



Biology Today

Remembering Elton

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I don't remember ever having heard of Charles Elton before reading a review of Peter Crowcroft's (1991) book, *Elton's Ecologists*. Crowcroft even notes that, "Nowadays, as a teacher, I find that most students have not heard of Elton." My own deficiency stems from the fact that I was trained in biochemistry, with just a smattering of other areas of biology. It is only lately that I've begun to read more widely in ecology. Crowcroft's book caught my eye, not because of this, but because my father-in-law's first name was Elton and so the name has very pleasant associations for me. My father-in-law was a wonderful man. This doesn't sound like much of a commendation, but I really can't put into words his richness as a person. It was thoughts of him that led me to buy *Elton's Ecologists* (in paperback, of course; sentiment only goes so far). Now, after reading this book as well as some of Charles Elton's own writings, I have two Eltons to admire.

Starting in the Arctic Circle

My Elton would have been interested to learn that, as Crowcroft notes: "Elton is not an uncommon name. There was a crusader named De Acton, and in later generations the name

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became De Elton and then plain Elton. There are four villages in England called Elton, and [an] Elton, Wisconsin." Charles Elton, who died in 1991, was English, though not from one of these villages. Born 1900, he attended Oxford University and in 1921 was Julian Huxley's assistant on an expedition to Spitsbergen in the Arctic Circle where he did an ecological survey of the fauna there. In 1922 he returned to Spitsbergen, and by 1924, he was in charge of the scientific work for Oxford University Arctic Expedition during which he continued his survey. He was particularly interested in the population fluctuations of Arctic mammals. He remained at Oxford to get an advanced degree and ended up spending his entire professional life there. It wasn't practical to continue studies of Arctic mammals, so he switched to looking at populations of small mammals in the Oxford vicinity. He recruited a team of young researchers to study rodents in Bagley Wood, which was located just a few miles from Oxford. They began by setting traps for 600 nights and counting the number of each species trapped each night.

This early research has many of the hallmarks of Elton's work throughout his career: recruiting dedicated workers, counting animals by setting traps for them, using a nearby study area and working on small mammals with special emphasis on the diseases they carry. This emphasis was the result of Elton's suspicion that cycles in rodent population size were due to outbreaks of disease among overcrowded animals. He obtained grant funds to continue and expand this study, and though the populations of wood mice and bank voles built up to a peak of abundance and then crashed, Elton's group couldn't find a cause for the declines. The exhaustive post mortem examinations on more than 2000 specimens did, however, tell them a great

deal about what was going on in populations of small rodents. This work does not seem as impressive today now that so much work has been done on small mammal populations, but at the time it broke new ground.

Writing "Animal Ecology"

Another of Elton's projects of the 1920s is still quite impressive. It is his book, *Animal Ecology*, published in 1927. It was produced at the behest of Julian Huxley, and its 200 pages were finished in 85 days! The great Yale ecologist Evelyn Hutchinson called it one of the greatest books on biology in the 20th century and one which served as a foundation for modern ecology (Berry 1991). Today, it is still a great introduction to animal ecology because it sets down basic principles so clearly. A comparable book written today might emphasize different points and give more detail on topics such as animal parasites in light of all that has been learned by ecologists in the last 60 years, but the basic outline would be surprisingly similar.

Elton begins by describing the factors that determine the makeup of an animal community, but his approach isn't to merely discuss these factors. He also goes into how such information can be obtained:

It is a comparatively simple matter to make a preliminary biological survey and accumulate lists of the animals in different communities. This preliminary work requires, of course, great energy and perseverance, and a skilled acquaintance with the ways of animals; but it is when one penetrates into the more intimate problems of animal life, and attempts to construct food-cycles . . . that the immensity of the task begins to appear and the difficulty of obtaining the right class of data is discovered.

This is a rather prophetic statement; it seems that right at the beginning of his career Elton was conscious of the

problems that would always face him in data collection.

Obtaining “the right class of data” is a problem for all researchers, since they are delving into the unknown. One of the difficulties is in determining just what is the right class of data to collect. In teaching ecology, the example of this problem that I use is one which Darwin described. Bees pollinate clover flowers, so the bee population determines seed production in this plant. Mice eat bees and cats eat mice, so the number of cat lovers in an area can affect the clover population. But if you were trying to determine the factors affecting clover plants, you would probably not, in a million years, consider statistics on the number of cat owners as “the right class of data” you would need to obtain. Problems like this make doing science a game, a sometimes very frustrating, but nevertheless exciting, game. The excitement comes when the right class of data is finally found, often after many frustrating wrong turns.

Acquaintance with Animals

In this quotation Elton also mentions the need for “skilled acquaintance with the ways of animals.” He goes on to write that the ecologist would do well to consult with those who spend their lives in close association with wild animals: fishermen, gamekeepers, foresters. He claims that he learned “a far greater number of interesting and invaluable ecological facts about the social organization of animals” from such people than from trained zoologists. From this statement and from many of Crowcroft’s observations, it is obvious that Elton was not one to stand on ceremony or to be impressed with rank or title. He was interested in finding out about animal populations and would seek out useful information wherever it might be found.

In *Animal Ecology*, Elton quotes an anonymous writer who argued that, “The notion that truth can be sought in books is still widely prevalent and the present dearth of illiterate men constitutes a serious menace to the advancement of knowledge.” In an age of mega-textbooks that appear to contain all the “truth” of biology, this statement and Elton’s attitude need to be remembered. Many of our students feel awed and overwhelmed by such texts, though some students have a great deal of practical knowledge about living things. I had a student

who was an expert breeder of seahorses, and another who spent his childhood observing nature in the tropics. I learned a great deal from them; class wasn’t so much my teaching biology as fellow biologists trading information. Many of our students have such areas of expertise, though they are often reticent to mention them. We must be like Elton and seek out their knowledge; we must be humble enough to admit that we can learn from other than the experts.

The Bureau Begins

Crowcroft, who was a student of Elton’s, portrays his teacher as a humble man, one of those quiet, unassuming people who manages to get a great deal done. It was his persistence in seeking grant money to continue his animal survey in Bagley Wood that led to the establishment of the Bureau of Animal Population in 1932. A year earlier Elton had attended the Canadian Matamek Conference on Biological Cycles. Crowcroft notes that, “Elton recalls Matamek as being the only conference he ever attended at which the chairman of a session walked in and threw two salmon on the table, announcing with pride that he had just caught them.” This was obviously a meeting where ecologists could feel comfortable. Elton’s presentation there was so impressive that Reid Blair of the New York Zoological Society recommended he be given a grant to operate a small animal ecology unit for two years. This unit came to have its rather unusual name—Bureau of Animal Population—because of Elton’s admiration for the work of the Bureau of Biological Survey in Washington, DC which “produced fine field-studies by tough, scholarly men.”

Elton’s Bureau began operation in January 1932, with the primary aim of “getting further knowledge of fluctuations in numbers of wild animals, with special reference to disease and other factors causing them.” This goal was difficult to achieve not only because of the Bureau’s very limited resources, but also because the ecological methods required were in such a crude state of development. Much of the Bureau workers’ time was spent in finding good census methods for such mammals as voles, woodmice and moles, as well as for game birds such as the partridge. Reading Crowcroft’s account of the early days of the Bureau is a good reminder of how far the science of ecology has come in the last 50 years.

Elton made a significant contribution to this progress, though he did not work alone. Over the years a steady stream of students and visiting researchers came through the Bureau. From his early days in science, Elton enjoyed an international reputation. Because of his experience in the Arctic, he served for five years in the 1920s as a consultant to the Hudson Bay Company in North America on fluctuations in populations of furbearing animals. He also had contacts in the United States. So it is not surprising that his staff was very cosmopolitan. Crowcroft himself is Australian, and a number of Canadians, Americans and other foreigners worked in the Bureau. This was definitely one of its strengths. With periodic infusions of new blood, with new ideas from around the world, the Bureau never stagnated. New projects were always being started and old ones updated.

Wytham Woods

One of the major projects over the years was an ecological survey of Wytham Woods, an estate near Oxford which was owned by the University. In discussing the Woods, Crowcroft describes the trouble he had trying to write about them in his doctoral dissertation:

When I tried to describe Wytham in my own words for this chapter, I failed badly. In trying to describe what it felt like to hear a cuckoo, to see the lacy foliage of beeches in spring, all of my attempts seemed mawkish as well as irrelevant. But the history of the Bureau of Animal Population became so intertwined with the advancement of knowledge of Wytham Estate, that it is necessary to impart a feeling for the spirit of the place. Elton has said that it is necessary to do fieldwork in order to have time to *think*; it has always given me time to *feel*.

The survey that Elton and his students conducted at Wytham Woods was not merely a biological survey but an ecological one. Crowcroft compares the difference between the two to that between elementary algebra and differential calculus. An ecological survey seeks to discover the dynamic processes within an animal community:

Mapping the species assemblages and their biotic network, the natural history and statistical stage, although difficult and still at an elementary level, is only a jumping off stage for the study of the community in action, considered as a system of events and processes operating in mixed populations.

The Bureau's Accomplishments

The accomplishments of the Bureau of Animal Population and its discoveries about animal communities "in action" are impressive. During World War II, Elton's knowledge of rodent populations was put to good use in the "war against waste," aimed at eliminating rodent destruction of food supplies. After the war, the Wytham Woods project got underway, while a number of members of the Bureau continued with other projects. The fact that there were projects on mites, woodlice, partridges, moles, voles and a number of other organisms shows the wide range of the Bureau's work.

Unfortunately, the Oxford University administration was not as impressed by this work as the world community of ecologists was. When Elton retired in 1967, the Bureau was disbanded, though some of its work was continued in the Oxford department of zoology. Elton's unassuming manner may have contributed to this outcome. He tended to keep a low profile, and it seemed that few within the university community were aware of the significance of the Bureau's work. His contributions were much more appreciated by ecologists throughout the world, who tried, unsuccessfully, to exert pressure to reverse this decision.

It is amazing that while managing all the Bureau's research, Elton also found time to write two books, *The Ecology of Invasions by Plants and Animals* (1958) and *The Pattern of Animal Communities* (1966). The latter is primarily a review of the Bureau's work on animal populations in Wytham Woods, while *The Ecology of Invasions* is a study of the ecological impact of foreign species. This book remains very relevant today and is quoted in much of the current literature on introduction of foreign species. It really is a great little book. Elton's writing is so clear and to the point that his books tend to be on the short side; he can say a great deal with very little clutter.

"Invasions"

Elton begins *Invasions* with a discussion of ecological explosions: enormous increases in the numbers of a particular organism. He argues that such explosions are most likely to involve foreign species which lack the parasites, pests and predators that normally keep populations under control. Elton sees such population explo-

sions as indications of the "terrific dislocations in nature being caused by the mingling of thousands of kinds of organisms from different parts of the world."

He describes Wallace's realms, the great faunal assemblages in different parts of the world that largely correspond to the continents. Each of these realms has a rather distinctive fauna, but these distinctions are being blurred by the large numbers of immigrant species invading all the realms. Elton contends that, in the future, the biological world will become not more complex, but simpler and poorer, as aggressive immigrant species wipe out native species.

Of course, biological invasions are hardly new phenomena. The discovery of the New World brought about a wholesale movement of plants between continents; the potato was brought to Europe and wheat to America, and movement of crop plants can be traced back to prehistoric times. But the pace of international travel today had sped the pace of invasions. A rather dangerous disease-carrying mosquito, *Aedes albopictus*, which probably arrived in this country in water-filled used tires, is now competing successfully in Texas with the less dangerous native mosquito, *A. triseriatus* (Livdahl & Willey 1991). Last year, a gypsy moth from the Orient traveled here on board grain ships from ports in the Asian part of Russia. It appears to be even more destructive than its European relative which was released in the U.S. at the end of the 19th century (Gibbons 1992). And though the tunnel under the English Channel is far from completed, there is already evidence that a spider native to France has taken up residence in England (Snazell 1991).

Preserving Biodiversity

Though he predicted such events, Elton would still view them with alarm. At the end of the book he gives his reasons for arguing for efforts to prevent such invasions if at all possible and to blunt their effects if they do occur. He was particularly anxious to prevent the extinction of native species. While biodiversity has become a familiar buzzword today, in the 1950s Elton was already stressing the importance of conserving diversity. He wrote that he "could make a good case for conserving the variety of nature on three grounds—because it is a right relation between man and living things, because it gives opportunities

for richer experience, and because it tends to promote ecological stability." Since that time, there has been debate over the relationship between diversity and stability; in at least some ecosystems, diversity can lead to instability, to chaotic patterns of change (Colinvaux 1978). But most ecologists would still agree with Elton that diversity, in many cases, "tends" to increase stability, especially in the species-poor ecosystems resulting from human intervention.

Yet diversity to preserve ecological stability is the last of the grounds Elton uses in his case for conserving variety. The first two are much more philosophical and relate to human needs, to spiritual, ethical and emotional needs. The first is obviously ethical or moral: preserving species diversity is the "right relation" between humans and other living things. This is a profound issue, and one which most of us do not give enough thought to. Bryan Norton's (1987) *Why Preserve Natural Variety?* is a very good exploration of this question, in all its ramifications. But for a reading on this subject that I can use in class, I turn to David Quammen's (1988) *The Flight of the Iguana* in which there is an essay called "The Face of a Spider." Quammen explores, in his tongue-in-cheek way, the question of how we are to determine our "right relation" with the living world using the black widow spider as a test case.

Elton's second reason for preserving diversity—that it provides us with opportunities for richer experience—is one also explored by another important figure in 20th century ecology, Aldo Leopold (1949) in *A Sand County Almanac*. Leopold argues that we seek contacts with nature because we derive pleasure from them. He sees this environmental aesthetic as a hierarchy with five levels. At the first and lowest level is the idea of trophy; people seek contact with nature to bring back some piece of it: a fish, a deer, a flower, a shell, a rock. The second level is a desire for solitude in nature, for a feeling of isolation, which relates to the third, the need for a change of scene. All three of these approaches to the natural world can damage that world. This is less true of the fourth component—nature study—which leads to a real perception of nature and can lead ultimately to the highest level of the environmental aesthetic, a sense of husbandry, which relates back to Elton's idea of a right relation between humans and the natural world.

A Personal View of Nature

In this discussion of Leopold's conservation aesthetic, I seem to have strayed far from Charles Elton and the Bureau of Animal Population. But the distance between these two men is not that great; their professional lives overlap in time and both had a passionate interest in the natural world. They both felt driven to write about this interest. Leopold's approach was much more philosophical and personal. From Crowcroft's descriptions, it appears that Elton was a rather introverted person, not given to showing emotion. So it is not surprising that his writings stick to the subject of ecology. But they are still very personal. Crowcroft notes that Elton possessed "an air of quiet wonder at nature," and this comes through in his writing. His books are full of information about animal populations, but they contain Elton's thoughts on how ecology should be done and on why it is such an important science.

From Crowcroft's book I get a picture of Charles Elton as a quiet, unassuming man driven by a passion to find out about nature's web of interrelationships. He had "an air of quiet wonder at nature that was sustained by random observation of anything that moved or grew at Wytham." Elton's research style, and that of the whole Bureau, was very British. Everyone gathered for afternoon tea dur-

ing which they discussed their work and Elton gave subtle direction. Crowcroft notes that, "There was no air of frantic research and precious little sense of overall direction." Each member of the Bureau conducted their own research as they saw fit; it was the genius of Elton's managerial style that, having chosen good people, he could let them work as they wished, knowing they would seek his guidance when necessary. He led without seeming to: "The all-pervading influence of the Boss was his most striking characteristic, in spite of his diffident manner and reluctance ever to give the appearance of being in charge."

My Elton, Elton Hendrick, was also a very unassuming man who had a diffident manner. He may not have made significant contributions to human knowledge like Charles Elton did, but his influence is nonetheless great. Many people were touched by his patience, competence, generosity and, most of all, by his joy of youth. He expressed that joy in his sense of humor, examples of which are much too corny to mention here. (He made Henny Youngman look original.)

At several points in his book, Crowcroft mentions Charles Elton's sense of humor. Though this humor was of a much higher level than my Elton's, it reveals another link between them. And they will always be linked in my mind. Elton Hendrick is

obviously more important to me personally, but Charles Elton is definitely a member of my biological hall of fame. My joy of life is increased by my memories of each of them.

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