Biologists and the management of conservation areas

European Communities Biologists Association

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BIOLOGISTS AND THE MANAGEMENT OF CONSERVATION AREAS

Report of the workshop on "The management of natural conservation areas" organised by the European Communities Biologists Association and the Colegio Oficial de Bi61ogos de Espaha, in La Laguna, Tenerife (Canary Islands), in May 1991

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Objectives of ECBA

1. To represent the professional interests of biologists in the European Communities.

2. To ensure the professional competence of biologists in the European Communities.

3. To assist with the exchange of information on professional matters relating to the work of biologists in the European Communities.

4. To assist with the free movement of biologists within the European Communities.

5. To promote the exchange of biology teachers at all educational levels.

6. To promote cooperation and the exchange of information between national biological societies about their activities througout Europe.

7. To advise the European Communities and the public in general on biological subjects with implications for society.

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I. INTRODUCTION

Biologists, with their knowledge of the different structural levels of living matter and the influence that time has on each of them, can offer an overall vision and a predisposition for understanding ecological processes unparalleled in other professions. This particular intellectual focus, centred on knowledge of the structures and processes of life, makes the biologist an ideal and almost indispensable element in the transdisciplinary teams whose job is to analyze, evaluate and plan the use of the planet's natural resources. The days when we could gaily exploit and consume these resources without concern for damage, exhaustion or lack of recovery are now coming to an end. Mankind, or at least a sector of it, is becoming aware that the available resources are limited and that their renewal rates cannot be exceeded; that pollution depletes the productive capacity of living systems, even when it does not endanger human life itself; that the planet's great ecological systems (such as the climate) are responding to the changes wrought by man and his technology; and that, in short, a new age of uncertainty is dawning, in which the environment could play a rather unwelcome role.

All this goes to explain the recent consolidation of two new areas of activity associated with the ideas put forward by environmentalists and conservationists. The former centre their attention on the problems of the quality of waters, the soil, and the air, and on the vast set of problems surrounding pollution. It is the area that has generated the most employment since it has a direct effect on human health and productive activity, on industry and, obviously, on the economy. Biologists have acquired a leading role in this professional "niche", contributing their particular knowledge to evaluations of environmental impact, environmental monitoring and control, the fight against pollution, the search for "soft" processes, etc.

The second sphere of activity, conservation, is more closely linked with Nature and the use of natural resources in a way which ceases to cause pollution or to be "pathological". Planning is applied to natural resources—especially those which are renewable—in order to bring about sustainable development, a rational and lasting form of exploitation. This has brought about a change in our approach to and the exploitation of certain resources (game, fisheries, forests, etc.), to national and regional planning, and, finally, in the man's attitude towards Nature.

The majority of civilised nations have recognised that the maintenance of biodiversity on Earth is a common responsibility for mankind to be undertaken in a spirit of solidarity. All but a minority of governments are now involved in policies for conserving Nature, developing networks of conservation areas, or protecting those of their animal and plant species which are more vulnerable or threatened with extinction. If, at the outset, the scarce domestic or international financial resources (e.g., those of the EC) were directed towards the so-called "blue line" (i.e., towards combating or reducing the effects of pollution), nowadays the growing importance of the "green line", or conservation, is appreciable. In contrast with the traditional "blue" principle that "the polluter must pay", the recent Habitats Directive of the EC has inaugurated, if not explicitly, at least on a *de facto* basis, the new "green" principle that "the conserver gains".

However, the conservation of Nature is still far from being as integrated into the economic and industrial framework as is the environmental sector, which is now an expanding industry in itself.

The European Communities Biologists' Association (ECBA) has always believed that it is important to achieve a better use of biological resources, in terms of both biotechnological exploitation[1] and conservation. It is now time to concentrate attention on the latter and on a very specific aspect: the "conservation of areas". This approach is particular/ important at a time when, through the Habitats Directive, the EC has laid down a resolute common policy of "Special Conservation Areas", which will eventually form the European network of NATURA 2000 conservation areas. It is certain that the member states possess numerous parks and nature reserves, but it is equally certain that many of them are mere "paper-parks" and that no progress has been made beyond their official designation.

In some cases this inactivity may be due to a lack of political will, the deficiencies of local legislation or the shortage of economic resources. However it is truly regrettable that when all these factors are favourably combined there is often still an impediment: the lack of experts, versed in conservation, capable of converting the will-power and the money into reality in the field. ECBA

"Biology and Modern Industry". ECBA publication no. 7.

wishes to make a contribution to wards relieving this problem, at the same time as drawing this fascinating area of professional work to the attention of its members.

II. OBJECTIVES OF THE SEMINAR

ECBA and the Colegio Oficial de Bi61ogos de Espana (Official Institute of Biologists of Spain) organised a seminar on the management of natural areas in La Laguna (Tenerife, Canary Islands). The aim was to explore the subject in depth on the basis of two questions: what can biologists contribute to the conservation of natural areas and what professional opportunities does this flourishing field offer for biologists?

Analysis was based on three specific aspects: management of conservation areas in order to maintain biodiversity, environmental education, and the training of biologists in the management of conservation areas. Debate was based on the wealth of experience already gained in Spain, from which general conclusions were drawn. There were three major reports, which also included the written contributions presented by the participants. The reports were by Cosme Morillo, of the National Institute for the Conservation of Nature, on biodiversity; Teresa Franquesa, of the trust in charge of the Collserola hills *(Patronato de Collserola)* in Barcelona, on environmental education; and Fernando Molina, of the Environmental Agency of the Junta de Andalucia, on the training of biologists. The reports were debated and the general conclusions were summarised from time to time by the rapporteurs.

The seminar ended with a lecture on the planning instruments applicable to Spanish natural areas by Carles Pareja, who discussed Spanish legislation in detail; this was followed by a general debate on the conclusions reached during the seminar.

The subjects of the analysis —conservation of biodiversity and environmental education— were obviously limited, but other aspects of the management of conservation areas —recreation, visitors* safety, interpretation, research— came up spontaneously in the debates and are fully included in the final summary. This report therefore follows a different form from that of the seminar itself, in order to offer a more coherent overall vision.

III. CONSERVATION AREAS

The emergence of conservation areas

The first designation of a national park came about in 1872, in the United States, inspired by a principle of admiration for nature which has come to be called "the spirit of Yellowstone" after the park itself. This was the beginning of a world-wide movement to establish conservation areas, with national parks acting as the flagship. However, the national parks chosen or spontaneously arising from this subjective aesthetic philosophy ran the risk of becoming isolated fragments, a sort of living museum, islands of conservation lost in an ocean of destruction. Fortunately, the doctrine of conservation areas has *r* advanced greatly in the 100 years since the foundation of Yellowstone, and today the motives used to justify the special conservation of an area are more varied and rational and efforts are made to integrate it into the overall framework of the region in which it lies.

Another, no less important, aspect is that the philosophy of conservation has been extended to include not only natural areas, but also semi-natural or even agricultural ones. This is especially important in a continent such as Europe, which has been settled by human beings for millennia, so that transformation of the original natural conditions has been deeper and more extensive than in other latitudes.

The basic elements of conservation

In democratic systems and countries where the rule of law is respected, it is not possible to designate a conservation area merely on the basis of a whim or the enthusiasm of a few people. The conservation of nature always involves limitations on the rights of individuals (if they exist) and a definite orienting of public interests towards the end in question. For this reason, every designation of a conservation area must provide the necessary public guarantees and justify the need for conservation with reasons such as those given below, in order to legitimise it and make it legally substantive. Unfortunately, this practice does not extend equally to every country, and many conservation areas have been legitimised (through parliament, for example) but not made technically substantive.

The reasons now used to justify the establishment of conservation areas are very varied and may be presented individually or collectively. The main ones are as follows:

Unspoilt nature
On the old continent of Europe it is absurd to sacrifice yet more of the few remaining natural areas to development, especially when there is usually enough transformed land not in use. Unspoilt nature has begun to be a scarce resource and for this simple reason deserves to be protected.

Samples of natural environments
It is an accepted practice that every country should preserve at least a sample of its natural environments. The basis of "representativeness" applies as much to geomorphological and geological features as to biological ones (usually vegetation).

Concentration of biodiversity
There are often particular parts of a country which, for biogeographical and historical reasons, accumulate a high concentration and different habitats, and complex ecological processes, or a wide variety of species. Since the preservation of biodiversity in its threefold aspect (genetics, species and ecosystems) is a universally accepted objective of conservationism, such "sanctuaries" are given priority attention.

Habitats and endangered species
The lists of animals and plants seriously threatened with extinction (vulnerable and endangered species) are unfortunately growing longer and longer. The safeguarding of these species is usually linked to the preservation of their habitats. We have now also begun to work with lists of endangered habitats. The Habitats Directive of the EC follows this criterion and its appendices include a list of European habitats considered to be under threat.

Scientific interest
There are species or geological features whose special interest lies in the field of science; sometimes these are local endemisms, relics of the past, or rarities and singularities of a definite biological group. The conservation of the ancestors of cultivated plants (potato, tomato, maize) has, in addition to a scientific interest, an obvious economic one, given the technological advancement in genetic engineering. Archaeological sites are also an object of conservation for scientific reasons, although their ecological value is not so great.

Biological production
Natural areas are producers of biomass, directly or indirectly useful to man (game, fisheries, mushrooms, firewood, medicinal herbs, fruit, honey, etc.), and other public "services" that usually go unnoticed (oxygen, the fixing of carbon dioxide, etc.). There are also cases of certain large developing countries—in South America for example—where vast areas are protected with the idea of delaying exploitation and conserving them for the future as "resource reserves".

Maintenance of processes
We may preserve an area which has little intrinsic value for the natural elements it contains but is of interest for the role it plays in certain ecological processes. For example, there are headwaters areas of rivers where it is in our interests to conserve the natural vegetation in order to avoid erosion or silting downstream; there are mountain forests which capture moisture from the clouds and contribute to recharging the aquifers; in southern Europe there are many lagoons essential to the migration of water birds.

Some areas have to be conserved for their strategic position. They constitute ecological "corridors" which interconnect or bring closer together remnants or fragments which would otherwise remain isolated. This helps to maintain the natural infrastructure and facilitates the dispersion of species. Genetic flow is considered indispensable for the normal evolution of populations.

The landscape
The landscape is the form in which man most directly perceives nature or what he has transformed it into. Public demand for natural landscapes is growing, and becomes more insistent in proportion to the development of a country. This has led to the conservation of harmonious natural or rural landscapes, or certain features that characterise them ("natural monuments"), which can become an environmental justification for the conservation of large areas in which not only natural but also cultural values (traditional customs, architecture) play a role.

Levels of conservation

Natural resources are not all equally fragile or subject to the same levels of exploitation and danger. For this reason, it is important to understand that conservation requirements vary from case to case and that, in principle, there does not have to be a one to one relationship between the high level of danger to a given resource and the need to assign it the strictest level of conservation. For example, there may be vulnerable animal species, that require very severe conservation measures, while the future survival of others, perhaps threatened with extinction, can be ensured with far more modest measures. This simple distinction is often confused, especially by scientists not involved in conservation, who automatically demand that maximum conservation be given to a highly interesting species or area, often generating unnecessary conflicts which make no positive contribution.

Meanwhile, protection against supposed threats (e.g., the construction of highways, fires) is not always a sufficient guarantee that an area will be conserved in the desired state: active conservation measures are needed. The area has to be managed. Thus we may distinguish between two major types of conservation areas: those where conservation is achieved basically through regulations (town-planning regulations, forest by-laws) and a certain level of vigilance ("passive" conservation) and those where direct conservation measures are applied (rehabilitation, management of habitats, environmental monitoring), which may be called "active" conservation.

It is obvious that a lot can be achieved through "passive" conservation without any need to employ large-scale human or economic resources. However, the essential point when establishing a "conservation area" is that the priority aim is always the protection of the features which justify its conservation. This does not mean, for example, that other activities compatible with conservation cannot continue there, although they may be subject to monitoring. Nevertheless these activities will always be secondary and remain subject to the aims of conservation should a conflict arise.

Furthermore, it is normal practice for the objectives of "active" conservation areas to include research, environmental education and recreation for visitors. A portion of the territory will obviously not be parcelled off for non-harmful uses unless it is strictly necessary for conservation purposes. The improvement

of the living standards of the local population is an aim common to many populated conservation areas. We must remember that "conservation" is not the same as "preservation".

Categories of conservation areas

We are therefore faced with areas that have different conservation requirements, and a variety of purposes and which require different measures for effecting conservation. The solution lies in having a number of categories of conservation area at our disposal, moulded to fit each case according to its purpose. This is not the place to discuss the many ways of classifying conservation areas that have been generated over the years and which are permanently debated in international conferences and symposia on the subject. We may use as a guideline the following scheme drawn from Spanish legislation, which is valuable for its simplicity and clarity. This schema identifies four basic groups:

Reserves: as their name indicates, these are "reserved" for a special use. They are devoted to nature and scientific ends and are assumed to contain no human population.

— *Parks:* like ordinary parks these are open to the public. They are for nature, but also for man (complementary recreational and educational ends), and sometimes have human populations living within them. Possible conflicts between conservation and use within their boundaries are usually solved by zoning.

— *Natural monuments:* the term is quite explicit: outstanding natural features which inspire admiration.

— *Protected landscapes:* the landscape rather than the processes and elements in it constitutes the object of protection, and this usuals involves passive conservation.

The International Union for the Conservation of Nature and Natural Resources (IUCN) has recognised eight basic general categories, irrespective of the fact

that every country uses its own system of classification adapted to its own circumstances. The United States uses more than 40 categories, with a wide variety of names. In Europe there is a certain resemblance between the definitions, but still no consensus on nomenclature; in England, for example, the terms "national park" are used for what other countries call "protected landscape". It is obvious that the situation becomes excessively complicated when other purposes are ascribed to the area (the conservation of archaeological remains, artistic heritage, indigenous lifestyles, places of historical interest, preservation of resources to be exploited in the distant future, etc).

IV. BIOLOGY AND CONSERVATION AREAS

Biological management of conservation areas

Although all conservation areas are oriented towards conservation, some are more directed towards preservation than others (e.g., reserves), while others are aimed more at public recreation (e.g., parks on the outskirts of cities). In any case, action in conservation areas cannot be left to improvisation. The possibility of committing errors and causing damage must be minimised and planning is the usual means of avoiding these dangers. Planning has to be based on a sufficient amount of suitable information, and must precede the design and execution of projects.

Objectives -> planning -> design -> execution -> monitoring

Every conservation area must have scientific support for the planning which permits monitoring, evaluation and control of the actions carried out within. This section has been entitled "biological management of conservation areas" in order to underline the priority status of correct management for the conservation of living resources and maintenance of biodiversity. This is equally true when the aim is to restore or recover damaged areas. The biological approach is based on discovering the key factors holding up natural recovery in order to eliminate them and let nature recover its own rhythm without further interference from man. The non-biological approach consists of trying to supplant the natural processes by applying "environmental cosmetics" or introducing "hard" technologies (e.g., fixing the soil with mooring ropes and concrete walls instead of with grass).

From this and the information provided in other sections it may be deduced that the biologist can play an important role in selecting and delimiting conservation areas and in their subsequent management. Part of the responsibility for such participation not being widespread lies with biologists themselves; lacking an enterprising spirit, they have merely reproduced the habits learnt as students and not gone beyond the role of describing nature. The management of conservation areas obliges the biologist to take decisions, to intervene in nature, and to sit at the same table as members of many different professions.

The work teams in conservation areas are transdisciplinary rather than multidisciplinary: the horizontal transference of ideas obliges everyone to make a big effort to facilitate interprofessional communication and mutual understanding. Biologists have traditionally been very "endogamous", and we should learn the technical language of our team mates.

Even a summary analysis of the different fields of action in conservation areas in which a biologist can work would confirm this. The most suitable professional background will obviously vary from case to case, and the "average" biologist will sometimes find his strategic position better and sometimes worse than that of the members of other professions (geographers, forestry experts, civil engineers, sociologists, etc.) competing for these posts. Consequently, the effort that biologists will have to make to complete their training and specialise will vary according to the activity chosen.

Biologists' sphere of action of in conservation areas

Figure 1 shows the different areas of activity related to the management of a conservation area. We will analyze these areas abstracting the underlying function in terms of general fields, in order to provide an overall view of the sectors in which biologists work.

1. Studies and research

First let us consider the studies and research carried out "on" the conservation area by researchers not involved in managing and administering it, who may or may not be involved with the "research plans" for the area. They are usually staff belonging to the nearest universities or research centres and the scope of their studies is not necessarily limited to the conservation area itself. This external research must be interpreted as a legitimate use of the area if it accords

with its purpose and is compatible with conservation. For this reason, depending on the fragility or the organisation of the area, it is common practice for its administrators to ask to see the research projects before authorising them, in order to evaluate the damage they could cause and to decide the best way of controlling it.

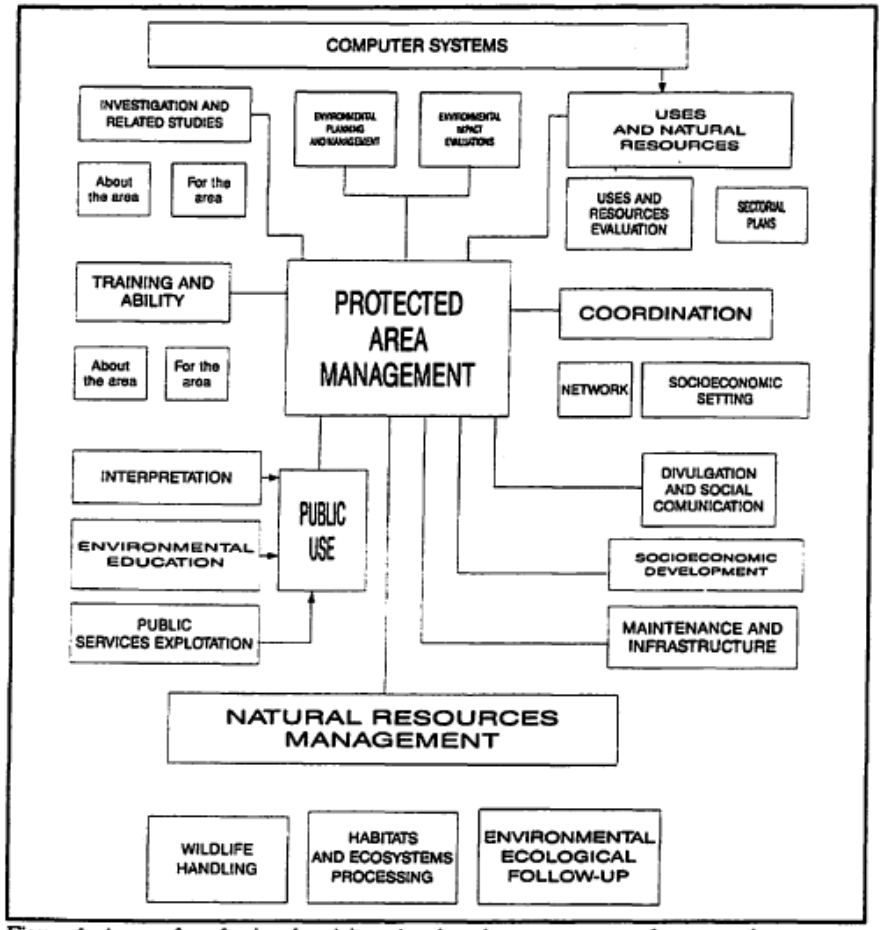

Figure 1. Areas of professional activity related to the management of conservation areas.

Secondly, there are studies done "for" the area, determined by the needs that arise in managing its natural resources. These are normally carried out following the "research plans" drawn up by the administration and are contracted out to third parties (universities, consultants, etc.) if the area's own staff cannot deal with them.

Biologists have traditionally been producers of environmental information. However, in the context of management, not everything has the same intrinsic merit as when it is produced for science. The depth and extensiveness of this information is largely predetermined by the use to which it will be put. The biologist will have to accept a compromise between the precision and quality of the data he is going to obtain and the time and money available. It is often more appropriate to speak of "applied studies" than "research".

In both contexts the professional background required is similar to the training a biologist can acquire at university, but there is a particular focus on application in the second case, which is the one that most concerns us here.

2 Management of natural resources

This includes all the tasks connected with the area, the natural habitats and the wild species: recovery of degraded areas, environmental monitoring, management of populations, plans for the recovery of species (with in situ and ex situ methods), censuses, protection against fires, control of introduced species, landscaping, extraction, etc.

This sphere should receive the most attention in a conservation area, although it is not unusual for it to be neglected in favour of use by the public, since this more popular. Annual examinations of the state of conservation are performed in only a few conservation areas; this is wrong.

Biologists must apply their knowledge to practical management and to solving real problems. This form of "applied biology" has an important technological component, and is not usually part of university instruction. Given the variety of habitats, species and problems, it is common for biologists to end up specialising in particular biological fields or groups (water birds, dunes, management of pastures, eradication of weeds). Experience is undoubtedly the most important component of any additional training and is the only way of obtaining "experts".

3. Environmental planning

Environmental planning covers three related fields. The first is the macro-level at which plans, regulations and directives aimed at achieving an optimum environmental quality in the conservation area and its surroundings are developed. Except in very large conservation areas, the territorial framework of environmental organisation usually extends far beyond the boundaries of the area (e.g. municipalities, districts). There is not usually an environmental planning team in every area or even in a network of conservation areas. The usual practice is to employ the teams or experts working nearby, or even more distant ones (international organisations, etc.).

The second field, that of evaluating environmental impact, employs individual experts or teams to carry out advance studies to determine the impact a project is likely to have on the area. Its purview includes the administration's own projects, those performed in the area by outside teams and others which, despite being performed outside the area[2], could have negative repercussions within it. It should be pointed out in this context that studies on environmental impact include ecological impact, but that in many areas carrying out studies on ecological impact will be all that is necessary.

Finally, the field of environmental management in the strict sense of the word (management of solid wastes, dumping of liquids, purification of waters) involves jobs normally done by professional workers employed by the local authority. However, there are conservation areas which are so large or remote that these tasks must be carried out by their own staff.

The background required in these three fields obviously involves complementary training for the "average" biologist in subjects such as environmental engineering, impact evaluation or purification and waste elimination methods.

[2] **Many conservation areas have "peripheral conservation areas" to protect them from this kind of impact. In other cases, legislation on prevention of environmental or ecological impact determines whether such investigation should be carried out, depending on the type of project or whether there are conservation areas nearby.**

4. Public use

Public use is one of the purposes of certain conservation areas and therefore involves detailed planning. The quality of such planning is crucial to the proper conscrvalion of the area. Installations and facilities for the public vary greatly and involve distinct forms of civil engineering. This is outside the normal capacity of biologists in terms of design and management, but not in terms of planning and subsequent monitoring.

Great care must be taken that the works and installations designed arc compatible with the conservation of nature in the area. Furthermore, the ecological impact of visitors within an area will vary according to the habitats and their phenophascs, and in most cases can only be determined through trial and error and subsequent discussion. Biologists therefore usually participate intensively in the "feedback" that allows plans for public use to be revised.

5. Environmental education and interpretation

Environmental education forms part of the statutes of some conservation areas, although conservation always takes priority. Environmental education, which helps to create or increase public awareness of conservation, this forms an integral part of the purpose of the area and an important support for it. In this way, environmental education can place itself at the service of conservation areas, and vice versa. The possibility, for example, of allowing students or teachers to examine nature "on the spot" is a worthwhile end, and nature-study facilities can frequently be found in or associated with such areas.

Providing an explanation and justification for the conservation of an area and thereby ensuring that its importance is made clear to both visitors and those who live in or around it is a crucial objective. It may also be necessary to design information programmes aimed at groups who are hostile to the establishment of the area; confrontations are often caused by a lack or distortion of information rather than truly opposed positions.

Directly associated with environmental education —which attempts to influence people's behaviour— is the area of "interpretation", which is not always well understood by the technicians working in conservation areas. Interpretation as an organised activity arose in order to help people get the most out of their visits to the parks. It does not consist of lectures about Nature but of providing the keys that will allow visitors to appreciate or interpret the natural

phenomena they see for themselves, and thereby help them get the most out of their visit, turning it into a unique highly personal, experience[3]. Interpretation is therefore linked more with the recreational aspect of an area (intellectual recreation) rather than the educational one, although this obviously does not —and must not— alter the fact that it affects the education of the individual. Nevertheless, we must also respect visitors who want to encounter Nature and appreciate it with their own untrammelled senses, without any "intellectual mediation" that seeks to explain everything or reveal what is hidden to the untutored eye.

In this field biologists will work alongside sociologists, teachers, graphic artists, information scientists and other specialists, but their particular role is to transmit at first hand the knowledge required about the biology of different species, the ecology of the area, or the reasons for and problems involved in its management. This area also provides biologists with a fascinating field for specialisation as an environmental monitor or planner of interpretations if they complement their ordinary training with psychology, pedagogy and planning techniques.

6. Training

Here we consider the training of staff for conservation areas. This includes specialisation in management techniques and the training of guides, wardens, supervisors and others to take part in the daily running of an area. It is also common practice to use conservation areas with experienced staff to train technicians in specific subjects (management of wild life, environmental monitoring), including those who are not going to work in conservation areas themselves. Training and retraining courses are common, almost routine, practice for the administration of established conservation areas, with a valuable exchange of teachers and students between different areas and even countries.

This teaching work usually involves many different members of an area team in a transdisciplinary approach and biologists can take part in it if they have had a university education in ecology complemented with a knowledge of pedagogy.

The interpreter answers or helps to answer the questions asked by the visitor: why does a valley have a certain shape? why are there no fallen leaves in a certain place? what is that bird trilling in the distance trying to do? why does the grass not grow higher next to the lake?.

7. Planning

This is perhaps the field of action most specifically associated with the management of conservation areas and the most complex because of the diversity of subjects involved. Planning in conservation areas is not a single entity, but is divided into different hierarchical levels, ranging from the general to the most specific and detailed, from plans for large-scale networks of conservation areas or for the organisation of resources in which the conservation areas of a given region are included, to plans for use and management (zoning) and the subsidiary plans that stem from them (research plans, interpretation, recovery).

Over and above skill in planning itself, all these levels require a highly detailed knowledge of the resources of the area, which must be assessed according to the ends pursued. This involves accumulating as much information on the area as possible and keeping it up to date and operative in order to maintain the dynamic process of planning, monitoring, reviewing and planning again in motion. It is therefore relevant to draw attention to a branch of information science associated with planning: efficient management of conservation areas is increasingly requires experts in information science and GIS (geographical information systems).

The biologist who works in the field of planning must have a solid background in ecology and the local fauna and flora, complemented by planning technique and, if possible, data-processing. Of course, a thorough knowledge of the administrative and legislative areas associated with the world of protected species is also necessary; the work will usually take place in multidisciplinary teams.

8. Management of the conservation area

Management of a conservation area includes all the fields mentioned above, as well as others more associated with the world of administrative and business management (accountancy, personnel management) than with biology. This does not mean that biologists cannot occupy management posts in a conservation area, but that they must add many other disciplines, including perhaps diplomacy and public relations, to their university education. Biologists who work in this field of conservation will have to accept that it will involve dealing more with people than with plants and animals and, to put it frankly, they will need to love people as much as they do Nature.

The authorities .sometimes choose a suitably qualified biologist to direct a conservation area in the hope that he or she will put a particularly biological seal on the work. The search for such a profile, which is inherent in any profession, is fully justified in certain especially fragile areas, where the aim is to ensure a high degree of concern for the ecological health of the area.

V. TRAINING FOR BIOLOGISTS IN TIIK MANAGEMENT OF CONSERVATION AREAS

Clearly, the present context in which biologists intervene in the management of conservation areas is the product of two fundamental developments: first, the significant growth in the number and size of conservation areas, and secondly, the diversification of types of conservation area, given that the traditional idea of conservation as the negation of all activity has now been superseded.

Europe currently has an extensive network of conservation areas, which is growing thanks to the implementation of the Habitats Directive (see Introduction). This situation provides an increasing number of job opportunities for biologists. It is therefore necessary to extend the scope of the training which biologists are given, so that they can compete successfully with other professionals in the area of conservation. It must be borne in mind that, in general terms, the training which biologists receive at university does not provide them with the complete range of skills needed in the management of conservation areas. It is of little consolation to say that this is also the case in other university disciplines.

An ecological option in the university curriculum

It is advisable for biologists wishing to work in the management of conservation areas to concentrate on ecological projects during their university course. There is an important dividing line within biology at the level of the individual-organism. Apart from those involved in teaching and management, the work of biologists falls into two spheres. Those working at the whole organism level and below are dealing with an intraorganic-physiological environment on a gradually diminishing scale (organs, tissues,cells, intracellular particles) using *ad hoc* instrumentation (scalpels, microscopes). On the other hand, biologists operating at the level of the individual and above are dealing with a biophysical-ecological environment on a rising scale (populations, biocenosis, ecosystems) and completely different working methods and instruments (binoculars, satellite images).

The complementary subjects which the biologist oriented towards ecology and field work (the field biologist) must be familiar with are edaphology, geomorphology, climatology, etc., which will permit a better understanding of the environment or elements under consideration: the plants and animals, or the living systems they form (communities and ecosystems).

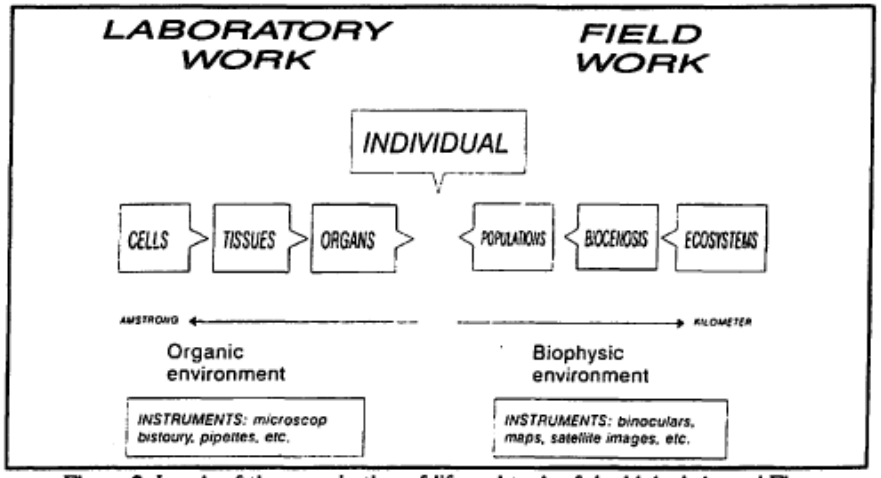

Figure 2. Levels of the organisation of life and tools of the biologist's workFig.

The basic education of a biologist[4] is supposed to guarantee a general understanding of living matter at all levels of complexity, from molecules to ecosystems, but a university course is not long enough to allow specialisation in both, either consecutively or simultaneously. Therefore, it would be advisable to make university courses more flexible, allowing biologists to concentrate on one of these two directions according to their future career plans.

ECBA held a seminar on this subject in Amsterdam on 3 and 4 October 1992, to bring up to date the conclusions of a similar seminar held in 1977.

Conservation or environmental biology as a specialisation

ECBA publication No. 5 "Biologists and the Environment" included the outline of an introductory course for specialisation in the environment - to follow the biologist's initial training (4 years). It consisted of the following:

Areas of knowledge:

- biology: the classification of living systems at all levels of complexity and their relationship to the physical environment
- ecology: the structure and functioning of ecosystems and their evaluation; assessment of use and planning
- bio-ethics: the ethics of conservation and life
- resource economics (environmental economics):environmental policy; systems theory
- the administrative sciences (basic): law, political science (including decision making theory), public administration, democratic control of the planning process
- action research: decision making, programming, simulation; pilot study and application techniques
- technology: technological aspects, their evaluation and selection; socio-political impact; alternative technologies
- social psychology: interaction processes

Aptitudes and skills:

- communication skills: written, spoken, negotiating, the use of audiovisual resources
- group work
- management

Attitudes:

- flexibility
- responsibility
- enterprise
- professional ethics

Conservation areas as a specialisation

Specialisation in specific areas within environmental or conservation biology should take place after undergraduate study, either in postgraduate courses or in training outside the university. The latter could include, for example, training courses held in conservation areas, with input from both academic institutions and the administrative bodies responsible for the areas. These courses should include periods of practical work or the production of practical studies by the students.

Experience has also shown the value of organising interdisciplinary courses in conservation area management. Students will recognise the opportunity which these courses give for interaction between professionals from different backgrounds as one of their most valuable aspects.

Subsequent specialisation in particular activities within conservation (interpretation, restoration of animal species, ecological impact,) should take the form of in-service training provided by the administrative bodies responsible for the conservation areas (seminars, workshops) or, no less important, the activities of professional organisations, which should be permanently concerned with raising the professional standard of their members such organisations will also be aware of opportunities available in the job market.

The detail and depth provided by these courses clearly depends on the level of specialisation in the work to be undertaken subsequently by the participants:

basic: application of previously acquired knowledge and specific techniques or following specific instructions at the higher levels.

intermediate: ability to interpret and organise work according to existing plans or assigned tasks.

higher: management, planning, programme design, coordination, supervision and evaluation of programmes.

VI. **RECOMMENDATIONS**

These recommendations are directed at the governments and administrative bodies responsible for conservation areas.

The designation and management of conservation areas

— Conservation areas must be set up within an overall regional planning process which identifies conservation as the most appropriate use for an area within a general designation of land use types.

— Conservation areas must be situated within a region according to an overall strategy which allows a minimum "natural infrastructure" to be maintained within that region.

— The distribution, size and form of conservation areas in **a** region must be considered in order to evaluate their impact on the preservation of biodiversity. The free movement of wild animal species should be ensured and impassable barriers to genetic exchange avoided.

— It is essential that geographical information systems are developed to store information about regions in the most efficient and cost-effective way, thus making possible the proper designation and planning of conservation areas and subsequent environmental monitoring.

— The sustainable exploitation of biological species is a legitimate activity and may even be desirable in the management of certain conservation areas. It is in no way incompatible with the modern conception of conservation.

The conservation of biodiversity

— In Europe, the existence of disused areas of degraded land where new economic activities can be established makes the incorporation of new areas of unspoilt land into the process of economic development unnecessary and unwise.

— The conservation of biodiversity is not synonymous with the protection of endangered species, which is simply one component and to some extent an indicator. The question of the conservation of biodiversity also refers to species which are not endangered, and to their habitats.

— Long term programmes to document the biodiversity within conservation areas are needed. The assistance of traditional institutions (zoos, natural science museums, botanical gard.) should be sought to accomplish this task.

Environmental education

— While environmental education programmes, and above all interpretation programmes, are usually directly linked with conservation areas and frequently take place within them, it is equally important to the disseminate knowledge about their existence and objectives more widely in society, particularly among politicians, so that the philosophy and politics of conservation of wild areas and countryside is taken into account in overall economic planning.

— Because of their natural and cultural value, conservation areas can make a fundamental contribution to the general process of environmental education in society. For this reason, conservation areas with an essentially educational purpose should be set up close to urban areas.

Legislation **and** economics

— It is essential to have specific legislation covering conservation areas, not simply concerning their establishment, but also to provide the legal instruments necessary for the management of their resources.

— Sectoral legislation concerning natural resources must not overlook their ecological significance. Water, for example, is both an important resource for man and a habitat for animal life.

— There is an increasingly urgent need for the development of an economic system which takes proper account of the economic value of natural resources and the environmental services which the conservation areas provide for society.

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APPENDIX A

TRAINING COURSE FOR MANAGERS OF CONSERVATION AREAS

Students: Between 15-25, wherever possible from a variety of disciplines biologists, geographers, engineers, etc).

Teaching staff: It is essential that the teaching staff should include both academics to provide expertise on specific subjects and professionals with experience in the management of conservation areas.

Length: To be fixed according to the intensity of the course (25-30 credits). However, between a quarter and a third of the time should always be devoted to practical work, in multidisciplinary groups, to take place whenever possible, in conservation areas.

Contents: The following list contains the topics which should be covered in a training programme but does not itself constitute a formally structured programme. The final section, covering the physical, biological and socio-economic make up of the region in question, is optional.

1. Conservation theory

1.1 The philosophy of conservation. The history of the conservation movement. Ecology, the ecological movement and the environment. Professional ethics.

1.2 Economic theory. The basic principles of environmental economics. The economic value of natural resources.

1.3 The document "Take care of the Earth". The basic principles of sustainable development: ecological, economic and social sustainability. Changing attitudes.

1.4 Global conservation issues: pollution, climatic change, the hole in the ozone layer, erosion, tropical rainforests and the loss of biodiversity.

1.5 The basic principles of conservation. The maintenance of essential ecological systems. The preservation of biodiversity. The sustainable use of natural resources. Criteria for the exploitation of non-renewable resources. The preservation of the countryside.

1.6 The ecological basis of conservation. Ecological succession. The theory of insular biogeography. Genetic drift.

1.7 The protection of endangered species. Risk categories. Risk factors. "Red lists".

1.8 Conservation areas: the fundamental elements of conservation. Categories of conservation area; international categories. The IUCN classification. National classifications.

1.9 Social factors in the management of conservation areas: socio-cultural problems. Agriculture and conservation in rural areas.

1.10 The basic principles of sociology. The rights of peoples. Levels of public involvement in democratic systems: information, consultation, participation and control.

2. Legislation and public administration

2.1 The basic principles of Law. Legislation: directives, laws, decrees. The rights of private property. The struggle against the abuse of power.

2.2 International conservation treaties and conventions (CITES, Berne, Bonn, Ramsar, World Heritage).

2.3 EC regulations. (Habitats Directive, Wild Birds Directive, Environmental Programmes, agro-environmental measures). Communities joint financing arrangements.

2.4 State/federal legislation and local legislation on conservation areas. Conservation regulations (including preventive measures). Their relation to other legal systems.

2.5 Sectoral legislation concerning natural resources: land, forest, agriculture, hunting, fishing. Conservation aspects.

2.6 Sectoral legislation concerning the cultural heritage.

2.7 Environmental and ecological impact legislation.

2.8 The public administration of conservation areas: administrative bodies and associated bodies (boards, trusts, advisory councils). The principles of administrative coordination. Non-government organisations.

2.9 Sanctions: procedures, types of infractions, reporting infractions, penalties.

2.10 Economic-administrative procedures. Proposals, yearly plans, inquiries.

3. Planning conservation areas

3.1 Planning theory. The identification of objectives. Hierarchical systems. The planning team.

3.2 Land use planning. Conservation areas within regional planning models. General/regional land use plans.

3.4 The "master plan" for a conservation area: contents and scope. Zoning. Drawing up a plan. Budgets.

3.5 Special plans: public use, research, restoration of animal population levels, environmental rehabilitation, interpretation, socio-economic development.

3.6 Environmental/ecological impact studies: application, contents and scope.

3.7 Geographical information systems: models and their use in planning.

4. The management of natural resources

4.1 The principles of forest habitat management.

4.2 The principles of open habitat management.

4.3 The principles of wetland management.

4.4 The principles of coastal and sea management.

4.5 Inventories of flora; calculation of biomass. Traditional use. Capacity for renewal. Techniques for the management of vegetation.

4.6 Inventories of fauna, censuses, sampling techniques, radio tracking. Damage assessment and control. Basic principles for the management of animal populations.

4.7 Hunting. Freshwater and sea fishing.

4.8 The ecology of fire. Combustible materials in the natural world. Fire detection and prevention systems. The use of fire as a tool in habitat management.

4.9 Land conservation. Factors causing erosion. Appropriate techniques in the fight against erosion.

4.10 Landscaping: landscape analysis and evaluation. Techniques of landscape restoration.

4.11 The restoration of natural habitats. Ecological succession. Replanting vegetation. Reintroduction of animal species. Elimination of exotic species.

4.12 Restoration of animal populations. Principles, *in situ* measures and *ex situ* measures.

4.13 Solid waste management and the fight against pollution. Autonomous systems. Appropriate methods.

4.14 Ecological and environmental monitoring. Study and sampling techniques. Analysis and evaluation.

4.15 Monitoring and control. Wardens.

5. Public use

5.1 Visitor management. Planning techniques, visitor needs, types of visitors, filtering. Surveillance and control.

5.2 Environmental education: basic principles of environmental education. Programmes for the provision of environmental information.

5.3 Interpretation. Principles of interpretation. Interpretative planning and design.

5.4 Techniques and methods (museum exhibitions, audiovisual resources, self-guided paths, brochures, signposting, pictograms).

5.5 Guide-interpreters, environmental monitors and park wardens. Job profile and psychology.

5.6 Infrastructure and facilities for public use. Absorption capacity. Recreational areas. Camping areas.

5.7 Visitor safety. Accident prevention. Rescue groups. First aid workers. Medical facilities. Signposting.

6. Personal abilities and efficiency

6.1 Decision making; problem solving. Group work. Management techniques. Negotiation and conciliation.

6.2 Time management. Agendas. Division by areas of activity and tasks. Management through objectives. Setting priorities.

6.3 Organisation: functional and organic organisational structures.

6.4 Documentation: data management, documentary archives (libraries, picture).

6.5 Financial management (budgets, auditing).

6.6 Communications skills: oral expression (use of audiovisual media), written reports. Drawing up projects.

6.7 Public relations. Protocol. The media. Social survey techniques: public opinion surveys: "ad hoc" groups. Marketing techniques.

6.8 Programming and organisation of courses and events.

6.9 Use of computers. General principles. Available programmes: data bases, word-processing, spread sheets, graphics programmes.

6.10 The application of statistics to ecological studies. Principal methods and their limitations. Computer programmes available.

6.11 The use of cartography. Photointerpretation.

7. Regional information[5]

7.1 The region. Ecological units. Geology, climate, geomorphology and hydrology.

7.2 Principal habitats, classifications. Vegetation formations.

7.3 Flora and fauna in the region.

7.4 Cultural heritage. Folklore and traditional customs in the conservation areas.

7.5 Human geography.

7.6 Local political-administrative organisation. Pressure groups.

This section is optional and reflects the essentially local character of the course.

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APPENDIX C

ECBA PUBLICATIONS

Reports published in English

1. Biology curricula at universities (1977)
2. Biologists in European society (1979)
3. School biology for child and society (1981)
4. Health education and school biology (1984)
5. Biologists and the environment. The role of the professional in a changing world (1984)
6. Professional biologists in Europe. Position and perspectives in employment (1986)
7. Biology and modern industry (1989)
8. The competence of biologists for experiments on animals (1989)
9. The European Communities Biologists Association. Aims, Activities, Members (1992)

Reports translated into Spanish

2. Los bi61ogos en la sociedad europea (Catalan and Spanish)
3. Biologia escolar dirigida a los alumnos y a la sociedad (Catalan and Spanish)
4. Educaci6n sanitaria y Biologia escolar (1986 Spanish)
5. Los bi61ogos y el medio ambiente. Papel de los profesionales en un mundo que cambia (1985, Catalan and Spanish)
6. Bi61ogos profesionales en Europa. A: Posici6n y perspectivas de empleo. B: Informe sobre la situaci6n laboral y socio-profesional de los bi61ogos colegiados en Espana (1982-1985) (published 1985)
7. La Biologia y la industria moderna (1988)