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Obituary

David W. Goodall (1914-2018): An ecologist of the century

On May 10, 2018, we lost one of the most active aged scientists – a numerical ecologist extraordinaire. David was 104 years old.

David was born on April 4, 1914, in Edmonton, England. He completed his studies at the University of London, Imperial College of Science and Technology. His early interests in science were focused on agriculture and plant physiology, as shown by the title of his Ph.D. thesis defended in 1941: *'Studies in the assimilation of the tomato plant*'. This work was completed when he was research assistant and then a scientific officer at East Mailing Research Station, Kent, England. David could not join the army before and during the World War II because, as he remembered: "I did, in fact, have a medical examination for the Navy, but as soon my boss heard of this [work in science] he said no, no, no you can't take my researchers, they are much more important to the world of agriculture, than the war effort." (Gartry 2017). As another proof for his early fascination with the agricultural sciences, he worked as a plant physiologist for the West African Cacao Research Institute in Tafol, Ghana, between 1946–1947. This was the first extended leave in David's new, complex and exciting life, which was dominated by teaching, research and, last but not least, travel.

A significant and decisive turning point in his life was his move to Australia in 1948 to teach botany at the University of Melbourne. In 1952, he went back to Africa, to become a senior lecturer, then reader in botany at the University College of the Gold Coast in Achimota (today Ghana). In the meantime, he received another doctoral degree from the University of Melbourne in 1953. A year later, he returned to his homeland to assume a professorship in agricultural botany at the University of Reading, then went back to Australia to work in various positions at the CSIRO institutions. Among other notable positions, he was Senior Principal Research Scientist at the CSIRO Division of Mathematical Statistics in Perth, Western Australia, until 1967. He spent some period in the USA as well, first at the University of California in Irvine (1967–1968) and then at Utah State University in Logan (1968–1974). After completing these commitments, he returned to the Australian CSIRO for which he worked until his

retirement in 1979. Naturally, retirement did not mean much for David; he continued writing, reviewing, and editing as an Honorary Research Fellow at CSIRO, and later at the Edith Cowan University which he joined in 1998.

Although his career was launched initially in the field of agricultural applications of plant physiology, he became better known internationally as a pioneer of statistical ecology and the first promoter of multivariate analysis methods in vegetation science. The first papers in this field deal with sampling vegetation by point quadrats *(Australian Journal of Biological Sciences),* and with the spatial distribution of plants (*Biological Reviews),* both published in 1952. In 1953–1954, he published a series of articles in the *Australian Journal of Botany* on the objective methods for the classification of vegetation – almost a decade before the school of numerical taxonomy emerged in systematics. In the third part of this series, devoted to factor analysis, David coined the term 'ordination' that became generally accepted for procedures whose objective is the reduction of data dimensionality. According to Google Scholar, this paper that scored 465 citations by 10 May 2018, is his most often cited paper. In the happy and revolutionary decade of the sixties, the British journal *Nature* was also open to articles promoting the use of statistical methods in biology. From 1964 to 1966, David published in *Nature* three short accounts on the use of probability in designing similarity coefficients and hypothesis testing in classification. He found himself also present in the mainstream of numerical taxonomy by contributing a paper in 1966 on the classification of bacteria and another one on grasses. Two book chapters, one on similarity coefficients and the other on classification, published in the seminal book *Ordination and Classification of Vegetation* edited by Robert H. Whittaker (1973), are seen key contributions to the development of numerical ecology.

In 1972, David was invited by Elsevier, Amsterdam, to serve as the Editor-in-Chief of the then planned book series *Ecosystems of the World*. The first volume appeared in 1977, and the series culminated by volume 30 in 2005 – all volumes supervised, and two volumes co-authored by him. This vast enterprise, unprecedented in the history of ecology, involved 46 subject editors from 14 countries, and almost 500 authors, was all coordinated by him. In the year of completion, David was 89 years old (!), but he did not stop writing and editing even after, not to mention the management of his correspondence with friends all over the world.

Travelling was a natural and indispensable component of David's life, not only as a necessity due to employment changes and later in the capacity of the book series editor, but also for conferences, short courses, or just for fun. He was present at many annual symposia of the International Association for Vegetation Science in the past decades, which required intercontinental travel in most of the cases, for example, to Brazil, South Africa, Mexico and Europe. There was only one case when he need not have to fly when the IAVS symposium moved to Perth in 2014. A large audience at the plenary session of this meeting greeted him on the occasion of his 100th birthday. David remained an adventurer until late days of his life. He did not hesitate to take solo trips on a long-haul train from Cape Town to Johannesburg in 2008 (his portrait was taken this year, during a field trip in South Africa), the iconic Darwin – Adelaide train in 2015, and travelled by boat with a group of naturalists to the Abrolhos Islands 60 km off the West Australian coast in 2017. Fantastic achievements considering his high age!

David had close personal relations with many Hungarian ecologists, especially the late Pál Juhász-Nagy and László Orlóci. We also had the fortune to meet him many times – and we cannot thank him enough for many things: encouragement, advice, direct cooperation and innumerable ways of assistance. The fact that one of us (JP) became engaged in multivariate analysis was much under the influence of David's series of papers in *Australian Journal of Botany*, and primarily by the one on coefficients of similarity. When JP has published his new coefficient in 1978 (actually a weighted variant of Manhattan metric), he sent a reprint of the paper to David. A letter, of most polite, arrived by return mail stating that the paper was 'interesting at first glance' (typical David…). David spent several periods in Trieste from 1984 to 1991, working at the Department of Biology of the University in a group of quantitative ecologists, focusing on the integration of his probabilistic indices with those on information theory and probability, developed by the Trieste researchers. His stay in Trieste was decisive for consolidating the idea of the International Center for Theoretical and Applied Ecology (CETA founded in Gorizia in 1987 that was active until a few years ago). Here David met Professor Abdus Salam, a Nobel Prize winner and the Director of the International Center for Theoretical Physics of Miramare (ICTP), who gave his support to the foundation of CETA. At that time, David already enjoyed the status of a legend among quantitative ecologists. Indeed, he was the one who introduced multivariate analysis in ecology and wrote computer programs (as early as 1956, when one of us – LM – was born!) serving reduction of the dimensionality of ecological space through application of the matrix algebra. His coefficient was also the first similarity index based on probability published by *Nature* in the 60s.

Apart from research pursued in Trieste, David held seminars and lessons in courses that the Department of Biology, organized or co-organized also in other Italian locations (Palermo, Rome) and elsewhere (Switzerland, Spain, China). During the periods spent in Trieste, David acted as if he were the most diligent of the young researchers of the Department. David was always on time at half past eight in the morning at the University Computing Center and, after a short lunch break at twelve, he would resume work until seven in the evening, interrupting him for another short break for his regular tea at five o'clock in the afternoon. David was known as a stoic, yet a cordial man who never showed nervousness or anxiety, and he was carrying out his work with method and tranquillity. He wrote everything by hand (then PCs were still a rarity) and prepared by himself the punched cards of his programs to be fed into the computer. David collaborated actively to launch the journal *Coenoses,* published in Trieste first by PROXIMA and then by LINT, dedicated to the ap-

David receiving the award of Honoris Causa Doctorate in Natural Sciences at the University of Trieste, in 1990.

At the celebration of David's 100th birthday at Edith Covan University, Perth, in 2014. On David's left: Prof. Andrea Hinwood, then Head of School where David served as a Honorary Fellow; Prof. John Finlay-Jones then deputy Vice-Chancellor of ECU, on David's right.

plications of mathematics and statistics to the study of ecological communities. In *Coenoses* founded in 1986, several legendary numerical ecologists including Ramon Margalef, Stuart Pimm, Ganapati P. Patil and László Orlóci, published their work. In 1990 the University of Trieste awarded David the Honoris Causa Doctorate in Natural Sciences for his innovative studies in quantitative ecology. On that occasion, he held his *lectio magistralis* in Italian. In 1994 the International Society of Ecology honoured David by bestowing upon him the Distinguished Statistical Ecologist Award.

In recent years, David became involved in the philosophy of science and cultural evolution of man, publishing in 2008 an exciting and stimulating article in the *Rendiconti Lincei*, a journal published by the oldest academia in the world. There are not many people who would publish at the age of 100. David published two papers.

David had direct contributions to shaping our journal. He published four papers in *Abstracta Botanica*, and three in *Coenoses* (both journals are the predecessors of *Community Ecology*), which assumed the new name by the fusion of the other two in 2000. The very first paper in *Coenoses*, which existed between 1986 and 1996, was written by him on his favourite subject – ordination and classification; he also served as an active member of the board for *Coenoses*. In 2002, our journal was honoured by receiving a manuscript on his other favourite topic, probabilistic classification, which we were happy to publish.

David was a very popular figure of Australian science. Not only he has been considered the 'oldest active Australian scientist' for a long (indeed long!) time, but he was admired and considered a raw model for many of us. David was on the national news several times and not only at the occasion of his centenary. National television ran a report on him when he landed a small, yet well-deserved role in one of the significant Perth theatres. Not many knew, but David was an accomplished actor and a great fan of Shakespeare. Australian ecology recognised his contribution to science by awarding David with a Gold Medal of the Australian Ecological Society. Last, but not least, David joined the rank of knighted citizens when, in 2016, Her Majesty Queen Elizabeth II made David the Member of the Order of Australia.

David used to travel from Yanchep (north of Perth) where he lived for many years, to ECU in the northern Perth suburb of Joondalup using his car until the local traffic authorities had to take away his driving licence (his unusually high age became a 'safety liability' for some). Being deprived of driving license, he had to take public transport until once he collided with a car. David recovered, but we are not so sure about the car though. In 2014, we dedicated the Annual Symposium of the International Association for Vegetation Science, of which David has been one of its Honorary Members. His presence at the Symposium was delightful and inspiring, as ever.

Public media all over the world have treated in much detail the very last days of David's life. The recent news that he would voluntarily discontinue his life journey brought a lot of sadness to those who knew him, yet many of us found solace in respecting his wish to leave in his way – gracefully as he was known to live his life. David reached the rare age of 100 in 2014, yet last two years he was gradually losing control over his body and could not follow his routine of an active scientist any more. David could not be helped in his adopted homeland – Australia – since euthanasia is still not an option in Western Australia, hence he decided to end his long and exceptional life in a Switzerland clinic. The world of science was taking the last steps of his journey with him. He left this world in dignity – and on his terms.

Ladislav Mucina, The University of Western Australia, Perth, Australia & Stellenbosch University, South Africa
János Podani, Eötvös University, Budapest, Hungary
Enrico Feoli, University of Trieste, Trieste, Italy

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