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Ecological Evaluation for Conservation

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General Preface to the Series

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Preface

During the last ten years there has been a rapidly growing interest in the development of methods for determining conservation priorities. This interest has emerged from the ever increasing pressures on our natural environment, the growing number of extinct and endangered species, and the widespread loss of biotic communities. Although biological conservation is not a new subject, the ecological basis of conservation has been slow in emerging from the ideals and the philosophy of nature conservation. Only more recently have we seen some exciting developments in the application of ecology to the problems of evaluating species, natural areas and formulation of environmental impact assessment. The need for environmental education has never been greater yet at the same time the role of ecology in conservation and in planning so often receives scant attention.

This book has been written with frustration and with excitement. Frustration because it was inevitable that I could not discuss as many aspects and topics as I had wished. Excitement because much of what is called ecological evaluation is new, often controversial but nevertheless it is already contributing much to a better and more rational approach to conservation. The role of ecology in helping to decide conservation priorities for animals and plants and for natural areas is a major theme. The main objective is to describe as simply as possible the methods currently used in evaluation, to outline the ecological basis and to stimulate discussions on the application of the evaluation methods and so contribute towards environmental education.

I would like to acknowledge the inspiration provided by both students and colleagues and in particular I thank Barrie Goldsmith and Colin Tubbs for their constructive comments.

Southampton, 1981 I.F.S.

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1 Biological Conservation and Evaluation

1.1 Some historical developments in biological conservation

An early and significant development in the emergence of biological conservation was the protection of large areas of land. For example in 1872 the Yellowstone National Park was established in North America, partly as a response to the considerable concern for protection of the environment from many kinds of pressures including the collecting of biological and geological specimens. Some of the world's first national parks were established in Australia, the first being the Royal National Park in 1886. Nearby in New Zealand the first National Park was established in 1894 and today it has ten National Parks which account for about eight per cent of the country's area.

The development of National Parks in Britain as a method of conservation had a slow beginning but in contrast to this the moves towards the protection and conservation of certain animal and plant groups were rapid. In 1889 a women-only group was formed with the aim of not wearing feathers of any bird not killed for the purpose of food (ostriches excepted) and it was from this that the now very large Royal Society for the Protection of Birds was formed. The National Trust for Places of Historic Interest and Natural Beauty was established in 1895 and this marked the commencement of protection of certain areas important for the biological and geological attributes. The Society for the Preservation of Wild Fauna of the Empire was established in 1903 and today it is the well known and successful Fauna Preservation Society. Rothschild in 1912 played a key role in the formation of the Society for the Promotion of Nature Conservation, and this group not only administers its own reserves but also coordinates the work of county naturalist trusts.

Today in Britain, as in many other countries, there is a bewildering array of societies, trusts, and other groups which all have a part to play in biological conservation. But perhaps the most notable development came in the field of legislation. For example one landmark was the National Parks and Access to the Countryside Act, 1949 which gave rise to a number of very important developments. The Nature Conservancy was created and their brief was to provide scientific advice on conservation and also to establish and manage reserves (which adequately represented major types of natural and semi-natural vegetation) with the organization and development of scientific services in this field. This Act led to the formation of the National Parks Commission which was to designate National Parks where there would be strict control of development.

This Act can be seen to be very appropriate on a very large scale but there was still a problem because there were many smaller areas of scientific interest that could not be established as **national nature reserves**. It was section 23 of this Act that was to go a step further and it gave the Conservancy a duty to notify planning authorities of any area which 'not being land for the time being managed as a nature reserve, is of special interest by reason of its flora, fauna, or geological or physiographical features'. These are what are called the Special Sites of Scientific Interest and they have been very important in the development of conservation in Britain.

There have been important changes since the time when the Nature Conservancy and the National Parks Commission was created in 1949. The Nature Conservancy is now the Nature Conservancy Council (with the Nature Conservancy Act, 1973 it became an independent statutory authority responsible to the Secretary of State for the Environment) and was divided off to leave the Institute of Terrestrial Ecology. The National Parks Commission has become the Countryside Commission. Further to this there have been a number of Acts which are aimed at the protection of named animals and plants (§ 2.4).

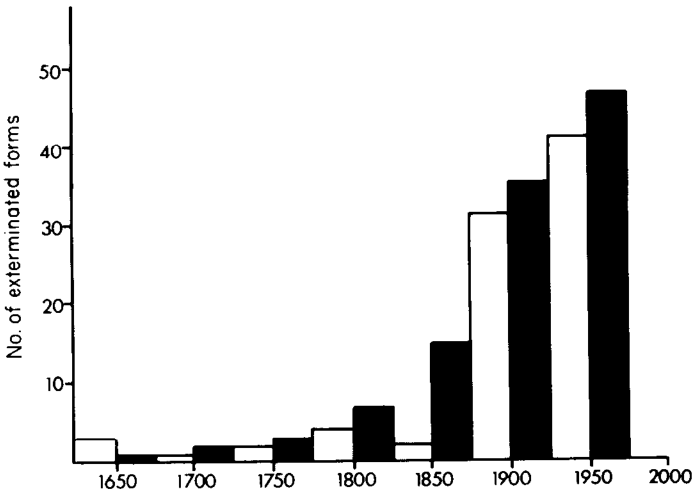

Fig. 1-1 The number of exterminated mammal forms (white bars) and bird forms (black bars) over the last three hundred years. Each bar represents a 50 year period. (From Ziswiler, J. (1967). *Extinct and Vanishing Animals.* Springer-Verlag, New York.)

To end this brief history we should note the beginning of developments on an international scale. It was UNESCO which was largely responsible for the formation of the International Union for the Conservation of Nature and Natural Resources (§ 2.1) which has made many achievements in the field of biological conservation. Equally successful has been the World Wildlife Fund which has played a very important role on the international scene. The Council of Europe's Information Centre for Nature Conservation was formed in 1967 and this was a very important international step which in 1970 led to the European Year for Nature Conservation. The Council of Europe has produced a series of short publications under the general title *Nature and Environment Series*. Topics include Aspects of forest management (No. 1), Soil conservation (No. 5), Evolution and conservation of hedgerow landscapes in Europe (No. 8), Threatened mammals in Europe (No. 10), and Heathlands of western Europe (No. 12).

In London on 5 March 1980 the World Conservation Strategy was launched and this sets out the objectives of resource conservation, the obstacles to achieving it, and the need for urgent action.

1.2 Aims of biological conservation

The case for biological conservation and the functions of wildlife (Table 8, p. 41) have been well documented. The rate at which species have become exterminated during the last 300 years has increased dramatically (Fig. 1–1). It is now believed that at least 25 000 plant species are threatened with extinction.

The rate at which biological communities have been destroyed in the last 200 years is equally dramatic. Over-grazing, de-afforestation and bad agricultural practices have all contributed towards diminished soil quality throughout vast areas of many countries. More than a third of the world's land surface is already desert or semi-desert.

The loss of biological communities arouses concern and the rate of loss is particularly alarming. One of the most remarkable landscapes of western Europe are the heathlands, and loss of lowland heathlands (Fig. 1–2 and 1–3) of southern England (and western Europe) is at a rate similar to that at which many

Fig. 1–2 Heathland in lowland Britain. Photograph by the author.

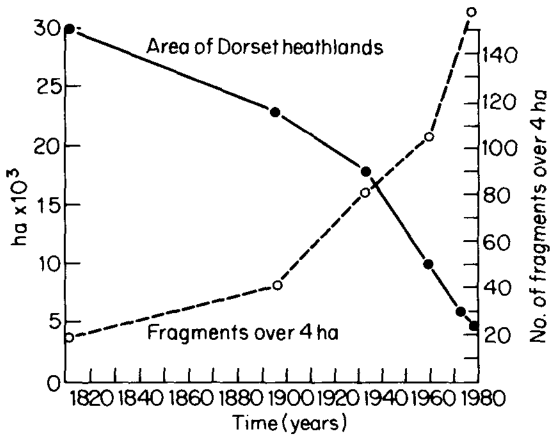

Fig. 1-3 The decline and fragmentation of Dorset (southern England) heathlands. (Data from Moore, N. W. (1962). *J. Ecol.*, **50**, 369–91, and Webb, N. R. and Haskins, L. E. (1980). *Biol. Conserv.*, **17**, 281–96.)

terrestrial and aquatic communities are being destroyed. The major factors contributing to the decline of heathlands include reclamation for agricultural purposes, re-afforestation and urbanization.

I suggest that the aims of biological conservation should therefore be (1) to safeguard a high level of richness of animal and plant species and (2) to manage wildlife resources wisely for the benefit and rational use by man. In some circumstances the preservation of a species of an area of land might be justified as part of the rational use of that natural resource.

1.3 Evaluation and ecological evaluation

Like 'landscape evaluation', 'ecological evaluation' now has common usage but its meaning is not often made clear. Although an evaluation may include value judgements, Fowler's *Modern English Usage* states that evaluate is a term of mathematics meaning to find a numerical expression for: hence, more generally, to express in terms of the known. It would seem reasonable to accept that an evaluation of a species, or a community, or a natural area could be based on ecology. The aims of an evaluation might be to determine the conservation requirements of a species, or it could be to assess the impact resulting from a change in land use.

Research in the Netherlands over the last ten years has resulted in identification of two types of ecological evaluation (PLOEG and VLIJM, 1978):

(1) Ecological evaluation as an assessment of ecosystem qualities *per se*, based on the thought that some ecosystem attributes are more important or interesting than others, regardless of their social interests.

(2) Ecological evaluation as a socio-economic procedure to estimate the functions of the natural environment for human society.

In simple terms, I like to think of ecological evaluation as a process involving the ecological assessment of an organism or environment. The application of ecological evaluation as introduced here can be explained by examining the topic at different levels as one might also examine ecology, for example at the species level, habitat level and community level.

Towards the end of the last century there were concerted efforts to preserve and protect certain groups of wildlife and also natural areas of land. We can be sure that the people who brought about these forms of early conservation were making an evaluation about their natural environment and as a result of this evaluation of the wildlife they could justify some form of protection of that wildlife. That is, a monetary value was not being suggested, they were not putting a price on the natural areas of land or on the groups of animals, they were assessing the status of the wildlife, finding out how many animals and plants of a certain kind there were, what the pressures on the wildlife were and then from this kind of information were proposing a form of conservation.

In a similar way we can today identify many animals and plants that are rare and endangered. The square-lipped or white rhinoceros (*Ceratotherium simum*), to name but one example of a mammal that is rare, has been the subject of much research and now rather than just saying it is rare we can, from studies of changes in its distribution and population, assess the status of this species and from an evaluation draw up proposals and plans in order to improve its status. One attempt to do this has come from the International Union for the Conservation of Nature (IUCN) in the form of the *Red Data Books* (§ 2.1). More recently there have been attempts to devise a combination of scientific and other methods of evaluation which help to elucidate the conservation needs or the degree of threat experienced by certain animal and plant species. The application of ecology in conservation and in the evaluation of a species' status is then sometimes supplemented with various other evaluation methods.

But conservation of a species might not always be the reason for evaluation. The opposite reason is also very important. Evaluation of a pest species' status (e.g. bracken, *Pteridium aquilinum*, in parts of Britain) needs to be undertaken before some form of control measures can be planned. Although not discussed here, the ecological evaluation of the status of pest species is a large and very important topic.

As important as the ecological evaluation of a species is the development of techniques and methods for the more complex habitat evaluation and priority ranking of natural areas. A hypothetical example illustrates in an elementary way reasons for the need to develop this relatively new aspect of biological conservation. A mining company has obtained permission to extract minerals underlying woodland and lowland heathland. The permission is such that the company may operate in two of the five available sites but not in all of the five sites. The decision as to which sites are to be mined now rests on the relative biological value of the different sites of woodland or heathland and ecologists have been asked to assess which of the two sites should be used. In this instance ecological evaluation would have important applications. This hypothetical example is but one area where ecological evaluation has and will be used more often in the future. In some parts of Britain, particularly in north-west England, there is a need for ecological evaluation particularly in connection with restoration of land and manipulation of derelict land containing industrial waste. In this context ecological evaluation has an important role in environmental impact assessment (Chapter 5). One important benefit of ecological evaluation could be improved communication. That is, the decision to conserve, manage or exploit wildlife resources is very often made not by the scientists but by the planner and the administrator. Economic, financial and other considerations have to be made before some course of action is recommended and ratified, and in order to form decisions the administrators and planners require results of research in a highly concise and quantitative form. Good ecological evaluation methods could be a basis for communication of ecological information.

2 Evaluation of Animal and Plant Species

Probably the most important and also the most common objective for the evaluation of a species is to propose some form of biological conservation. It could be conservation by active management, conservation of the species by providing protection in a nature reserve, conservation with protection by law, or it could be a combination of these and other aspects.

2.1 The Red Data Books

In 1934 an organization (L'Office International pour la Protection de la Nature) was founded which was later to evolve into the International Union for the Protection of Nature, and then in 1956 it became the International Union for the Conservation of Nature and Natural Resources. The IUCN, as it is now popularly known, has its headquarters in Morges, Switzerland and it works through a number of commissions, one of which is the Survival Service Commission. This Commission is concerned primarily with action to prevent the extinction of plant and animal species and also to preserve viable populations in their natural habitats. Since 1966 the Survival Service Commission has been collecting information on animal and plant species in order to help achieve these aims. The information is presented in synoptic form in volumes of the *Red Data Books* (Fig. 2–1). It was Sir Peter Scott who in the mid-1960s initiated these *Red Data Books*: each contains a long list of threatened species.

The task of gathering information for the production of these books is enormous and an evaluation or judgement first has to be made as to whether or not a species is to be entered in one of the volumes which include (1) Mammals, (2) Birds, (3) Amphibians and Reptiles, (4) Fish, (5) Angiosperms – flowering plants.

Until now, *Red Data Book* compilers were scattered around the world. This has now changed and the Species Conservation Monitoring Unit (SCMU) set up by IUCN's Survival Service Commission is now based at Cambridge, England. Members of the Survival Service Commission have in the past readily admitted that whether or not to include an animal and plant species has to be a matter of professional judgement. An example of part of a synoptic report is shown in Fig. 2–1. First the IUCN requires the common or popular name as well as the scientific name such as Galapagos giant tortoise (*Geochelone elephantopus*). The next relevant piece of information is the former and present distribution of the species, in this case the Galapagos archipelago. There are several races of this tortoise and 11 of the 15 original races were known to be present on the islands in 1974. In an evaluation of the status of a population it is necessary to have some knowledge of the numbers and also the method used to calculate the numbers.

SOUTH ALBEMARLE TORTOISE

Testudo elephantopus elephantopus Harlan, 1827 (= T.e. vicina (Günther 1875))

Order TESTUDINES Family TESTUDINIDAE

STATUS Endangered. Could well become extinct(7).

DISTRIBUTION Cerro Azul, eastern Isabela (Albemarle), Galapagos, and probably distributed through the whole southern end of Isabela. At Iguana Cove only one subspecies appears to be present, but near Vilamil one finds both T.e. elephantopus and T.e. guentheri (1). However, it may eventually be shown that these two taxa should be combined, since Van Denburgh has found much overlapping in morphological characteristics and apparent mixing. Until 1925, there was no barrier separating the two volcanos of southern Isabela and the lava flow which occurred in that year still does not separate the tortoise populations of Cerro Azul and Sierra Negra in a large sector along the southern coast (7).

POPULATION 400-600 individuals (7), of which 276 were permanently marked by January, 1974 (C.G. MacFarland, pers. comm.). The population was somewhat depleted by the activities of seamen in the past two centuries. Extensive slaughter in the late 1950s and late 1960s by employees of cattle companies based at Iguana Cove, resulted in the virtual elimination of tortoises in this area, leaving surviving populations only further to the east and west. Poaching is still a problem in one area to the west, but the major threat at present is predation by introduced mammals: to the west of Iguana Cove dogs and cats destroy almost all the young and to the east, pigs destroy most nests and dogs, cats and pigs kill the young. Cattle and black rats are present throughout the range of this subspecies (7).

HABITAT In dry, transition, moist and grassy vegetation zones (2), originally over most of the volcano (MacFarland pers. comm.).

BREEDING RATE IN WILD Mating and nesting still occur normally, but there is a great preponderence of adult animals, with few small or medium-sized individuals to be found (7).

CONSERVATION MEASURES TAKEN In 1959, Ecuador declared all uninhabited areas in the Galapagos to be a National Park and made it illegal to capture or remove many species from the islands, including tortoises or their eggs; in 1970, it became illegal to export any Galapagos tortoises from Ecuador, regardless of whether they have been reared in captivity or the wild, and whether from continental Ecuador or the islands; United States Public Law 91-135 (December 5, 1969) automatically prohibits importation of Galapagos tortoises into the U.S.A., because their export from Ecuador has been declared illegal (5). A 1971 decree makes it illegal to damage, remove, alter or disturb any organism, rock or other natural object in the Galapagos National Park (7). The Galapagos National Park Service wardens now visit the Albemarle population frequently during the breeding/nesting season; in the eastern area nests are protected with lava corrals and an attempt is being made to control pigs by systematic hunting (8). Lastly, since 1971, eggs have been taken from wild nests to the Charles Darwin Research Station for hatching and raising of young (MacFarland pers. comm.).

CONSERVATION MEASURES PROPOSED Stationing of semi-permanent wardens in the Western area to prevent poaching (6).

RDB-3. IUCN © 1975 9(2)F Code: 2.1.6.4.1.1 E

Fig. 2-1 An example of part of a synoptic report from the IUCN *Red Data Book* Vol 3. This entry is for a Galapagos tortoise (*Geochelone* [*Testudo*] *elephantopus*).

Population sizes of the giant tortoise races have been calculated on the basis of numerous samples and extensive habitat surveys by researchers on the Islands (MacFARLAND *et al.*, 1974) and it has been found that most races number only a few hundred. Further to this, it has been possible to show from historical records that there has been a significant reduction in the size of the populations. Along with the population size estimates it is useful to have information on breeding rates in the wild and in this case it has been possible to examine the sex structure, size class structure and reproductive potential of the different races.

The habitat for the several races of the Galapagos giant tortoise is of course restricted to the Islands of the Galapagos archipelago and most suitable regions occur in limited transitional and moist grassy vegetation zones where in some cases there is competition from introduced mammals. This then identifies a further factor which has contributed towards the change in the tortoise populations. Of the 11 surviving races, eight are threatened with extinction by one of the following: decreased population size; predation on nests by introduced mammals; competition from introduced mammals. Human exploitation is now relatively unimportant, partly because Ecuador in 1959 declared all uninhabited areas in the Islands to be a National Park.

Having evaluated the current status of the Galapagos giant tortoise it is then possible to suggest and also implement conservation measures. Methods for the control of the feral mammals are being sought and in addition successful techniques have been found for the establishment of breeding colonies and the raising of young in captivity.

The *Red Data Books* are in themselves an invaluable source of biological information, providing a synopsis of the animal's or plant's status and also a brief account of the kind of conservation measures that should be or have been implemented. From the viewpoint of species evaluation there is a further important piece of information which is included (in each of the species accounts). This is the category of the species (Fig. 2–1). Each of the species is assigned to a particular category and these categories are defined in the following ways:

(i) *Endangered* Taxa (that is species or subspecies) in danger of extinction and whose future survival is unlikely if the factors continue to operate. Included are taxa whose numbers have been reduced to a critical level or whose habitats have been so drastically reduced that they are thought to be in immediate danger of extinction.

(ii) Vulnerable Taxa believed likely to move into the endangered category in the near future if the causal factors continue to operate. Included are taxa of which most or all the populations are decreasing because of over-exploitation, extensive destruction of the habitat or other environmental disturbance; taxa with populations that have been seriously depleted and whose ultimate security is not yet assured; and taxa with populations that are still abundant but are under threat from serious adverse factors throughout their range.

(iii) Rare Taxa with small world populations that are not at present endangered or vulnerable, but are at risk. These taxa are usually localized within the restricted geographical areas of particular habitats or are thinly scattered

over a more extensive range, for example, the Dorset heath (*Erica ciliaris*). This plant is abundant on heaths in the south of England but the species has declined dramatically as a result of the destruction and fragmentation of heathlands.

(iv) Out of danger Taxa formerly included in one of the above categories, but which are now considered relatively secure because effective conservation measures have been taken or the previous threat to their survival has been removed. An interesting example of an animal in this category is the tuatara (*Sphenodon punctatus*), a lizard-like reptile which occurs on at least 30 islands around the coast of New Zealand. The conservation measures taken have included very strict protection for tuataras by the New Zealand Government and protective measures to prevent accidental entry of rats and cats to the islands on which this species is found.

(v) Indeterminate Taxa that are suspected of belonging to one of the first three categories but for which insufficient information is currently available.

It might well be suggested that a certain amount of subjective judgement is used when a species is being considered for inclusion in one of the above categories. Is this subjective element undesirable? When the aims of the Red Data Books are considered as a whole then the subjective element in this evaluation is probably not very important. It is far more important to have available at least some kind of information, which after all helps to identify the relative conservation needs of the species. The nature of the conservation measures that are proposed may at times be disputed, but before that stage can be reached evaluation based on scientific studies should first be undertaken.

2.2 British Red Data Books

The first *British Red Data Book* (vascular plants) was published by the Society for the Promotion of Nature Conservation in 1977 (Perring and Farrell, 1977). Basic information required for the preparation of this book came from distribution maps which are available for Britain's plants and also for several groups of animals. These maps are prepared by the Biological Records Centre based in Huntingdon, England. This centre began in 1954 as the Distribution Maps Scheme of the Botanical Society of the British Isles and resulted in the publication of the Atlas of the British Flora in 1962. The Atlas contains distribution maps for each of the plant species using a system of dots in areas of 10 km^2 (Fig. 2–2).

Here then, at least for Britain's plant species, was information which could be used for an ecological evaluation of the species and for an assessment of their status. The species included in the first of the *British Red Data Books* are those recorded in 15 or fewer of the 10 km^2 from 1930 onwards. The final list contained 321 species and represents about 18% of the native or probably native flora. The next step was to provide information on the status of each of the 321 species and this was in fact a very extensive exercise for it meant the collection of ecological and other relevant information. The compilers of this *Red Data Book* were still not satisfied however and took the work of evaluation a step further by arranging the plant species in some order or priority and avoiding the subjective

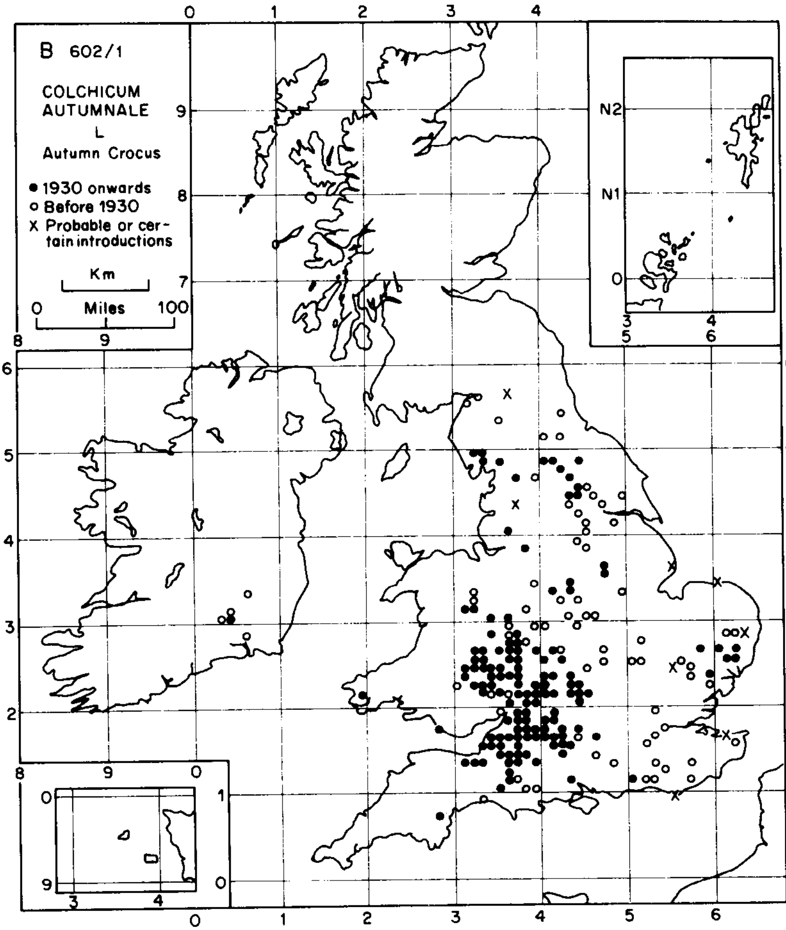

Fig. 2–2 An entry from the *Atlas of the British Flora*. A symbol indicating the presence of a species in a 10 km. sq. of the Ordnance Survey National Grid is the basis of the scheme. (From Perring, F. H. and Walters, S. M. (1976). *Atlas of the British Flora*. E. P. Publishing Ltd.)

elements of 'rare' and 'endangered'. This exercise culminated in the calculation of a 'threat number' for each plant species: the method employed is particularly interesting (Table 1).

In the example taken from the *British Red Data Book* (Table 1), *columns 1 and 2* contain information about the distribution of the species but do not contribute to the threat number. *Column 3* refers to Great Britain and the first entry gives information about past and present distribution while the second entry contributes to the threat number based on the following: 0 = decline of less than 33%; 1 = decline of 33% to 66%; 2 = decline of over 66%.

Table 1 A table of threat numbers for British Plants. (From Perring, F. H. and Farrell, L. (1977). *Brtish Red Data Books*: 1 Vascular Plants. S.P.N.C.)

SPECIES	Rate of Decline				Loci							
	Ireland (H) 1	Channel Isles (S) 2	Great Britain (GB) 3	I	Total 4	I	Attractiveness I 5	Conservation I 6	Remoteness I 7	Accessibility I 8	Threat number 9	IUCN category 10
Minuartia stricta	—	—	*1/1*	*0*	*1*	*4*	*1*	*1*	*1*	*2*	*9*	*V*
Muscari atlanticum	—	—	*10/17*	*1*	*17*	*0*	*2*	*2*	*2*	*2*	*9*	*V*
Narcissus obvallaris	—	—	*7/9*	*0*	*7*	*2*	*2*	*1*	*2*	*2*	*9*	*R*
Neotinea maculata	*19/32*	—	*1/1*	*0*	*1*	*4*	*2*	*2*	*0*	*1*	*9*	*R*
Oenothera stricta	—	*4/4*	*10/29*	*2*	*12*	*1*	*2*	*1*	*1*	*2*	*9*	*R*
Ophrys fuciflora	—	—	*4/6*	*1*	*10*	*1*	*2*	*1*	*2*	*2*	*9*	*R*
Paeonia mascula	—	—	*1/2*	*1*	*1*	*4*	*2*	*0*	*0*	*2*	*9*	*V*
Phyllodoce caerulea	—	—	*3/3*	*0*	*4*	*3*	*2*	*1*	*1*	*2*	*9*	*V*
Polygonatum verticillatum	—	—	*4/10*	*1*	*5*	*3*	*2*	*1*	*1*	*1*	*9*	*V*
Polygonum maritimum	*1/1*	*1/3*	*2/11*	*2*	*2*	*4*	*0*	*2*	*0*	*1*	*9*	*E*
Potentilla rupestris	—	—	*3/3*	*0*	*3*	*3*	*2*	*2*	*1*	*1*	*9*	*V*
Ranunculus ophioglossifolius	—	*0/1*	*2/4*	*1*	*2*	*4*	*0*	*1*	*1*	*2*	*9*	*E*
Rhinanthus serotinus	—	—	*5/68*	*2*	*10*	*1*	*1*	*2*	*1*	*2*	*9*	*V*
Selinum carvifolia	—	—	*2/5*	*1*	*2*	*4*	*0*	*1*	*2*	*1*	*9*	*V*
Senecio cambrensis	—	—	*5/5*	*0*	*6*	*2*	*1*	*2*	*2*	*2*	*9*	*R*
Taraxacum acutum	-	—	*2/2*	*0*	*2*	*4*	*0*	*2*	*1*	*2*	*9*	*V*
Taraxacum austrinum	*1/1*	*1/2*	*1/2*	*1*	*2*	*4*	*0*	*1*	*1*	*2*	*9*	*V*
Taraxacum glaucinum	—	—	*2/4*	*1*	*2*	*4*	*0*	*1*	*1*	*2*	*9*	*V*
Tetragonolobus maritimus	—	—	*9/9*	*0*	*9*	*2*	*1*	*2*	*2*	*2*	*9*	*R*
Trichomanes speciosum	*22/47*	—	*8/15*	*1*	*8*	*2*	*2*	*2*	*1*	*1*	*9*	*V*
Trifolium bocconei	—	*1/1*	*2/3*	*1*	*5*	*3*	*1*	*1*	*1*	*2*	*9*	*R*
Valerianella rimosa	*9/41*	—	*9/96*	*2*	*10*	*1*	*0*	*2*	*2*	*2*	*9*	*V*
Veronica verna	—	—	*1/8*	*2*	*8*	*2*	*0*	*1*	*2*	*2*	*9*	*E*
Woodsia ilvensis	-	—	*4/12*	*2*	*4*	*3*	*2*	*1*	*0*	*1*	*9*	*V*

Column 4 refers to Great Britain and the first entry gives the number of extant localities of the species known to the Biological Records Centre (in effect the number of 1 km^2 in which it has been recorded) and the second entry contributes to the threat number as follows: 0 = 16 or more localities; 1 = 10–15 or more; 2 = 6–9 localities; 3 = 3–5 localities; 4 = 1–2 localities.

Column 5 is an assessment of the attractiveness of the species (for collectors) and is recorded in the following way: 0 = not attractive; 1 = moderately attractive; 2 = highly attractive.

The conservation index is provided in *column 6* in the following manner: 0 = more than 66% of localities in nature reserves; 1 = between 33% and 66% of