International Panel for Biodiversity and Ecosystem Services (IPBES) Global Assessment.

She broke a few glass ceilings, too. Georgina was the first president of the international Society for Conservation Biology from outside North America, and the first female president of the British Ecological Society. Her many awards and honours included a Fellowship of the Royal Society and a DBE, the UK equivalent of a knighthood for women.

In many ways, Georgina was an ideal role model: firm but fair, collaborative, reliable, unassuming, approachable, the kind of critical friend we all need. She supported the career progression of countless ecologists and influenced many more. Yet few knew that she was battling cancer and had done so for nearly a decade. She was never the one to make a fuss about herself, and she continued working until her last few days. Her death leaves a very big void; she will be sorely missed.

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