

THE CHANGING RELATIONSHIP BETWEEN CITIES AND BIOSPHERE RESERVES

**A report prepared for the Urban Forum of the
United Kingdom Man and the Biosphere Committee
and derived from a workshop held in Manchester in 1994**

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The UK-MAB Urban Forum

Introduction

The roots of MAB lie in the International Biological Programme and the 'Biosphere Conference' organised by UNESCO in 1968. The main result of this was the development of an interdisciplinary research and training programme aimed at improving the relationship between people and their environment.

The MAB approach reconciles conservation with the rational use of natural resources and the maintenance of cultural values.

MAB originally started with 14 international project areas. This has now been concentrated to six: Coastal areas and islands, humid and sub humid tropics, arid and semi-arid zones, temperate and cold zones, urban systems and Biosphere Reserves.

The Urban Forum of the UK Man and Biosphere Committee was established in 1987 to act as a think tank to give fresh lustre to established concepts and identify new areas for research and review.

Key areas of work:

- Initiating and reviewing key areas of research, especially ecology, human ecology, and social sciences applied to urban areas.
- Generating new concepts and reviewing existing ones in the field of urban ecology in its widest sense, including, for example, social sciences, planning, urban design and the dynamics of human communities.
- Preparing and commenting on papers dealing with urban ecology issues.
- Assisting statutory agencies in assessing the needs of and for nature conservation in and around towns and cities.
- Encouraging, reviewing and appraising applications to use the MAB logo, including site visits, providing technical advice and awarding use of the MAB logo.
- Maintaining international links with other organisations such as the European Urban Ecology Network, the European Sustainable Towns and Cities Campaign and the INTECOL / UNESCO Working Group on Urban Ecology.
- Organising events such as workshops and conferences.

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Executive summary

Cities and natural areas have a range of relationships and interdependencies and many different demands are made by city people on these areas with ecological, social and economic consequences. Strategies and action plans are often devised for particular sectors, such as health, transport or education, without considering their individual or cumulative impacts on natural areas. One local authority may prepare plans for its area without necessarily communicating with adjacent administrations in respect of a river valley, for example, or a linear park common to both.

Levels of public consultation and participation in the management of natural areas vary, even within the same urban area. Often people are unsure of the status of a particular site, knowing its value only for their particular leisure activity but not understanding its ecological and conservation values. Many protected areas contain valuable historic sites and other aspects of the cultural heritage which merit attention when planning for ecological and wildlife values.

The Biosphere Reserves developed and internationally recognised under the UNESCO Man and the Biosphere Programme are natural units containing core ecosystem and landscape areas surrounded by buffer and transition zones with varying levels of human activity. Many of the existing Biosphere Reserves are close to cities and illustrate how both residents, local communities and urban dwellers can gain enjoyment and a livelihood from protected landscapes. They provide examples of sustainable management of rural areas. Yet cities, particularly in Europe, have to become more sustainable, including their energy consumption and recycling, as well as becoming more interesting places in which to live. Applying the Biosphere Reserve concept to cities could be a viable way of demonstrating environmental sustainability. Developing natural areas in cities, interlinking them with their hinterlands, and incorporating the concepts and practices of Biosphere Reserves will enhance both sustainability and biodiversity.

Flexibility and adaptability will be needed in applying the Biosphere Reserve concept to urban and peri-urban areas. The vision of a city and its adjacent natural areas as a single Biosphere Reserve with core areas of differing size, both on the periphery and within the city has much merit, particularly if it can provide an overall planning and management framework. Small areas of unused abandoned land of 50 ha or so could become core areas of a Biosphere Reserve if allowed to develop naturally. These would be part of a range of open natural spaces in cities, which should form corridors along rivers, canals or former railway routes linking city centres to the larger natural areas on the periphery. However, the vision needs to be broad. In Britain, new Biosphere Reserves could include parts of London and the lower Thames estuary whose grazing marshes are a rich natural habitat, or parts of Greater Manchester with its river valleys and links to the Peak District National Park and the West Pennine Moors, or Telford with its Green Network including the River Severn and the Ironbridge Gorge World Heritage Site.

In any proposition to add another land protection and management status, there has to be a clear statement of why that status is being sought and the gains to be obtained. For all the people involved, particularly the local people, there has to be some added value, be it in terms of enhanced economic activity, or improved quality of life, or personal enjoyment. Wide consultation should occur with particular emphasis on encouraging local development and elaboration of plans.

Projects that develop from the bottom upwards with the full involvement of the local communities have a greater chance of success and long-term viability. Projects that include education, both informal and formal, with commitment by volunteer and professional workers, are likely to develop enduring support and good management. A sense of possession and ownership in a project leads not only to local pride but to stronger local pressure on all levels of government.

1. Introduction

This report sets out to summarise the way urban activities and urban people affect Biosphere Reserves close to cities; to examine threats to Biosphere Reserves close to cities; to assess good practice and examples of successful action to maintain the integrity of Biosphere Reserves while encouraging the enjoyment of nature by urban people; and to put forward ideas about urban Biosphere Reserves which bring wildlife conservation and the benefits of access to natural spaces close to hearts of cities. The report begins by examining ideas of cities and their relationships to natural spaces and Biosphere Reserves and the need to have strategic plans for the management of those relationships. It then examines several case studies in Europe and elsewhere to establish the key issues facing the development and maintenance of Biosphere Reserves close to and impinging upon urban areas. These case studies include two examples from Britain which exemplify the development of nature reserves within cities and the possibility of using networks of nature reserves to develop truly urban Biosphere Reserves. Finally, some general principles on the management of such areas are set out, emphasising the problems of reconciling the interests of different stakeholders in natural areas in and around cities and suggesting that in strategic thinking about the future of cities provision for urban biosphere reserves will have an important role to play.

The report stems from a meeting sponsored by the UNESCO Man and Biosphere Programme and organised by the Urban Forum of the UK-MAB Committee at the University of Manchester in 1994. The contributions of individual participants who brought their practical experience as managers, planners and wildlife specialists to the meetings helped form the ideas expressed in this report. Their descriptions of individual situations have been incorporated into the general text.

2. Evolution of ideas on cities and biosphere reserves

2.1 Cities as ecosystems

Undoubtedly the greatest urban environmental pressures of the twenty-first century will be in the rapidly growing cities of low-latitude countries. Nevertheless, a perspective from the highly urbanised, old industrial countries of Europe is appropriate. In many European cities, land has undergone several urban uses with much former industrial land being converted to urban greenspace and being developed as a habitats for wildlife. The immense flows of people during weekend excursions and summer holiday migrations from cities into National Parks and other areas of spectacular and attractive countryside pose severe problems for ecological management of natural areas and for the preservation of the benefits of both wilderness and cultural heritage. The total area of land required to sustain an urban region (defined by William Rees (1992) as its "ecological footprint") is typically at least an order of magnitude greater than that contained within municipal boundaries of the associated built-up area. Part of that footprint falls on natural areas used for recreation and the "wilderness" experience. However, the metabolism of urban areas often extends that imprint into natural areas, including designated Biosphere Reserves, in more indirect ways through resource exploitation and pollution.

If ecology is the science which studies the relationships between organisms and their surroundings, the city is an ideal location for ecological investigation. The city is a greatly modified habitat for people, but one which provides an enormous diversity of ecological conditions for all living things (Rohde & Kendle 1994). In the past there has been a tendency to emphasise the difference between rural and urban conditions, rather than to recognise the enormous ecological diversity within cities, from the arid areas of paved city squares, to the cool,

moist conditions of cellars and the wooded conditions of abandoned land and ancient, overgrown cemeteries. In particular, the wealth of gardens and open space in most European cities has much greater botanical diversity than the majority of modern farmland subject to monoculture.

Urban ecologists have sometimes described the various greenspaces in the city in terms of biomes, such as "mown grass savanna", "peripheral wetland", and "arid steppe". However, it is more important to recognise that the variety of urban greenspaces creates potential habitats for a wide range of wildlife and that many under-managed spaces in cities are colonised by a wide range of plants, some of which are local and others exotic, but all of which add to the variety of urban life (Gilbert 1989; Kowarik 1990). In many old industrial cities in Europe, these adventitious greenspaces are being incorporated into new systems of linear parks, especially along river valleys. Such linear systems can provide green corridors from the heart of the city to the open countryside beyond the suburbs (Barker 1997).

Urban greenspaces have other important functions, such as modifying the urban heat island, reducing the concentrations of pollutants, providing opportunities for sport and recreation, giving city children a contact with nature, encouraging recreational gardening, acting as a source of food through allotment cultivation or forms of urban farming. Many green areas have dual functions, floodplains being used for recreation and wildlife habitat most of the time, but acting as flood storage areas during extreme river runoff events.

2.2 Biosphere Reserves

A Biosphere Reserve is an area of terrestrial and coastal/marine ecosystems which is internationally recognised within the framework of UNESCO's Programme on Man and the Biosphere Programme (MAB) as being of international importance in demonstrating three complementary functions: nature conservation; environmental education, research and monitoring; and sustainable development (UNESCO 1996). The aim is a world-wide network of Biosphere Reserves which will include:

- representative examples of natural biomes;
- unique communities or areas with unusual natural features of exceptional interest such as a population of a globally rare species;
- examples of harmonious landscapes resulting from traditional patterns of land-use
- examples of modified or degraded ecosystems capable of being restored to more natural conditions.

Biosphere Reserves play an increasingly important role in conservation and use of genetic resources of wild species (Halffter, 1985; Ingram, 1990). The size and type of biosphere reserves vary greatly from one country to another depending on national government approaches to the declaration of Biosphere Reserves. The United Kingdom has 13 Biosphere Reserves with a total area of 443 km². In the United States of America, the Everglades National Park alone forms a Biosphere Reserve of well over 1200 km².

2.3 Evolution of the concept

At the beginning of the MAB Programme, MAB Project 8 concerned the conservation of natural areas and of the genetic material that they contain. The rationale behind this theme was the need to counter the increasing loss of living species, the lack of knowledge of how to conserve them and the inadequacies of traditional approaches to nature protection. This project area was developed subsequently in 1974 by a Task Force which drew up a set of objectives and characteristics for special sites called "Biosphere Reserves" to identify them with the rest of the MAB Programme. Inherent in the original formulation of the Biosphere Reserve concept was the idea that Biosphere Reserves would serve as a locus, or logistic base, for national activities - which now include pilot projects and comparative studies - which contribute to the MAB Programme at both national and international levels. Also, there was the basic idea that the human factor in MAB should be present and benefit from Biosphere Reserves, particularly in that they generate the knowledge and skills required for rational, sustainable development.

Over the years, the international network of Biosphere Reserves has gradually become a key element of the MAB Programme in general (as of March 1995 there were 324 Biosphere Reserves in 82 countries). An international conference organised by UNESCO at Seville in 1995 developed the 'Seville Strategy' for the future development of Biosphere Reserves in the 21st century (UNESCO 1996). One of the first actions that new MAB National Committees are encouraged to do is to consider the establishment of a Biosphere Reserve to act as a focus for MAB work in the future.

2.4 Present practice

2.4.1 Value for nature conservation

Biosphere Reserves should help to strengthen the conservation of biological diversity, genetic resources and ecosystems. A Biosphere Reserve must contain at least one sample of an ecosystem that is typical of a biogeographic unit using criteria of diversity, naturalness and effectiveness as a conservation unit. The area concerned should be large enough to ensure the sustainability of viable populations of the component species of the ecosystem. Such ecosystems should normally be present in the core area (or core areas) and should be effectively protected so that they are minimally disturbed. Human activities in the core area are limited to those which will not adversely affect the continuing natural evolution and functioning of the ecosystem. There should be Biosphere Reserves in as many biogeographic regions and covering as many biological communities as possible in order that the global network of Biosphere Reserves can contribute to the conservation of terrestrial and coastal/marine biological diversity and provide models for sustainable and appropriate development. In terms of conservation, Biosphere Reserves alone are not intended to protect all of biological diversity but to complement other efforts.

2.4.2 Core area

Each Biosphere Reserve includes one or more core areas which are strictly protected according to well defined conservation objectives and consist of typical samples of natural or minimally disturbed ecosystems. Collectively these core areas should be large enough to be effective as *in situ* conservation units and, whenever possible, have value as benchmarks for measurements of long-term changes in the ecosystems they represent. The size and the shape of the core area(s) depend on the type of landscape or aquatic environment in which they are located and on the conservation objectives they are intended to meet. They can obviously be much larger in regions

of low human population density than in regions with heavier human pressure and less available land.

2.4.3 Buffer zone

The core areas are normally surrounded by a buffer zone which must be strictly delineated. Both the core area and the buffer zone must have a clearly established legal or administrative status (eg National Park) even when several administrative authorities are involved in its management. Only activities compatible with the protection of the core areas may take place. This includes research, environmental education and training, as well as tourism and recreation or other uses carried out in accordance with the management requirements. Besides its other functions, the buffer zone often serves to protect areas of land that could be used to meet future needs for experimental research.

2.4.4 Transition area

The core area(s) and the buffer zone are surrounded by a transition area which promotes several characteristic functions of the Biosphere Reserve, particularly its development function. It may include experimental research areas, traditional-use areas or rehabilitation areas. Usually, the transition area as a whole is not strictly delineated and corresponds more to biogeographic than to administrative limits. It normally extends the above-mentioned areas into a larger and open area where efforts are made to develop co-operative activities between researchers, managers and the local population, with a view to ensuring appropriate planning and sustainable resource development in the region while maintaining the greatest possible harmony with the purposes of the Biosphere Reserve. The management of the transition area is usually the responsibility of a variety of authorities and therefore requires appropriate co-ordination arrangements.

2.4.5 Cluster Biosphere Reserves

The cluster concept is a combination of a number of neighbouring, but separate, areas which collectively serve the various functions of Biosphere Reserves. The overall spatial distribution is comparable to that of a Biosphere Reserve made up of only one land unit. In many cases the different parcels of land making up a cluster Biosphere Reserve may be administered by different organisations. Co-ordinated, overall management of a cluster Biosphere Reserve requires close co-operation between the authorities involved and the local communities to achieve balanced, sustainable planning and oversight of the whole site.

2.5 Changes in philosophy

In the 1990s, particularly since the UNCED meeting at Rio de Janeiro in 1992, local government has given much greater attention to urban environmental issues, including the maintenance of greenspaces and natural areas in cities. In places ranging from inner city ecology parks and urban nature reserves to suburban and peri-urban country parks, a variety of contacts with nature and wild plants and animals may be derived and enjoyed. Some of these urban sites may be of significance for the preservation of biodiversity. Others may be closely related to parts of the cultural heritage, for example the open spaces of Hampstead Heath in north London contain the historic Kenwood House with its valuable art collection. The variety of habitats and the accessibility of such sites makes them of particular value to society. A new philosophy of the value of natural areas in cities is spreading and proposals that there should be an opportunity for

experience of a natural environment within walking distance of every child's home are gaining currency (Box & Harrison 1993). These trends suggest that the concept of Biosphere Reserves should be extended to enable parts of urban areas to form either local Biosphere Reserves or to be part of a cluster Biosphere Reserve. The establishment and strengthening of Biosphere Reserves where there are critical interactions between people and their environments (eg peri-urban areas) is provided for under Goal II of the 'Seville Strategy' for the future development of Biosphere Reserves (UNESCO 1996).

People have contrasting, even conflicting, recreational needs which impinge on their expectations of, and attitudes to, Biosphere Reserves. Those who wish to enjoy hiking in a wilderness require different conditions from those wanting to observe wildlife. Social needs for watershed protection may conflict with ideas of public access. Today in Europe and North America, virtually all Biosphere Reserve land has multiple uses. However, without adequate planning and management, the multiple uses can lead to degradation of the Biosphere Reserve. This is particularly the case for reserves and natural areas close to cities where recreational access to areas of outstanding beauty or wildlife interest leads to excessive visitor pressure and the kind of restoration work that has been necessary on the Pennine Way in Britain.

3. Existing Biosphere Reserves and cities

The urban areas of cities expand into adjacent mountains, encircle biologically diverse wetlands and envelop local woodlands and meadows. New roads running out of the city cut through natural areas, but also provide access to those country spaces for city dwellers wishing to enjoy the scenery, wildlife and open air. Elsewhere, patches of abandoned industrial land, quarries and gravel pits provide a variety of habitats ranging from heaths to wetlands. The special linear features provided by old gravel workings along the Lee Valley to the east of London and the Colne Valley to the west are particularly noteworthy, while the meanders of the Seine perform a similar function in Paris. In many urban areas the transition between built-up zone and natural areas is irregular with a zone of farming or modified landscape often forming a transition, such as the areas of sheep-grazing intervening between mining towns and the high mountains in many central European areas. All such elements can have their place in an Urban Biosphere Reserve System (Figure 2).

Fragmentation of natural spaces, temporary occupation of land on urban fringes and the need for key "honeypot" locations for informal recreation are some of the critical impacts which urban areas have on natural areas. However, there is also the question of the exploitation of these urban fringe and near-city zones for water resources or for traditional rural activities. The diverse urban and rural interests and demands create a complex set of existing and potential future stakeholders in natural areas close to cities. The stakeholders may be divided into:

- those with direct interests in using the natural area: farmers, foresters, hunters, walkers, recreational users, water catchment managers and wildlife conservationists;
- those with indirect involvement from water supply authorities to those concerned with the climatic role of greenspaces.

Pressures are not merely the direct land-use pressures, but can include the effects of other activities adjacent to, upwind of, or upvalley from a natural area. Two examples are used to illustrate this: the impacts of external pressures on the Everglades Biosphere Reserve in Florida

and the effects of land-use conflicts and industrial activities in relation to the Tatra Mountains Biosphere Reserve on the Poland-Slovak border.

3.1 The Everglades National Park and Biosphere Reserve

The ecological footprint of urban development on a Biosphere Reserve is well illustrated by the Everglades National Park and Biosphere Reserve in Florida. Originally the Everglades stretched for 100 km south of Lake Okeechobee through the core of southern Florida covering a drainage area of 11500 km² (Kushlan 1991). The basin occupied an elongated trough in the underlying limestone covered by peat varying in depths from 6 m in the north to a few cm in the south. The overall gradient of the wetland was only 0.3 % and the movement of water derived from a mean annual rainfall of 1300 mm through the swamps was slow. Surface water moved into the Everglades from higher ground to the west, including the Big Cypress Swamp. The Atlantic coastal ridge to the east, a narrow limestone and sand coastal barrier, did not act as a water source for the Everglades, rather the water moving from the west passed under the ridge and out to the ocean. Originally water flows were most rapid immediately south of Lake Okeechobee and close to the coast where the hydraulic gradient steepened (Kushlan 1991). Over much of the area, the peat substrate of the Everglades formed a barrier to infiltration, with as much as 90% of the water being lost by evapotranspiration. In the south, however, the surface waters were in direct contact with the Biscayne aquifer which took some of the water out beneath the coastal ridge to emerge in submarine freshwater springs offshore.

The ecological functioning of the Everglades is driven by the pattern of water movement, but human activity through agricultural food production and the demands of urban areas has greatly altered that hydrologic pattern. Four great water control gates and 2200 km of canals and levee banks now regulate the entry of water into the National Park area. The current water management system has prevented flooding during hurricanes, conserved water for the dry season, permitted the development of rich agricultural areas, stopped saltwater intrusion into the aquifer, and provided water for the expanding urban population. However, the regulation of water for flood control and urban consumption has now made the Everglades too wet in the wet season and too dry in the dry season. Every day some 900 people move to southern Florida and 39 million tourists come each year of which 12 million arrive in the dry season when water supplies are naturally low. The rate of population growth since 1970 (Figure 3.A) has created new demands to supply almost a million litres more freshwater every day (Figure 3.B). As the paved and roofed areas expand, infiltration to aquifers is reduced and even in this relatively well-watered state, residents on the west coast are using some desalinated water. The important freshwater habitats of the Everglades (Figure 3.C.) become drier and the historic water flows as slow, shallow groundwater movement to the southwest (Figure 4) has been drastically reduced, with a consequent fall in the period of inundation of these important wetlands (Figure 5). Spiker *et al.* (1995) have written in strong terms about the rate and consequences of ecological change in the Everglades:

"This ecosystem is changing rapidly and may be on the verge of collapse, as a result of nearby urbanization, agricultural activity, and nearly a century of water management. This crisis has led to heightened public concern and recent court rulings mandating restoration of the Everglades and Florida Bay".

Willows and malaleuca and other swamp trees have invaded into the now drier northern areas. The Australian malaleuca threatens to turn large parts of the areas suffering shorter inundation

seasons into a swamp forest. Sawgrass species, such as muhly grass now dominate large areas of higher marsh where they were once scarce. Conversely, water lily marshes have decreased in these areas (Kushlan 1991). Effects on animal populations have been drastic, with declines in populations of herons, ibises and storks, all highly dependent on dry season water sources, in the second half of the twentieth century. The well known wood stork has virtually ceased nesting in the Everglades, while the Cape Sable sparrow has increased from near extinction in the drier areas and the snail kite has increased due to the creation of specific deep water pools.

Agricultural runoff has increased levels of phosphorous and other substances in drainage canals and bordering wetlands, leading to large changes in plant communities (Davis 1994). Furthermore, high concentrations of mercury sometimes occur in mammals, fish and birds and may have contributed to the near extinction of the Florida panther (Roelke *et al* 1991). Mercury probably comes from fossil fuel combustion and urban emissions and may also be in some agricultural runoff (Delfino *et al* 1993).

The hydrological transformation of the Everglades Biosphere Reserve has been so great that the transition and buffer zone concepts have been applied indirectly in an effort to restore the subsurface water flows. In the 1980s, the Everglades National Park Protection and Expansion Act authorised the addition of 43,544 ha close to Miami to the Park's existing 566,552 ha, specifically to restore the natural flow of freshwater into the Shark River Slough and thereby help the wildlife. In the 1990s, a much bigger scheme to buy out irrigation farmers in order to reduce groundwater consumption has been initiated with the goal of reducing the seasonal drought in the Everglades. Such measures clearly demonstrate the importance of managing parks and biosphere reserves in their regional context and the value of seeing that transition zones are critical areas where there must be a gradation in land use. Speculative property development and natural resource exploitation right up to park boundaries is always likely to lead to the degradation of the park itself.

3.2 The Tatra Mountains National Park

Just as Miami and its suburbs impinges on the Everglades, so the city of Zakopane and the highly urbanised Podhale industrial region impinge on the Tatra Mountains National Park, introducing a complex set of land use management problems. The Tatra Mountains, the highest part of Carpathian Arch, were designated as an international Polish-Slovakian Biosphere Reserve in 1992. The Polish part of the mountains has been protected by the state law as a National Park since 1954. This designation promoted nature conservation but it also led to numerous conflicts with the local authorities and individual members of the local community. The Tatra Mountains National Park and Biosphere Reserve covers 200 km² of mountainous terrain rising to 2500 m above sea level, with an altitudinal range of over 1600 m. Mean annual temperature decreases with altitude from 8°C to -2°C. The vegetation shows a marked zonation: low and high mountain forests up to 1550 m, a dwarf pine zone to 1800 m, an alpine meadow zone to 2300 m, and a higher rocky peaks zone. Further variety stems from the geology, the Western Tatras being on limestones and the High Tatras on crystalline rocks. The vegetation has a high biodiversity, with numerous natural and semi-natural plant communities, especially at higher elevations and on steep, rocky slopes. The flora contains over 1000 species of vascular plants and more than 2000 non-vascular plants with endemic and rare mountain species, such as saxifrage, gentian, pasque-flower, edelweiss, aconite, and orchids.

The rich wildlife has many typical mountain species, such as the chamois, the symbol of the national park, or the groundhog. The Tatra Mountains contain many other animal species, once

common throughout the country, but now confined to the least accessible areas, including brown bear, wolf, wild cat, red deer, otter, golden eagle, wood grouse, wall-creeper, and dipper. The High Tatra landscape has been little changed through the ages and still presents a relatively wild appearance.

The Tatra Mountains National Park adjoins the Slovakian National Park and Biosphere Reserve along the international border with the urbanised area at the foot of the mountains to the north. The densely populated and highly urbanised Podhale region has two relatively large towns, Zakopane with about 30 000 residents is just across the boundary of the Biosphere Reserve, and the same sized Nowy Targ is 30 km away. The main city of this part of Poland is Krakow, 100 km from the Tatra mountains. The many villages in Podhale region bring the total population of the urban zone to over 100,000. The main agricultural economic activity in the Tatra Mountains is sheep breeding. However, tourism is a major regional activity, with thousands of hotels, pensions, guest houses and other facilities, including winter sports. During the 1980s, over 2 million tourists each year visited Zakopane and the Tatra mountains, the only high mountains in Poland.

The concept of the Biosphere Reserve in the Polish Tatra Mountains provides that one third of its area will be a core zone with very limited human influence, the next third will be a buffer zone, and the rest will be managed as a transition and cultural zone. This ideal zoning meets with both co-operation and conflicts from the local authorities. Protection of nature within the area means restrictions on commercial exploitation and economic uses of the land which ultimately lead to opposition to the whole idea of nature conservation from some quarters.

Private land owners in Zakopane, as well as the local authority, tend to build new houses, hotels, car parks and restaurants directly adjacent to the Biosphere Reserve boundary in the most attractive places which are convenient for visitors. The growth of the town shows how this gradual expansion towards the Biosphere Reserve, especially along minor valleys, presents a real danger of interrupting ecological corridors which could result in the breaking-up of the Biosphere Reserve into a series of island refuges.

Another conflict is connected with the permanent pressure of sport and recreation on the Biosphere Reserve area. The Tatra Mountains offer a wide range of tourist and sport facilities both inside and on its borders (including 250 km of marked footpaths, mountain shelters, skiing areas, resting places, mountain bike trails and car parks). Strong pressure is permanently exerted on the national park authority to permit the construction of many new cable car, chair lift and ski trail facilities in the central part of the buffer zone. There are even proposals to remove some areas from the designated Biosphere Reserve for more intensive commercial use.

Good co-operation between the Tatra Mountains National Park and the local authorities is illustrated by the fight against air pollution, the most serious environmental threat to both the National Park and the town of Zakopane. The high pollutant levels have caused visible degradation of forests both within and outside the Tatra Mountains to the disadvantage of both residents and visitors. The atmospheric pollutants are derived from both the industrial regions west and south west of the Tatra Mountains, and from local town chimneys and car traffic. The majority of the pollution is from local coal-fired domestic and institutional heating. The National Park and the town authorities work together to encourage the use of cleaner electricity from natural gas, wind power and geothermal sources. The moderately successful progress is constrained by the lack of sufficient financial support.

Another example of successful co-operation between the National Park and the local communities is over the problem of sheep grazing in the Tatras. Sheep grazing has been the common traditional life style of the local people from the Middle Ages onwards. The traditional, local culture of the Podhale region, unlike elsewhere in Poland, is still alive and very strong. On the other hand, the scale of sheep grazing has exceeded the natural carrying capacity of the mountains several times in the past. Serious damage was done to the forests and erosion of steep slopes occurred in the high mountain meadows. Accordingly, the state law from the 1960s, reaffirmed in 1981, completely forbade sheep grazing within the National Park. As a result of strong opposition, it was recognised as an important cultural activity which could be allowed to a very limited extent in specific, individually negotiated areas.

In general, both in the Tatra Mountains National Park and Biosphere Reserve and in most other protected areas in Poland, there are more conflicts than examples of fruitful co-operation with urban areas. This arises from the attitude which puts lifestyle gains first and environmental matters last: "economy first - ecology later". Such a philosophy needs changing through ecological education, public discussion of ecological problems, and popular publications.

The Biosphere Reserve concept has been highly useful in helping to develop better co-operation between nature conservation and the local communities. The transition zone of the Biosphere Reserve permits a measure of economic activity as part of the interrelationship between people and nature, so allowing such traditions as sheep grazing to continue while protecting the buffer and core zones of the Biosphere Reserve. This helps to demonstrate to society in general, and to planners and administrators in particular, that there can be an harmonious coexistence between nature and society.

The future of the Tatra Mountains National Park and Biosphere Reserve is seen as involving a more careful and persuasive application of the Biosphere Reserve concept. The National Park is regulated by a wide range of state laws protecting nature and zoning it into the core zone, buffer zone and transition zone of the Biosphere Reserve concept. However, the town has a totally separate development plan which envisages urban expansion closer to the boundary of the National Park. Thus the National Park's plan to organise a buffer zone by its borders and the town's plan to extend the urbanised area closer to the Park come into direct spatial conflict. To overcome this, both the Biosphere Reserve and the town should be recognised as one unit with a single basic land-use zoning rule (Figure 6). The two priorities are: a) nature conservation which is highest in the core zone of the Biosphere Reserve and gradually decreasing towards the centre of the town, and b) the quality of urban life which is low in the Biosphere Reserve but steadily increases toward the town centre. The two priorities meet in a zone lying close to the Biosphere Reserve (but not on its boundary) which should be planned to cater for such activities as recreation, sport, extensive agriculture and cultural traditions. Adequate facilities for these kinds of land-use should be located in this zone, provided they are compatible with the conservation of nature as nature itself is an important element in this zone.

Moving towards the town centre, the next zone is one with a higher priority for human needs and should be planned as an attractive low-rise residential area where people would like to live. Housing would be dispersed in the natural habitat which should be modified to meet the needs of residents with decorative trees and shrubs, small gardens, and lawns. Nature would still be present in this zone, but the priority would be residential comfort.

The town centre has to be a zone where human needs are dominant and nature is a background element. This zone has to be organised for shopping and office provision with shops, offices,

hotels, restaurants, and car parks. Green areas should be provided in the form of parks, children's playgrounds, street trees and shrubs.

The proposed town zonation would extend the Biosphere Reserve zonation and would be a model applicable to cases where protected and urbanised areas directly adjoin each other. The Biosphere Reserve has already been zoned, but the zoning now needs to be extended into the town of Zakopane town. Such zoning would help to resolve the conflicts over the location of new hotels and the balance between traditional grazing uses and the protection of nature through close collaboration between park authorities, local authorities, farmers and the tourist industry.

3.3 Summary

The Tatras and the Everglades both show that close proximity of urban areas to Biosphere Reserves or areas of high nature conservation value brings the contrast between natural and urban ecosystems into a sharp focus. Urban expansion and associated agricultural, recreation and real estate activity will spread closer and closer to any designated reserve or park boundary unless there is a concept of the transition zone in regional planning policy. The benefits of a transition between natural areas and built-over vegetationless areas need to be more clearly recognised. In reality, most of the suburban areas of cities contain considerable green areas and a variety of wildlife, while the peri-urban countryside contains many semi-urban activities, semi-industrialised food production and recreational areas such as golf courses and equestrian centres. In these transition zones, water use, applications of agricultural chemicals and emissions of gases to the atmosphere have no special controls and their effects directly impinge on the adjacent reserve or park. Thus, recognition of the different interests of the stakeholders in these areas is important and the conflicting interests and demands, for example between urban food supplies and enjoyment of the park by urban residents, need to be balanced and reconciled in careful management and planning of the transition zone.

4. Potential Biosphere Reserves at the edges of cities

Many cities have maintained areas of natural vegetation close to their boundaries for the enjoyment of the urban population. In Britain, municipal concerns are illustrated by the Corporation of the City of London's ownership of Epping Forest and Burnham Beeches. More striking examples of state involvement in protecting nature close to the city are the Kuring-gai Chase National Park to the north and the Royal National Park to the south of Sydney, New South Wales, designated more than 100 years ago. Today, greatly expanded cities like Sydney come right to the boundaries of such areas and natural resource and biodiversity depletion become major threats, while risks, particularly of fire, increase. Two contrasting case-studies from Spain will be examined, one involving the protected areas on the hills around Barcelona and the other being La Huerta of Valencia.

4.1 Barcelona

Barcelona is surrounded by much steeply sloping land unsuitable for urban development. Immediately inland of the city centre is the Collserola massif, while further afield a series of natural parks form a ring around the city from Garraf in the west, Sant Llorenç del Munt i l'Obac to the north, Montseny to the northeast and Montnegre el Corredor to the east (Figure.7). The planning of land use in these areas of high natural landscape value is split between different agencies - forestry, minerals and roads - yet already urbanisation is spreading in finger-like fashion up the valleys into the hills, gradually dissecting the zone of natural vegetation. There is no overall plan, nor even a comprehensive waste management strategy, for the Barcelona urban area and its hilly periphery.

The growth of the metropolitan population of Barcelona, from 2.4 million in 1960 to 4.2 million in 1990, means that 70% of the Catalan population are now living in the major built-up area. Studies of leisure interests show that while 58% enjoy watching videos, 52 % participate in walking, 17% go on excursions, 6% visit second residences and 2% visit the countryside or beach. The great involvement in walking and second homes impinges directly on the national parks in the steep lands around Barcelona. The link between protected natural areas and the city is direct in that 70% of the second homes of Barcelona people are in the national parks and most of the weekend excursions and walks by city people take place there. There is a great need to achieve a balance in the usage of the natural areas around Barcelona: a balance between urban culture, the enjoyment of nature, and the protection of biodiversity.

The Collserola is now an island of semi-natural vegetation surrounded by the built-up suburbs of Barcelona. It has been under constant pressure from urban expansion and some 730 ha are still classed as agricultural land. Ecologically the massif is important, because although dominated by Mediterranean species, the deep, steep-sided valleys contain animal and plant species typical of central Europe, while some of the sea-facing slopes carry purely African grasses (Jordà 1985). Now under the control of the municipal authorities, priorities in the management of Collserola have included fire prevention and security; maintenance and cleansing ; establishment of special protection zones of areas containing the greatest ecological interest; strict control on development on private estates within the area; and encouragement of walking and related recreational uses of the area. This city-ringed natural area is administered and planned separately from the surrounding natural parks which themselves are under considerable pressure from urban recreational uses.

Here the impact of the city on protected natural areas is direct. There is a great need to achieve a balance in the usage of the natural areas around Barcelona. To do so must include developing links between the separate parks and endeavouring to have a link between the Collserola and the more distant parks. Barcelona thus demonstrates how natural areas within cities have to be brought together with national parks outside the city to achieve a balance between urban culture and the enjoyment of nature while protecting biodiversity. The uplands around Barcelona complement the historic city, jointly providing a case for planning an integrated urban biosphere reserve which might contain core areas from the existing national parks, the urban historic core and some coastal and marine areas.

4.2 La Huerta of Valencia

The city of Valencia lies on the Mediterranean coast of Spain in the coastal alluvial plain of the river Turia. To the south there is a sand dune barrier ridge separating the lake of Albufera (2,400 ha), part of the Valencia municipal area, from the sea. The 13,600 ha Valencia municipal area has 760,000 inhabitants and also contains 2,100 ha of La Huerta.

Valencia is the capital of a 64,000 ha metropolitan area called L'Horta, with 1,300,000 inhabitants and 44 municipalities. Much of the agricultural land of L'Horta is devoted to irrigated citrus crops (Figure 8) and rice fields, the produce of which plays a major role in the local economy. The horticulture which occupies 7,600 ha of L'Horta is the essential activity of La Huerta, where the ancient relationship between human activity, agriculture and water, initiated by the Romans, and perfected by the Arabs, remains virtually unchanged and high quality soils support high-yielding intensive vegetable production. The typically Mediterranean climate, with hot and dry summers, high level of evaporation, and moderate rain (400 mm a year) concentrated in autumn means that underground reservoirs and regulated surface waters have to be managed for the benefit of the community by institutions like the Tribunal de las Aguas (Water Court) which has been doing so for more than 1000 years. The characteristic buildings of La Huerta are part of an important architectural heritage, particularly the barraca (modest housing of the horticulturist), the alqueria (bourgeois housing), and the mill (industrial installations powered by the water flowing along irrigation ditches).

L'Horta has severe problems, caused by the spread of urbanisation, demands of production and trade competition, reduction of income levels and the ageing of the working population. The urban pressure is evident through soil and water pollution, as well as speculative real estate operations. Land use changes over the last 20 years, as a result of manufacturing and service industry growth, have reduced the area of dry crops, while the citrus area has expanded transforming part of the irrigated lands of the plain, including some of La Huerta. The area of La Huerta and of rice land has decreased. Tourist developments line the coast while second homes begin to crowd the hills overlooking the coastal plain.

Nearly all the population lives in urban centres with only 3-5 % in dispersed rural settlements among the fields. However, the edge of the built-up area is steadily advancing into the peri-urban rural area (Figure 9), altering land values and intensifying the occupation of the soil, changing the agricultural workers into new types of workers and employees. Such a sequence of land use changes is similar to that of other Mediterranean irrigated coastal wetlands, for example the Rhone delta, Languedoc, parts of Provence, and the lower Po Valley.

The future use of La Huerta may be considered as a challenge for the Biosphere Reserve concept in a peri-urban environment. The Valencia Master Plan was approved in 1989 and in 1992 it was agreed that the city would produce the first Green Plan to be prepared in Spain. This Green Plan reflects the growing concern of European Governments and local authorities for the protection and improvement of the urban environment. The Valencia Green Plan tries to minimise such risks as the expansion of commercial and urban residential activities into peri-urban spaces, particularly those of L'Horta, a zone of high agricultural, landscape and cultural quality immediately adjacent to the present city. A key point in the Green Plan of Valencia is the protection of La Huerta.

The huerta crops are distributed in a zonal pattern in and around the city Valencia, including the surrounding municipalities. These fields contain considerable biodiversity and much interesting wildlife. To maintain the biological and cultural heritage of La Huerta, the threefold zoning system of the Biosphere Reserve concept can be applied. The zones of greatest concentration of huerta lands, to the north and south should be the core area, as in the definition of a Biosphere Reserve, each being of 600-700 ha. In these areas, the management goal should be the conservation of the huerta ecosystem, with the aim of achieving a sustainable productive agricultural system compatible with the adjacent urban lifestyle. In Biosphere Reserve terms, the buffer and transition zones extend both into the built-up area and outwards into areas of citrus and rice cultivation.

Over the metropolitan area as a whole, the environmental tensions created by land use changes to industry, tourism or housing are apparent.. The axes of communication and the spatial land-use differentiation are key elements for the future planning and functioning of the metropolitan area. The Green Plan is an initiative by the local authorities within the city of Valencia and has the protection of La Huerta as a key component. Consultation with the public about such issues as agricultural production and future land use has already taken place and must continue as a major contribution to the work of the urban planning agencies. Environmental education is an important activity, essential for raising public awareness, as is the increasing involvement of scientifically trained people.

Excellent contributions at an International Seminar on La Huerta of Valencia held in April 1993 provided many varied suggestions for action, which are now being followed up by the managers of the city. One of them led to the elaboration of a Chart of Valencia in 1994-95, creating a document related to urban fringe problems common to other ecological zones similar to La Huerta. Nevertheless, such environmental planning needs to be set in the framework of the overall planning of the whole metropolitan area because of the interdependencies of the entire area. The Green Plan needs to be converted into a Metropolitan Green Plan, which would enhance the protection of La Huerta with wider commercial co-operation. An excellent case can be made for the landscape of La Huerta de Valencia to be declared a Biosphere Reserve, due to its high cultural quality, the influence of human history and society, and the interactions with a city of medium size.

5. Potential biosphere reserves within cities

Central Park in New York (which covers some 340 ha) and the Bois de Boulogne in Paris (850 ha) represent extensive areas of semi-natural vegetation which form extremely important recreational and ecological places within major cities. Central Park has a totally protected bird sanctuary at its southern end and a major area of managed woodland in its northern sector. The Bois de Boulogne is far more diverse in its land uses and more dissected by roads, but nevertheless has some value for wildlife and helps to reduce the urban heat island effect locally. These two well-known greenspaces raise the issue of the potential role of woodland or areas of natural vegetation within cities as Biosphere Reserves where landscapes of ecological and cultural heritage of value can play a significant role. To test this potential role, two examples from Britain are examined: Saltwells Nature Reserve in Dudley and the Green Network of Telford New Town which incorporates the Ironbridge Gorge World Heritage Site.

5.1 Saltwells Nature Reserve

Saltwells Nature Reserve is situated in the Metropolitan Borough of Dudley, in the west of the West Midlands industrial conurbation. Owned by the local authority, the site is designated a statutory Local Nature Reserve (LNR) and is one of the top 10% LNRs in Britain in terms of size. Part of the reserve (Doulton's Claypit) is designated as a nationally important Site of Special Scientific Interest for its geological exposures of Carboniferous coal and clays.

Saltwells Nature Reserve covers some 100 ha and comprises woodland, a disused claypit, previously derelict or industrial land, and open space (Netherton Hill) dominated by grassland and gorse scrub (Figure 11). Most of the land was previously owned by the Earls of Dudley and was worked by them for minerals such as coal and clay, and as a source of brine - hence the name "Saltwells". This means that much of the land in and around the Nature Reserve has been disturbed over the last 200 years. The woodland mainly dates from about 1795, although before that the area was part of the Pensnett Chase which included a great deal of heathland. It comprises mixed deciduous trees with a well developed understorey and ground layer; in recent years, 55,000 more trees have been planted. The claypit was excavated from the 1870s to the 1940s. A rich flora of scrub and emerging woodland has developed within the claypit and the base of the pit, after some infilling, has gained an interesting flora which includes marsh orchids. Although bodies of water are relatively scarce in the Nature Reserve, those which do exist support a rich fauna including amphibians (newts, frogs and toads), grass snakes, and dragonflies. The Nature Reserve occupies a prominent position in the local landscape, especially Saltwells Wood and Netherton Hill. The latter is a landmark visible for some miles around. The Nature Reserve is surrounded by urban development, including Merry Hill which is one of Europe's largest shopping centres, dense housing, industry, and a reservoir. Thousands of people live and work within easy reach of the site.

The many visitors to the Nature Reserve include local people and others seeking rest and recreation, school and university students pursuing educational projects. There are close links with the University of Wolverhampton. Many organised groups and families visit, some of them becoming volunteers and helping with site management tasks. There is a single-storey centre containing a classroom with a capacity of 60 people, display area, visitor information and offices, a small laboratory and a library.

The Nature Reserve has to withstand a lot of pressure from visitors. It is essential that it is seen to be well-managed, with much attention paid to boundaries, internal fences, grassland management and paths. Litter, dumping, unauthorised grazing, and vandalism are being actively tackled. Interpretation and guidance is provided for visitors to lessen the adverse impact that they might otherwise cause. The Nature Reserve has a comprehensive management plan which has guided the work on site for some years. This calls for natural and semi-natural habitats to be conserved and improved. Educational programmes continue to be developed according to the needs of students and the frequently changing demands of the education system.

The Nature Reserve has five full time staff: a senior warden employed by the local education service, and a warden and three assistant wardens employed by the local leisure services department. The work originally started under the auspices of a project for the regeneration of the Blackbrook Valley (Smyth 1990) and the Project team consists of representatives of various departments from the local authority (Dudley MBC) and English Nature, the Government's nature conservation agency. Outside agencies who are consulted or involved include the Black Country

Urban Forestry Unit, British Trust for Conservation Volunteers, Black Country Geological Society, University of Wolverhampton, West Midlands Police, and various local and national conservation bodies.

Saltwells Nature Reserve thus combines important nature conservation functions with urban recreation. It retains elements of the cultural heritage, but is carefully managed to maintain significant wildlife habitats. The threefold zoning scheme of Biosphere Reserves is not directly applicable, but multiple small cores of highly protected habitat exist within the areas of easy access to the public. Nature Reserves like Saltwells have a much higher focus on urban wildlife conservation than the larger open spaces such as Central Park and the Bois de Boulogne.

5.2 Telford Green Network and the Ironbridge Gorge World Heritage Site

Telford New Town is some 50 km to the west of Birmingham in the West Midlands region of England. It is a new town comprising a number of existing villages which, from the early 1960s onwards, have been extended and linked by major new housing, industrial and commercial areas. Telford was planned to create a new environment away from the conurbation of Birmingham. It has been a success and lessons can be learned about the planning and construction of new settlements world-wide.

The characteristic landscape of Telford has been formed by a unique integration of naturally regenerated industrial areas with high-quality mass planting involving around 6 million trees and 10 million shrubs (Telford Development Corporation 1986). This unusual combination of natural regeneration and landscape planting has resulted in a rich and complex post-industrial landscape. The dominant place of landscaping has given the town a particularly green appearance and firmly established the original design concept of "The Forest City".

Much of the open space of Telford has been incorporated into a Green Network (Figure 12) which forms a high-quality landscape with recreational, aesthetic and nature conservation functions. Sites with nature conservation value lie within this network rather like plums in a pudding. The network links with the surrounding countryside of the Wrekin and Ercall hills to the west and to Wenlock Edge to the south-west, and to the River Severn to the south.

A Biosphere Reserve could be formed from such a network of open space. This would demonstrate some of the processes and mechanisms required if environmentally sustainable development is to deliver the provision and management of multi-functional open space in urban areas in combination with built development. Such an integration of conservation and development is one of the key functions of a Biosphere Reserve.

The Green Network covers some 2300 ha and includes all the open areas of the town which are of ecological, aesthetic and recreational value. The Green Network is important for both formal and informal recreation and for nature conservation and educational purposes. Some 2000 ha of the Green Network is in public ownership, but there are also open areas in private ownership which make a valuable contribution to nature conservation and the open character of the town, for example golf courses, paddocks and fields. More than 45 miles of strategic and local footpaths make these areas accessible to the residents. Each individual piece of land in the Green Network is not only important to local residents but is equally important in the contribution it makes to the overall aims of the Green Network. Significantly, the network includes the key to sustaining the attractiveness of Telford for residents, for visitors and for investors.

The wildlife habitats include scrub and deciduous woodland, limestone grassland and species-rich meadow, heathland, marsh and fen, open and running water (Wassell 1981). The diversity is a direct result of the industrial history of Telford which has been subject to mining for coal, ironstone, clay and limestone over hundreds of years (Sinker *et al.* 1985; Cossons & Box 1988). The last two centuries have seen these operations carried out on a scale sufficient to leave permanent reminders on the landscape. The pit mounds (spoil heaps) are well-loved and characteristic landscape features. They support a complex series of habitats which are the result of interactions between the chemistry of the various spoil materials and the age of the pit mounds.

There is a hierarchy of nature conservation designations within and adjacent to the town. Benthall Edge Wood (to the south), Lincoln Hill, Lydebrook Dingle (to the west), Muxton Marsh and Hadley Brickpit are nationally important sites which have been given the statutory designation of Site of Special Scientific Interest (SSSI) by English Nature, the national nature conservation agency. There are two statutory Local Nature Reserves, designated by Wrekin District Council: one covering much of the Town Park and the other at Granville, which is in the north of the town and forms part of a larger Country Park. There is a small part of the Shropshire Hills Area of Outstanding Natural Beauty (a national landscape designation) lying within Telford. This landscape designation forms the link between the Green Network and the hills of the Wrekin and the Ercall and the limestone scarp of Wenlock Edge, all of which are designated as SSSIs because of their national nature conservation value.

There are 20 Prime Sites for Nature Conservation which are identified by the Shropshire Wildlife Trust as being of county importance and are recorded in the Environmental Record produced by Shropshire County Council. Additionally, there are 30 Sites of Ecological Value (a third tier of designation) which are locally important sites identified by the local group of the Shropshire Wildlife Trust and recognised by Wrekin District Council. The sites themselves are in a mixture of public and private ownership.

The present population of Telford is over 119,000 and the population in 2001 is expected to be around 140,000. The open spaces and recreational areas within the Green Network are subject to a wide range of informal and formal activities.

The Ironbridge Gorge forms the southern end of the town with settlements on both banks of the River Severn. Much of this area has been designated as a World Heritage Site by UNESCO because of the significance of the buildings associated with the start of the Industrial Revolution. There is a matrix of buildings, ancient monuments and open spaces, centred around the first iron bridge in the world, and the whole of the area is a major tourist attraction. The River Severn forms a rich wildlife corridor, particularly to the south-east towards the town of Bridgnorth.

The Telford Local Plan is a statutory plan covering the period 1991-2001 which was formally adopted by Wrekin Council in 1993. The Green Network is defined in the Proposals Map which is part of the Local Plan. Wrekin District Council is obliged through the Local Plan to protect the Green Network and built development will not normally be permitted within the Green Network. However, the Local Plan recognises the need for a framework of sustainable development in the Green Network. In exceptional circumstances, development may be acceptable, but only where this would complement the aims of the Green Network and be offset by the provision of environmental and community benefits. The various aims of the Green Network will be implemented through the policies set out in the Local Plan. Specific policies are included for the key sites of nature conservation importance and the corridors and links between them.

The key issues in the management of the Green Network are the maintenance and enhancement of its recreational, aesthetic and nature conservation functions. The interweaving of open space and natural features with the urban fabric sets up new management issues. Sustainability requires extensive planning and careful use of finite land and its features. Natural succession, eutrophication and pollution, and public pressure need to be managed with the overall aims of the Green Network in mind.

Telford is recognised as a regional growth point. There will be an ongoing problem of demand for land for built development. Increased density or urban population and land use is a likely result of existing policies to protect the countryside and prevent urban sprawl. There are a number of key partners involved in the processes of planning and management associated with the Green Network: Wrekin District Council, Shropshire County Council, English Nature, the Countryside Commission, the National Rivers Authority, and the Shropshire Wildlife Trust. As a model for a Biosphere Reserve, it illustrates both the principle of using clusters of natural spaces and of incorporating the cultural heritage with sites of importance for wildlife into recognised protected areas.

6. Reconciling the benefits and problems of designating urban Biosphere Reserves

Designating nature reserves in areas close to large centres of human population and activity requires the balancing of the outcomes of ecologically sound scientific planning with cultural, social and community pressures in order to preserve all aspects of urban nature and the historical heritage. Campaigns to save specific trees in inner cities exemplify the community passion which diverts attention from wider strategic planning. In 1998 in Manchester the residents of the regenerated inner city residential zone of Hulme had a "save the Birley tree campaign" to try to prevent the removal of an isolated battered willow. Their enthusiasm for nature did not stop them from building a campaigners' tree house to deter any would-be chain-saw operator. Such idealism and passion has to be brought closer to the scientific understanding of nature reserve planning and management. The urban context not only highlights this need, but provides the greatest challenges for conservation science. It is comparatively easy to manage a reserve on a remote offshore island or relatively inaccessible high moorland. Now, however, nature conservation has extended from preservation in nature reserves and habitat protection to include the enjoyment of the experience of being close to wildlife and nature. This implies conservation in and around the places where people live and thus the achievement of balance between purposeful conservation on sound ecological principles and the needs of culture and society.

Urban areas contain a huge variety of natural greenspaces of varying degrees of nature conservation and recreational value. There are many small sites awaiting redevelopment which have been colonised by spontaneous assemblages of plants and animals. Such sites are temporary parts of the urban green network. Other larger areas may be the legacy of earlier human endeavour, such as Central Park was deliberately created even to the extent of moving large masses of rock, or may be tracts of "encapsulated countryside". Other forms of preserved rural land use now occur in the designated green belt areas around British cities, for example the rural fringes of Greater London in Hertfordshire between the continuous built-up area and the commuter nodes of the "new towns" of Hemel Hempstead, Welwyn Garden City and Stevenage. Many of these pockets of land may be envisaged as ribbons or belts, for example along river valleys, and therefore are accessible to all the residents on either side of the linear greenspace

zone. All these diverse areas will be used, enjoyed and valued by urban residents and will also help to modify the physical and biological effects of buildings and urban paved areas.

As the habitat of most people, cities have to become less demanding on distant ecosystems by reducing their ecological footprints and providing more of their people's needs from within their own boundaries. Moves to provide more diverse, more accessible recreation and environmental educational opportunities in cities reduce the need to travel to distant areas and increase sensitivity to environmental management and resource management within the city. Local Agenda 21 strategies pay great attention to nature conservation and urban greenspace management. Sustainability indicators include assessments of occurrence of wildlife and changes in species biodiversity in urban areas.

Nevertheless potentials for conflict and contradictory sustainability goals remain. Fear of air pollution leads many to prefer landfill of waste to incineration, thus leading to the continuing pressures on urban fringe areas for waste disposal sites and all the disturbance to wildlife movements associated with them. Any successful urban biosphere reserve planning will have to tackle comprehensive urban ecological and environmental education to overcome the single issue views of a large part of the community.

Presence of nature in the city has always enhanced the liveability of the city, from the gardens of the Alhambra at Granada to the naturalistic plantings that decorate new business parks on the fringes of modern European cities. Creation and careful management of wild flower meadows, ponds, and urban woodland add to the resource base of cities. Management of the historic heritage is often closely associated with the management of urban wildlife. Many historic sites, such as old industrial sites from water mills, to canals and forges are now in a semi-natural setting, with spontaneous vegetation and animal life occupying the old yards and dumping grounds adjacent to them. Changing views on the management of traditional municipal parks can lead to elements of both cultural heritage, such as stately mansions, and nature conservation, such as woodland nature reserves, being part of a single park. The setting of heritage sites within urban natural greenspaces provides an obvious application of the Biosphere Reserve concept.

As rural areas become more ecologically simplified through the impact of commercial agriculture, patches of natural land in urban areas gain an increasing biodiversity value. The presence of both native and introduced species on urban wasteland and the extreme diversity of parent materials on urban sites are good for biodiversity. Such values can be added to landscape, cultural and social values through a sequence of management strategies and techniques which leave some areas of extremely high biodiversity value nearly totally protected and permit differing intensities of public access and use in other areas. Such strategies involve the concepts of Biosphere Reserve core areas, buffer and transition zones. These designations can be applied to quite small parcels of land in the urban context provided those small components are linked together in some form of corridor or green belt to form a greater whole. Often these small city core areas will be linked by a green corridor to larger core areas beyond the city. Designation and strategic management go hand-in-hand in raising opportunities, enhancing urban wildlife and advancing the environmental education needed to ensure sustainable use of resources in the future.

7. New urban-related Biosphere Reserves

Flexibility and adaptability are needed in applying the Biosphere Reserve concept to urban areas. The vision of a city and its adjacent natural areas as a single Biosphere Reserve with core areas of differing size, both on the periphery and within the city has much merit, particularly if it can

provide an overall planning and management framework. Small areas of unused abandoned land of 50 ha or so could become biosphere core areas if allowed to develop naturally. These would be part of a range of open natural spaces in cities, which, where possible, could form corridors along rivers, canals or former railway routes linking city centres to the larger natural areas on the periphery. However, the vision needs to be broad. In Britain, new Biosphere Reserves could include parts of London and the lower Thames estuary (whose grazing marshes are a rich natural habitat); the important wetland, dune and sandstone areas around Liverpool and the Mersey estuary; parts of Manchester with its river valleys forming links with the Peak District National Park; or Telford New Town with the Ironbridge Gorge World Heritage Site. In Spain, in addition to the national parks which abut on to Barcelona and wetlands like the Donana close to Seville, the cultural landscape of La Huerta de Valencia offers a special opportunity for an exciting Biosphere Reserve embodying traditional agricultural practices which maintain a sustainable landscape. There are already important Biosphere Reserves close to Berlin which are closely integrated with the patterns of urban life. Considerable areas of forest remain around Brussels which offer the potential to develop an urban Biosphere Reserve.

In any proposition to add another land protection and management status, there has to be a clear statement of why that status is being sought and the gains to be had from it. For all the people involved, particularly the local people, there has to be some added value, be it in terms of enhanced economic activity or improved quality of life or personal enjoyment. Wide consultation should occur with particular emphasis on encouraging local development and elaboration of plans. Projects that develop from the communities involved, from the bottom upwards, have a greater chance of success and long term viability. Projects that include education, both informal and formal, at all levels, with commitment by volunteer and professional workers, are likely to develop enduring support and good management. A sense of possession and ownership in a project leads not only to local pride but to stronger local pressure on all levels of government to support and maintain provision of natural areas in and around cities.

One of the major outcomes of this approach to urban Biosphere Reserves is a contribution to more sustainable urban development. It suggests that the expertise in managing natural areas in and around European cities - from government agencies to local agencies such as the London Ecology Unit, academic bodies such as the European Academy for the Urban Environment, and a whole host of natural history societies and environmental NGOs - should be used to define core, buffer and transition zones in urban greenspaces as a step towards the spatial and functional differentiation of the environment within cities. Local Agenda 21 and sustainable, healthy cities require both careful land use management and provision of opportunities for the development of the individual that do not rely on energy consuming transport and artificial electronic amusements. The idea that recreation in natural areas can be close to home and should not require the great weekend migrations that cause such summer traffic problems in London and Paris can be fostered through urban biosphere reserves. Already people living close to natural areas in cities make good use of managed river valleys and similar natural areas. Even though the majority of such visitors in areas like the Mersey Valley in Manchester use cars, their journeys are seldom more than 5 km and do not lead to traffic congestion. Urban ecologists have recommended the provision of some kind of natural area within walking distance of every home (Box & Harrison 1993). The Telford Green Network illustrates how that may be achieved.

Much of the debate about green spaces in cities is now over the quality of that space. Formal parks and sports and recreation grounds are on the decline. Although the majority of suburban areas in European cities appear green from the air, most of that greenness is from trees in streets and private gardens. Much temporarily unused land colonised by natural vegetation and many

former private sports grounds are seen as potential development sites. The process of urban regeneration and inner city redevelopment throughout Europe is causing the loss of many such habitats and their associated biodiversity. An urban Biosphere Reserve strategy would evaluate such sites and see that nature not only has a place in the city, but that biodiversity, environmental education and human contact with other species are maintained and developed as key elements in the lives of city people (Millward & Mostyn 1989; Rohde & Kendle 1994).

8. Conclusions and synthesis

The value of the new ideas on urban Biosphere Reserves was elegantly summarised by Jaroslav Machacek, head of the National Committee for UNESCO/MAB of the Czech Republic, at the MAB European Scientific Consultation in Manchester in 1994: ie

"Let me strongly endorse the intention to stress and explain the values of environmentally important areas to the public. This effort should influence the process of comprehensive territorial planning, which involves economic and social aspects, particularly in relation to the people living therein.

Czech MAB National Committee, along with its partner institutions is about to enhance research into the issue of "Environmental-economic assessment of regional and local development concepts and projects, particularly with regard to environmentally valuable (protected) areas". We have set up close professional links with the Administration of the "Křivoklátsko" Biosphere Reserve to this effect and hope to carry out pilot investigation on the carrying capacity of the territory: in terms of visitors, local population, traffic etc. Should the results be deemed interesting, we would appreciate very much any possibility of comparative analysis and, as the case may be, verification of outcome in compatible areas.

Designing urban development concept derived from biosphere reserves sustainability appears to be one of the major ideas. Great spatial and functional differentiation of the environment within cities, when the same is to some extent true for their hinterland, suggests, however, that this kind of approach be applicable preferably to selected parts of the cities, especially to those which in Czechia form the "skeleton of ecological stability," even on the urban territory. This particular subject, together with the above "carrying capacity" applied to urban areas, ecological aspects of land use in cities and their hinterland and environmentally assessed location of small enterprises and production units, which should contribute to multifunctionality of urban areas, represent the field of special concern for our institute as well as for activities stimulated by Czech MAB Committee."

8.1 Summary of proposals

Urban development should incorporate the maintenance of natural areas and the protection of biodiversity. Planning of new housing and industrial areas, extensions to existing cities and the regeneration of old urban areas should respect areas of wildlife significance, provide opportunities for people to have contact with nature close to their homes, allow for the creation of many diverse habitats and link the historic heritage with nature conservation. Wherever possible areas of high biological interest and specific conservation value, whether within the city or on its periphery should be seen as potential core areas of Biosphere Reserves.

People have differing attitudes to and ideas about natural areas and the wildlife conservation. Habitat protection within and adjacent to cities requires great understanding by the urban population. Designation of highly protected areas may alienate those with customary land use rights, for grazing, recreation, hunting, fishing, forestry and agriculture. Successful planning for the establishment of a Biosphere Reserve requires close collaboration with the diverse human interest involved.

In designing an urban development concept which incorporates Biosphere Reserves, sustainable development appears to be one of the major ideas. Great spatial and functional differentiation of the environment within cities, as well as in their hinterlands suggests that such an approach may be readily applied to selected parts of cities. The old industrial areas of Europe contain areas of derelict and contaminated land which are often covered with wild plants and invaded by wild and feral animals occupying a variety of semi-natural and artificial habitats. Such opportunities should be seized to link the urban "green networks" - involving both abandoned transport corridors, canals and rivers and patches of urban greenspaces - to the natural areas beyond the city. A Biosphere Reserve could be formed from such a network of open space. This would demonstrate some of the processes and mechanisms required if sustainable development is to deliver the provision and management of multi-functional open space in urban areas in combination with built development.

Such an integration of conservation and development is one of the key functions of a Biosphere Reserve. In such a concept, multi-nodal core areas and buffer zones emerge and the value of small natural areas can be linked to a greater whole. The framework also provides a mechanism for linking management of the biophysical environment to the conservation and use of the built heritage of historic and archaeological interest. Here is a means of building for the future and enhancing sustainability and associated urban biodiversity whilst enhancing the enjoyment of legacies from the past use of the land.

Any attempt to develop a strategy involving urban or peri-urban Biosphere Reserves would be full of political implications. Management of National Parks is increasingly being separated from local and regional authorities, even though cities and parks depend on each other. Integrated strategies for linking urban green areas to external natural areas are required so that biodiversity, access and visitor pressure may be managed. The relevant agencies have to be brought together to develop a strategy in partnership with the communities involved. The people using natural areas embody a wide range of interests which readily conflict with one another. The core, transition and buffer zones in the Biosphere Reserve concept provide an aid in untangling these diverse interests, ensuring that core areas retain their fundamental character and ecological interest and that other activities can take place in the buffer and transition zones. Management must combine ecological awareness with understanding of the needs of the urban population.

The strategy for urban Biosphere Reserves in Europe over the next 50 years is therefore a marriage of natural areas around towns and cities with the urban "green". In some ways this can be compared to the widening experience of nature for the urban child, beginning with nature in a pond or natural area within walking distance of the home, extending to the nature conservation zones in the local river valley or urban park, then moving to a nature reserve within the city, and finally going out to the national park on the fringe of the city. The reclamation and re-use of old industrial land, the opening up of urban floodplains as green corridors, and the retention of hills and ridges within the city as greenspaces all make use of the legacies of past industrialisation in a positive way. They challenge both the growing cities of southern Europe and the old industrial areas of central and northern Europe to take a view of sustainable development and strategic

planning which recognises that urban planning and countryside management cannot be separated. A great range of experience has already been accumulated, but "green plans" now have to go far beyond green belts and tree planting to incorporate nature conservation into life at the heart of the city.

The key issues then are planning, management, policy-making and participation. The latter is essential in the maintenance of natural areas within cities and in the appropriate use of national parks. The experience of local natural history societies and Groundwork Trusts in the United Kingdom is that vandalism and damage are greatly reduced where there is a sense of involvement in a local project and the local people feel they have a stake in an urban greenspace. In many European countries, park managers feel that plans developed from the bottom-up with the community have a better chance of being readily accepted and sustained than those imposed by remote authorities. As our understanding of what people seek from natural areas in and around cities grows, better strategies can be evolved. The public consultations over Local Agenda 21 now being undertaken by many cities ought to incorporate thinking about urban Biosphere Reserves. Nature conservation looms large in the concerns of many people involved in the Local Agenda 21 discussions in cities like Manchester.

Community involvement in the maintenance of natural areas builds confidence in the relationship between managers and users and further strengthens local pride in natural areas. Biosphere Reserves can meet the needs of society by helping to build cities which are more sustainable in providing for the recreational and spiritual needs of people as well as attenuating the heat island and pollution effects of the urban metabolism.

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