Deutsche Stiftung für internationale Entwicklung
German Foundation for International Development

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John M. Sweeney (ed.)

Environmental Information – Issues and Sources of Information

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C O N T E N T

Introductory Remarks

The German Foundation for International Development (DSE) and the Infoterra-Programme Activity Centre of the United Nations Environmental Programme (UNEP) joined their resources in November 1993 and February/March 1995 to organize two training workshops on Environmental Information Services for documentation staff working in Infoterra National Focal Points in African and Asian/Pacific countries respectively. Both programmes included two different weeks of tuition and practical work: During the first week, participants were made acquainted with issues of environmental information such as sources identification, database construction, creating an information service, etc.; during the second week they received hands-on training in basic Infoterra operations, including database searching, electronic mail use, source registration, integrated national and regional capacity building, network promotion and information handling to assist users in substantive information retrieval.

This publication is a summary of the first week of the training workshops, containing the amended versions of the lecture notes prepared by two resource persons from the British Library's Environmental Information Service, namely John M. Sweeney together with Nigel Lees in 1993 and with Dr. Paula Owen in 1995. Although most of the examples mentioned in the chapters concentrate on environmental information matters as encountered in Africa, Asia or the Pacific today, they are also applicable in other world regions. The course organizers are deeply indepted to Mr. Sweeney for compiling the materials for this document.

The 1993 workshop in Nairobi brought together 23 participants from 20 countries: Angola, Botswana, Cameroon, Ethiopia, Eritrea, Gambia, Kenya, Liberia, Malawi, Mauritius, Mozambique, Lesotho, Sao Tomé, Seychelles, Sierra Leone, Sudan, Swaziland, Tanzania, Uganda, and Zambia. The 1995 workshop in Bangkok was attended by 25 participants from 24 countries: Bangladesh, Bhutan, Cambodia, China, Fiji, Hongkong, India, Indonesia, Kiribati, North Korea, South Korea, Malaysia, Maldives, Mongolia, Nepal, Papua New Guinea, Philippines, Samoa, Singapore, Solomon Islands, Sri Lanka, Thailand, Vanuatu, and Viet Nam.

The organizers of the two workshops hope that more environmental information specialists - not only in Africa, Asia or the Pacific but also in other parts of the world - will be able to benefit from the contents of these training activities through the intensive study of this publication.

Lutz Hüttemann
Information and Documentation Training Officer, DSE

October, 1995

The importance of environmental information

What is the environment?

A good definition of the environment is that from the McGraw-Hill Encyclopedia of Science and Technology :

"Ecologically the environment is the sum of all external conditions and influences affecting the life and development of organisms." (4th edition, volume 5, p.12, 1977)

This definition emphasises the all-embracing quality of environmental matters and their profound effect on human activities. What needs to be added to this definition is how the environment itself can be affected by those "external conditions and influences", many of which result from the activities of man and other living things.

Factors that affect the environment

The conditions and influences that can affect the environment are many and varied. Some are constant within a given locality whereas others are constantly changing or may be unpredictable. In some cases effects are caused by the activities of living things but in other cases natural phenomena are responsible. The sorts of effects that can contribute to environmental impact are :

1.Radiation of all kinds. This can include both light and heat as well as less obvious sources such as radioactivity. Light and heat are generally constant or vary in a known way at any one place so their environmental impact is generally well understood. Radioactivity, on the other hand, can often be unpredictable. Natural radioactivity can in some cases cause health problems, for example in the release of the radioactive gas radon from certain rocks. This radon can accumulate in any dwellings built on such rocks and in some cases become a serious health hazard. There is also man-made radioactivity that can be particularly dangerous following an accident to a nuclear installation. A good example of this is the

Chernobyl disaster of 1986 when radioactive material from the nuclear reactor caused damage not only in the vicinity but in other areas of Europe due to its dispersal in the atmosphere.

2.Materials, chemicals, etc. These can be of natural origin but the ones that cause environmental damage are usually man-made. Two types of chemical are of particular concern. Firstly, pesticides of all kinds can be concentrated in the food chain with serious consequences for the predators at the top of the chain. Certain heavy metals such as lead, cadmium, chromium and mercury have caused severe environmental problems because of their toxic nature. Many countries now have strict regulations on the use of chemicals and compile lists of those chemicals whose use is permitted within their territory. An example is the United States Toxic Substances Control Act (TSCA).

3.Soil, hydrological conditions. Environmental effects are caused not so much by steady state conditions but rather by changes in those conditions. For example, soil can be eroded due to excessive clearance of forest for agriculture or can be denuded of vital trace materials through over intensive farming.

4.Climate. Linked to changes in soil conditions are changes in climate that can be brought about by man made projects such as irrigation, dam construction, industrial activities, etc. Sometimes the changes are brought about by activity in another country. For example, the building of a dam in one country may affect the water supply in another country downstream. Lax controls on gaseous emissions in one country may cause acid rain outside its boundaries. Longer term climatic changes can be caused by the interaction of certain chemicals with the environment, for example the destruction of the ozone layer by chlorofluorocarbons. The burning of fuel produces carbon dioxide which contributes to the greenhouse effect. Changes in climate can have both short-term (e.g. flooding) and long-term (e.g. desertification) consequences.

5.Living things. The activities of some living things, e.g. corals, can drastically alter a particular environment. Overgrazing by domesticated or feral animals, e.g. goats, can cause serious damage

to vegetation. The introduction of alien species into a particular environment can have drastic effects on the indigenous species. For example, cats can be serious predators of species on isolated islands that hitherto have had no natural enemies.

6.Man. Potentially the most serious of all threats to the environment. Several of the examples already given are the result of man's activities but there are less direct influences, for example the enormous consumption of energy and materials, particularly in the World's richer countries, and the effects of overpopulation.

Increasing awareness of environmental matters

Until the 1960's environmental problems were generally not seen as having particular significance despite some environmental disasters that affected large numbers of people. An example was the overcultivation of land in the American Mid-West that led to soil erosion and the "dust bowl" of the 1930's. Since then the number of environmental problems has increased and this has in turn increased awareness about man's activities and the effects that they have on his surroundings. Among such effects are :

1.Industrialisation and its impact on individuals. A particular example is the effect of unrestrained burning of fossil fuels on air pollution. Up until the 1960's the burning of coal for fuel was common in the industrialised cities of the developed world. Untreated coal nearly always contains some sulphur and on burning this produces the noxious gas sulphur dioxide. The London "smogs" of the early 1950's were due to the burning of fossil fuels combined with foggy conditions in winter to produce effects that caused a large number of fatalities. Subsequently the UK passed the Clean Air Act which regulated the burning of fossil fuels. A more recent example is the build up of photochemical smog in cities such as Los Angeles resulting from air pollution caused by the internal combustion engine.

2.Awareness of the impact of technology. An example is the shrinkage of the Aral Sea. This small inland sea in Central Asia - about the

same size as Lake Victoria was fed by two rivers, the Amu Darya and the Syr Darya. The diversion of their waters for irrigation purposes in the surrounding desert areas has led to the steady shrinkage of the sea so that it is now only about half the size it was in 1960. Unless the amount of water entering the sea can be increased the shrinkage will continue with serious effects on the fertility and economic well-being of the region. Salt whipped up by winds blowing over the dried up sea bed has had a harmful effect on agriculture in the surrounding area. The problem has been exacerbated by the break up of the former Soviet Union and the division of the Aral Sea between a number of separate states so that there is now no centralised control over the area.

3.Resource pressures. The use of wood as fuel can lead to deforestation or even desertification if not properly managed. The lack of ready access to other energy sources in many areas increases the use of firewood. Sometimes it is possible to use trees or bushes which rapidly regenerate themselves after being chopped down so that damage to the environment is kept to a minimum.

4.Environmental effects of chemicals. The Minamata Bay tragedy in Japan in the 1950's alerted the World to the potentially lethal effects of industrial chemicals that are discharged to the environment without proper treatment. A chemical company in the area made organomercury compounds which after discharge were ingested by sea creatures in the Bay. These were then eaten by the local human population. The mercury compounds caused serious and often irreversible neurological damage. A further serious chemical problem has been the indiscriminate use of pesticides such as DDT. These concentrate in the food chain and predators such as birds of prey at the top of the chain feel the full effects of the toxicity. Many birds of prey in the 1960's laid eggs with very thin shells that led to a high mortality rate among their offspring. A ban on DDT has helped remedy the situation.

5.Disasters. In January 1993 the oil tanker Braer ran aground on the southern tip of the Shetland Islands to the north of the British Isles. Bad weather combined with a short period of daylight combined

to make it difficult to contain the resultant oil slick which affected several kilometres of coastline and resulted in a large number of seabirds being killed. (The weather did however lead to the fairly rapid break-up of the oil slick.) Similar tanker incidents have happened elsewhere, e.g. the Exxon Valdez disaster in Alaska. Other environmental disasters include leaks of chemicals as at Seveso and Bhopal and nuclear accidents such as Chernobyl.

Some of these factors such as the effects of increased industrialisation have been present since about 1800 but most have developed since about 1950. The use of oil on a large scale and the manufacture of many chemicals not found naturally have also helped to increase environmental awareness through their adverse effects.

Alarm at the increasing damage to the environment resulted in the publication in 1963 of the influential book *Silent Spring* by Rachel Carson (Penguin Books, 1990. ISBN 0-14 013891 9). This was followed by another important book, *Only One Earth : the care and maintenance of a small planet*, edited by Barbara Ward and René Dubos (1972) which was commissioned by the Secretary-General of the UN Conference on the Human Environment. Books such as these were particularly important in raising awareness of environmental matters and the present attention now given to the environment can be said to have dated from this time.

Despite the publicity given to environmental disasters it is important to see concern about the environment as positive rather than as reactive after the event, i.e. to emphasise anticipation and control of possible environmental problems through environmental impact analysis. Human activities will always have some effect on the environment and it is important to ensure as much as possible that environmental impact can be managed so that resources available now will also be available for future generations.

Environmental information

The relatively recent growth of environmental awareness has implications for finding environmental information, both positive and negative.

On the positive side the rapid growth of interest in the environment has led to an equally rapid growth in the provision of environmental information, not only of a scientific and technical nature but also information concerned with legislative, regulatory and commercial activities. This growth in provision is apparent not only in the printed and electronic sources but also in the number of organisations offering environmental information services. Many information sources that cover environment among other areas have become "greener" as they increase their coverage of environmental information.

There is however a negative side. The late development of environmental awareness means that environmental information still to some extent falls between several older established scientific disciplines such as chemistry, engineering and the life sciences. This makes information retrieval more difficult in that there are not only specifically environmental information sources to consider but also those covering the more traditional disciplines.

In the phrase "environmental information" it is important to stress the word "information" as much as the word "environment" as information gathering is a specialised technique that needs training and experience to master properly. There are some particular points worth bearing in mind as far as environmental information is concerned. These are :

1. It is split among several disciplines with no overwhelmingly important source dedicated to it. Hence to retrieve information several sources may need to be searched.

2. Information can be more subjective than in some other disciplines. For example, there could be different views on the implications of

emission data from a chemical factory. The factory owners may want to emphasise that the emission data show that their factory poses no threat to its workers or to the local community. On the other hand, a regulatory body or an environmental pressure group may interpret the figures as showing that there is a real pollution risk. Hence it is important to obtain as many points of view about a particular piece of information as possible.

The information that is required by a particular user may depend more on that user's understanding of and attitude to environmental issues than on any objective criteria.

3. Information gathering can be costly hence data are sometimes not available. This can be particularly important in measuring the effects of air and water pollution at different localities.

4. Organisations with special collections may restrict access or charge for their information. A company for example may be unwilling to release data about emissions. Even some public bodies that are charged with collecting data may not necessarily be prepared to release it, even to *bona fide* enquirers. If the data are made available it may be at a charge that would discourage frequent requests. There has been much debate over such policies and many public bodies are very reluctant to charge for data which are badly needed by countries and organisations that have limited financial means. Unfortunately there is increasing pressure on such suppliers of information to recover their costs, especially if their own funding from public money is diminishing, and an increase in charging for information is therefore likely.

In some cases there may be legal requirements to provide information but this can vary from country to country. In the USA, for example, companies are required to publish details of emissions from their factories but there is no such requirement in the UK.

5. "Grey" literature abounds in the environmental area and can be difficult to trace. This is literature outside the easily record able categories such as books and journals. Typical grey literature, for

example, would be conference proceedings, reports, theses and pamphlets that often contain important information but which are not often recorded in the standard information sources.

6. Care must be taken not to inadvertently provide misleading information. This could be caused by not providing all the information that exists on a particular subject that is readily available or by giving the impression that there is no more information on a subject when in reality there is. It can also be misleading to present information in such a way that it is understood or used incorrectly.

7. An information provider needs to check the validity of information by giving the source of that information and by providing the user with as much information as possible to enable the user to decide how credible the information is.

8. Users often want information to be interpreted. Information providers should be careful not to do this unless they have particular knowledge of the environmental issues concerned.

Environmental issues in Africa, Asia and the Pacific

While all the environmental problems mentioned so far are important in Africa, Asia and the Pacific there are some issues which are of particular significance. Land degradation and deforestation are two such issues, reflecting the great importance of agriculture in most countries of the region. Problems associated with urban life such as waste disposal and air and water pollution are significant in a number of countries. The use of wood for fuel is widespread and leads to deforestation problems. Biodiversity and conservation are important issues for many countries in the region that have very rich fauna and flora. Small island states, particularly those that are low-lying, can have problems with land use and also the effects of climate change.

Another area of great importance is the ability of many countries to reap the reward of their own national assets rather than have these

exploited by other nations. The Biological Diversity Convention of 1992, signed by over 150 countries, aims to protect countries from such exploitation.

Also of concern is the possible dumping of hazardous wastes from countries with strict anti dumping legislation to those whose legal restrictions are less tight or which need foreign exchange that may be forthcoming if they agree to accept noxious waste. Such cross border movement of hazardous waste is now controlled by the Basel Convention of 1992.

In order to respond effectively to environmental matters it is useful, indeed essential, for countries to coordinate their environmental activities and to have an environmental policy. In practice, environmental policies are often fragmented and responsibility for environmental matters can be spread over a number of government ministries. However, several countries have recognised that this is not an ideal situation and are now adopting a more coordinated approach.

As mentioned above, it is often expensive to collect environmental data and in consequence data for many countries are frequently incomplete or out of date.

Country case studies

In order to put the environmental issues of the region into better perspective it is useful to look at reports that were compiled by the Overseas Development Administration in the UK on three African and three Asian countries (Ghana, Zimbabwe, Uganda, Pakistan, Sri Lanka and Indonesia). There are several environmental issues common to all six countries and indeed to the region as a whole.

Ghana's main environmental issues are deforestation, waste disposal and industrial and mining pollution. Population growth adds to the pressures on the environment. The timber industry is Ghana's third largest but the level of logging is above the rate needed to stabilise the remaining forest areas. The reduction in the forest

areas affects biodiversity. Waste disposal is inefficient in most areas and solid waste is often just dumped in residential areas. Energy is provided mainly through the Volta Dam although there have been problems with silt in the Volta Lake behind the dam. Mining for various metals (gold, manganese, aluminium) gives rise to pollution which is generally more severe than that from non-metallic minerals. Environmental matters are divided between several ministries but there is an Environmental Action Plan which has proposed a single national agency responsible for policy, planning and implementation. Environmental courses are offered at university level. Data are generally out of date, in many cases dating from before 1980, but moves are being made to rectify this situation.

Land degradation and urban pollution are the most important issues in Zimbabwe. The principal causes of land degradation are deforestation, overgrazing and soil erosion. Deforestation is exacerbated by the demand for fuelwood by an increasing population although its main cause is the clearance of forests to make arable land. There is a large number of livestock which are important in Zimbabwe's agricultural economy but which have led to considerable overgrazing. Both deforestation and overgrazing have contributed to soil erosion. The Government has adopted a wide ranging programme to assist agricultural development and combat environmental damage of which the land resettlement programme is a major factor. Urban pollution is chiefly concerned with sewage disposal. Zimbabwe has a rich fauna and flora and conservation is consequently of great importance. This is reflected in the Ministry of Environment and Tourism which is the main government department dealing with the environment although other departments also have environmental responsibilities. No comprehensive environmental policy is yet in operation. There are at present no university courses on the environment as a whole. Environmental data vary in currency and accuracy but are fairly reliable on the whole.

Uganda suffered considerable political upheaval in the 1970's and 1980's which had a serious effect on the state of the environment. Resources that might have been devoted to environmental matters were diverted elsewhere and the country experienced severe breakdown in

important environmental services such a sewage and waste disposal. The considerable biodiversity was also badly affected. Deforestation and soil erosion have resulted from attempts to bring marginal agricultural lands under cultivation. Efforts are now being made to restore the environment in Uganda and there is a Ministry of Environmental Protection which is part of the Ministry for Energy, Minerals and Environmental Protection. At present there is no general environmental policy nor is there any overall environmental legislation. A review of environmental legislation is under way. In education the Makerere University Institute of Environment and Natural Resources was created in 1990. Data have been affected by the political situation and are still unavailable in many cases.

In Pakistan the major environmental issues are soil erosion, the overuse of pesticides, deforestation and urban pollution. Much of the country is barren and this increases the environmental pressure on the productive areas, for example by the use of wood for fuel (which accounts for 50% of all energy consumption). Biogas has been proposed as an alternative but although there are many biogas plants none were operational in 1992. The use of pesticides has caused pollution of water supplies. Pollution is also evident in urban areas and there is marine pollution around Karachi. Environmental affairs are mainly the responsibility of the Environment and Urban Affairs Division of the Ministry of Housing and Works but other Ministries control particular environmental matters. There is an Environmental Protection Ordinance (1983) which made provision for a national Environmental Council and an Environmental Protection Agency but this had not been set up by 1992. Some universities are now offering training in various aspects of the environment. Most environmental data are current although there is some inconsistency and variability.

Deforestation is also a problem in Sri Lanka where the other major issues are coral mining, sanitation and water supplies. The use of fuelwood accounts for an even higher percentage of total energy use than in Pakistan at about 70%. The use of coral as a source of lime has caused the destruction of part of the important coral habitat in coastal areas. This activity has now been stopped. Industry is concentrated around Colombo and has contributed to pollution

problems. A Ministry of Environment and Parliamentary Affairs was established in 1990 and administers the Central Environment Authority which is responsible for environmental policy and strategy. While there are several postgraduate courses on the environment only Colombo University offers a first degree course. Data are fairly consistent and up to date but there are some gaps, e.g. in urban pollution.

Indonesia occupies over 10000 islands of which nearly 1000 are inhabited. However there is a severe population imbalance with a large proportion of the population living in Java and Bali. Efforts have been made through the transmigration programme to redress this imbalance but there are still severe pollution problems in Java and particularly in Jakarta. Deforestation is another serious problem and is exacerbated by clearing of land for cultivation and in some areas by forest fires. The effect on Indonesia's biodiversity is potentially serious as it has one of the world's richest fauna and flora, is one of the three major areas of tropical rainforest in the world and includes two major floral and faunal zones, the Asian and the Australasian. Environment is covered by the Ministry of Population and the Environment but there is also the Environmental Impact Management Agency which was set up in 1990. The Environment Management Act of 1982 led to the establishment of an Environmental Impact Assessment process in 1986. Indonesia has 52 environmental study centres in the state and private university system. Data collection is hampered by the large number of islands and much of the information available concentrates on Java and on coastal areas. There is limited information on freshwater resources, effluent discharges and industry.

The implications of environmental problems for the effective provision of environmental information

It is important to gather as much local data as possible to ensure that monitoring of environmental problems is as comprehensive as it can be. The potential importance of the data must be evaluated as much as possible to see whether they will provide a long term financial return on the cost of gathering. This could be very

important for example when conducting an environmental impact assessment where some preliminary work may avert a major problem later on.

Current awareness of environmental developments in Africa, Asia, the Pacific and elsewhere is essential. This is best achieved by regular reading of important international newspapers or general science magazines such as New Scientist.

An overall knowledge of important sources of environmental information and how to access these sources are essential.

Similarly it is essential to know about important organisations in the field such as the United Nations Environment Programme and who the most suitable contacts are in those organisations.

Good record keeping, cataloguing and classification is important to ensure efficient information retrieval.

Current trends in EI systems and services

Scope

This chapter will cover general sources of information on the environment. These either deal with the environment as a whole or are devoted to disciplines which include environmental aspects. Information sources on particular areas of the environment are dealt with in the more specialised chapters that follow.

Introduction

We are currently experiencing a revolution in the way information is published and distributed. Nowadays, we find more and more information coming to us in some sort of electronic format rather than the traditional printed source. Indeed there is talk of journals being produced only in electronic format in future or new journals being made available on the Internet (through a subscription service). Environmental information is an interesting area to study when looking at trends in information media. As a result of its relatively recent emergence as a topic in its own right there are no preconceived 'hard and fast' rules about how the information should be published, unlike a discipline such as chemistry for example.

It can be said that environmental information, to a greater extent than other scientific disciplines, is available to the enquirer in a plethora of formats, for example:

Traditional printed sources (primary, secondary and tertiary)
Grey literature (primary and secondary)
Electronic sources (mainly secondary)
Internet/WWW sources (mixture of primary and secondary)
Personal Contact

By *traditional sources*, one simply means printed or hard copy sources of the information. There are six main types of printed source, namely: books, journals, patents, grey literature, directories and secondary sources such as abstracting or indexing journals.

This type of information (with the exception of grey literature) is usually the most extensively advertised and easy to access through book shops, publishers or libraries.

Grey literature is very important in the environmental information field as a large proportion of important facts and data are reported here that cannot be found elsewhere. The problem with grey literature is that it is notoriously difficult to locate as there is no one standard procedure for classifying it. One attempt to organise and collate information on grey literature comes from the database SIGLE (System for Information on Grey Literature in Europe) produced by the British Library.

Electronic sources consist of CD ROM and on-line sources. There are (usually) no new sources of information in this type of medium. Information is taken from the printed primary and secondary sources and converted into electronic format with searchable indexes. There are a number of important sources for environmental searchers, databases such as Enviroline, Environmental Bibliography and Pollution Abstracts. Even the more general databases such as Chemical Abstracts, Compendex (the main engineering database) and CAB Abstracts offer a wealth of information on environmental issues (see later for further details on the individual databases).

The exceptions to this are the databases such as ECDIN (Environmental Chemicals Data Information Network) and HSDB (Hazardous Substances Data Bank) which supply the enquirer with data such as that concerning human and animal health, LD50 toxicity levels or the environmental fate of chemicals once they have been released into the environment. These databases supply a compendium of data that would be difficult and more time consuming to find from other sources.

Internet/WWW sources The Internet has been separated from the other electronic media as there is a succinct difference in the type of information available from Internet or World Wide Web sources.

As mentioned above, the majority of electronic sources act as secondary sources of information, simply reporting on details of primary source information. The Internet is different in that the material now available almost matches the range of material available in other formats. For example, there are electronic journals; searchable databases and library catalogues; E-mail discussion groups and bulletin boards; up to date environmental texts and documents; technical reports and conference proceedings; computer software, images and sound archives that can be downloaded. This allows the environmental enquirer a larger range of sources than any other single medium.

In addition, most of the active environmental organisations and government agencies now have their own home pages on the Internet. Institutions from Greenpeace to the US EPA have information about themselves and other related organisations easily accessible through their home page. Some pages even have searchable data banks available and hence one is able to explore individual topics. Sometimes even images can be accessed and downloaded without copyright restrictions.

One of the most useful functions of the Internet, however, is its ability to put people in touch with experts and other interested parties in most environmental fields around the world. Through the use of E-mail it is possible to join pertinent discussion groups and bulletin boards that focus in on your topic of interest. Within the groups one will find experts from academia, commerce and industry who specialise in the area. A word of caution here : one must be very selective in choosing discussion groups because some of them are very active and produce copious amounts of correspondence that may not be of any relevance.

Personal contact. Sometimes this source is the most useful and timely method of retrieving information. Instead of wasting valuable time searching around for the right book or journal that could take days, one telephone call to the relevant person could answer your query or point you in the direction of the most useful sources of information. The only disadvantage to this source of information is

that a good contact list takes time to build up and also people move on and new contacts have to be made.

Types of information available

As mentioned above, information is available not only through printed and electronic sources but also from organisations and indeed personal contacts. These latter categories can often be traced, however, through printed and electronic sources. Printed sources of information consist not only of books and periodicals but also patents, directories, business literature, reports, theses, conference proceedings, translations etc. There are a number of specialised information sources that cover these categories of literature as follows :

1. Books and journals. Details of environmental titles can be obtained from Subject Guide to Books in Print (Bowker, 5 vols, 1992-93, ISBN 0-8352-3251-4) and Ulrich's International Periodicals Directory (Bowker, 4 vols, 1992-93, ISSN 0000-0175 : also on-line and CD-ROM). The latter has a section specifically on environmental titles. If the title or author of a book is known it can be traced through Books in Print (Bowker) or Whitaker's Books in Print (J. Whitaker) for UK titles. Both are available on-line and as CD-ROMs.

b) Patents. A patent is granted to an inventor to give his invention legal protection against exploitation by others in return for disclosure of the details of the invention. Patents are very important sources of information on technical developments and are often where a new idea first appears in print. (Patents cannot be granted if the idea has already appeared in print as the invention to be patented must always be new.) A good knowledge of patents is essential to avoid accidental infringement. The best sources of information for patents are the on-line databases INPADOC and World Patents Index.

c) Grey literature. This term includes literature such as conference proceedings, reports, trade literature, theses and translations. In some environmental areas grey literature is very important and

however difficult it is to track down no search in such an area can be complete without it. A useful on line database for such material is SIGLE. The British Library also publishes British Reports Translations and Theses (ISSN 0959 4922) and the Index to Conference Proceedings Received which cover particular aspects of grey literature. For details of the latest research in the environment in the UK there is also Focus on British Environmental Sciences Research (ISSN 1350 4940).

d) Directories. Directories are invaluable for details of environmental organisations and companies. There are too many good directories to list here but two typical and very useful ones are the PIRA International Environmental Information Sources and the Environment Industry Year Book (Environment Press, annual). Other directories on international and national organisations are listed in the chapter dealing with such bodies.

Information retrieval methods

Information can be retrieved not only from manual but also electronic sources, chief among which are on-line and CD-ROM databases. Electronic sources can be searched in a greater variety of ways than manual ones and are faster to search. Concepts can be combined in a way that is impossible with printed sources and the search is interactive, allowing the searcher to refine the search. They also offer a potentially vast source of information, are more up to date and avoid the need for extensive storage space. On the other hand they are expensive and for on-line searching at least need specialised searching skills. CD-ROM databases can be cheaper to use than on-line ones and require less skill but are not as current. In addition several CD-ROM databases cannot be searched together as is increasingly the case with on-line. CD-ROM databases are usually obtained on a subscription basis, being updated at regular intervals (e.g. one month) and the superseded discs being returned to the supplier. Most on-line and CD-ROM databases are bibliographic but some are numerical, giving e.g. physical property data, and some give the full text of articles.

Abstracting and indexing services

Abstracting and indexing services (which are also called secondary services) on environmental topics fall into three categories : those covering an area wider than the environment, those on the environment in general and those on specific aspects of the environment. Among databases which include environmental topics in a wider field are the following :

1. Chemical Abstracts. One of the largest of all secondary services, it deals with all aspects of chemistry and chemical technology and is a comprehensive source of information on any aspect of the environment that has any connection with chemistry (which in practice covers a large number of environmental topics, e.g. pollution, hazardous chemicals, waste and recycling). It is less good on other environmental topics such as conservation and environmental impact assessment. It covers books, periodicals, conference proceedings and patents in all major languages. Manual and on-line versions are available although the sheer bulk and cost of the printed version means that few libraries are now able to subscribe to it. The indexes for 1987-1991 are available on CD-ROM.

2. Biological Abstracts (available on-line as BIOSIS Previews and also on CD-ROM.) Good for biological aspects of the environment such as biodiversity and also for the effect of pollutants on the environment. Another very large database although not as big as Chemical Abstracts. The printed version is not particularly easy to use so it is preferable to use the on-line or CD-ROM versions.

3. CAB Abstracts. Available on on-line and CD-ROM. The printed version consists of over 50 separate abstracts journals. Covers a wide range of environmental topics, not just agriculture. Examples are biodiversity, conservation, pesticides, renewable energy sources, environmental legislation, environmental policy, waste disposal, water quality, tourism and climatology. It has a very good coverage of both African and Asian literature and includes topics such as rural economics.

4. Engineering Index. Available on on-line and CD-ROM as Compendex. Covers technology in general including many environmental topics such as transportation, building materials, flood control, water treatment, sanitary engineering, pollution and waste.

5. Georef, Geobase, Geoarchive. These three earth science databases contain much useful material on environmental geology and geography. Georef is available on CD-ROM.

6. ICONDA. A database devoted to construction and civil engineering which covers the environmental impact of construction projects. Also on CD-ROM.

Databases devoted to the environment in general include three major titles:

1. Environment Abstracts, available on-line and in CD-ROM as Enviroline. This covers all aspects of the environment including legislation and policy. It has recently been taken over by the Congressional Information Service and it is likely that it will shift its emphasis more in future to policy, legislation, environmental assessment, auditing etc. although it will still continue to cover science and technology as well. This is the most comprehensive database devoted solely to the environment.

2. Environmental Bibliography. Also available on-line and on CD-ROM. Also covers all aspects of the environment and should be used in conjunction with Enviroline. Overlap between databases, even in the same subject area, can sometimes be surprisingly low so whenever possible it is advisable to use more than one source in order to obtain as much relevant information as possible.

3. Pollution Abstracts. Available on-line and on CD-ROM. Covers all areas of pollution including air, land, water and noise. Gives references on scientific, technical and legislative aspects of pollution problems and control.

Case study of one country's rapid information technology development

Pakistan, at the time of its creation, in 1947, had no educational and research base. There was only one university, the Panjab University. Scientific research started in 1951 when Prof. Salimuzzaman Siddiqui was appointed chairman of the Pakistan Council of Scientific Industrial Research and established research laboratories in major cities of Pakistan. He realised the importance of scientific and environmental information and established the Pakistan Scientific Documentation Centre (PANSDOC). The objective of this centre was to procure scientific publications and act as a liaison.

Now Pakistan has 20 universities and over 250 research institutes. The government of Pakistan, realising the importance of science and technology, formed a separate ministry in the late 1960s and PANSDOC now functions as a section of the Pakistan Science Foundation. It is renamed Pakistan Scientific & Information Centre.

The information system, though conceived and established in 1971, is still in its infancy. Its headquarters are in Islamabad. It has sub-offices in all four provinces and provides services of acquiring research papers for scientists from abroad or from libraries within the country. It is publishing a number of documents and has a limited electronic database.

The University Grants commission decided in 1989 to provice bibliographic search services of Biological Abstracts and Chemical Abstracts to the universities and research institutions.

The Govt. of Pakistan formed a committee on scientific information in 1989, and it is hoped that the major research institutions will be linked to data banks in Europe or the USA.

The `Rio' Summit

Introduction

The Rio Summit was also called the `Earth' Summit, but its official title was the United Nations Conference on Environment and Development (UNCED). It took place in Rio de Janeiro, Brazil, on 3-14 June 1992.

What was the Rio Summit?

The Summit was attended by 118 heads of state, the largest ever such gathering. It resulted in international agreements on global climate and biological diversity and drew up a set of principles to serve as the basis for a future convention on forests. More generally it produced the Rio declaration, an ethical statement on the relationship between humanity and the planet, and Agenda 21, the implementation strategy for the declaration.

Why was the Rio Summit organised?

The world's environmental problems are steadily getting worse and it was on account of this that the UN formally resolved to convene a UN Conference on Environment and Development (UNCED), in December 1989. It is important to recognise that concern for the environment does not exclude the proper development of resources. In fact the Summit stressed `sustainable' development as the way forward.

Agreements signed at the Rio Summit

There were four major documents signed at the Rio Summit which were as follows :

1. The Rio Declaration on Environment and Development. This contains 27 principles on the general rights and obligations of countries. The principles build upon ideas from the Stockholm Declaration at the 1972 UN Conference on the Human Environment. They include recognition on the

international nature of environmental matters but also stress the right of individual nations to exploit their own environmental resources without causing damage beyond their borders. Sustainable development is emphasised as is the principle that the polluter should bear the cost of the pollution caused. The enactment of effective environmental laws is stressed.

2. The Climate Convention. This was signed by 153 countries although the USA did so only after the enforceable emission levels were replaced by unenforceable broad aims. The Convention provides for global emission inventories, monitoring emissions and dealing with trace gases.

3. The Biodiversity Treaty. This states that countries have compensation rights for products developed from their own genetic resources. It was signed by 153 countries at the Summit and later by the USA.

4. Agenda 21. This is described in the next section.

In addition to these agreements there was also a statement of principles on the management, conservation and sustainable development of all types of forests.

Agenda 21

This massive document sets out the tasks and priorities for the coming century. It was, and still is, the working document of the Summit. There is a total of 40 chapters split into 4 separate sections:

Section 1 : Social and economic dimensions

This includes the following chapters :

2. International cooperation. (Chapter 1 is a preamble to Agenda 21 as a whole.)
3. Combating poverty.
4. Changing consumption patterns.

5. Population and sustainability.
6. Protecting and promoting human health.
7. Sustainable human settlements.
8. Making decisions for sustainable development.

Section 2 : Conservation and management of resources for development

This includes the following chapters :

9. Protection of the atmosphere.
10. Managing land sustainability.
11. Combating deforestation.
12. Combating desertification and drought.
13. Sustainable mountain development.
14. Promoting sustainable agriculture and rural development.
15. Conservation of biological diversity.
16. Management of biotechnology.
17. Protecting and managing the oceans.
18. Protecting and managing fresh water.
19. Safer use of toxic chemicals.
20. Managing hazardous wastes.
21. Managing solid wastes and sewage.
22. Managing radioactive wastes.

Section 3 : Strengthening the role of major groups

This includes the following chapters :

23. Preamble to strengthening the role of major groups.
24. Women in sustainable development.
25. Children and youth in sustainable development.
26. Strengthening the role of indigenous people.
27. Partnerships with non-governmental organisations.
28. Local authorities.
29. Workers and trade unions.
30. Strengthening the role of business and industry.

31. Scientists and technologists.
32. Strengthening the role of farmers.

Section 4 : Means of implementation

This includes the following chapters :

33. Financing sustainable development.
34. Technology transfer.
35. Science for sustainable development.
36. Education, training and public awareness.
37. Creating capacity for sustainable development.
38. Organising for sustainable development.
39. International legal instruments and mechanism.
40. Information for decision making. This chapter mentions INFOTERRA and ACCIS.

Agenda 21 has particular relevance for cities and local authorities as many of them are working towards a "Local Agenda 21".

The cost of implementing the 115 projects set out in Agenda 21 is estimated at $125 billion. The Summit fell short of obtaining commitments from the developed countries to devote a larger proportion of their GNP to Agenda 21. It is hoped to make the year 2000 the target date for them to allocate at least 0.7% of their GNP to Agenda 21 : at present the average is 0.35%. (Source : "The Rio Earth Summit : what does it mean?" J. Schnoor, *Environmental Science and Technology*, vol. 27, no. 1, pp. 18-22, 1993.)

The relevance of the Rio Summit to environmental information

This is taken from chapter 40 of Agenda 21.

1. There is a very large information gap between developed countries and less developed countries. It is very important to collect data locally.

The data and information already published should be made more freely available.

2. We already have Gross National Product (GNP) to indicate the economic health of a country. We need now to develop indicators for the sustainable development and social welfare of a country.

3. Information inventories of environmental and development information, available nationally and internationally, should be encouraged.

4. Satellite and Geographic Information Systems (GIS) should be developed nationally and regionally.

5. Relevant international organisations should oversee the coordination of data collection and assessment.

6. Information technology should be made more available.

7. The Advisory Committee for the Coordination of Information Systems (ACCIS) and INFOTERRA should be strengthened.

8. Electronic networks should be established and/or strengthened.

National and international sources of information

Introduction

This chapter focuses on the most important organisations and global systems dedicated to the provision of environmental information. Many of these organisations are relevant to particular aspects of the environment and should be borne in mind when consulting later chapters in this guide.

The United Nations System

The principal organisations within the UN system that are concerned with coordinating information on the environment are ACCIS and INFOTERRA.

1. ACCIS. This stands for the Advisory Committee for the Coordination of Information Systems. It is an inter-agency body of the UN and was set up by the Economic and Social Council in 1983. ACCIS produces a number of specialised information products (databases and guides) that identify information from all UN organisations. It maintains a database of computerised databases and information systems that are operated by the UN. Information about this database is published in the Directory of United Nations Databases and Information Services (DUNDIS). In addition to this listing ACCIS produces a series of specialised guides to information sources in specific subject areas.

In 1988 ACCIS, in collaboration with INFOTERRA/PAC produced the ACCIS guide to United Nations Information Sources on the Environment. Section 1 of this guide provides short descriptions of sources of information on the environment within 34 organisations of the UN. It also provides contact details. Section 2 is split into 11 subject categories all of which describe specific programmes of UN agencies.

The sub-section on Industry and Transportation includes environmental activities from a number of UN bodies. Many of these organisations have libraries, information centres, databases and publications.

ACCIS produces a free bimonthly newsletter on its activities.

2. INFOTERRA. This is the global environmental information network that was set up in 1975 as a result of the Stockholm Conference on the Human Environment in 1972. It is a decentralised information system working through a network of national environmental institutions designated by their governments as national focal points. INFOTERRA can call on over 6000 sources of information from government bodies, universities and research institutes, non-governmental and international organisations. It is coordinated by the Programme Activity Center (PAC) which is located at the United Nations Environment Programme headquarters at Nairobi. There are 10 regional service centres that have been set up within key National Focal Points to act as centres for regional cooperation. Four of these are in Africa and three are in Asia.

There are also about 35 special sectoral sources within the INFOTERRA network that provide specialised information, for example on subjects such as wetlands, waste management and occupational health. Some of these specialist organisations are mentioned in the relevant chapters of this book, e.g. the World Conservation Monitoring Centre. Some charge for the information they provide but INFOTERRA/PAC may be able to subsidise the cost of the enquiry. There is an INFOTERRA publication *Guide to Special Sectoral Sources* (Nairobi 1992).

The INFOTERRA network handles over 24000 queries per year. The main source that INFOTERRA has for accessing information is its International Directory of Sources which is available both as hardcopy and as a computer database (this can be supplied on diskette). It does not contain all the world's environmental information itself but is the means of access to the 6000 sources mentioned above.

Other UN Organisations

Other organisations of interest, particularly in the environmental and chemical area, are :

1. The International Register of Potentially Toxic Chemicals (IRPTC). This service (one of the special sectoral sources) provides data for evaluating the hazards of specific chemicals. It holds information on national, regional and global regulations and standards for chemicals and is constantly seeking to identify the gaps in existing knowledge and to fill them.

2. The Industry and Environment Office (IEO). This organisation is well known for its quarterly journal Industry and Environment. This is widely circulated and contains much work of relevance to environment and development issues. The IEO aims to bring government and industry together to cooperate in reducing the adverse effects of industries on the environment. It has a computerised databank dealing with pollution abatement and control technologies.

3. The International Programme on Chemical Safety (IPCS). IPCS evaluates the effects of chemicals on human health and also on the environment. It produces the Environmental Health Criteria series, a joint programme with the International Labour Office and the World Health Organisation.

4. The Global Environmental Monitoring System (GEMS). Another special sectoral source, this coordinates the collection of data worldwide on such trends as climate change, soil degradation and air quality. The Global Resource Information Database (GRID) was established within GEMS to make basic environmental data available to national and international decision makers.

5. The Global Environment Facility (GEF). This is jointly operated by the United Nations Development Programme, UNEP and the World Bank. It funds environmental projects that have global benefits but where costs within a country are greater than the benefit to that country. GEF is active in four areas : global warming, biodiversity, pollution of international waters and stratospheric ozone depletion. It has provided funds for several important projects in the Asian-Pacific area that have benefits for more than one country.

Other non-UN global or regional systems

1. The Organisation for Economic Cooperation and Development (OECD). Among its many activities OECD has a special programme on the control of chemicals, in particular "existing chemicals". (These are simply chemicals that are listed in various registers of chemicals approved for use within certain countries or areas.) OECD supplies data to IRPTC. It also produces regular reports on the relationship between economic development and the environment.

2. The European Union (EU). The European Union - often referred to as the European Community - consists of 15 member states and includes most of the countries of Western Europe. It produces a great deal of information on the environment that is available on its own databases via the database hosts ECHO and Eurobases. In addition there is a special database on environmental aspects of chemicals called ECDIN (Environmental Chemicals Data Information Network), available through the DIMDI host and also as a CD-ROM.

3. The Asia-Pacific Economic Cooperation Forum (APEC). This recently created trading group aims to achieve completely free trading and investment within its area. At present there are 17 members from around the Pacific. If this organisation develops along similar lines to the EU it may become increasingly concerned with the environment.

4. The Asia-Pacific People's Environment Network (APPEN) aims to bring together diverse non-governmental groups and people in the Asia-Pacific region and collect and disseminate information on environmental issues. It publishes an Environment News Digest three times a year as well as the quarterly Asia-Pacific Environment Newsletter. It also produces a directory of environmental non-governmental organisations in the region. (c/o Sahabat Alam Malaysia, 19 Kelawei Road, 10250 Penang, Malaysia)

5. The African NGOs Environment Network. This has a special working relationship with UNEP and liaises with about 530 NGOs in 43 African countries. It has a database of subjects of concern for African

environmental and developmental issues. The magazine *Eco-Africa* is published six times a year. (P.O. box 59944, Nairobi, Kenya)

6. The International Association for the Protection of the Environment in Africa. This has both individual and institutional members and publishes the *ENVIRO-PROTECT* information bulletin. It has a library and documentation centre. (B.P. 13623, Yaounde, Cameroon)

These are only some of the many international organisations concerned with the environment. Details of many others can be found in the *Yearbook of International Organisations* published by K.G.Saur, ISSN 0084-3814.

Sources of information on organisations

As well as the INFOTERRA International Directory of Sources and the *Yearbook of International Associations* the following directories give excellent coverage on environmental organisations worldwide :

1. ACCIS Guide to United Nations Information Sources on the Environment.
United Nations, 1988
ISBN 9211003393

2. ACCIS Guide to United Nations Information Sources on Food and Agriculture.
Food and Agriculture Organisation (UN), 1987
ISBN 9251026041

3. Directory on United Nations Databases and Information Services.
United Nations, 4th ed, 1990
ISBN 9211003490

4. World Directory of Environmental Expertise.
INFOTERRA, 1987
ISBN 9280711520

5. World Directory of Environmental Organisations.
Thaddeus C Trzyna & Roberta Childers, eds
California Institute of Public Affairs, Sierra Club, IUCN - The World Conservation Union, 4th ed, 1992
ISBN 0912102977

6. Environmental Profiles : a global guide to projects and people.
Linda Sobel Katz, Sarah Orrick, Robert Honig
Garland Publishing Inc., 1993

7. World Guide to Environmental Issues and Organisations.
Peter Blackley, ed
Longman, 1990
ISBN 0582062705

8. 1993 Directory of Country Environmental Studies : an annotated bibliography of environmental and natural resources profiles and assessments.
World Resources Institute (WRI), 1992
(Also published by the International Institute for Environment and Development (IIED) and IUCN - The World Conservation Union)
ISBN 0915825880

Air Pollution (including hazardous chemicals)

Scope

There are various classifications of pollution in the literature today and many sources that can be consulted for information. There are some sources which cover all forms of pollution, whether gaseous, liquid or solid but many others which are more specific to particular types of pollution. This chapter will devote itself to talking about air pollution in particular. Hazardous chemicals can, of course, appear in all types of pollution but are discussed briefly in this chapter.

Air pollution

Air pollution arises from a number of sources, the most important one being the burning of fossil fuels. Major global and urban pollutants are nitrogen oxides, sulphur dioxide, ozone, methane, volatile organic compounds (VOCs), dust and carbon dioxide. Some of these compounds produce acidic solutions when dissolved in rainwater which can then fall as acid rain, often at locations well away from the source of the pollution. Others are acted upon by sunlight to produce photochemical smog that acts as a health hazard in many major cities. Carbon dioxide (and other air pollutants such as methane, tropospheric ozone, nitrous oxide and CFCs) act as greenhouse gases, trapping the heat from the Sun and causing a rise in the Earth's temperature. Concern has been expressed that the resultant global warming could result in an unprecedented rapid rise in global mean surface temperatures with serious implications for the Earth's delicately balanced ecosystems (see below).

The Ozone layer

Just as the greenhouse effect is responsible for the continuation of the ambient temperature we enjoy on Earth, so is the ozone layer partly responsible for the beginnings of life on this planet.

Approximately 4½ billion years ago the Earth had an oxygen-free (or anaerobic) environment. The only species that could survive in such conditions were single-cell organisms that lived below the sea surface. No living thing could survive out of water as a result of the cell damaging, high intensity, UV radiation that was hitting the Earth's surface without hindrance.

Very slowly over geological time, the single cell organisms began to produce oxygen which eventually drifted up into the atmosphere. As the oxygen was travelling upwards the intense rays of the Sun split the oxygen molecule into oxygen atoms. The oxygen atoms, as a result of the high energy bombardment, were in a very reactive state and reacted with other oxygen molecules to form the tri-atomic state of oxygen known as ozone.

Ozone then accumulated in the atmosphere, its concentration centring around 15-25 km above the Earth. This part of the atmosphere is known as the stratosphere.

As the ozone "shield" developed around the Earth it filtered out the majority of the cell damaging UVB and UVC rays from the Sun's radiation. Without this damaging radiation, plants and early life forms were able to develop on land. These processes produced more oxygen and were responsible for the atmosphere we live in today.

The ozone layer exists in a dynamic equilibrium. It is continually being created and destroyed by natural processes in the atmosphere. However, over the last 50 years that equilibrium has been altered by man with potentially disastrous consequences.

In the 1930s, chlorofluorocarbons (or CFCs) were invented to aid refrigeration. They were chosen because they were thought to be an inert, harmless class of compound. Over the decades increasingly more uses were found for CFCs so that by the 60s and 70s their use was ubiquitous throughout the industrialised world in everything from solvents to air conditioning.

By the 1980s there were serious doubts about the safety of the ozone layer and blame was finally laid on the CFCs. As a result of the CFC's chemical inertness they travel through the lower atmosphere without reacting with any species normally found there. As the CFC reaches the stratosphere it is then bombarded by intense, UV radiation which breaks up the compound and allows free chlorine atoms to escape. These chlorine atoms are very reactive and immediately react with ozone to produce chlorine oxide and an oxygen molecule. The chlorine atom is then reformed and it goes on to destroy up to 10,000 ozone molecules before eventually being removed from the atmosphere by other means.

The hole in the ozone layer was officially recorded in 1985 and has increased steadily over the years. Proof that CFCs were destroying the ozone layer at an alarming rate galvanised the world's governments into action and so in 1987 the Montreal Protocol on Substances that Deplete the Ozone Layer was signed by over 150 countries. This protocol aimed at reducing and finally phasing out CFCs from use. Since 1987, the protocol has been amended and updated periodically. The latest directive states that CFC use in the industrial world must cease after 1 January 1996. The industrialising world has a further ten years grace before it too has to find alternatives to the CFCs.

The main concern with a decrease in the ozone layer is the increase in the amount of UVB radiation that will arise as a result. UVB is known as a carcinogen and an increase in this form of radiation will increase the number of skin cancers and cataracts for both humans and animals. UVB is also known to kill plankton, and as this is at the base of the marine food chain the consequences of such a decline could be devastating to the marine ecosystem.

CFCs are being temporarily replaced with HCFCs, which are known to be powerful greenhouse gases. It is hoped that they too will be banned by the middle of the next century at the latest. Unfortunately, as CFCs have very long lifetimes (up to 150 years), it will take the ozone layer about 100 years to recover completely from the concentration of chlorine injected into the atmosphere.

The Enhanced Greenhouse Effect

The existence of a greenhouse effect is one of the main reasons that we have life on Earth. Without the occurrence of this phenomenon the average surface temperature of this planet would be approximately 30° C colder than it is today (-18° C instead of +15°C). It would be the equivalent of living at the north pole all year round.

The planet Mars has no greenhouse effect at all and the average temperature on that planet is -50°C. Hence no living thing can survive on Mars for any length of time. In contrast, the planet Venus has what is known as a 'runaway greenhouse effect' and surface temperatures on that planet are in the region of 560°C, hot enough to melt tin. It is a direct result of the Earth's distance from the Sun that allows the greenhouse effect to produce a temperature that is beneficial to living things.

The greenhouse effect is basically a result of the existence of gases in the lower atmosphere that absorb infrared radiation. Gases such as carbon dioxide, water vapour, methane, ozone, CFCs and HCFCs are effective absorbers (or greenhouse gases) and are, on the whole, natural components of our atmosphere.

Energy from the Sun, the Earth's only form of external radiation, is mainly in the form of high powered, ultraviolet (UV) radiation which can travel through the atmosphere relatively unimpeded and warm the Earth's surface. As the Earth is much cooler than the Sun, the energy that re-radiates from the Earth is of a lower intensity and is known as IR or infrared radiation. This radiation then travels through the lower atmosphere and eventually escapes to space. A certain proportion of the IR radiation is absorbed by greenhouse gases in the troposphere and this helps to warm the lower atmosphere.

The greenhouse effect has been in equilibrium with the Earth's surface for millions of years. There have been major changes in the Earth's climate, i.e. the ice ages, through time but they have always taken place on an extremely slow time scale. Even so, the results of

these changes have been catastrophic - the extinction of the dinosaurs has been attributed to the intolerable changes in conditions that accompany an ice age.

Over the past two hundred years, since the industrial revolution, Man has been burning fossil fuels and destroying forested land at an unprecedented rate. Thus adding to the amount of carbon dioxide and methane in the atmosphere. This, in turn, affects the amount of IR radiation that is absorbed by the atmosphere.

As the concentration of greenhouse gases in the atmosphere has risen over the past two hundred years, so has the average surface temperature. The concentration of CO_2 has risen from 285ppmv in 1800 to 355ppmv in 1990. In this time, the temperature of the Earth has risen by 1.5°C. This may not seem a large change, but if you consider that there was only a 4°C difference between modern day temperatures and the average surface temperature of the last ice age, then a 1.5°C rise is quite significant.

One problem that climate change scientists have to face is that the changes in temperature experienced over the last few decades are still, just about, within the realms of natural variability. This means that it is very difficult to prove without any doubt that the climate change we are experiencing is due to a build-up of anthropogenic greenhouse gases in the atmosphere. However, if we wait a few decades to prove conclusively that anthropogenic climate change is occurring, then we could be committing ourselves to an amount of global warming that can only be estimated at the present time, an amount that could be catastrophic to certain areas of the world.

To prevent future increases in greenhouse gas concentrations, the countries of the world must reduce their dependency on fossil fuels. The 'slash and burn' deforestation techniques of the 70s and 80s must cease and a huge reforestation programme must be introduced. Individuals and families can help by reducing the amount of energy they waste, e.g. by using their cars less and not buying anything with CFCs, HCFCs or HFCs included.

Study: Air pollution in Bangkok

Bangkok, the capital of Thailand, is growing rapidly. Large numbers of motor cars congest the city and create noise and air pollution problems. Many small-scale factories are located in the area and new industry is being moved to the suburbs.

Sulphur dioxide (SO_2) is not a problem as there is no winter heating season and WHO guidelines are being met. Suspended particulate matter (SPM) exceeds the WHO annual guidelines at all three monitoring sites within Bangkok.

Lead (Pb) meets WHO guidelines at ambient monitoring stations but not at kerbside level. Carbon monoxide (CO) meets WHO guidelines at ambient air monitoring stations. Nitrogen dioxide (NO2) and ozone (O3) meet WHO guidelines where measured in Bangkok, although higher values could occur in downwind areas that are not monitored.

Epidemiological data for air pollutant effects are not available. The population exposed to these levels of automotive pollutants are likely to suffer pulmonary impairments leading to some restrictions on activity. Susceptible individuals will have increased rates of respiratory illness. The World Bank estimates that vehicle emissions will double by the year 2000. Unless strict motor vehicle controls are put in place the air quality will worsen significantly in the next decade.

Generally, the main air pollution problem in metropolitan Bangkok results from the very high SPM levels. In traffic-influenced areas, a large proportion of the SPM consists of man-made respirable particles and could have potentially serious health effects on people living or working near streets with heavy traffic.

Most other air pollutants have low concentrations in most urban areas. However, the air pollution situation is more severe in roadside locations influenced by heavy traffic.

It has been reported that each year there are 10-50 million person-days of restricted activity for respiratory reasons in Bangkok which are not reported.

Information taken from: *Urban air pollution in megacities of the world*. UNEP/WHO, Blackwell publishers.

Air pollution information sources

Among sources of information on air pollution is the on-line database **Pollution Abstracts** which provides comprehensive coverage of liquid and solid pollution, as well as air pollution. There is a printed equivalent with the same name. It includes references to social and political aspects of pollution as well as technical articles. Another useful pair of databases is **Acompline/Urbaline** which deals with the urban environment including pollution. It covers urban air pollution and the quality of air in cities in general. **HSELINE** is a data bank that covers air pollution from an occupational health and safety viewpoint and is also available in CD-ROM form as part of the OSHROM/MHIDAS discs.

For information on acid rain there is the database **Acid Rain** which covers all aspects of the subject from its source to the effect on the aquatic environment. Two databases that relate to the United States Clean Air Act are Air Toxic Report and Air/Water Pollution Report. For climate change, two useful databases are the **Global Environmental Change Report** and the **Greenhouse Effect Report**. Finally, it is worth bearing in mind the major databases already mentioned, such as **Enviroline, Chemical Abstracts** and **GEOBASE** which contain a large amount of information on air pollution.

Two specific but important sources of air pollution are vehicle emissions and power station emissions. The former are the source of much photochemical smog while the latter can contribute to acid rain if they use sulphur containing fuel or if they are not equipped with gas scrubbers to remove the sulphur before it enters the atmosphere. Hence databases that deal with transport and energy can be useful

sources of information on air pollution – see the relevant chapters for details.

Among journals on air pollution are **Atmospheric Environment**, which is a technical journal covering all aspects of air pollution. It is in two parts of which part B is specifically on air pollution within the city. The journal **Clean Air** has a lot of information on air quality legislation and regulations, particularly in the UK and EC. The **Journal of the Air and Waste Management Association** covers not only air pollution but also air quality, pollution control and hazardous waste. For world-wide reports there is the **World Meteorological Organisation Bulletin** which as well as containing articles, reports etc. lists the publications of the WMO.

Air Pollution organisations

Among organisations connected with climate and air pollution the **World Meteorological Organisation** has already been mentioned. Another organisation concerned with weather is the **Climatic Research Unit** (University of East Anglia, Norwich NR4 7TS, UK). The **International Union of Air Pollution Prevention Associations** (136 North Street, Brighton BN1 1RG, UK) is a union of national, professional, or voluntary, non-profit-making associations concerned with air quality. It has a library and information service.

Directories/Bibliographies

A useful guide to information in this area is **Air and water pollution : sources of information and bibliography.** This contains a list of organisations world-wide plus a bibliography. It is published by Infoterra and the Industry and Environment Office of UNEP (1989, ISBN 9280712330).

Hazardous chemicals

Many chemicals have the potential to cause environmental damage either through direct chemical action or by changing conditions such

as local acidity. Those of particular concern to the environment include :

1. Air pollutants. These have been discussed in more detail previously but include many products of combustion as well as aerosol products, diesel and petrol fumes etc.

2. Fertilisers which can be washed from the land into local rivers and lakes where their nutrient qualities can encourage the growth of algae. In severe cases algal bloom can occur in inland waters and the oxygen demand of the algae results in eutrophication of these waters, rendering them incapable of supporting much life.

3. Pesticides, used increasingly in intensive farming techniques, can be slow to degrade in the environment and can have adverse effects on animals, especially those at the top of the food chain where the levels of pesticide will accumulate. Predators are therefore particularly at risk : in birds of prey the effect of DDT and other pesticides causes them to lay eggs with very thin shells, reducing the chances of survival of the offspring. As birds of prey are important in controlling rodent pests such a fall in numbers has serious consequences.

4. Heavy metals such as mercury, cadmium and lead. These are particularly dangerous in certain chemical combinations. Mercury, for example, is used in organomercury compounds that if ingested cause serious health problems. They were responsible for the Minamata Bay tragedy in Japan in the 1950s.

Besides these particular categories there are many other chemicals which can cause problems if allowed to escape into the environment.

Environmental fate data banks

There are several on-line data banks which deal with the fate of chemicals in the environment. The **Environmental Chemicals Data and Information Network (ECDIN)**, produced by the EC, deals with over

21,000 chemicals and is also available on CD-ROM. It includes chemical and physical properties, production, uses, trade statistics, hazard information, exposure limits, toxicity including aquatic toxicity, effects on micro-organisms, carcinogenicity, mutagenicity and environmental fate. It is available on the DIMDI host system.

The **Hazardous Substances Data bank** contains scientifically reviewed data on about 4,200 substances and like ECDIN is also available on CD-ROM. The data are scientifically reviewed and edited and the areas covered are similar to those in ECDIN. It is produced by the US National Library of Medicine.

The **Environmental Fate Databases** contain on four files details of about 12,000 substances. DATALOG covers the properties of a wide variety of chemicals and CHEMFATE lists information about the environmental fate of some of the chemicals listed in DATALOG. BIOLOG lists microbial degradation and toxicity data for about 6000 chemicals while BIODEG has information on the biodegradability of more than 700 chemicals.

Hazardous chemicals information sources

Apart from data banks specifically on environmental fate there are several compilations on hazardous substances in general. **Chemical Abstracts** is always worth searching for information but another good source is the **Kirk-Othmer Encyclopaedia of Chemical Technology** (Wiley, 3rd edn, 1978-84, 26 vols. The 4th edition is presently being published). This is available in printed form, on-line and on CD-ROM. A further large chemical encyclopaedia similar to Kirk-Othmer is **Ullmann's encyclopaedia of Industrial Chemistry** (About 28 volumes, 5th edition, 1984-) whose index is available on CD-ROM. Other printed sources are **Sax's Dangerous Properties of Industrial Materials** (Van Nostrand Reinhold, 8th edition, 3 volumes, 1992, ISBN 0-442-01132-6), the **Hazardous Chemicals Data Book** (Noyes, 2nd edition, 1986, ISBN 0-8155-1072-1) and the **Materials Safety Data Sheets**, an updated loose leaf compilation from Genium Publishing. A data bank on hazardous properties is the **Registry of Toxic Effects of Chemical Substances (RTECS)** which deals with about 109,000 substances and is also

available on CD-ROM. It provides toxicity data measured on humans and a number of animals. The data are not only for ingestion but also for external effects, e.g. on the skin and eyes.

The International Register of Potentially Toxic Chemicals (IRPTC), produced by UNEP, contains information on a large number of chemicals which can affect the environment. It includes not only technical information but also details of regulations on chemicals at national and international level. It is available on-line as part of ECDIN.

Water Pollution - issues and information sources

The importance of water

The plentiful supply of clean, fresh water is important for any society, but for a modern industrial society it is essential. Water is not only used for drinking, washing and cleaning but also used in vast quantities in industry and agriculture. Industry uses water as a coolant in many processes, to 'wash or scrub' liquids or gases in the chemical industry, or simply as a transport medium to carry away waste products. Large or small scale irrigation is the primary use in agriculture. A good water supply is essential for an effective sewage system in cities, otherwise water can be the medium that carries disease. The United Nations World Health Organisation had an ambitious goal that all the peoples of the world should have a clean water supply by the end of 1980s; sadly this goal has not been reached. Freshwater use globally doubled between 1940 and 1980 and is expected to double again by the year 2000.

Ways in which water is polluted

Pollution of water usually falls into three categories:

Liquid inorganic wastes

These are mainly industrial wastes from factories. In many African and Asian countries these wastes are sometimes untreated and often include heavy metals (cadmium, mercury, lead etc.) which are extremely poisonous to humans and animal life.

Liquid organic wastes

In Africa and Asia these wastes are primarily animal and human sewage and agricultural runoff (fertilisers and pesticides). These wastes are broken down by bacteria which gradually use up all the available oxygen in the water. This results in a river or lake much depleted in aquatic life (especially fish) and in extreme cases the river is described as 'dead'.

Bacteria, viruses and worms are carried by water and live off organic wastes. These spread diseases like cholera, diarrhoea, typhoid and biharzia. Most of these diseases can be eradicated by a good supply of uncontaminated water and sewage treatment facilities.

Case studies

Water pollution in Nigeria

This is taken from *Habitat International*, vol. 14, no. 1, pages 5-15, 1990.

In Nigeria the principal sources of waste are industrial (especially the oil industry), municipal, solid wastes, water-craft wastes and sedimentation/erosion.

1. Industrial wastes. In northern Nigeria it is estimated that 50-60 tons of harmful industrial wastes are dumped annually into the river Kaduna and this waste pollutes around 20 miles of the river. The waste comes from a variety of industries, for example fertiliser, automobile and textiles. Lagos is home to 40% of all industry in Nigeria and faces an extremely difficult waste management problem.

2. Municipal wastes. Most of these wastes are left untreated and are dumped into rivers or streams.

3. The oil industry. Oil spillage is one of the biggest problems in Nigeria. Between 1970-1983 there were 1711 spillages of oil recorded. Deliberate or accidental spillages by foreign or national ships cause a marine problem along the Nigerian coast.

4. Sediment and erosion. This produces the greatest volume of wastes. Sediments from croplands, unprotected forest soils, overgrazing, strip mines and untreated roads all add to this problem.

Water pollution in Indonesia

In the last twenty years, concern has increased over the problem of water pollution. The main contributors to this are from agricultural, urban and industrial activities with major contributors being domestic waste and industrial discharges.

In the heavily urbanised areas population growth and industrial activities are producing pollution levels which impede community development and damage rivers, estuaries and coastal waterways.

In Java, for example, the pollution of the water sources is a direct result of the increasing population and industrial activity, especially since 80% of large scale and medium scale industries are located there.

The World Bank has estimated that during dry years (normally one in five), Java will experience a 10% average shortfall in water, with the percentage rising from the west to the east of the island.

The Ministry of Pollution identified 20 badly polluted rivers which require immediate attention. Eleven of these rivers are on Java alone. Jakarta is a main source of pollution. All of the capital's rivers are choked with rubbish, sewage and industrial effluent. As a result, there are serious public health and economic impacts, which, in the long term, will only be overcome by properly enforced anti pollution legislation, appropriate sewage systems and water treatment plants.

Reservoirs are also badly affected. The Saguling reservoir, downstream of Bandung, is one of the most heavily polluted bodies of water in West Java. It is currently used only for hydro-power generation. Pollution by industrial and domestic users in Bandung severely affects water quality for downstream users and limits options for the use of the river water.

The problem of ground water pollution is most acute on Java, especially around Jakarta. About 90% of Java is underlain by ground water reserves.

Most of these are already exploited mainly for urban drinking water, in some cases intensively, due to high population densities. It was originally thought that the intrusion of saline water into these aquifers was a result of uncontrolled extraction rates. However, as saline water has been reported in wells for centuries it is now thought that the aquifers are being polluted by saline water within the overlying and underlying aquifers, rather than by the intrusion of sea water. Land to the south of Jakarta is being converted to urban land at a rate of 4,000 ha/yr. This land is a source of recharge for the superficial and unconfined aquifers exploited by Jakarta. Its development will reduce the size of the recharge zones and therefore the water recharge to these water sources.

Water pollution in Pakistan

In Pakistan, contaminated water in both rural and urban areas pose significant problems. Water supply standards set by the WHO, particularly for microbiological content, are rarely achieved in Pakistan. Almost all surface water, except near headwaters in mountain areas, is contaminated and unfit for human consumption. Water quality is continually deteriorating due to increasing biological contamination from human waste, chemical pollution from industrial wastes and agricultural inputs, salinisation and siltation.

The largest rivers are severely polluted. Where they pass through urban areas, pollution from domestic waste is a greater problem than that from industrial sources, e.g. the rivers Lyari in Karachi, Leh in Rawalpindi and Ravi in Lahore.

Sewage is also used to irrigate crops, some of which are eaten raw. Consequently, 50% of salad crops are contaminated with pathogens.

Pollution can have a cumulative effect on rivers and streams. There was a sudden drop in dissolved oxygen levels in Pakistan rivers in the period 1983-1985. It has been estimated that 50% of the biochemical oxygen demand (BOD) of the projected waste load for the year 2000 will need to be removed merely to maintain existing water quality levels.

Water shortage is a major environmental problem in Pakistan. Rainfall varies both regionally and seasonally, and most of the country receives inadequate rainfall to sustain cultivation. It is only through large scale irrigation that sizeable tracts of land in the Indus basin have been protected from water shortages and are able to grow crops. The traditional rainfed or Barani agricultural system occupies only about 5,000,000 ha. These areas lying beyond the reach of the canal irrigation systems are vulnerable to chronic water deficit, due to low riverine discharges and high evaporation.

Problems associated with clean-up

Cleaning up rivers, reservoirs and lakes is an extremely expensive and time consuming business; it is best to avoid polluting in the first place. Adequate water standards are needed as well as a relevant legislative and enforcement framework for industry. Clean technology requires new equipment and technology, though much can be done by the careful application of older technology. Much of the waste will either be chemical or biological, which requires very different treatment technologies. It is essential to have trained water and sanitation engineers to advise on the best procedures.

Sources of information

Air and water pollution: sources of information and bibliography
INFOTERRA, Industry and Environment Office
United Nations, 1989

This guide contains a list of world wide organisations plus a useful bibliography. The organisations are drawn from national and international bodies, research companies and organisations, consultancies and academia.

Other UN organisations of importance:

1. The International Maritime Organisation (IMO). Based in the UK, this is a specialised agency with responsibility for Safety of Life at Sea (SOLAS), prevention of marine pollution and maritime transport. It publishes the International Maritime Dangerous Goods Code (IMDG) and many reports on marine pollution.

2. The World Health Organisation (WHO). WHO is based in Switzerland and has overall responsibility for health programmes within the UN. It also has programmes in community water supply and sanitation, environmental pollution control and chemical safety.

3. The World Meteorological Organisation (WMO). This is also based in Switzerland and deals with world climate change and its accompanying problems. WMO has a Hydrology and Water Resources programme which is concerned with every aspect of water provision, monitoring and forecasting.

4. The Joint Group of Experts on Scientific Aspects of Marine Pollution (GESAMP) is an advisory body consisting of experts from various UN agencies such as IMO, WMO, UNEP, FAO, UNESCO and IAEA.

These bodies are all connected with the United Nations. Other important organisations include :

5. The International Water Quality Association (IWQA). This is a professional membership organisation based in the UK but which encompasses more than 80 countries. It publishes the journals Water Research, Water Science and Technology and Water Quality International

6. The Water Research Centre (WRC) is the most important UK research organisation on all aspects of water and is a leading

International organisation in the field. It produces the Aqualine database and publishes many reports.

7. The Commonwealth Agricultural Bureau (CABI). This is one of the leading organisations concerned with food and agriculture publishing in the world. It offers training in many countries in specialised information work. Its database, CAB Abstracts, is important among other areas for water resources literature.

8. The InterAfrican Committee for Hydraulic Studies, (ICHS) is based in Burkina Faso and fosters cooperation among states and provides technical assistance in water sciences and technology, including climatology.

Databases:

The most important commercial databases are:

Aqualine
This international database covers water resources, water quality, analysis, treatment, sewage, effluents, technology, regulations and legislation.

Aquatic Sciences Fisheries and Foods (ASFA)
ASFA is a general database on the marine and freshwater environment.

CAB Abstracts
This international database covers the whole range of agricultural activities, including waste disposal and water quality.

Oceanic Abstracts
This database covers issues related to pollution of oceans and estuaries as well as general marine biology.

BIOSIS Previews
This is the most important life sciences database, with good coverage of the water environment, including agricultural and biological wastes.

Water Resources Abstracts

This database covers information on the water cycle, water engineering, water supply and control and water quality management.

All these databases are available through easily accessible online hosts.

Standardisation of information services

Introduction

It is important to ensure as much as possible that the systems used within an information department correspond with those used by similar departments elsewhere. By doing so the department will be able to use the services of information providers more easily than would otherwise be the case and will have access to a wider variety of sources. Switching between information sources also becomes easier. If an outside system is used it also avoids the need to develop an in house system.

Standardisation of processing

Standardisation in processing the holdings of a library or information department is possible due to the availability of classification schemes and cataloguing rules. Unless the contents of the unit are so specialised that they need a "home-grown" classification scheme it is best to use one of the major international schemes.

The Dewey and Universal Decimal Classification schemes are similar (UDC is based on Dewey) and are widely used. Another well established scheme is the Library of Congress one. These schemes can be used to classify general collections quite well but are not so suitable for classifying environmental literature because they were devised before the environment became recognised as a subject in its own right. Hence within these schemes material on the environment is scattered among other subject areas such as chemistry and engineering.

Infoterra have produced their own classification scheme for the environment and this should be ideal to meet the needs of most environmental collections. It is stronger on scientific and technical matters than social or commercial ones but nevertheless is a good scheme if the collection to be classified is confined to environmental material.

For cataloguing, it is recommended that the second edition of the Anglo-American Cataloguing Rules be used. This is the standard scheme used in much of the English-speaking world and therefore will mean that any organisation using it will have cataloguing records compatible with those of many other organisations.

Standardisation in enquiry work

When handling enquiries adopt a standard technique. This can for example involve the use of forms on which to record the enquiry. If properly designed these can help to ensure that the enquirer is asked all the relevant questions about the enquiry. The sort of information needed from the enquirer can include :

Urgency of the enquiry.
Amount of information needed.
How recent the information needs to be, e.g. should it cover the last five years only?
What languages should the information be in.

A form also acts as a prompt which enables the librarian or information officer to ask the enquirer all the relevant questions about the enquiry and can be particularly helpful in enabling a new member of staff to learn enquiry techniques quickly. If the information unit charges for its enquiry services, ask the enquirer whether they have a spending limit and keep within it. (Whether to charge for information services is an area that raises all sorts of issues, and the decision may be outside the control of the information unit. Factors which could influence a decision include the ability of the enquirer to pay, the use by the information unit of sources which are costly to use and the possible need for the unit to cover its running costs.)

Keep detailed records of all enquiries and other services such as current awareness and selective dissemination of information. Provide a feedback mechanism, especially for something like current awareness, so that your customers can rapidly obtain the information they require and also comment on its usefulness. A feedback mechanism

enables the information provider to respond flexibly to the needs of the people who use the service.

When dealing with online enquiries a problem arises with searching techniques. Databases are available on a number of different host systems and each of these has its own search language. Database hosts that contain databases useful for retrieving environmental information are Dialog/Datastar, ESA-IRS, STN and Orbit/Questel. (Details of which hosts particular databases are on are given in the list of databases.) The search languages for some of these hosts are fairly similar (e.g. Dialog, ESA-IRS and STN) but even so any searcher who wishes to access a wide range of databases will need to search on several hosts and so will need to learn more than one search language. An individual can probably learn up to about five search languages. Efforts are being made to standardise search languages but the interests of the individual hosts will make progress slow. Most host systems charge for the amount of time connected to their computers plus the number of citations obtained. ESA/IRS however, charges almost exclusively for citations with only a small connect time element and other hosts may be adopting a similar approach. Dialog, for example, has recently changed its pricing structure in this direction.

Online databases are being increasingly made available on the world-wide computer network, the Internet. This also includes a considerable amount of other environmental information (e.g. discussion groups) and can be used to send electronic mail all over the world. However, it does have the disadvantages of being unstructured and slow to use, especially at times when American usage is at its peak. Online databases are still more easily accessible directly from the hosts. (See also the end of the chapter.)

CD-ROM databases are more user-friendly than online ones and so the problem of search language is less acute. Once purchased, there are no further costs to pay the producers apart from regular subscriptions in order to receive the updates. There is however no standard search software so if you purchase CD-ROM discs it is advisable to obtain them from the same producer if possible. CD-ROMs

are also not as up to date as online sources and because there is a limited amount of information on each disc it may be necessary to search more than one disc for a large database.

IT standardisation

If you purchase a personal computer for your library or information department ensure that it is compatible with standard IBM models. (Many are, but some are not.) Disc drives, for example, should take 3½" or 5¼" discs. This will make it easier to use discs from machines in other locations - although when accepting a disc from elsewhere ensure it is free from computer viruses which can cause a lot of damage if they infect your machine! In some cases data can be completely destroyed.

Even if you can accept discs from other machines there is still the problem of software compatibility. Try to ensure that the software that you use is the same as that of other centres with which you work closely. The Mini-Micro CDS/ISIS software available through Infoterra ensures that there is standardisation of software between many users of environmental information.

Networking

Networks are increasingly being established between one information unit and another. The network can be simply a formal or informal agreement to refer enquirers from one unit to another if the unit receiving the enquiry does not have the expertise or resource to answer the enquiry but believes that the other unit does. In such a case it is very important to ensure that the enquirer is not confused by the transfer so the techniques in the two units should be the same or similar. If there are any major differences, e.g. in levels of pricing if the enquiry services are priced, then this should be clearly explained to the enquirer.

Networks may also take the form of electronic connections between the units. This can be through a local area network and if one of these is set up it is important to ensure as much consistency as possible

in the choice of hardware and software within the organisation. This will make the electronic transfer of files from one person to another much easier. Information sources such as CD ROMs can also be networked which makes multiple searching much easier. However, any such networking must be negotiated with the CD ROM supplier who may charge more for a larger number of access points or may impose restrictions on the use of the CD-ROMs.

The most important development in networking in recent years is the Internet, a global network of computers that can provide a vast amount of information. It contains a lot of environmental material but because it is so large it can be difficult to find exactly what you are looking for. Generally it is best for finding very specific subjects or documents (e.g. the Montreal Protocol or the Asian Institute of Technology) rather than wider topics (e.g. waste treatment) which will produce so much information that it takes a long time to go through it all to see what is really relevant. There are now a number of searching tools on the Internet that make its use much easier than was formerly the case.

Pollution information sources - Waste disposal

The context

The disposal of solid waste can cause severe environmental problems if not handled properly. Waste can contaminate surrounding areas and can also pose health problems if it contains either agricultural or chemical matter. Methods of treating waste can themselves be a potential source of environmental concern and the way in which waste is disposed should take into consideration as far as possible the nature of the waste and its location. The following points should be borne in mind :

a) Waste arises from different sources, e.g. industrial, agricultural or domestic, and each of these will have its own characteristics and hence environmental problems. Within each category the nature of the waste can vary widely. For example, the composition of industrial waste will depend on the industry concerned.

b) Waste usually consists of a mixture of different materials - metals, polymers, glass, paper, organic waste etc. - with their own individual disposal problems. The mixed nature of waste can cause problems if some components are incompatible with each other. For example, two components may slowly combine chemically to give a toxic product which can escape from the disposal site.

c) Waste has tended to increase in amount and also become more toxic as an increasing number of synthetic chemicals are used in both agriculture and industry. Waste disposal sites can leach toxic chemicals which can contaminate water sources.

d) Transport of some kinds of waste can itself cause problems in e.g. ensuring that containers are safe and the risk of accidents is minimised. Particular care needs to be taken in the transport of toxic, hazardous, inflammable or radioactive chemicals.

d) There are alternative disposal methods - dumping, landfill, incineration and recycling. The method used to dispose of waste will

depend on individual circumstances. Dumping is generally the cheapest option but can produce unsightly areas which often pose a serious environmental threat, especially in urban areas. Landfill, i.e. the burying of waste in man made depressions, is more desirable in that the waste is out of sight and is less of a disease hazard. However, problems have arisen when dwellings are built on the site as the ground is often contaminated. There is also the problem of leaching. Incineration can destroy the waste but sometimes causes a problem itself if it releases toxic fumes or other potential air pollutants. Recycling is dealt with at the end of this section.

The Basel Convention on Hazardous Waste, which came into force in April 1992, seeks to restrict the dumping of hazardous waste from one country on to another. The Convention requires that any country exporting waste it considers hazardous must obtain permission from the importing country which has 60 days in which to issue this consent.

The European Community has banned the shipment of waste to a number of countries which receive aid from it but will still export substances on a "green" list that are considered less toxic. This list contains substances such as scrap metals, some of which can have toxic effects, e.g. lead, cadmium and thallium.

Case Study - Love Canal

Love Canal is a classic example of what can happen when land contaminated by the disposal of waste is not treated and where subsequent users have inadequate information about the nature of the land.

From 1942 to 1953 the Olin Corporation and the Hooker Chemical Corporation buried over 20000 tons of chemical waste in the Love Canal area near Niagara Falls in the USA. In 1953 the land was deeded to the local Board of Education who were not clearly warned about the toxicity of the chemicals buried there, even when houses and playgrounds were built on the site.

In 1976 following several years of heavy rains the water table rose and basements were flooded. Houses smelt of the chemicals and children suffered chemical burns on their feet. There was a high level of medical problems such as cancer, miscarriages and infant deformities. A 1979 study showed that out of 17 pregnant women in the area only 2 gave birth to normal children. In 1980, following a two year fight, most of the residents were relocated. The cost of cleaning up the area was estimated at $250 billion.

(Source : Environmental Encyclopedia. William P. Cunningham et al, eds. Gale Research Inc., 1994. ISBN 0 8103-4986-8)

Sources of information

Many of the major abstracting and indexing sources have extensive coverage of waste disposal. *Chemical Abstracts* is particularly good for the chemical aspects of waste while *Compendex/Engineering Index* can be used for the technical aspects. For agricultural waste it is worth trying CABI.

A useful printed source of information on waste disposal is *Waste and Environment Today*. This appears in two parts, a bibliography which contains abstracts with an index, and a news journal which contains technical articles and news on waste disposal and treatment.

The main online database devoted exclusively to waste (excluding radioactive waste) is *Wasteinfo*. This is produced by the Waste Management Information Bureau and is one of the best sources of information on all aspects of waste. It now has over 65,000 citations and covers not only technology but also regulations, legislation, policy and business information. It is also available on CD ROM.

Among other databases *Acompline/Urbaline* deal with the urban environment and contain a lot of material on waste disposal. They are particularly useful for information on regulations and policy. They are also available on CD-ROM.

Geobase and *Georef* can be useful for information on leachates from tips. *Georef* also contains information on the long term effects of waste disposal, including that of radioactive waste.

Pollution Abstracts covers solid waste in addition to other types of pollution and *Environmental Abstracts/Enviroline* also includes solid waste.

Other useful databases include *RENLINK* which has useful information on the transport of hazardous wastes. *BIOSIS Previews* has information on the biological treatment of wastes and sewage. Finally, for radioactive wastes the best source is the *International Nuclear Information System (INIS)*.

There are several journals covering waste management, among them *Bioresource Technology* which contains technical articles on agricultural, industrial and organic wastes. The *Journal of Hazardous Materials* is another technical journal which includes the handling and disposal of hazardous materials.

Waste Management and Research is published by the International Solid Waste Association and covers all aspects of waste management. *Industrial Environmental Management* is another journal which covers waste thoroughly (it was formerly called *Industrial Waste Management*). Journals dealing with more general subjects such as *Environmental Science and Technology* can also contain useful articles on waste.

Two other services are worth noting. The UK Department of the Environment produces a series of *Waste Management Papers* which provide excellent reviews of topics such as landfilling wastes and the control of landfill gas. Paper no. 28 is on recycling. They contain information on legislation, regulations, organisations, statistics and often a bibliography and glossary. *Croner's Waste Management* is an excellent loose leaf updating service which covers both legislation (UK and EC) and the practical aspects of waste management.

Organisations

The Waste Management Information Bureau (Building 7.12, Harwell, Didcot, Oxfordshire OX11 0RA, UK) is the publisher of *Waste and Environment Today* and also produces *Wasteinfo*. It provides a library and information service on all aspects of waste except radioactive waste. WMIB is one of Infoterra's special sectoral sources.

The International Solid Waste Association is the main international organisation in this field and is based in Denmark (Bremerholm 1, DK-1069, Copenhagen K).

Recycling

Recycling, when practicable, is a more suitable method of dealing with waste than disposal, landfill or incineration as it not only saves on the use of raw materials but also helps reduce the build up of waste. It is however costly as waste materials often have to be separated before recycling and there can be considerable costs associated with the recycling process itself. The products obtained from recycling may have limited uses because of their starting materials. For example, many plastics have carefully controlled ingredients to give them certain properties which cannot be reproduced if the starting material for recycling consists of a number of differently treated plastics.

The World Action for Recycling Materials and Energy from Rubbish (WARMER - 83 Mount Ephraim, Tunbridge Wells, Kent TN4 8BS, UK) acts as a worldwide information service to encourage the recycling of materials. They have a library of over 7,000 items and will answer enquiries. They also produce the *WARMER Bulletin* which deals with recycling worldwide, including national and international legislation.

Other journals which cover recycling are *Biocycle*, which concentrates on new technology involved in producing energy and new materials from waste, *Resources Conservation and Recycling* which covers interdisciplinary aspects of renewable and non-renewable resource

management and *Re use, Recycle* which includes technical aspects of the recycling of all types of material.

The major environmental databases already mentioned can be used to retrieve information on recycling. Most of the pioneering work on recycling has been done in the USA and consequently American sources of information are the most valuable ones in this subject.

Environmentally Sustainable Development

What is sustainable development?

The World Commission on Environment and Development (the Brundtland Commission) in 1987 defined it as: "not a fixed state of harmony, but a process of change in which the exploitation of resources, the direction of investments, the orientation of technological development, and institutional change are made consistent with future as well as present need". This rather long definition can be summed up as: development that meets the needs of the present without compromising the needs of future generations. Sustainable development is a process of integrating economic, social and ecological goals, and should not mean a trade off between the environment and development. Sustainable development should imply balance rather than conflict. In fact there are over 70 definitions of sustainable development! *(OECD report 1990)*.

Why we need sustainable development

Global development must become sustainable - that is, as stated earlier, it must meet the requirements of the present society without jeopardising those of future generations. This means drawing on the earth's ecological interest, not, as we do at present, its capital. It cannot mean a planetary standard of living at western standards, because there are not the resources available; and if everyone consumed as much fossil fuel as does North America, global carbon dioxide emissions would multiply 6-fold, with unspeakable consequences for the greenhouse effect.

Sustainability is a new, largely untested, theory, but broadly speaking it would have to be ecologically sustainable, economically viable, socially just, peaceful in all ways, and use the most appropriate and humane modern technology. It will mean the wide use of natural resources, equitable development, providing the basic necessities for all people, participation by the underprivileged, regional self

sufficiency, local control over resources. It must grow from within and not just be tagged on at the end as an appeasement measure.

Movement towards sustainable development

Industrial society has always promoted the economic benefits of development first, with social benefits coming in second. For a very long time environmental issues of development were hardly ever considered.

The countries of the industrial West or 'North' were the first to be industrialised due to exploitation of natural resources to feed manufacturing industry. As a result the environment in Britain during the 1800s, for example, was severely degraded. There is now great pressure in the countries of the 'North' to put the environment much higher up the political agenda.

There is also much pressure on the rapidly industrialising countries of the 'South', with primarily agrarian economies, to integrate development with the environment. This, of course, is not an easy option and requires co-operation, technology transfer, planning and policy improvements and financial incentives.

The Earth Summit and sustainable development

One of the main themes of the Earth Summit was the promotion of sustainable development. To many people and governments in the countries of the 'South', sustainable development sounds like an expensive option. Many countries wish to develop rapidly (and some have) to provide their people with a better standard of living, and to reduce their dependency (via the debt burden) on the richer nations. Sustainable development, they argue, interrupts their growth, costs too much, and is not practised in the countries of the 'North'. It is these countries, who are the greatest polluters, who should reduce emissions and protect the ozone layer. Sustainable development is therefore a very controversial topic.

The Earth Summit encouraged all countries of the world to identify renewable and non-renewable resources, and formulate long term environment and development plans. Short term gain, as we have so often seen, is not a sensible option.

Chapter 35 of the Summit *'Science for sustainable development'* encourages a scientific and strategic approach. Long-term scientific research, nationally and internationally, should go hand in hand with policy formulation. Each country should collect information and data, locally and regionally, to be communicated to people at all levels of society. Educating people about development issues is also very important if they are to understand the sustainable approach. It is most important to communicate that sustainable development, *is still development*, and does not imply stagnation. In the end any development that totally disregards the impact on the environment will be more costly in financial and human terms.

Relevance to Africa - example of Nigeria

Nigeria is one of the most industrialised nations in Africa and has developed very rapidly. As a result it faces many environmental problems such as:

1. Unsanitary conditions in many of its urban areas.
2. Industrialisation centred on Lagos, Port Harcourt and Kano has led to severe environmental degradation.
3. Agricultural degradation, from traditional and modern techniques.
4. Deforestation.
5. Soil erosion and desertification.
6. The environmental effects of mining and oil production.

Because of greater awareness of environmental matters and the problems Nigeria faces there have been a number of policy responses, culminating in the creation of the Federal Environmental Protection Agency (FEPA) in 1988. The main role of FEPA is the establishment of national

guidelines, standards and criteria, especially in the region of water quality, effluent discharge, air and atmospheric quality and protection of the ozone layer. The agency has wide powers to initiate policy on the environment and enforce this policy by a range of fines. Despite the short period of existence and shortage of money, FEPA has made notable advances. It has set up a series of laboratories to carry out research, monitor discharges and collect data. In 1989 it established the "National Policy on the Environment". FEPA now requires all major industrial and development activities to conduct an Environmental Impact Assessment (EIA). It also publishes a newsletter called The Nigerian Environment and it prepared a detailed report on sustainable development for the Earth Summit.

Relevance to Asia - example of Pakistan

Pakistan is confronted by a number of environmental problems all these problems have one aspect in common; they have either been created by, or enhanced by, past and present unsustainable patterns of resource use. Pakistan has a population of 110 million people and, as such, is one of the ten most populous countries. The population is, in fact, growing at one of the fastest rates in the world. Couple this with the fact that Pakistan has a limited availability of suitable resources needed to cope with an rapidly growing population, we can see that Pakistan will experience an increasing pressure on its environment.

Some of these pressures will result in the following problems:

1/ Unsanitary condition of many of its urban areas.
2/ Increasing industrialisation will lead to severe environmental degradation.
3/ Agricultural degradation, from traditional and modern techniques.
4/ Deforestation.
5/ Soil erosion and desertification.
6/ Mining and oil production.

To become sustainable, Pakistan must adopt low-energy, low waste systems of production and lifestyle in order to sustain welfare and development. However, so far, Pakistan is noted as being notably inefficient in its use of energy: its energy use per unit of goods or services produced is even more intensive than that of the USA. High energy wastage, combined with the need to import fossil fuels, results in a very low productive use of energy per capita. The challenge in Pakistan is to create the right incentives to conserve energy, and to develop relatively "clean" indigenous energy sources, notably hydro-electricity and solar energy.

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Energy and Energy Conservation - issues and sources of information

How energy is produced

The sun provides most of the energy used on Earth in the form of radiation, wind, photosynthesis and water. In fact, the sun is the Earth's only external form of energy. The sun also plays a major part in the production (over millions of years) of the fossil fuels: coal, oil and gas. The major sources of energy are the following:

- wood
- fossil fuels
- hydro-electric
- nuclear power
- solar energy
- biogas and biomatter
- wind power

In many African and Asian countries wood and hydro-electric power are the principal providers of energy. In Uganda, for example, wood provides up to 96% of current energy consumption and 90% of wood is used as fuelwood. Ghana's energy, on the other hand, is supplied by hydro-electricity, mainly from dams on the Volta river. In Sri Lanka the only indigenous energy resources are fuel-wood and hydro-electric power. However, biogas is now being used by several hundred households and a few farms and some hotels use solar power to heat water. Wind energy is used for irrigation by some farmers in the dry zone of the country. In contrast, thousands of islands spread throughout the far-flung islands of the Indonesian archipelago have no electricity at all. Millions of rural Indonesians still use candles, oil or kerosene lamps to see after dark.

It has been reported that 95% of 'Southern' households rely solely on wood or charcoal for cooking. This can be contrasted with many countries in the 'North' with a more mixed energy supply and much

greater consumption. The United Kingdom relies heavily on fossil fuels to generate power, although a small percentage is provided by nuclear energy (approximately 2-3%). In France more than one third of the energy supply is through nuclear power.

We should also not forget that food (converted energy of the sun, soil and water) produces energy for humans and animals, and without this basic need satisfied we can do very little else.

How energy is used

Energy is used for a variety of purposes and activities. Some of the most important are:

- cooking
- heating/cooling
- lighting
- industry and commerce
- agriculture
- transportation

In countries such as United Kingdom the supply of energy is regular and consistent. In many other countries, however, this is not the case. When there is a less consistent supply of energy, or a reliance on just one or two sources, then energy use and conservation becomes an extremely important issue.

Energy conservation

Energy conservation is beginning to be taken very seriously in most industrialised countries. This is a result of some common energy sources starting to decrease in abundance through intense exploitation, whilst others sources become more expensive. The principal ways to conserve energy are through:

- better insulation

- the use of more efficient equipment
- education in the home and in industry
- recycling of energy, for example 'combined heat and power' (CHP)
- better use of natural unpolluting resources, for example using solar energy during the day.

Energy conservation is not just a concern of the more industrialised nations. It also covers topics such as the conservation and management of forests in those countries that rely on wood for power. Many countries and international organisations are developing small-scale energy sources for use in rural areas.

Alternative sources of energy, such as solar energy or biogas are becoming increasingly important. Brazil, for example, has pioneered the use of alcohol (produced from biomass) to fuel vehicles. A major petrochemical company in France is also taking an interest in this.

Case studies

1. Solar power for Indonesian Islands

As stated earlier, millions of Indonesians do not have access to electricity. More than 60% of Indonesian households, some 60 million people, are still not electrified and are forced to rely on kerosene lamps, car batteries and dry cells for light and power. Electrification has been restricted in the main as a result of the archipelago nature of Indonesia with 3,000 inhabited islands stretching 5,000 km from the east to west and 2,000 km from north to south. This makes expansion of the public grid on a national or multi-province basis tremendously difficult and expensive. But for villagers of Suktani, a rural community located on the slopes of Mt. Selak, 80 kms southeast of Jakarta, sun power is now utilised both day and night.

In early 1989, the Indonesian Agency for Assessment and Application of Technology (BPPT) and R&S Renewable Energy Systems, a Royal Dutch Shell Group Company, introduced decentralised solar systems to provide power to individual homes.

To cover the US$430 purchase price, each family could apply for an 18 year government loan which could be repaid in monthly instalments of US$2. In comparison, monthly household outlay for candles and kerosene for lighting was usually three to four times as much.
The solar system is easy to operate, relatively maintenance free and has an expected useful life of more than 20 years.

There is now a waiting list of other villages that would like the solar home systems. In Indonesia, the long distances between villages mean that many cannot expect to be linked up to the electric grid for years. As long as reasonable credit facilities are available, the solar systems offer an alternative to traditional lighting sources.

2. Solar power gives access to telephones in Malaysia

In Malaysia, solar energy is giving rural residents access to telephones. The telephone company, Syrikat Telecom Malaysia (STM), has set up coin operated telephones in remote areas, that are equipped with radio transmitters powered by solar panels. STM claims these were the first solar powered public phones in the world.

The phones are linked to the country's only nation wide cellular phone system. STM has worked with Swedish equipment manufacturer Ericsson to overcome radio interference caused by Malaysia's rugged terrain.

3. Energy efficient stoves in Pakistan

The traditional stove design used in northern Pakistan is a three-sided mud hearth. Although these stoves are fairly efficient when new, they lose efficiency as they age, making it necessary to burn increasing

amounts of scarce wood. A major problem is that the build up of ashes reduces the flow of air to the base of the fire.

A new stove was invented in 1988. The result looked like a large shiny paint pot. When in use, the firewood is burned on a steel plate pierced with 16 holes. The holes allow ashes to drop through to an easily cleaned compartment underneath and let air flow through to the base of the fire.

When boiling water, the stove uses less than half as much fuel as traditional hearth stoves. In tests, just 145 grams or wood was needed to boil 5 litres of water on the new stoves while a traditional hearth used 367 grams. Equally important, the new stove has been well-accepted by housewives. In one home, a housewife said that her new stove smoked less than her old hearth.

Energy information sources

There is an abundance of information on energy, countries like the United Kingdom, have specific journals, directories, statistics and organisations dedicated to energy information. However, there is much information available internationally.

Organisations

The United Nations Environment Programme (UNEP) has very many projects focusing on energy. Other important organisations include:

International Energy Agency (IEA)
The IEA, founded in 1974 as an autonomous body within the OECD, is the energy forum for 21 countries. IEA collects statistics and produces many reports on energy in collaboration with the OECD and other organisations. It publishes *World Energy Statistics and Balance* (1971-1987) which contains energy data for more than 80 developing countries.

UNITAR/UNDP Centre on Small Energy Resources

The United Nations Institute for Training and Research (UNITAR) and the United Nations Development Programme (UNDP) promote the development of small energy resources, particularly for the benefit of rural populations.

Food and Agriculture Organisation (FAO)

This runs an Environment and Energy Programme Coordinating Centre and publishes a newsletter called *Environment and Energy*.

United Nations Educational, Scientific and Cultural Organisation (UNESCO)

UNESCO runs an information programme on new and renewable sources of energy.

International Solar Energy Society (ISES)

This society is dedicated to the advancement and utilisation of solar energy. It is the premier body operating in this field and organises a world solar congress every two years. It publishes *Solar Energy* (the ISES journal) and *Sunworld* (a technical magazine).

International Atomic Energy Agency (IAEA)

IAEA promotes the safe and peaceful uses of nuclear energy, issue standards and codes of practice and provides technical expertise. Over 100 countries are members.

Intermediate Technology Development Group (ITDG)

This UK based organisation has much experience in working with small scale energy production and appropriate technology.

Databases

There are a number of good commercial online databases in this area. Some of the best are:

Energyline

This database is international in scope and covers most energy related topics from nuclear power to alternative energy.

Energy Science and Technology

The largest of all energy databases with over 2 million references. Also covers general environmental topics, for example air pollution, extremely well.

Compendex

Although this is a general engineering database, it is also a good source for the nuclear energy industry.

International Nuclear Information Service (INIS)

From the International Atomic Energy Agency, INIS is the largest and most comprehensive database on nuclear energy.

Other databases include: *TULSA*, for petroleum exploration (which is very expensive to search) and *APILIT*, for petroleum refining. A database such as *CABI* would give information on small scale energy production in Africa or Asia. Many of these databases are also available in CD-ROM format.

Food and Agriculture

Introduction

For many countries of the 'South' with primarily agrarian economies, the issue of food and agriculture is an extremely important one. The issue is very complicated and bound up with other considerations such as deforestation, land degradation and desertification, loss of biological diversity and climate change.

Modern farming techniques, irrigation and the use of pesticides have done much to increase the agricultural yield per hectare, but there have been disadvantages too. Some farming techniques are not appropriate to a particular land type; intensive farming can damage long term fertility; extensive irrigation and damming of rivers can have other environmental impacts; and pesticides that are not used carefully can kill aquatic life.

Deforestation

Deforestation can have a major effect on the environment and food production. Forest land is often wasted for short term gain. It is estimated that approximately 8 million hectares of tropical forest are cleared each year for agriculture. Much of this land is used for cattle ranching, especially in Brazil. The land is productive for a few years but is rarely sustainable. Within 10 years the soil has been degraded due to the constant impact of cattle hooves and the vegetation becomes weedy. The cattle are then moved on to new, more fertile pastures and the land is left in a state that is vastly degraded.

A traditional use for that land would be to support a small community, which would clear a small stretch of forest and plant it with a variety of appropriate food crops (known as 'inter cropping'). The area would be fertilised by animals and wood ash from the trees. This would sustain a population for many years, and not devastate the land. After

20-30 years of being left fallow, the forest would grow back and retain its fertility.

Global agriculture is being degraded at a rate of 6 million hectares each year, with a further 20 million hectares being rendered unprofitable to agriculture. Once land has been badly degraded it can be very expensive to restore. Chemical fertilisers can help produce larger yields, but they do little for soil structure and are very expensive. As with all chemical additions to the soil correct application and dosage is very important. Excess pesticides and/or fertilisers will be washed out of the soil at the next heavy rain and cause much environmental damage to water courses.

Overpopulation

If we do not solve the present day food production problems, the results for future generations may well be devastating. By the end of the next century, the human population of our planet is likely to be at least twice as large as it is today. But even at today's level of about 5.2 billion, the human race is hard pressed to keep itself well fed. Current annual rates of food production (approximately 5.2×10^{15} calories per year), could provide enough food for approximately 6 billion people, if all the food were shared equally and nearly all the calorific output came from grains. (Each person would receive about 2350 calories per day, the UN recommended daily dietary input). If the world's current food output were used to provide every person with a diet like that typical in South America - containing about 10% of the calorific input from animal products - only 4 billion people could be fed at today's level of production. If everyone were to eat a European-style diet, with about 30% of the calories from animal products, only 2.5 billion people could be fed from the food produced world-wide today (World Resources Institute, 1988).

Needless to say, the world's food output is not distributed equally - neither within countries nor between countries. It has been noted that among 46 countries where food consumption levels were below those needed

to support a health and productive life, 43 were in sub Saharan Africa, Asia, Latin America or the Caribbean (Bales et al 1988). A World Bank study (1986) of 87 developing countries, indicated that in 1980, 44 of the population or nearly 730 million people, got less than 90 of the FAO/WHO minimum daily requirements - not enough calories to support an active working life. Even worse, 16 (nearly 440 million people) received less than the amount of food required each day to prevent stunted growth and major health problems.

Even within poor countries hunger is unevenly distributed. The Fifth World Food Survey (FAO, 1985) noted than in Bangladesh, for example, urban dwellers are better fed than their rural cousins. In rural areas, landless peasants averaged about 1990 calories per day while members of households owning more than 7 hectares received an average of almost 2400 calories per day.

In 1980, nearly 70 of the world's total arable land was under the plough. Dramatic increases in productivity would be necessary in both food production and in the management of food distribution systems, just to keep pace with the expected population growth over the next century.

Information from:

Confronting Climate Change: Risks, implications and responses
Edited by Irving M. Mintzer
ISBN 0 521 42109 8

Case study: Decline in Asian rice yields

The high-yielding rice varieties, developed in Asia in the 1960s are yielding less and less each year. On test plots, varieties which yielded 10 tons a hectare in 1966 are now yielding less than 7 tons per ha.

In the fields of Asian farmers, yields are stagnating rather than dropping, partly because few farmers achieved the high yields which were

possible in theory. But stagnation of rice yields is causing concern, verging on alarm.

Over 90 percent of all the world's rice is grown and eaten in Asia, and the crop is important both for political stability and economic development. But the rice output in Asia is now growing at 1%/year, compared to a growth rate of 1.9%/year.

"Increases in rice production have slowed dramatically since 1985 in the 10 countries that account for 85% of world production". The International Rice Research Institute (IRRI) scientists estimate that in south Asia alone, around 10 million hectares of highly productive ricelands - 10% of the global area under irrigated rice - are showing signs of fatigue. They also estimate that farmers are having to apply up to 40% more nitrogen fertiliser than they did 10 years ago to produce the same amount of rice.

While yields are stagnant, rice output will have to increase by 70% in the next 25 years to keep up with demand, according to the IRRI. This means an extra 350 million tons/year will have to be grown. And because of competing demands on land and water, rice in the year 2020 will have to be grown on less land, using less water.

The first high yielding variety to be released by IRRI was called IR8. This has a shorter growing season than traditional varieties, and meant that for farmers with irrigation, two crops and even three crops a year were possible. Most farmers had previously grown only one crop a year. But even by 1982, IRRI scientists were noting a decline in IR8 yields, a decline which has continued.

The problem is that intensive rice cultivation has lead to environmental degradation, with irrigated rice land unable to cope. Prabhu Pingali, leader of IRRI's irrigated rice programme, says that the cause of the "long term degradation of the paddy environment under intensive cultivation... is the switch from a single crop of rice to an intensive monoculture system involving 2 or 3 crops a year". This results in a

"sharp increase" in environmental costs, he says, "through changes in land use and crop management practices". These detrimental changes include a reduction in the period when the soil is dry, the substitution of inorganic for organic fertilisers and a greater uniformity in the varieties grown.

The practice of growing rice standing in water, means that the soil is robbed of oxygen and this eventually erodes its fertility. "Under submerged conditions, there appears to be a reduction in the amount of nitrogen the soil can provide to the crop", says Ken Cassman, head of IRRI's Agronomy, Plant physiology and Agroecology Division.

Recent research at IRRI has shown, however, that intermittent flooding, keeping the soil saturated but with no standing water, causes no significant decline in yields. Pingali believes that too much nitrogen fertiliser has been applied to rice crops, compared with other nutrients, and that the reduction and eventual removal of fertiliser subsidies would encourage farmers to use it more efficiently "and make technologies that reduce fertiliser use more viable".

He also points out that a crop rotation that involves, each year, a rice crop followed by a legume crop, or two rice crops followed by a legume crop, is an "economically feasible organic fertiliser technique" where markets exist.

Hopes of achieving the 70% increase in rice output within 25 years are now pinned on the development of a new rice plant that can yield 20 to 25% more than existing irrigated varieties. The new rice plant differs from existing varieties in many ways. It has for example fewer tillers (stems) but larger panicles (the part of the plant which carries the rice grain). The variety is now growing at IRRI and was harvested for the first time in May 1995. The new rice is thought to also help the environment. "We must feed more and more people with existing resources or rice farmers will start cultivating fragile hillsides and open up mangrove swamps and tidal wetlands in order to produce more."

Article taken from:

Perspectives, No.13, 1994, IIED

Sources of information

Food and agriculture is a particularly well served area. The FAO (Food and Agriculture Organisation) and ACCIS (Advisory Committee for the Coordination of Information Systems) have produced a useful and comprehensive guide:

ACCIS Guide to United Nations Information Sources on Food anc Agriculture
FAO, 1987
ISBN 9251026041

Food and Agriculture Organisation (FAO)

FAO is a specialised agency of the UN with headquarters in Rome and a regional office in Accra, Ghana. FAO was established in 1945 and has over 160 member countries. FAO carries out major programmes of technical advice and assistance; collects, analyses and disseminates information; advises governments on policy and planning; and brings together governments, NGOs and funding organisations to discuss food and agricultural problems. FAO publishes a large number of reports, yearbooks and statistics. It also publishes *CERES*, a bimonthly newsletter. The major FAO units are:

1. The Interdepartmental Working Group on Environment and Sustainable Development

2. The Forestry department

3. The Fisheries department

4. The Agricultural department

5. Regional commissions and technical committees. For example, there is a regional Forestry Commission for Africa.

Useful organisations in Africa

1. African Centre for Technology Studies, Nairobi Kenya

2. African NGOs Environmental Network (ANEN), Nairobi Kenya

3. African Timber Organisation (ATO), Libreville Gabon

4. Eastern African Environmental Network, Nairobi Kenya

5. Economic Commission for Africa (ECA), Addis Ababa Ethiopia

6. Inter-African Committee for Hydraulic Studies (ICHS), Burkina Faso

7. International Centre for Insect Physiology and Ecology (ICIPE), Nairobi Kenya

8. International Council for Research in Agroforestry (ICRAF), Nairobi Kenya

9. International Institute of Tropical Agriculture (IITA), Ibadan Nigeria

10. International Livestock Centre for Africa (ILCA). Addis Ababa Ethiopia

11. West African Rice Development Association (WARDA), Monrovia Liberia

12. Pan-African Council for the Protection of the Environment and for Development, Mauritania.

In addition to these organisations there is also the Commonwealth Agricultural Bureau International (CABI). This is a major centre for information services in food, agriculture and allied subjects. It produces CAB Abstracts and has been designated by UNEP as a "special sectorial source". CABI has a number of field stations around the world.

Databases

There are a number of very good databases in this area of which the following are particularly important :

1. International System for the Agricultural Sciences and Technology (AGRIS). This is produced by the FAO. It is the collective input from more than 120 countries and has been going since 1975. There is also a printed journal called AGRINDEX.

2. Current Agricultural Research Information System (CARIS). This database is also coordinated by the FAO. It is produced through a decentralised network of national and regional centres in developing countries, each centre being responsible for the collection, processing and dissemination of information on current research in agriculture in its own country/region.

3. AGRICOLA (US National Library of Agriculture). This contains the literature acquired by the US national Agricultural Library.

4. ASFA (Aquatic Sciences and Fisheries Abstracts). ASFA is a general database on the marine and freshwater environment.

5. BIOSIS Previews. The leading biological database. It does have much relevant agricultural information.

6. CAB Abstracts (Commonwealth Agricultural Bureau). This is the largest agricultural database and corresponds to 52 individual journals produced by CAB. It contains worldwide information on every aspect of agriculture and is especially good for developing countries.

7. FSTA (Food Science and Technology Abstracts). This contains comprehensive coverage on the worldwide literature in food science and technology.

8. Chemical Abstracts. The world's largest chemical database is also an excellent source of information on food science and agricultural chemistry.

Patents and Technology Transfer

What is technology transfer?

Technology transfer is the application of existing technology to new areas. This can mean for example the use of academic research to develop commercially useful products or the exploitation of patents through licensing agreements. Technology transfer usually involves a sequence of commercial transactions although it can also come about through other means such as international cooperation agreements.

Patents

Technology transfer relies heavily on patents for many new ideas that can be exploited. A patent is basically an agreement between an inventor and the state by which the inventor reveals details of his or her invention in return for the exclusive but temporary right to exploit that invention. Most countries have their own patent systems and a patent is valid only in the country in which the patent application has been granted. Hence a patent has to be taken out in each country where it is hoped to exploit the invention. The lifetime of a patent varies from country to country but is usually about twenty years. The inventor, who in most countries can be either an individual or (more usually) an organisation, normally pays an annual fee to keep the patent in force. Once it expires, either because it has reached the end of its lifetime or because the fees have not been paid, the inventor loses the sole right to exploit the invention and anyone can then exploit it.

In most countries which grant patents an application for a patent is subjected to an examination to see whether the invention is novel. If it is not (for example if a patent already exists on the same invention or if it has already been described in print) then the patent is not granted. The grant of a patent is very important for an organisation as it enables it to protect its ideas against competitors : if a patent is not applied for a competitor may patent the same idea and so make it impossible for the organisation to continue to exploit that idea.

There are two patent schemes which enable a patentee to file an application in several countries simultaneously. The Patent Cooperation Treaty is a system of centralised examination, it then being up to member states to decide whether to grant a patent. It has the advantage for the inventor that he need make only one patent application. Most of the countries that have signed the treaty are in Europe or North America. There are several African signatories but most are francophone : anglophone and lusophone African countries are poorly represented. Only a few countries in Asia are signatories.

There is also a European patent by which one centrally granted patent becomes a number of patents in the member states. The member states include all the members of the European Union plus a few other countries such as Switzerland.

Many patentees do not exploit their inventions themselves but license their inventions to other organisations. Such licensing agreements are important in helping to bring about technology transfer. Before any agreement is entered into on technology transfer, however, it is important to assess what is on offer to ensure that it is in the best interests of the country to which the technology is being transferred.

Case studies on technology transfer

1. The fertiliser industry in Bangladesh. Fertiliser manufacture accounts for about three quarters of the total public expenditure in manufacturing. 85% of the fertiliser manufactured is urea which is made from ammonia. The manufacturing process is being constantly improved due to research carried out in other countries and plants manufacturing urea in Bangladesh have entered into licensing agreements with companies from Japan, India, the USA and elsewhere. However, the transfer of technology has not been as effective as it could be due to the tendency not to make use of local resources, equipment and expertise. A systematic national policy may help to overcome this problem.

(Source : *Science, technology and development : North-South cooperation*. M. Huq, ed. Frank Cass, 1991. ISBN 0-7146-3455-7. Pages 176 186.)

2. Hydraulic ram pumps in rural Africa. The University of Warwick in the UK was asked to help design water powered hydraulic ram pumps for irrigation and general water supply purposes in a number of African countries. This was identified by the countries concerned as an important piece of equipment. The development programme revealed various problems that were dealt with as the project progressed. The important points to arise from the project were that it matched significant needs and it benefited from the combination of the University's expertise and local knowledge in Africa. Much of the design and research work should however be located in the recipient country.

(Source : T. Thomas, *ibid*, pp. 73 81.)

Sources of information on patents and technology transfer

A number of journals provide useful information on various aspects of technology transfer. *Technology Transfer International*, for example, is a monthly newsletter listing projects available for licensing. This covers inventions of environmental interest among others. A more academic journal from the USA is the quarterly *Journal of Technology Transfer*.

Sources of information which are more specifically about countries outside Europe and North America include *Science, Technology and Development : North-South cooperation*. This is edited by Mozammel Huq and published by Frank Cass in 1991 (ISBN 07146 3455 7). This contains a number of useful articles on technology transfer and the two case studies above are taken from this book.

Another useful source, although now getting rather old, is *Legal aspects of the transfer of technology to developing countries*, by M. Blakeney. This was published in 1989. Also dealing with legal aspects is *Compilation of national laws applying to the transfer of*

technology, by J.F. O'Farrell, published in 1988. This compares the legal position in 32 countries, including South Africa, India, South Korea and Japan.

Some of the databases already mentioned cover patents, for example *Chemical Abstracts*. The two major databases that concentrate on patents are *World Patents International (WPI)*, produced by Derwent, and *INPADOC*. *WPI* at present covers over 30 patent issuing authorities and has nearly 6 million records. *INPADOC* has more records (over 17 million) from 56 patent issuing authorities, covering almost all the world's patents, but unlike WPI it contains bibliographic details only, lacking abstracts.

The Asia and Pacific Centre for the Transfer of Technology (49 Palace Road, P.O.Box 115, Bangalore 560 052, India) aims to strengthen capabilities of developing countries of Asia and the Pacific in the development, transfer and utilisation of technology.

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Environmental Impact Assessment (EIA)

What is an EIA?

An EIA is generally understood to be an instrument of preventative environmental management. It should provide all the information necessary for effective decision making before major projects commence. The purpose of the EIA is to ensure that appropriate attention is paid to environmental issues.

Environmental impact is the difference between the future environment, as modified by the project, and the future environment as it would have naturally evolved without the project. An EIA is a management and planning tool and to be effective must be conducted at the earliest opportunity, before any decisions about the project have been made. Once a major project such as a dam is under construction it is much more difficult to introduce modifications in order to protect the environment. An EIA is now mandatory in many countries of the world : Kenya, for example, was one of the first countries to evaluate possible impacts of large projects.

The development of EIAs

EIA, as a decision supporting tool, was first developed in the United States, within the framework of the *National Environmental Policy Act (NEPA)*, 1970. The EIA is the procedure or process, whilst the Environmental Impact Statement (EIS), is the report on the work. Since 1970 many countries of the world and many international organisations have embraced EIA. For example, specific requirements for EIA have been established in Malaysia, Indonesia, Thailand and the Philippines.

Trends in EIA practice

There are seven main trends in EIA practice :

1. EIA works in all political systems, and has been adapted to several different legal traditions.

2. EIA works best when there is an independent authority able to oversee the process.

3. EIA is effective in providing local people with an opportunity to be heard and to participate in the decision making process.

4. EIAs encourage the collection of data, and facilitate inter agency communication.

5. There has been resistance in some quarters to conducting an EIA. Some regard it as 'anti development' or expensive, while others feel that it is time consuming or difficult to administer.

6. EIAs tend to be used for large scale projects, but they are still useful for small scale projects, which can also have harmful environmental effects.

7. EIAs have not been universally successful and some have been poorly designed and carried out. The EIA process needs to be reviewed constantly.

Steps in carrying out an EIA

Conducting an EIA can be a complex affair. Many countries have evolved their own criteria and use different methodologies, but ideally the following stages should be included :

1. Screening. At the beginning of the project it must be decided whether an EIA is necessary.
2. Scoping. The scope of the EIA must be determined.
3. Preparing the EIA.
4. During the preparation of the EIA there must be consultation with interested authorities and also with the public.

5. Evaluation of the results of consultation and participation.
6. Reaching a decision on the project based on the EIA.
7. Monitoring the impacts after the project has been completed.

It is also essential to have environmental impact statements of previous projects available for consultation and this is a function that can be carried out by a national environmental information service.

Case studies

1. The Øresund bridge-tunnel

The Øresund is the narrow straight between Denmark and Sweden and is one of the few entrances to the almost enclosed Baltic Sea. It is intended to build a road bridge across the straight linking the two countries. Part of this crossing will take the form of a tunnel to allow the free passage of shipping but this will result in the creation of artificial islands.

A number of potential impacts to the environment have been assessed before the start of construction. The Baltic is brackish and its ecology is fragile. Any major change in the salinity or even the mixing of fresh and saline water in the Sea could have repercussions on the wildlife, including the fish population. The Baltic is periodically flushed with more saline water from the North Sea and this appears to be essential in preserving its ecological balance. Much of this flushing occurs through the Øresund and environmental assessment has been carried out to determine how the building of the crossing will affect the Baltic s salinity balance.

There are also local environmental factors that have been assessed. The creation of artificial islands will result in release of sludge which if not controlled would smother marine life such as seaweed. Hence there must be limits on the amount of waste material allowed to escape into the water - a limit of 5% has been set. Other local factors include disturbance to local populations of seals and breeding birds.

In addition to the effects of construction there will also be the environmental effects of the crossing once in operation. The increase in road traffic will for example lead to increased emissions from vehicle exhausts. On account of this some people have argued that a rail tunnel rather than a road crossing would be environmentally better.

These are the sorts of factors that need to be taken into account when assessing the environmental impact of a project.

(Source : "How to build greener bridges". F. Pearce. *New Scientist*, 21 January 1995, pp. 25-29.)

2. EIA in Ghana

Ghana set up its Environmental Protection Council(EPC) in 1972 with an advisory, coordinating, investigational and educational role. Although it initiated EIA with respect to industries this was not backed up with the necessary legislation. However, in 1985 the Ghana Investment Code was passed which led to the setting up of the Ghana Investment Centre. This was required among other matters to assess the environmental impact of any project that it might fund. Consequently the EPC set up an Environmental Impact Assessment Committee to oversee the introduction of EIA techniques in Ghana.

In 1988 the Government initiated an Environmental Action Plan(EAP) to cover the years 1991-2000. This plan stresses the need for EIA. At about the same time EPC produced as a result of a government directive a set of draft guidelines for EIA. Despite these developments there is still no formal EIA procedure. As part of the EAP however the EPC is to be restructured to enable it to lead in the management of Ghana's environment and oversee implementation of the EAP. There will be an Environmental Assessment Unit as part of EPC and this will be responsible for EIA in Ghana. One of the priorities is to ensure that a formal EIA system is enforced by legislation.

(Source : "EIA in Ghana". J.A. Allotey, *Environmental Assessment*, vol. 2, no. 1, pp. 21-22 (March 1994))

3. Jubail Industrial City

Jubail Industrial City on the Arabian Gulf in Saudi Arabia was built from 1977 onwards as a centre of manufacturing industry. The industries located there are mainly chemical. The city also functions as a port.

While there does not seem to have been any EIA before the decision to construct the city there has been very careful monitoring of the environment before and after construction and it is intended that the development should be in accordance with sound environmental practice. Hence there has been a comprehensive environmental study and monitoring plan with particular attention given to possible environmental contamination by discharges to air, water and land. To this end systems for monitoring air and water pollution have been set up as well as land surveys to monitor the dumping of waste and spillages both on land and in the sea.

The fauna and flora of the area were surveyed prior to construction and also after the city had been built to monitor any changes. Material was dredged from the sea for landfill during the construction and this resulted in a considerable amount of suspended solid in the adjacent Gulf waters which took about 3-4 years to settle.

The development had a significant and sometimes unacceptable effect on air pollution but levels of pollutants have remained below the acceptable limits since 1983. Concentrations of heavy metals in the adjacent Gulf waters have not shown any significant upward trend except that zinc concentrations have sometimes been above acceptable levels.

(Source : Reference 3 (see below), "Environmental Impact Assessment of Jubail Industrial City, 1978-1988". P.L.O'Brien et al., pp. 103-123)

Sources of information and references

General information on EIA can be obtained from the major environmental databases such as *Enviroline*. For any EIA relating to a particular aspect of the environment the sources relevant to that area can be used. Two Asian organisations which have expertise in dealing with EIAs are the *Asian Development Bank* and the newly formed *Asia Pacific Institute of Environmental Assessment* (APIEA : Suite 711 (7th floor), Wisma Lim Foo Yong, Jalan Rja Chulan, 50200 Kuala Lumpur, Malaysia).

Useful references include :

1. Environmental Impact Assessment
A G Colombo (editor)
Kluwer Academic Publishers, 1992

2. Environmental Impact Assessment (EIA) for Development
DSE/UNEP
Joint seminar, Feldafing, Federal Republic of Germany, April 9 12, 1984

3. Environmental Impact Assessment for Developing Countries.
ed. A.K.Biswas and S.B.C. Agarwal
Butterworth-Heinemann, 1992
(ISBN 0-7506 1190-1)
This contains a chapter (no. 14) entitled "Environmental assessment and review during the project cycle : the Asian Development Bank's approach," B.N. Lohani, pp. 178-183.

4. International Trends in Environmental Impact Assessment
Nicholas A Robinson
Boston College Environmental Affairs Law Review (1992), 19(3), 591-621

5. APIEA impacts Southeast Asia. D. Turberfield. Environmental Assessment, vol. 2, no.3 (September 1994), pp. 104-106.

6. Environmental Impact Assessment in Nigeria : current situation and developments for the future.
Femi Olokesusi
Journal of Environmental Management (1992), 35, 163-171

7. EIA Effectiveness and Mechanisms of Control : case studies of water resources in Kenya.
Rafik Hirji & Leonard Ortolano
Water Resources Development (1991), 7(3), 154-167

8. Controlling Industrial Pollution using EIA : case study of a Kenyan tannery project.
Rafik Hirji & Leonard Ortolano
The Environmentalist (1991), 11(4), 255-266

9. Environmental Impact Assessment in Ghana - an *ex post* Evaluation of the Volta Resettlement Scheme : the case of the Kpong hydro-electric project.
Sam Ofori-Cudjoe
The Environmentalist (1990), 10(2), 115-126.

Factors affecting biodiversity

Fauna and flora can be affected by the loss of their specialised habitats as well as by over exploitation. The extinction or even rarity of species can have an important effect on the ecology of a country, for example in the impact that this would have on the species' natural predators. Species from elsewhere are often introduced into a particular area for purposes such as biological control but can have unforeseen effects on the native species. As an example, the introduction of new species of fish into Lake Victoria has led to the decline in native fish species important for the local fisheries. Pollution can also be an important factor as some pollutants can adversely affect the ability of species to reproduce. Birds of prey, at the end of the food chain, are particularly at risk and it has been found that the effects of pesticides such as DDT has caused their eggshells to become thinner, increasing the risk of breakage. A more recent development is the adverse effect of synthetic chemicals that imitate the action of female hormones on male animals, decreasing their fertility.

Threatened species may have real or potential economic importance. Certain animals may be important in promoting tourism while plants may contain substances effective against particular diseases. Some important crops rely heavily on one variety which lessens their ability to combat pests so it is important to preserve their other varieties, however obscure. Serious reduction in numbers of any species restricts the variety of its gene pool so making it less able to adapt to new conditions in the future.

Case studies

1. The harmful effects of introduced species. The introduction of the African land snail on the island of Moorea in French Polynesia resulted in damage to crops. In order to control this snail another snail, *Euglandina*, was introduced. This species is carnivorous and it was expected that it would attack the land snail. Unfortunately it

attacked instead snails of the native *Partula* genus with the result that of the seven species one became totally extinct and the others became extinct in the wild. It is hoped that *Euglandina* will itself soon become extinct in Moorea so that the six remaining species of *Partula* that have been bred in captivity can be reintroduced. (New Scientist, 24 August 1991, p. 14)

2. The value of rare species. A rare vine growing only in the African state of Cameroon has been found to contain a chemical that helps prevent the Human Immunodeficiency Virus (HIV) from killing human cells *in vitro*. It therefore has considerable potential in the treatment of AIDS. The properties of the vine were discovered by the US National Cancer Institute which recognises the need to compensate source countries for the use of their natural products. Whether this will benefit Cameroon in the long or short term is not certain. The Biodiversity Convention (see below) may help to strengthen the position of countries such as Cameroon in future. (New Scientist, 16 January 1993, pp.12-13)

3. The need to maintain genetic variability. The potato is one of the most important food plants in the world yet the genetic variability of most of the potatoes grown around the world is limited. This makes it more susceptible to disease and the failure of the crop can lead to famine as happened in Ireland in the 1840s. There are many varieties of potato in its native America that are not known elsewhere and it is important that these are preserved to maintain as many variations as possible.

Trade in endangered species is controlled by the *Convention on International Trade in Endangered Species (CITES)*. Species can be added to those covered by this treaty if they become threatened.

The *Convention on Biological Diversity* was drawn up in parallel to the Rio Summit and has now been signed by most countries in the world including (after initial refusal) the United States. It gives countries rights over their genetic resources so that these cannot be exploited by other and richer countries without benefits for the host country. However, it also gives countries responsibility for

conserving their biological diversity and the Convention spells out the means by which this is to be attained.

The Convention says that :

1. Countries are to facilitate access to genetic materials within their borders for environmentally sound uses.

2. Developing countries are to have access to environmentally sound technologies that they need for conservation and sustainable use of biodiversity. This access will be under fair and most favourable terms and will recognise patent rights.

3. Developing countries are to have access to technology that makes use of resources they provided.

4. Developing countries are to receive technical and scientific assistance, so that they can develop their own institutions and expertise in the sustainable uses of biological diversity.

5. Countries are to consider the need for an agreement on the safe handling and use of living organisms modified by biotechnology.

6. Developed countries that sign the Convention shall provide new financial aid to developing countries to help them implement terms of the Convention.

Sources of information

a) Printed.

The World Conservation Union (IUCN) publishes a series of *Red Data Books* of endangered species. These are grouped into classes of animals such as mammals, birds and reptiles. Some of these publications are now rather old which is a problem in an area where the status of many species is changing rapidly. The IUCN also produces the *IUCN Journal* which gives details of its work, meetings and events.

Other important journals are *Ambio*, *Conservation Biology* and *Oryx*. All three cover conservation issues throughout the World including Africa, Asia and the Pacific.

b) Online and CD-ROM sources

Unfortunately there is no single source devoted to conservation and biodiversity so to search for information in this area involves looking at a number of databases. *BIOSIS* is probably the best database in this area and if time or resources are limited it should be the first to be used. *CAB Abstracts* also has a large number of entries on biodiversity which deal on the whole with conservation issues that are linked to agriculture, such as soil conservation, land use and farming methods. Other useful databases include *GEOBASE* (for earth science related aspects such as remote sensing) and the *Life Sciences Collection*. For details of newly discovered species, *Zoological Record* is a good source. There are also some CD-ROM sources, particularly on plant species, including *Index Kewensis* and *Tree-CD* from the Oxford Forest Institute.

Organisations

This is an area where specialist organisations are particularly important, whether international or based in particular countries. As a result of the Rio Summit, every nation undertook to produce a report on biodiversity and conservation in its own country although not all of these have yet been completed. Many countries have also set up their own national biodiversity units or will do so in future. One result of all this activity is that the literature of biodiversity is dominated by "grey literature", (i.e. literature other than books and journals which is not so well covered by abstracting and database sources) mainly in the form of reports. These can be important but are often difficult to obtain. Biodiversity organisations can be particularly important in helping the enquirer find relevant information such as that contained in grey literature.

The *World Conservation Union* (IUCN - World Conservation Centre, Avenue du Mont-Blanc, 1196 Gland, Switzerland) is the main international organisation with a membership formed from sovereign states, government agencies and non-governmental organisations. It undertakes a wide variety of conservation activities besides the Red Data Books mentioned above.

The *World Conservation Monitoring Centre* (219c Huntingdon Road, Cambridge CB3 0DL, UK) has an extensive collection of specialist journals and reports, covering the whole world, and will also undertake to help outside enquirers, sometimes for a fee. It is actively involved in the collection, interpretation and analysis of information on species, habitats and conservation efforts worldwide. It is one of Infoterra's special sectoral sources.

The *International Plant Genetic Resources Institute* (Via delle Sette Chiese 142, I-00145 Roma, Italy) has established a network of genebanks in 30 countries to house 40 important collections of plant species, totalling half a million species in all.

The *World Wide Fund for Nature* (Panda House, Weyside Park, Godalming, Surrey GU7 1XR, UK) is a membership organisation which works with Governments and other organisations to protect endangered species and promote conservation.

The *Fauna and Flora Preservation Society* (79-83 North Street, Brighton, East Sussex BN1 1ZA, UK) is the World's oldest conservation society and publishes the journal Oryx.

An important society for Africa and Asia is the *Henry Doubleday Research Association* (National Centre for Organic Gardening, Ryton-on-Dunsmore, Coventry CV8 3LG, UK) which runs an international research project to prevent desertification (the "Drought Defeaters" campaign) and also seeks to preserve rare fruit and vegetable varieties in order to maintain as much genetic variety as possible.

The *Environment and Development Group* (13 St. Giles, Oxford, UK) is a consultancy that is a useful source of grey literature on environmental topics including biodiversity.

Transport and urban issues

Introduction

Transport and urban issues are often thought to be more of a problem for the industrialised countries of the 'North' than for the more agriculturally based economies of the 'South'. A higher percentage of people in the 'North' live in large cities and also produce most of the world's pollution. Large cities elsewhere may be growing rapidly but in general have less people in proportion to their overall population. However it is precisely because of this rapid industrialisation and urban population growth that most of the problems arise.

Environmental problems associated with cities

These can include :

- rapid industrialisation
- industry concentrated around a few key cities
- poor regulations, legislation or enforcement
- poor planning and local authority control
- economy and employment considered more important than the environment
- weak infra-structure (roads, sewage, water supply etc.)
- untreated waste from industry
- growth in commercial and domestic transport
- energy inefficient equipment, including cookers
- problems with the weather (temperature inversions, dust storms etc.)

Transport and the environment

The January - June issue of Industry and Environment (1993), vol. 16 (1-2), is devoted to environmental and social problems caused by an increase in transport. Some of the major problems that are highlighted are:

- inefficient combustion and maintenance of vehicles
- lead in petrol
- congestion

- poorly maintained roads
- the variety of transport (traditional & modern) on single-lane roads
- health problems caused by pollutants (carbon monoxide, nitrogen oxides, ozone (from photochemical oxidation) and Volatile Organic Compounds (VOCs)

Some of the possible solutions include:

- transport planning and traffic management programmes
- vehicle inspection and maintenance
- use of alternative fuels where possible (such as 'biofuels')
- use of diesel fuels to reduce emissions
- improved vehicle and engine technology

Not all of these solutions will be appropriate for every country, especially as most involve considerable expense. But improvements can be made to transport policy which can have significant effects on the environment. Encouraging public transport rather than private ownership is one step forward. Cairo, the largest city in Africa and one of the largest in the world, has chronic urban and transport problems. Because of the developing industrial and commercial economy initiated by President Sadat's "Open Door" policy and continued by his successor, many more people can afford their own private transport. Unfortunately the road infra-structure is not developing as fast as the growth in the numbers of vehicles. The situation has been somewhat alleviated by the creation of roads on both sides of the Nile. In Cairo the Metro, built by the French, and now being extended, is a positive development. Another example is Pakistan where the public transport system is insufficiently funded to service the rapidly growing population. As a result, the public relies on an inefficient private system with poorly maintained vehicles. The road accident rate is high.

Transportation growth in Asia

In recent years, the motorisation of developing nations has led to a burgeoning motor vehicle fleet which runs virtually entirely on fossil fuels. The gradual replacement of traditional forms of transport -animal carts,

walking and bicycling by motorised vehicles has led to more multipurpose use of roads, which lowers fuel efficiency and increases congestion. All of this contributes to high levels of local pollution, and increasing emissions of greenhouse gases, including carbon dioxide, volatile organic compounds (VOCs), nitrogen oxides, carbon monoxide (CO) and chlorofluorocarbons (CFCs).

The congestion, inefficiency and devastating environmental impacts of today's transport systems all point to the need for more effective transportation strategies. However, particularly for financially constrained developing countries, many potential options for reducing transport emissions (e.g. by substituting electricity generated from solar, nuclear or hydropower sources) prove too expensive.

The emergence of modern transportation systems in developing countries has followed a pattern similar to that of the industrialised world: economic growth has been accompanied by rapid industrialisation and urbanisation, with transport structures evolving to keep pace.

Today, most motorised passenger transport in developing countries occurs in cities. Thus, the greatest problems associated with passenger transport - pollution, traffic, high accident rates, poor efficiencies - tend to occur most severely in metropolitan areas. In Bombay, ownership of cars per capita almost doubled between 1970 and 1982 while increasing only 15% on the national scale.

In many cities, the use of cars, motorcycles and taxis is common. The gradual replacement of bicycles with motorised two-wheelers has become a feature of Asian urban development. In addition, for some cities the number of registered taxis surpasses the number of buses. For example, Hong Kong and Bangkok each have more than 17,000 taxis versus just over 7000 buses in Hong Kong and about 4000 in Bangkok. However, because of their larger passenger carrying capacity, buses transport far more passengers than do taxis.

There are many worries about the decrease in local air quality as a result of this rapid urbanisation. The local ambient air quality in Bangkok, Jakarta, Manila and Singapore often fails to meet those nations' standards.

In Thailand, the Office of the National Environment Board has monitored levels of carbon monoxide, particulate matter and lead near major roads in Bangkok since 1984. In areas of the city where traffic is heaviest, all of these exceed the air quality standards on a daily basis. In Hong Kong, almost 2 million inhabitants are regularly exposed to unacceptably high levels of sulphur dioxide and nitrogen dioxide.

Carbon dioxide emissions from motor vehicles in the developing world presently account for about 30% of the world wide vehicle releases. Developing nation vehicle emissions are expanding at a rate of about 3.5% per year, accounting for about 45% of the global increase.

Vehicle congestion is an important contributor to inefficient fuel use and higher emissions. A 1984 survey in Thailand, for example, showed that cars with equivalent engine sizes used 10% more fuel in Bangkok than in the rest of the country. Congestion has worsened in Bangkok since then, and average speeds have declined rapidly over the last few years. Similar patterns have been observed in Jakarta, where fuel consumption is 30% higher due to traffic congestion, amounting to $133 million of unnecessary oil use.

Changes in city traffic patterns have been successful in alleviating congestion and increasing traffic speeds. Successful measures include conversion to one-way streets, timed signals, lane controls to segregate traffic, limiting parking spaces and timed lane entry. Congestion in Singapore and Hong Kong, for example, could be far worse had the transportation system not been tightly managed in these cities by their governments. In Singapore, to reduce congestion in the central business district, the government has adopted the systematic development of housing estates and roads, given priority to public transportation and carefully managed the growth and use of private vehicles through higher taxes, user fees and petrol taxes. These measures have held car saturation to 90 cars per 1000 inhabitants. Traffic flows freely in this densely populated city.

In another example, Shanghai has banned motor vehicles registered elsewhere and trucks over eight tonnes from using city roads between 7am and 7pm.

Beijing has mandated staggered work hours, to spread the traffic over longer periods of the day.

Singapore and Hong Kong offer low cost, efficient public transport services. Singapore's MRT system has been operational since 1987; half of the city's population lives within one kilometre of its route. In Hong Kong, auto-restriction methods took place alongside the completion of new metro rail facilities. Thus, the percentage of passengers carried by metro rail increased from 13% to 25% between 1980 and 1985, while the percentage using cars declined from 8% to 5%.

Emission control approaches differ significantly among nations due to varying types and degrees of air pollution problems, vehicle characteristics, economic conditions and other factors. In choosing the best available measures, each nation will have to consider its own circumstances carefully.

Recent years have witnessed some promising trends in transport policies. Japan, the wealthiest country in Asia with one of the largest vehicle populations, has traditionally been one of the worlds leaders in motor vehicle pollution control. It has one of the cleanest fleets in the world, at least for petrol powered engines. Just within the last few years, Japan has started to introduce particulate controls on diesel vehicles, boding well for future controls on this especially hazardous pollutant. Two rapidly industrialising Asian nations, Taiwan and South Korea, have recently introduced state-of-the art controls on new petrol cars and are in the process on enacting comprehensive vehicle control programmes. Hong Kong and Singapore have decided to follow suit, and Thailand appears to be on the verge of implementing similar measures as well.

Reference : Confronting climate change :- risks, implications and responses
Edited by Irving M Mintzer, Cambridge University Press, ISBN 0 521 42109 8

Sources of information

Information on transport and the urban environment is produced from many sources, including:

a/ The World Bank produces the Urban Management Programme.

b/ The United Nations Conference on Trade and Development (UNCTD) publishes *Least Developed Countries*, a series of annual reports that include brief information on the environmental problems in the LDCs.

c/ The United Nations Development Programme (UNDP) publishes *World Development*, a general magazine, and *Cooperation South*, a magazine about technical cooperation in developing countries.

d/ The United Nations Environment Programme (UNEP) produces *Health and Human Settlements*.

e/ The United Nations Centre for Human Settlements (Habitat) (UNCHS) publishes *Habitat News* (3 times a year). In 1990 Habitat launched a Sustainable Cities Programme, which aims to provide municipal authorities with improved environmental planning and management.

f/ The Organisation for Economic Co-operation and Development (OECD) contains a Group on Urban Affairs.

g/ The International Civil Aviation Organisation (ICAO), the International Maritime Organisation (IMO) and the International Labour Organisation (ILO) are all useful sources of information on urban and/or transport matters.

Publications

The following publications will be found useful for coverage of the effect of transport and urban issues on the environment ;

1. Environment and Urbanisation (2 times a year)
   Published by the International Institute for Environment and Development (IIED)
2. Industry and Environment (quarterly)
   Published by UNEP - Industry and Environment Office (IEO)

3. Environmental problems in third world cities. Jorge E Hardoy, Diana Mitlin and David Satterthwaite.

Published by Earthscan Publications Ltd., 1992. Copyright is with the International Institute for Environment and Development, London

Databases

As well as the databases of the United Nations, the following are useful:

Enviroline
The most general of all environmental databases, it also covers transport and urban issues especially when related to the environment.

Acompline (from the London Research Centre)
A database specialising in transport and urban issues.

Transportation Research Information Service (TRIS) (from the US Transportation Research Board)
TRIS contains references to literature on all modes of transport with special reference to transport projects

International Road Research Documentation (IRRD) (from the OECD Road Transport Research Programme)
An international database on all aspects of road transport.

CAB Abstracts
As well as being the premier agricultural database, CAB also covers urban issues in developing countries.

Geobase
A geographical and climatological database that has good coverage of urban issues and human settlements.

Environmental policy issues

Introduction

The need for countries to have comprehensive environmental policies has grown in importance as the increasing effects of human activities on the environment become more apparent. Most countries have built up a range of legislation covering the environment but this is often fragmented. Similarly many countries do not have a single Government department or public body which is responsible for monitoring developments that are of concern to the environment. In many countries such activities are split between a number of departments and this can lead to a lack of co ordination.

Agenda 21, agreed at the Rio summit, calls on all governments to prepare national strategies for sustainable development so that each country is committed in this sense to an environmental policy.

Many countries already have national development plans which can include environmental policies. Similarly some countries may have national science and technology policies which can encompass research and development on the environment.

An environmental policy should ideally include the following :

1. A public body (or bodies) controlling and/or co ordinating the policy and with a clearly defined role. In many countries there has been a trend towards this situation as the importance of the environment grows. It does however create a problem in that the environment can encompass so many topics that to put them all together could create an unwieldy situation.

2. A positive strategy for sustainable development. The strategy must be positive, i.e. it must take into account the needs of the country for social and industrial development while anticipating the environmental effects of such development and taking steps to prevent or minimise problems.

3. A comprehensive set of legislation and regulations governing the environment. This should include provision where resources permit for proper measurement and monitoring of environmental effects.

4. An education and training programme as comprehensive as resources permit.

5. Environmental impact analyses for all major projects. While this may be costly it is far more costly to deal with the harmful environmental after-effects of a project whose impact has not been properly assessed.

6. Measures to anticipate and prevent environmental damage. These should arise as a result of environmental impact analyses and also be incorporated in legislation where appropriate.

7. Measures to protect threatened habitats and/or wildlife.

8. Encouragement in the use of energy efficiency and reduction in pollution from fossil fuels. This can be difficult to achieve if resources are limited and where a particular country may be reliant on particular fuels but should be attempted if possible as greater energy efficiency can lead to a reduction in costs as well as helping to protect the environment.

9. Conservation of resources, renewable and non-renewable. Once again this can be difficult to achieve if resources are limited but can lead to valuable savings in costs.

Examples of successful international policies/conventions

1) The Montreal Protocol on substances that deplete the ozone layer. Under the Montreal protocol, global consumption of ozone destroying chlorofluorocarbons (CFCs) dropped from 1.3 billion kilograms in 1988 to some 510 million kilograms in 1993. To encourage this trend, the treaty has banned CFC use in the industrial world after January 1, 1996. As a result, many scientists are investigating less harmful

alternatives such as the use of hydrocarbons as refrigerants in both commercial and domestic refrigeration units.

Chemical halocarbon substitutes, including hydrofluorocarbons (HFCs) and hydrochlorofluorocarbons (HCFCs), show some promise because, as these substances either do not contain chlorine or contain it in such a way that it can do no harm to ozone molecules, they do not damage the ozone layer. However, they are well known as powerful greenhouse gases which is a problem that also has to be addressed.

The protocol signatories further established a $240-million fund in 1990 to help developing countries implement alternatives to CFCs before 2006, a 10 year extended deadline. An additional $510 million was pledged two years later. So far only $226 million has been collected. Still, had the treaty not provided this money, countries such as India and China most likely would not have been able to participate - and their use of CFCs would have continued to rise.

There is a negative side to the protocol however. As a result of many industries (e.g. the dry cleaning industry) not properly preparing for the demise of the CFC from the commercial world, a thriving Black Market has developed. The black market can operate very effectively through the exploitation of a loop hole in the convention. Although the protocol bans the production and use of new or 'virgin' CFCs it does not regulate the usage of recycled CFC from refrigeration and air conditioning units. The black marketeers have used this clause to their own advantage. They purchase, in great quantities, virgin CFCs from countries that have large stockpiles of CFC (such as Russia and China) and sell it to the rest of the world as recycled material. This type of crime is very difficult to detect. However, a court case was brought against two such marketeers early in 1995 in America and the maximum sentence was given. This is, hopefully, indicative of how seriously the larger nations are taking the threat to the ozone layer

2) Intergovernmental Negotiating Committee for a Convention on biological diversity.

Biodiversity, or biological diversity to give it its full name, is a relatively new concept, but has already attracted international attention with respect to its implications for conservation and land management strategy. It has even given rise to its own global convention, agreed at the Earth Summit in Rio de Janeiro in June 1992.

Three years on from the Earth Summit, the Convention on biological diversity has been ratified by over 30 countries. Each country that ratifies the convention pledges to undertake a full, comprehensive study of their own diversity of species and the apparent threat to that biodiversity through extinction within a specified timescale.

Extinctions are occurring more frequently in present times because of the rate and scale of destruction of natural habitats as a result of human disturbance, for example through forest clearance, pollution and changes in hydrological cycles. WWF, IUCN and UNEP have suggested that at least 25 per cent of the world's species may become extinct, or be reduced to tiny fragments, by the middle of the next century.

What happens after these reports are completed is still open, in the main, to general debate. But it is hoped that laws and directives aimed at promoting species diversity will be brought into play and that a 25% decrease in species can be avoided.

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3) Convention on climate change.

The Convention on climate change was also signed at Rio in 1992. The convention needed 50 ratifications to ensure it became legally binding. This occurred in December 1993. Since then over 100 countries have ratified and each one of them is requested to put together a breakdown of the power generated and consumed in their respective countries and to attribute various percentages of emissions to the sectors involved. From that each country has to explain how it hopes to reduce CO_2 emissions over the next 5 years.

The target is for each country to reduce its CO_2 emission by the year 2000 to 1990s levels.

What happens after the year 2000 has started to be addressed through the first Conference of Parties (COP1) which was held in Berlin, March/April 1995. This was the first time that the parties had met since the Earth Summit in 1992. The COP agreed upon a new framework on climate change, the Berlin Mandate. This mandate provides a reassessment of the original convention and other sustainable development targets in light of new scientific evidence concerning global climate change.

Certain large, industrialised countries, such as the USA, look very unlikely to meet the targets set for them in 1992. In fact, these countries are likely to see increases in greenhouse emissions between now and 2000.

Despite calls from developing nations (principally the Alliance of Small Island States, AOSIS) for a 20% cut in greenhouse gas emissions by 2005, Australia, the USA and other oil producing nations in the Middle East have blocked any attempt to set new, tougher reduction targets post the year 2000.

Although there is a lack of definitive targets, Parties to the Conference have agreed to recognise the need for reduction commitments up to the year 2020, and they will meet again in two years time. The Berlin Mandate concludes that current commitments will not be adequate to reduce the threat of climate change to a level where certain, vulnerable ecosystems will be able to adapt.

Agenda 21

Agenda 21 is a 500 page document on sustainable development that emerged from the Rio convention. It offers policy recommendations on such daunting issues as alleviating poverty and providing clean water around the globe. The ambitious guidelines challenge the financial and technical resources of many nations, but the hope is that they will inspire national governments to make sweeping policy changes

whenever they can. Already more than 100 nations have set up sustainable development commissions designed to translate Agenda 21 into action. The UN has formed a commission on sustainable development charged with overseeing the implementation of the Rio accords.

Agenda 21 also strongly encourages the work of citizens' groups, business coalitions and other NGOs. Because such groups do not use the obfuscating jargon of diplomacy, they can often explain failures in compliance and in negotiations more clearly than can government representatives. They also frequently have access to crucial information that governments overlook or lack. For these reasons, such groups have played an increasingly important role in international environmental talks. In the light of the contributions NGOs made at the Rio conference, the new Sustainable Development Commission has accredited more than 500 organisations to participate in its activities.

Whether an agreement be soft or hard, developing nations often find it impossible to act on the accords they sign. Redressing this imbalance will depend in large part on providing financial and technical assistance to developing nations and ensuring that funds are well spent. Before that can happen, however, the international community needs to develop better means for securing and dispensing such help. The UNCED secretariat estimated in 1992 that developing countries would need a total of $125 billion in aid every year to implement Agenda 21 - more than twice the amount of current development assistance. In Rio, industrial governments promised to give top priority to Agenda 21 goals when figuring their existing aid budgets, but they offered scant new funding.

Environmental policy progress in Africa

A number of important conferences took place from 1964 onwards to stimulate the development of science and technology policies in Africa. Although these meetings did not concentrate on environmental matters the subjects that they discussed often had a major environmental impact.

The first of these conferences was the International Conference on the Organization of Research and Training in Africa in relation to the study, Conservation and Utilization of Natural Resources, Lagos, 1964. This was concerned with setting scientific and technical research programmes for the study, conservation and utilization of natural resources, especially in connection with improving economies through industrialisation. It also emphasised the importance of training and developing the potential for research, including the provision within national planning for the scientific and technical potential needed for such research.

This conference was followed by the Symposium on Science Policy and Research Administration in Africa, Yaounde, 1967. This endeavoured to develop a methodology for preparing science policy studies in Africa in order to analyse and forecast national science policy situations. It also set out science planning and research programmes and to compile science statistics for Africa and assess the situation on science policy in Africa following the Lagos conference.

In 1970 there took place the Regional Symposium on the Utilization of Science and Technology for Development which was held in Addis Ababa. This produced forty-three in six topic areas which were a) Policy making and planning in science and technology, b) human resources for scientific and technical development, c) infrastructure for science and technology, d) national resources survey, research and development, e) industrial research and development and f) regional cooperation in science and technology.

A particularly important conference was the Conference of Ministers of African member states responsible for the application of Science and Technology to Development. (CASTAFRICA I) held in Dakar in 1974. There were three main themes : 1. Trends of science and technology policies in Africa 2. Development and application of new techniques in Africa 3. Scientific and technical cooperation in Africa. It produced 31 recommendations which centred around these themes but did not specifically address environmental issues. The main result of the CASTAFRICA I conference was to emphasise very strongly the central

role of science and technology training and development in the development of Africa.

CASTAFRICA I was followed 13 years later by the Second Conference of Ministers of African member states responsible for the application of Science and Technology to Development. (CASTAFRICA II) which was held at Arusha in Tanzania in 1987. A large number of recommendations at the national, regional and international level. These included the encouragement of free circulation of scientific and technical information, the creation of databases of scientific and technical information, the sharing of equipment and research facilities and the strengthening and developing of coordination to make better use of opportunities afforded by international cooperation. Further cooperation between countries in scientific and technological development was encouraged. Like CASTAFRICA I the conference did not specifically address environmental matters.

A specifically environmental conference was the African Ministerial Conference on the Environment (AMCEN), held in Cairo at the end of 1985. This led to the Cairo Programme for African Cooperation with the objectives to "strengthen cooperation between African Governments in economic, technical and scientific activities with the prime objective of halting and reversing the degradation of the African environment in order to satisfy the food and energy needs of the peoples of the Continent". The conference endorsed the objective that environmentally sustainable development should be central to national economic policy.

As a result of the conference a number of institutions and programmes were set up as follows :

1. Environmental monitoring through the UNEP Global Environmental Monitoring System.

2. Climatology through the World Meteorological Organisation regional office at Bumumbura in Burundi.

3. Soils and fertilisers through the Soils Research Institute at Kumasi in Ghana supported by the FAO and the International Institute of Tropical Agriculture.

4. Energy conservation through the Renewable Energy Research Centre at Dakar.

5. Water through the Water Research Centre in Cairo.

In addition a network was established between national institutions working in the fields of scientific and technological environmental training. Four Committees were also set up to improve environmental protection in four habitats, which are a) deserts and arid lands, b) river and lake basins, c) forest and woodlands and d) seas, oceans and coastal regions.

Information sources

a)Information on science policy developments in general, including environmental policy, can be found in Science and Technology Policy, published by the British Library. Each issue includes a bibliography and although the journal covers science and technology in general there are a considerable number of references to environmental policy.

b) A useful source of information on African science and technology policy is Science and Technology in Africa by J.W. Forje. Longmans, 1989. ISBN 0 582-00086-6. This covers in much greater detail the policy issues and conferences discussed in this paper.

c) A useful source of information on Asian science and technology policy is Asia Technology.

d) There are a number of On-line databases which give a comprehensive coverage of environmental legislation/policy issues. Two of the most well known of these are LEXUS Federal environmental and Westlaw Environmental which are produced by the database hosts LEXUS and Westlaw respectively.

Legislation and Regulations

The importance of environmental legislation

Legislation to monitor and control the environment is not new; as early as 1285 Edward I of England set up the first environmental commission to investigate pollution from the burning of coal in medieval London. However until recently environmental legislation has been very patchy. Many countries of the world have had legislation to protect water resources, including fishing rights; mining and minerals; health; town and rural planning; forest and wildlife protection; and air pollution. The division of environmental responsibilities between various departments and ministries produces a very fragmented approach and there is usually no overall responsibility.

Trends in environmental protection

The United States led the way in 1970 to consolidate most of the government's environmental regulatory activities into one single body; the *Environmental Protection Agency (EPA)*. This agency is responsible for regulating major areas of the environment and has very strict powers of enforcement. Since that time there has been a movement towards the creation of similar environmental agencies and authorities in other countries. The United Kingdom produced an Environmental Protection Act in 1990, and is considering merging its two leading environmental regulatory bodies (Her Majesty's Inspectorate of Pollution and the National Rivers Authority) into an Environmental Agency, to be set up in 1996. The powers given to such agencies do however vary so for example the new Agency in the UK is unlikely to have the same enforcement powers as the US Environmental Protection Agency.

Several African countries have also moved in this direction. Nigeria established a Federal Environmental Protection Agency in 1988, and launched a National Policy on the Environment in 1989. Ghana has an Environmental Protection Council, which will have increased powers under the Environmental Action Plan (1990). Zimbabwe produced a National

Conservation Strategy in 1987, while Zambia is moving towards implementation of its first comprehensive environmental law, with the establishment of a National Environmental Council. The Council is a statutory body set up under the Environmental Protection and Pollution Control Act of 1990. Similar moves have taken place in Asian and Pacific countries. Nearly every country now has a ministry either devoted to the environment or including it as part of a wider area. In many countries there are also environmental protection agencies with greater or lesser powers. Environmental legislation is generally widely developed but enforcement of the legislation is often a problem if there are insufficient resources to do so.

The best source of information on a country's environmental legislation will be the country's national government. An environmental information service should whenever possible obtain copies of its country's legislation or at least have easy access to it. However, it should provide only information on legislation : interpretation of the law should be left to trained lawyers.

Important organisations

As well as the legislation drawn up by individual countries there is a large body of international law and regulations resulting from various international treaties. As this has generally been drawn up through agreement between various countries it suffers from being watered down to satisfy the requirements of all the participating nations. It has been argued that "softer" agreements where the results are not legally binding on the signatories may be more effective, particularly if funding is possible. These agreements can lead to expectations that action will take place and this can eventually lead to more strongly binding agreements. ("Making Environmental Treaties Work", Hilary F. French, *Scientific American*, vol.271, no.6, December 1994, pp.62-65.)

Among important international organisations concerned with legislation are :

1. *International Maritime Organisation (IMO)*. The IMO was established as a UN specialised agency in 1948. It fosters inter governmental cooperation in technical matters relating to shipping and is charged with preventing and controlling marine pollution caused by shipping.

2. *IUCN World Conservation Union*. The IUCN includes states, government agencies and non-governmental organisations in its membership. It is a professional body working to preserve the world's natural resources. Like the IMO it was established in 1948.

3. *Organisation for Economic Cooperation and Development (OECD)*. The OECD is an instrument for international cooperation among industrialised member countries on economic and social policies. Its objectives centre on economic growth, world trade and aid to developing countries.

4. *United Nations (UN)*. The UN is a voluntary association of states dedicated to the maintenance of international peace and the solution of economic, social and political problems through international cooperation. The General Assembly is the main deliberative organ of the UN. The *United Nations Environment Programme (UNEP)* - established in 1972 - coordinates UN activities in the field of the environment and ensures the cooperation and participation of governments and the international scientific and professional communities.

International regulations, agreements and conventions

There is a growing recognition that the actions of nations in the environmental field can have international effects. Air pollution knows no boundaries and the effects of acid deposition ('acid rain') is well documented. Also the growing awareness of the 'hole' in the ozone layer and the greenhouse effect ('global warming') is causing concern. The big problem with international conventions and treaties is that not every country signs them. As recently as the 1992 Earth Summit in Brazil, the United States refused to sign the Framework Convention on

Global Diversity (although it has done so since), and watered down the Framework Convention on Climate Change.

Important international conventions and agreements include :

1. The Convention Concerning the Protection of the World Cultural and National Heritage (1972)

2. The Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES) (1973)

3. The United Nations Convention on the Law of the Sea (1982)

4. The Vienna Convention for the Protection of the Ozone Layer (1985)

5. The Geneva Convention on Long Range Transboundary Air Pollution (1983)

6. The Montreal Protocol on Substances that Deplete the Ozone Layer (1987)

7. The Basel Convention on Transboundary Movements of Hazardous Wastes (1989)

8. The Framework Convention on Biodiversity (1992)

These conventions often take a number of years before coming into force. The Basel Convention, for example, came into force in May 1993.

Sources of information

This is one of the most difficult areas in which to find accurate and up-to-date information. At a basic level a search on general databases such as *Enviroline* and *Pollution Abstracts* can be very useful. These databases can provide articles on countries and their respective environmental legislation.

The *United States Aid for International Development (USAID)* has been very active in drawing up environmental profiles of countries, including the relevant legislation.

A very important source of information is the *IUCN Environmental Law Centre (ELC)* based at Bonn. This is the "legal arm" of the IUCN. It monitors and maintains databases on legal trends and developments in the environmental field, including international agreements, national legislation and legal literature. It is an Infoterra Special Sectoral Source.

The ELC's *Environmental Law Information Service (ELIS)* was first proposed at a 1972 UN Environmental Conference. It now contains over 37,000 environmentally relevant law reports from around the world. ELIS works closely with the UN and the German government.

The most authoritative source for any legislation is, of course, the national government of that country. This information can sometimes be difficult to obtain and difficult to interpret. However DataCentra, a computerised bureau in Ghana, produced a legal database called Solon. Solon is a full text database comprising all the laws, statutes, law journal articles and law reports of Ghana. Developments like this are extremely welcome.

Many countries have professional organisations dedicated to the law and some may even have environmental law associations. UKELA (United Kingdom Environmental Law Association) is one such body and represents the views of those working in this area.

The United Nations via its specialised agencies is one of the best sources of information on environmental legislation and all its reports and studies should be freely accessible.

DATABASES

The following list of databases takes the structure:

Title
Producer:
Hosts:
CD ROM version (if any):
Time Span:
References (approximate number):

This is a list of all the major databases described in the text. Where possible the availability of a CD ROM version (CD:) is indicated; the relevant CD ROM directories should be consulted for contact addresses. Hosts like DIALOG are now producing an ever expanding collection of CD ROMs based on their extensive online databases. In many cases CD-ROM versions cover a more limited date range than online equivalents : the actual date range should be checked when acquiring a CD-ROM.

Principal sources used in this compilation are :

1. *Directory of Online Databases, Cuadra/Gale, 1995*

2. *The CD-ROM Directory 1993, TFPL, 9th edition*

3. *Environment Databases, Aslib Online, 1991*

ACOMPLINE/URBALINE
Producer: London Research Centre (UK)
Host: ESA-IRS
CD: METROPOLITAN. Contact the London Research Centre.
Time Span: 1974 -
References: 200,000

AGRICOLA
Producer: US Department of Agriculture, National Agricultural Library
Hosts: Dialog, Dimdi, OCLC, EPIC
CD: SilverPlatter
Time Span: 1970-
References: 2.8 million. Adds 9,000 a month

APILIT
Producer: American Petroleum Institute
Hosts: Dialog, Orbit, STN, Questel
Time Span: 1964 (Abstracts from 1980)
References: 510,000

AQUALINE
Producer: Water Research Centre (WRC) (UK)
Hosts: Orbit, ESA-IRS
CD: SilverPlatter
Time Span: 1960
References: 160,000

Aquatic Sciences and Fisheries Abstracts (ASFA)
Producer: Food and Agricultural Organisation (FAO)
Hosts: Dialog, Dimdi, ESA IRS, STN, CANIOLE
CD: SilverPlatter
Time Span: Varies as database is equivalent to several printed sources
References: Over 400,000

BIOSIS Previews
Producer: BIOSIS (US)
Hosts: Data Star, Dialog, Dimdi, ESA-IRS, STN, CDP Online, CANIOLE
CD: Diskette (BIOSIS Previews)
Time Span: 1969 - or 1970 - Varies with host
References: 9.3 million

BRIX/FLAIR
Producer: Building Research Establishment (UK)

Hosts: ESA-IRS
Time Span: 1950
References: 180,000

CAB Abstracts
Producer: CAB International (UK)
Hosts: Data-Star, Dialog, Dimdi, ESA IRS, STN, CANIOLE
CD: SilverPlatter
Time Span: 1973 -
References: 2.8 million

Chemical Abstracts (CA Search)
Producer: Chemical Abstracts Service (US)
Hosts: Data-Star, Dialog, ESA IRS, Orbit, Questel, STN (the only host with abstracts), CDP Online, CANIOLE
CD: 12th Collective Index only, covering the period 1987-1991
Time Span: 1967
References: 10 million

COMPENDEX PLUS
Producer: Engineering Information Inc (US)
Hosts: Data Star, Dialog, ESA-IRS, Orbit, STN, CANIOLE
CD: Dialog (Knight Ridder Information Inc.)
Time Span: Earliest from 1970 -
References: 2.8 million

ECDIN (Environmental Chemicals Data and Information Network)
Producer: Commission of the European Communities (CEC), Joint Research Centre
Hosts: Dimdi
Time Span: 1970-
References: Approximately 122,400 chemical compounds

Energy Science and Technology
Producer: US Department of Energy, International Energy Agency, International Atomic Energy Agency
Hosts: Dialog
CD: Knight-Ridder Information Inc.
Time Span: 1974 -
References: 3 million

ENERGYLINE
Producer: Congressional Information Service (US)
Hosts: Dialog, Orbit
CD: Part of Enviro/Energyline Abstracts Plus
Time Span: 1971-
References: 85,000

ENVIROLINE
Producer: Congressional Information Service (US)
Hosts: Data Star, Dialog, Dimdi, ESA-IRS, Orbit
CD: Part of Enviro/Energyline Abstracts Plus
Time Span: 1971 -
References: 200,000

Environmental Bibliography
Producer: Environmental Studies Institute (US)
Hosts: Dialog
CD: Environmental Periodicals Bibliography
Time Span: 1973 -
References: 500,000. 4000 added every 2 months

GEOARCHIVE
Producer: Geosystems (UK)
Hosts: Dialog
CD: GeoArchive on CD ROM
Time Span: 1974
References: 800,000

GEOBASE

Producer: Elsevier Science Publishers

Hosts: Dialog, ESA-IRS, Orbit, OCLC

CD : SilverPlatter

Time Span: 1980 -

References: 620,000 citations

GEOREF

Producer: American Geological Institute

Hosts: Dialog, Orbit, STN, CAN/OLE, OCLC

CD: SilverPlatter

Time Span: 1933

References: 1.8 million citations

Hazardous Substances Data Bank (HSDB)

Producer: US National Library of Medicine (NLM)

Hosts: Data Star, Dimdi, TOXNET, Medlars

CD: Part of TOMES Plus (Micromedex Inc.)

Time Span: Current information

References: 4,400 chemical compounds

HSELINE

Producer: Health and Safety Executive (UK)

Hosts: Data-Star, ESA-IRS, ORBIT

CD: Part of OSHROM from SilverPlatter

Time Span: 1977-

References: 260,000

IBSEDEX

Producer: Building Services Research and Information Association (UK)

Hosts: ESA-IRS

Time Span: 1960- (Some material 1930-)

References: 90,000

ICONDA
Producer: Fraunhofer Society, Information Centre for Regional Planning and Building Construction (GER)
Hosts: Orbit, STN, CANIOLE
CD: SilverPlatter
Time Span: 1976-
References: 348,000

INPADOC
Producer: European Patent Office (EPO)
Hosts: Dialog, Orbit, STN
Time Span: 1968 -
References: 20 million patent documents

International Nuclear Information System (INIS)
Producer : International Atomic Energy Agency
Hosts ESA-IRS, STN, CANIOLE
CD: SilverPlatter
Time Span: 1976 -
References: 1.5 million

International Road Research Documentation (IRRD)
Producer: OECD
Hosts: ESA-IRS
Time Span: 1972
References: 202,000

Kirk-Othmer Encyclopedia of Chemical Technology
Producer: John Wiley and Sons (US)
Host: Dialog
CD: Knight-Ridder Information Inc.
Time Span: Updated regularly
References: Full text articles

Life Sciences Collection (plus Marine Biology & BioEngineering Database)
Producer: Cambridge Scientific Abstracts (US)

Hosts: Cita Del™ Service (LIF)
CD: Life Sciences Collection
Time Span: 1983 -
References: 1.8 million.

Oceanic Abstracts
Producer: Cambridge Scientific Abstracts (US)
Hosts: Dialog, ESA-IRS, STN
Time Span: 1964
References: 250,000

Pollution Abstracts
Producer: Cambridge Scientific Abstracts (US)
Hosts: Data-Star, Dialog, ESA-IRS, STN
Time Span: 1970- (1978- on Data-Star)
References: 190,000

RTECS (Register of Toxic Effects of Chemical Substances)
Producer: US National Institute for Occupational Safety and Health (NIOSH)
Hosts: Dialog, Dimdi, Chemical Information Systems, STN, TOXNET
CD: Part of CHEM BANK on SilverPlatter
References: 124,403 substances

SIGLE (System for Information on Grey Literature in Europe)
Producer: European Association for Grey Literature Exploitation
Hosts: Blaise-line, STN, SUNIST
CD: SilverPlatter
Time Span: 1981 -
References: 300,000

Transportation Research Information Service (TRIS)
Producer: Transportation Research Board (US)
Hosts: Dialog
Time Span: 1968-
References: 285,000

TULSA

Producer: Petroleum Abstracts (US)

Hosts: Orbit

CD : Part of Petroleum Abstracts (Knight-Ridder Information Inc.)

Time Span: 1965

References: 550,000

Wasteinfo

Producer: Waste Management Information Bureau (UK)

Host: Orbit

CD: SilverPlatter

Time Span: 1973 -

References: 100,000 abstracts

Water Resources Abstracts

Producer: Us Geological Survey

Hosts: Dialog

CD: SilverPlatter

Time Span: 1968

References: 290,000

World Patents Index (WPI)

Producer: Derwent Publication Ltd (UK)

Hosts: Dialog, Orbit, STN, Questel

Time Span: 1963 -

References: 7 million

Zoological Record Online

Producer: BIOSIS

Hosts: Dialog

CD: Zoological Record on Compact Disc (SilverPlatter)

Time Span: 1978-

References: Over 1 million

Appendix : Results of discussion sessions

Introduction

The Nairobi and Bangkok workshops on environmental information both included a number of discussion sessions. The participants were divided into four groups which discussed particular issues in environmental information, or in information provision generally. Results of these discussion sessions were written up on flip charts and presented to all the participants.

The responses from participants at both workshops indicated that they found these discussion sessions very useful as a means of exchanging information and learning from the experience of others. The results from the Nairobi workshop were typed up at the time and presented to the participants. This was not done at Bangkok but the results from the Bangkok workshop are reproduced in the following pages. It is hoped that participants in both workshops, as well as other readers of these notes, will find them valuable.

The results are arranged in the order in which the discussions were held in Bangkok. The issues discussed in Bangkok were basically the same as those covered in Nairobi and were dealt with in almost the same order. In each case the original problem for discussion is given first, followed by the discussion notes.

Building an EI database

Study No. 1

Monitoring emissions from factories

You are responsible for the creation of a database of industrial facilities (factories) in your country. This database will be used to monitor the emissions and discharges of chemicals from the facilities.

1. Identify the number and type of fields you will need

2. How will you collect this data?

3. What preparation will you need to do before creating the database?

4. Identify the useful types of reports (statistics) you could print off for your manager

5. How could you find out about the toxic and hazardous properties of these emissions/discharges?

Please feel free to make any necessary assumptions.

Building an EI database

Study No. 2

Specialist environmental resources centre

You are creating a new library resources centre in a newly established Environmental Agency. The resource centre will cover most types of environmental information but especially the control and disposal of industrial, domestic and agricultural wastes.

You have:

- a microcomputer with proven database software
- journal subscriptions
- conference proceedings
- all UN reports on the environment
- various directories and reference books
- reports on microfiche
- trade and product literature from various companies

How do you

a/ Start to create a bibliographic database?

- relevant database fields
- data entry
- data output
- maintenance of database
- production of a current awareness bulletin

b/ Set up an enquiry service?

c/ How would you organise the trade literature?

Please feel free to make any necessary assumptions.

Case study 1 Building an EI database

Group 1

Purpose: To monitor emissions and discharges of chemicals from industrial facilities

1> Number and types of fields

E.g. Crude palm oil industry

Fields:
1. Name of company
2. Address: (a) Mailing address
(b) Premises
(c) Contact person (name)
3. Tel No:
4. Fax No:
5. Year set up:
6. Types of emission : (a) XX load: YYY
(b) AA Load: ttt
etc.
7. Types of discharges: (a) ss Volume: uu
etc.
8. Parameters monitored: (a) BOD (biological oxygen demand)
(b) SS
(c) pH
9. Location of premises: Upstream/downstream of H2O intake point
10. Date of visit
11. Quantity of H2O used
12. Disposal method (a) Land application
(b) Water course

2> Questionnaires; enforcement visits, annual reports, quarterly reports, license application

forms

3> PCs, software, computer support staff, liaison with enforcement section (for details of questionnaires)

4> Types of reports

a) Major air polluters among the CPO industries

b) Major water polluters

c) Trends of emissions and discharges

d) No of industries upstream/downstream of water intake points

e)Check emissions/discharge (properties) against sources of information such as ECDIN, Hazardous substances databank, environmental fate databases (hardcopies/CD ROMs/online)

Group 2

Title: Environmental Protection Agency Group

1> Name of factory
Location/address
Contact No
Contact person
Size of area
Employee/manpower size
Type of factory
Production capacity
Operation time
Wastewater facilities
Kind of emission
Amount of chemical content (pH, temperature, level of toxicity)

2> Collection of data

1. Questionnaire
2. Monitoring and evaluation
3. Random survey

NOTE: The above are needed for license/accreditation and safety regulation pass

3> Preparation needed for database

1. Resources capability (PC, Mac, Software)
2. Trained personnel/manpower
3. Funding capability

Group 3

1> Registration No. of factory
Name of factory and address
Type of industry
Products made at factory
Chemicals used in the production process
Type of emission/by-product
Volume/concentration of emissions
Name of researcher
Method of discharge of waste
Method of monitoring
Date of data collection/inspection
Keywords

2> How to collect this data?

1. Company's annual/biannual reports
2. Governmental reports
3. Questionnaires
4. Sampling of emissions/discharges
5. Site inspections

3> What preparations will you need...?

1. Preparation of data sheets
2. Thesauri
3. Hardware & software
4. Standard format for data entry
5. Computer operator for data capture
6. Identify the category of users

4> Identify the useful types of reports

- No of factories in different fields and its emissions
- Chemical emissions and pollution status
- Manufacture of products and locality
- Volume/quantities of products by specific or groups of factories

5> How to test?

- By testing in laboratory
- Comparison with existing standards
- Random sampling in neighbourhood
- Hospital reports

Group 4

Database on chemicals in factories

Chemfact

Name of factory
Location
Tel No
Type/prod/c.p/

Chemicals used

Volume of sewage disposed

Environmental effects of chem

Treatment made before disposal

Flora
Fauna
Human
Soil
Others

Possible disposal methods

Toxic effects of chemicals

Monitoring methods

Effects DO/BOD

Acts to follow

Data collection

Data analysis

Software

Building a local information centre

Study No. 1

You are taking over as librarian/information officer in a small government agricultural library. You are the first trained staff member of the library and your objective is to make information retrieval more efficient. The library holds:

2,000 international reports from a number of agricultural organisations (printed and microfiche)

500 internal reports published by government or a government agency

shelf of conference proceedings

shelf of government and international regulations, codes of practice, legislation

shelf of directories, guides, manuals

subscription to agricultural journals

Equipment and other materials

- microfiche reader
- typewriter
- card catalogue and cards
- good shelving (but you need more)

How do you

a/ Carry out scanning and current awareness?

b/ Choose a classification and cataloguing system?

- build up a card catalogue

c/ Operate an enquiry service?

d/ Investigate the possibility of bringing in computer information retrieval?

A. HOW DO YOU CARRY OUT SCANNING AND CURRENT AWARENESS?

- Decide a "Search Strategy". Note key words. - Limitation of language and countries.

- Type of document e.g. article, journal , book etc.

- Year coverage.

- Information category of use: article, research paper etc.

- Information Sources - Abstracts, Index, Bibliographies.

B. Use Dewey Classification System.

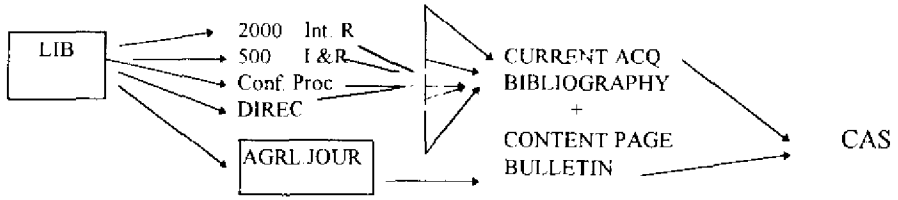
Subject Headings
Build up a card catalogue

- Author
- Title
- Subject
- Classification
- Publisher
- Year of Publication
- Type of Publication
- Language
- keyword

C. Subject & keyword
- author
- publisher
- information sources: online, cd Rom, Printed material, make notes from printed material and make copies.

D. - Hardware & software purchase, modern & telephone line.
- On-line for linkage to other libraries.- domestic & international.
- Preparation of date sheet
- standard format of fields -input, retrieval
- Computer operator for data capture

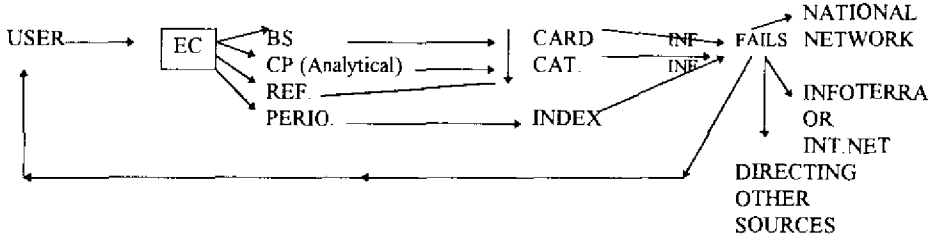
(a)



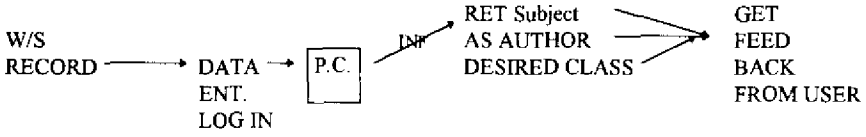
(b) DD/UDC/COLON/THESAURUS

CAT AACR - 2

(c)



(d)



Building a local information centre

Study No. 2

You are creating an environmental resource centre specifically devoted to conservation protection in your country. You will specialise in deforestation, desertification, soil degradation, plant diversity and wildlife management. You have an important responsibility for the collecting, compiling and dissemination of research results in this area. There are 5 research stations dedicated to conservation in your country. You also run training courses in conservation for staff in your organisation and these remote research stations.

1/ Think about the sort of resource centre you would like and build it. What materials, publications and equipment will you need for its creation?

2/ You will need to network with other national, regional and international organisation; what administrative and professional structures do you need to set in place?

3/ The results from these research centres are a national resource. How will you collect, compile and present these results?

4/ Using material in your resource centre how will you go about designing and implementing a training course?

Please feel free to make any necessary assumptions.

STUDY NO.2

ENVIRONMENTAL IEC CENTRE

1. Think about the sort ....

- EIC Resource Centre
- Journals, Reports, documents, AVP's, flipcharts etc.
- Equips. - computers [486, 586 or higher]
  - riso photocopies, printers, cameras etc
  - fax, modem, scanner, CDROM - software

2. - Conduct Seminars/Workshop at National Level on deforestation.
- Regional and exchange info

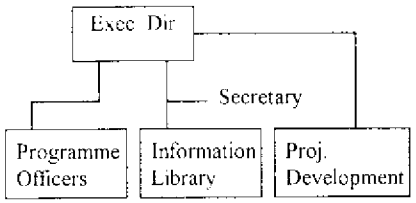
International level direct communication - fax
- email

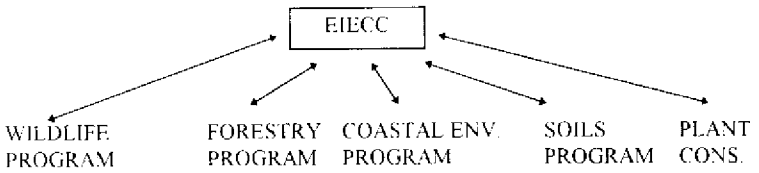
Production of materials for use by others.

- Need : forestry graduate - project development officer
  admin officer - secretary - liaison officer
  Executive/Manager, Librarian/Information Officer
  (5 research centres will be resource/field personnel.

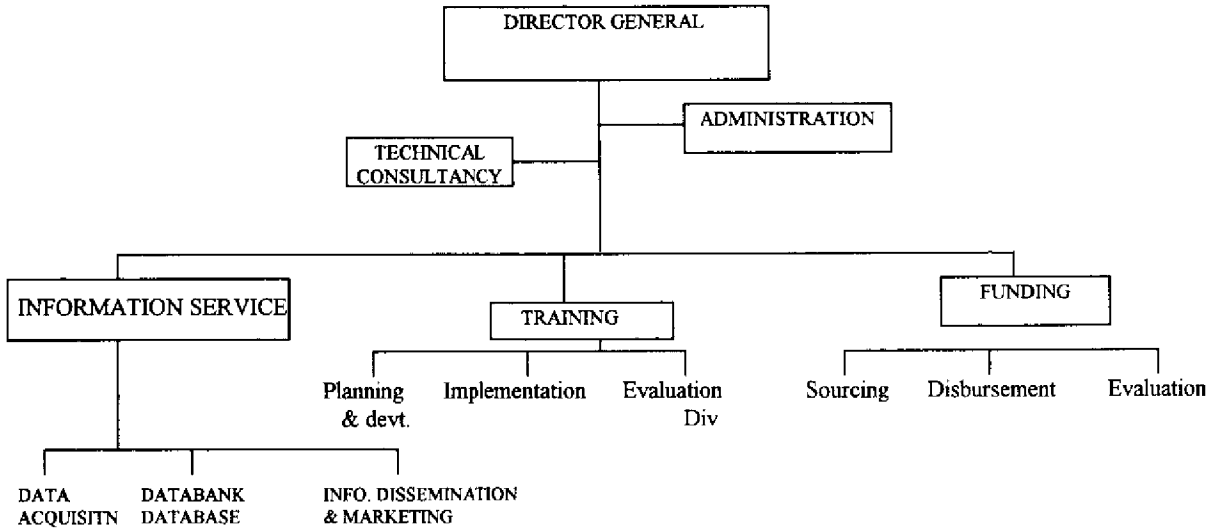
3. Periodic Reports -
Popular booklet series
Presentation.
  - Reports, Newsletter i.e. Published Materials
  - Campaign thru media,
  - Meetings - community up to decision-makers

4. - Needs analysis
- Preparation of training materials based on level of community capability
- I.D. participants - subject
- I.D. Resource personnel to be involved





TECHNOLOGY & ENVIRONMENT RESOURCE CENTRE (TERC)



How to assess and respond to users' needs

Study no.1 - Assessment

You are in charge of your country's main environmental information service which is part of the Department of the Environment and Planning. The service that you operate is provides the following :

1. A reference facility open during normal office hours for personal callers. The resources available include a substantial set of environmental monographs, about 200 current environmental periodicals, the reference collection of environmental impact statements for your country, selected CD ROMs and online access to the Dialog host system.

2. An enquiry service for both personal callers and remote enquirers. Online enquiries are charged for (unless performed directly by personal callers with their own passwords) but other enquiries are free. The service is the country's Infoterra focal point.

When responding to requests for information what do you need to know about :

1. Your users as individuals?
2. The jobs that your users do?
3. The resources available to them?

What other practical information will you need in order to assess their needs as accurately as possible?

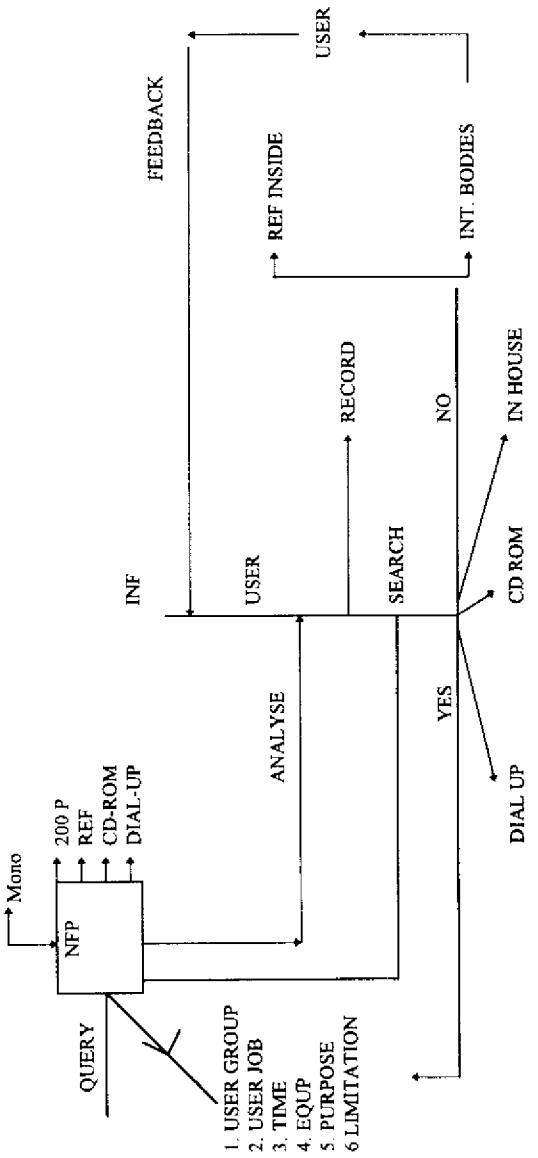
Please feel free to make any necessary assumptions.

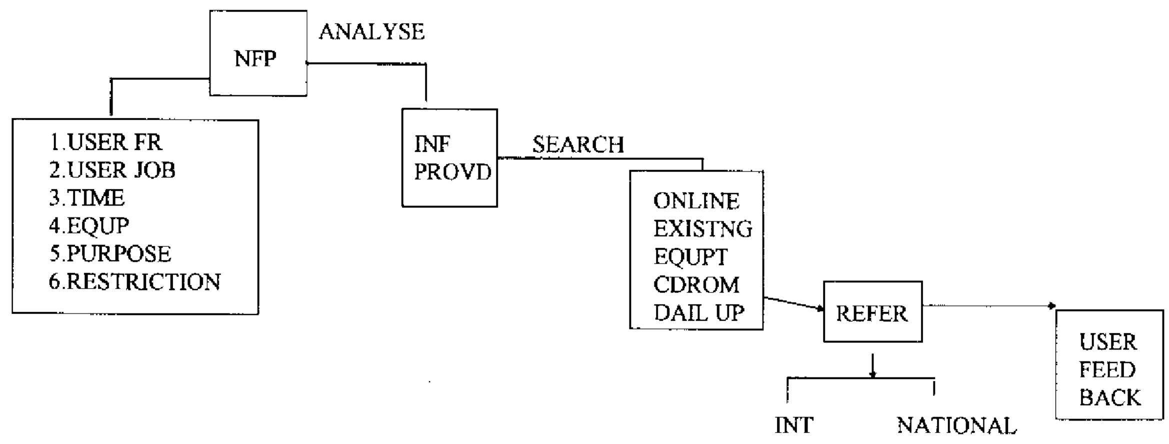
HOW TO ASSESS AND RESPOND TO USERS' NEEDS

1. Users as individuals:
   - Name
   - Address/tel no.
   - Urgency of request

2. Jobs that users do:
   - Profession
   - Organisation/employer
   - Specific area of interest
   - Purpose of information (research? EIA?, etc.)

3. Resources available to them:
   - On-line facilities
   - Inter-library loan facilities
   - Information exchange system (e.g. INFOTERRA)
   - INTERNET


Mono
200 P
REF
CD-ROM
DIAL-UP
NFP
QUERY
1. USER GROUP
2. USER JOB
3. TIME
4. EQUP
5. PURPOSE
6 LIMITATION
ANALYSE
INF
USER
FEEDBACK
SEARCH
RECORD
YES
NO
REF INSIDE
INT. BODIES
USER
IN HOUSE
CD ROM
DIAL UP


NFP
ANALYSE
1.USER FR
2.USER JOB
3.TIME
4.EQUP
5.PURPOSE
6.RESTRICTION
INF
PROVD
SEARCH
ONLINE
EXISTNG
EQUPT
CDROM
DAIL UP
REFER
INT
NATIONAL
USER
FEED
BACK

REPUBLIC OF CONFUSION NATIONAL LIBRARY	
NAME:	Phone No.
Address:	
Organisation:	
DATE of Request:	Medium of Request:
Urgency	Profession
Book/Article Request	
Subject:	Resources Available - Online facilities - Inter library loan - Information exchange (infoterra) - Internet
ACTION (Official use)	

4. - Inform him of the charges - Can he afford our services?
   - Purpose of information (Research, E.I.A. Theses etc.)

How to assess and respond to users' needs

Study no. 2 - Responding to needs

You are providing an environmental information service which attracts enquirers from a wide range of backgrounds. Some also work in the library and information profession but others are "end users" rather than information intermediaries. You have a limited range of books and journals as well as some CD-ROMs but you cannot afford to obtain all the information sources that would help you provide a really comprehensive service. The enquiries are normally received either from personal visitors or via the telephone.

1. On receiving an enquiry, what further information (if any) would you need to ask the enquirer?
2. How would you deal with any difficulties arising from their response?
3. How would your own resources affect your response?
4. If you cannot directly provide the information that is needed what would you do?
5. How would the background of the enquirer affect your response?

Please feel free to make any necessary assumptions.

Study no. 2, Responding to Needs

1. Following Information need to be asked to the Enquirer:

   a. Name
   b. Profession
   c. Office
   d. Address
   e. Tel./Fax/Email/Cable
   f. Subject of Interest
   g. Kind or Type of Materials needed
   h. Scope of Information (Specific Subject)
   i. Urgency
   j. Reasons for Enquiry
   k. Budget availability

2. Case to case basis

3. Maximize our Resources to cater to Enquirer's needs, up to the level of the information service expertise and refer the Enquirer to others.

4. Referral System - by building up group of contacts, network with other Information Service Centres.

5. Our response will depend on the parameter of No.1.

NEEDS

Qn 1. a. Who - name, designation
b. Where is he from
c. Contact no.
d. Purpose - study, consultancy, decision-making etc.
e. Urgency
f. Recency
g. Type of info reqd. (Bibio/Abstracts/Full doc)
h. Language
i. What areas have been covered
j. Payment

Qn 2. a. Payment - Lib. policy
b. Copyright issue - declaration forms
c. Language - Translation service
d. Limited resources - ILL
BLLD } networking
Referral

Qu 3. Need to network (Strengthen, enlarge)
Update collection
Strengthen subject coverage
Budget/Manpower increase.

Qu 4. 1.Contact other sources -
a. Local
b. International

——→ Referral
——→ Interlibrary Loan.

Qu 5. 1. Level of education - students, researchers.
2. Status
3. Language
4. Ability to pay

Environmental Impact Assessment (EIA)

Case study no. 1

You have been asked to conduct an EIA for a large dam on a major river system. This dam is expected to meet up to 15% of the country's energy needs by the year 2000. The most probable site for the dam is somewhere along a 20 mile stretch of the river which flows through heavily wooded land. There are at least two human settlements (about 5,000 people) that may be affected by the dam. An aluminium smelting company is eager for the dam to go ahead so it can provide it with cheap electricity. The aluminium smelting facility has not been built yet.

Using some of the information discussed previously draw up a list of environmental and social implications of building this dam. Please feel free to use your imagination!

SCOPE OF EIA

1	RIVER	TEMPERATURE CHEMICAL COMPOSITION VELOCITY PH AQUATIC LIFE
2	FOREST	FOREST COVER TYPE OF TREES OTHERS VEGETATION
3	LAND	TYPE OF SITE PH SOIL QUALITY
4	AIR QUALITY	
5	HUMANITY OF AREA	
6	PEOPLE	EFFECT ON LIVELIHOOD COMMUNITY
7	INDUSTRY	ECONOMIC IMPACT

NEGATIVE EFFECTS

ENVIRONMENT

1. FLOOD
2. DEFORESTATION
3. WASTEWATER
4. AIR POLLUTION
5. DIVERSITY LOSS
6. SOIL EROSION
7. EFFECT ON RAINFALL
8. EFFECT ON AGRICULTURE PRACTICES
9. CLIMATE CHANGE
10. POLLUTION

SOCIAL

1. DISPLACEMENT MIGRATION OF FAMILIES AROUND THE DAM SITE
2. LOSS OF INDIGENOUS LAND
3. EFFECT ON TRADITIONAL WAY OF LIVING
4. RESETTLEMENT PRESERVE OF OTHER AREAS FOR FLOOD, SHELTER, SHORTAGE OF LAND A PROBLEM OF INTEGRATION WITH OTHERS
5. LOSS OF PRODUCTIVE LAND

POSITIVE EFFECT

1. GENERATION OF LIVELIHOOD/EMPLOYMENT
2. POWER GENERATION
3. ROAD SYSTEM AND BRIDGES
4. TELECOMMUNICATION
5. INDUSTRIALISATION
6. REVENUE INCOME INCREASE
7. GENERATE ENHANCEMENT OF SKILLS
8. RECREATION
9. CHEAP ELECTRICITY
10. IRRIGATION
11. FISH CULTURE

MITIGATION

- REPLANTING AROUND DAM AREA
- EDUCATION OF THE COMMUNITY OF THE BENEFIT OF THE DAM

CONSULTATION WITH
- GOVERNMENT ENVIRONMENT AUTHORITY
- LOCAL NGO
- LOCAL GOVERNMENT UNIT
- CONSULTANCY GROUP

OTHER ACTIVITIES
- PUBLIC HEARING
- NEWSPAPERS NOTICES
- MEDIA
- PROMOTION CAMPAIGN

(E.I.A.)

Case study no 1.

1. SCREENING

- Is EIA necessary? YES

2. SCOPE

When built.

1. Human Settlement — resettlement
   — source of livelihood
2. Ecology — Biodiversity (flooding)
   Hydrogeology
3. Time Schedule of project
   - disruption it will cause

After

- Industries ← pollution that may arise
  waste disposal
  toxicity/envt. health

- people/downstream
  - quality of nutrient of water
  - water flow

(3/4) Prepare EIA

(a) data collection — consulatation with interested authorities concerned public

(b) set up parameters

(c) monitoring plan for control of construction to ensure standard sets are complied.

(5) Evaluation of results

- See if decision can be made.

(7) Set up Guidelines for monitoring and its frequency

Environmental Impact Assessment (EIA)

Case study no. 2

A proposal has been put forward to build a new coal fired power station to service a number of large cities. It is expected to account for 7% of the power in the national grid when it is fully functioning which is expected to be 2020.

The most economically viable site for this power station is an unused site set at the bottom of a steep valley in which there reside about 100,000 people. Unemployment is rife in this area. The railway system into this area has not been fully developed yet and there is no natural coal supply within approximately a 100km area of the proposed station. The nearest coal supply is low grade brown coal and it will have to be transported in by road until the rail link can be fully developed at the moment this aspect is uncertain.

The station would consist of 8 large batteries. Sulphur scrubbing has been looked into but has been dismissed as being too expensive to implement. It is hoped that the tall batteries will compensate for this.

When the station is opened it is hoped it will employ approximately 5,000 local people.

It is your job to undertake an exhaustive EIA study of this proposition, bringing in all the positive and negative aspects to its development. Long term effects should not be ignored.

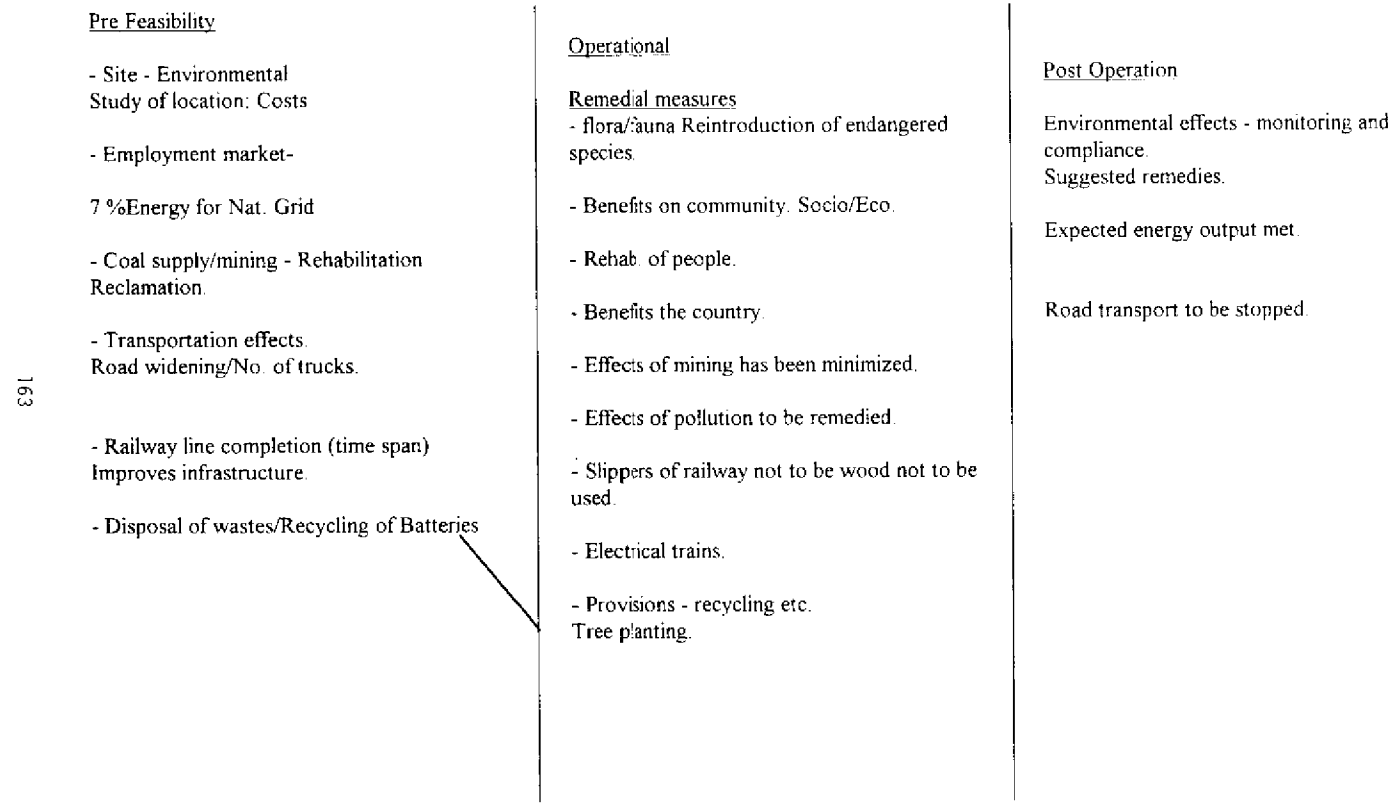
E.I.A. OF COAL POWER STATION

POSITIVE

1. Employment
2. Power supply
3. Creating new railway station
4. Develop road
5. Urbanisation (hospitals schools service)
6. Heating
7. Reducing deforestation benefit to ecosystem

NEGATIVE

1. Far from coal supply
2. Transport problem
3. Pollution air
   - acid rain
   - coal ash
   - ach rain
   - water pollution
   - soil contamination
   - noise
4. Haven't railway
5. New railway road have impact to livestock
6. Health


Pre Feasibility
- Site - Environmental
Study of location: Costs
- Employment market-
7 %Energy for Nat. Grid
- Coal supply/mining - Rehabilitation
Reclamation.
- Transportation effects.
Road widening/No. of trucks.
- Railway line completion (time span)
Improves infrastructure.
- Disposal of wastes/Recycling of Batteries
Operational
Remedial measures
- flora/fauna Reintroduction of endangered species.
- Benefits on community. Socio/Eco.
- Rehab. of people.
- Benefits the country.
- Effects of mining has been minimized.
- Effects of pollution to be remedied.
- Slippers of railway not to be wood not to be used.
- Electrical trains.
- Provisions - recycling etc.
Tree planting.
Post Operation
Environmental effects - monitoring and compliance.
Suggested remedies.
Expected energy output met.
Road transport to be stopped.

Yes

- Site is not environmentally sensitive area.
- Residents agree to relocation/rehabilitation: Compensation agreed.
- Economy of scale is good :- cost of power vs. production.
- Improvement of infrastructure.
- Mitigating measures address adequate to control pollution.
- Recycling to address barrery issue.
- Replanting to act as buffer zone.
- Regular monitoring - during and after.

YES Signed:

THE CHERNOBYL ASSOC. OF E.I.A. CONSULTANTS

CAEC

The Chernobyl Association of E.I.A. International Consultants

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Developer: ALL INDIA ASSOCIATION OF COAL FIRED ELECTRIC POWER DEVELOPERS

- SITE - VANE
- SOCIAL ECONOMIC - MALAYSIA
- ENGINEERING/TECHNOLOGY - KOREA
- ENVIRONMENT - MONGOLIA
- MANAGER - SAMOA

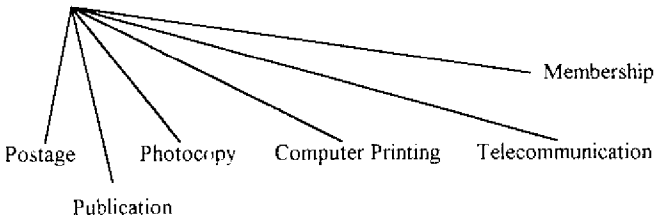
Costing and availability of information services

Study no. 1 - Costing

Your environmental information service is part of the country's Ministry of Environmental Affairs. It has always provided a free enquiry service to anyone in the country who is in need of information. However, funds are becoming increasingly tight and it has been made clear to you that your service will be expected to earn some revenue in future as a contribution to its overall funding. This suggests that you need to consider whether to charge for at least some of your enquiry work.

1. How would you determine the costs of providing the service at present?
2. What are likely to be the main items of expenditure within the service?
3. What factors would you need to take into account when considering whether to charge for an enquiry? How would this depend on the type of enquiry and/or the type of enquirer?
4. If you decide to charge for enquiries how would you determine the structure and level of the charges?

1. CHARGING



A 1. Computer Database -Printout
2. Postage
3. Telecommunication
4. Electricity
5. Maintenance
6. Staff Overtime
7. Publication
8. Membership & Affiliation

B. TYPE OF ENQUIRIES

- Books - lending) fines
  - ILL)
- Video tape borrowing) charges & fines
- Photocopy
- Telecommunication
- Time Spent

TYPE OF ENQUIRER

- Own Staff - Free
- Consultant - Total Cost
- Membership - Cost Recovery Basis
- Student - 50% of the cost
- Decision Maker - Free
- International Organization - Cost Recovery

4. STRUCTURE & LEVEL OF THE CHARGES

* Users - 1st Priority
* Services - 2nd Priority
* Resources - 3nd Priority

CRITERIA:

(1) Service - Literature Searches (Computer, Manual)

- Enquiry Services (Postage, Telephone, Fax, E-Mail, Visits)

- Current Awareness
  (SDI, Table of Contents, Photocopy)

- ILL (

- Publication (Newsletter, etc.)

- Referral — Photocopy

- Literature — Computer, Manual

- Network

(2) Resource - Printed Media — Book, Periodicals, Newsletter, Report, Poster etc.

- Audio Visual Media — Computers, CD-ROM, Microfilm, Microfiche

(3) Users
- Decison makers
- Consultants
- Students
- Researchers, Scientist
- Environmental - List
- General Public

Costing and availability of information services

Study no. 2 - Availability

You operate a publicly available environmental information service that is part of your country's Ministry of Environmental Affairs. Concern has been expressed at the continued availability of this service because of financial constraints. You need to justify to the Ministry the importance of continuing the service while at the same time making it clear that you understand the need to raise revenue and provide information principally for those with the greatest need.

1. How would you justify the continued provision of at least some free services?
2. How would you assess the relative needs of your enquirers?
3. Are there any services which should continue to be provided free or at a low charge, and if so why?
4. Is there any type of information to which access should be restricted and if so what restrictions should apply?

Qn (1) a. Enhance awareness in the environment

b. Not to hinder/discourage/dampen interest in the environment

eg. Free to → Funding agencies
Govt. leaders (decision-makers)
Non-profit organisations (NGO)
The media
Students

(2) Through forms/interviews for the "who, what, why" of the info. required

(3) Yes -

For those services which incur costs
eg. Photocopies
Online
Inter-library loans
Sending (postage & handling)

(Nominal charge - to the above category)

Full charge to profit making organisations

Real cost + %

Access to collection - free to all

(4) 3 Types

(1) Confidential, Draft reports } Only to authorised personnel

(2) Limited restriction → not for loan/ photocopying- reference only

eg. EIA reports, risk analysis, etc.
- to protect copyright/plagiarism

(3) Expensive/valuable documents
(Bks/journals etc.)

Legislation and Regulations

Study No. 1 - Legislators

You work for the National Environmental Protection Agency in your country and you are charged with drawing up a new package of anti pollution laws. The present laws are inadequate and allows industry to dump waste without regard to the environment. The new laws will minimise waste production, protect the health of workers and the neighbourhood, and encourage better monitoring procedures.

1. How do you investigate the compliance with the present laws?

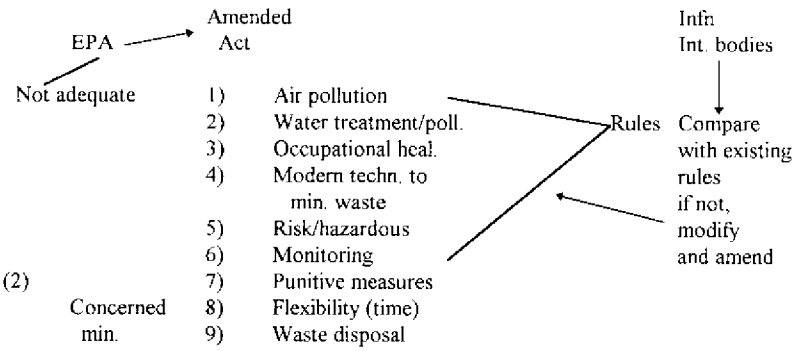
2. Who within the country do you need to consult with? Are there any international organisations to assist you?

3. What are the most important areas to legislate on, and why?

4. How would you enforce those new regulations?

Please feel free to make any necessary assumptions

(1) Present Act



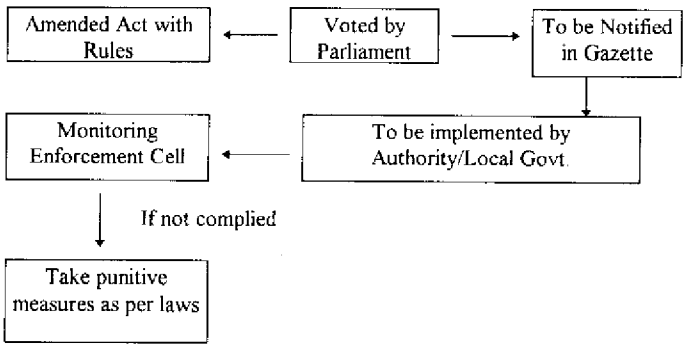
(2) Concerned min.

Min. env & forst.

(3) OCC. Heal. - Risk/Life Ins. - Monitoring/Mitigating

- time in addition to schedule

(4)



Legislation and Regulations

Study No. 2 - Industry

You are a very large textile company and produce a wide variety of textiles (natural and man-made fibres). You are expanding rapidly and need to invest heavily in new plant and machinery. Previously the pollution laws were very weak and most of your waste (dyes, other chemicals, solid waste and air emissions) went straight into the environment untreated. Soon the National Environmental Protection Agency in your country will bring in tough new law, and you have to comply.

1. How would you determine the amount of pollution that you cause?

2. Where do you seek advice about the best and most cost effective pollution control equipment?

3. Who do you need to talk to and consult?

4. How should you organise yourselves within your company?

5. What are the benefits of good environmental management?

STUDY 2. INDUSTRY

1. Employ a pollution consultant to test:

   Water - Concentration. ph
   - Type of chemical waste
   - Quantity of wastes
   - Air pollution: suspended particles
   : Type of gas/fumes

   General - Check hospitals - types of sickness
   - Investigate possible links to factory emissions.
   - 'Before & After' scenario

2. Consultant

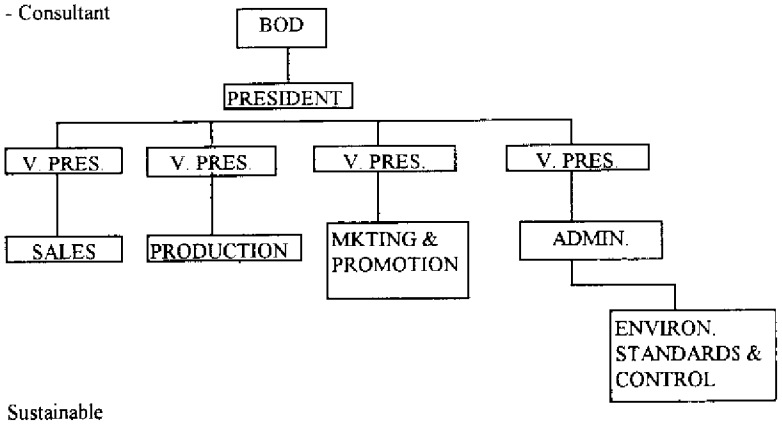
   - Environmental Info. Services & Agencies

   e.g. IUCN-World Conservation Union

3. National Environmental Dept. Protection Agency

   - Locals through public participation exercises
   - Public Meetings
   - Questionnaires
   - Town Council

   - Consultant



5. Sustainable
   - Good P.R. with locals
   - Use this environmentally sensitive to market goods
   - Assume: Govt will reduce tax if good environmental mgt.

Murphy's Law: Co. will not implement environmental mgt. unless they are forced to (by govt.) because it is unprofitable.

DSE in Brief

The German Foundation for International Development (DSE) is an institution for the initial and advanced training of specialists and executive personnel from developing countries. In addition, it prepares German experts for their assignments in a developing country, and maintains the Federal Republic of Germany's largest centre for documentation and information on development policy.

The DSE works in the areas "Education, Science and Documentation", "Economic and Social Development", "Public Administration", "Industrial Occupations Promotion", "Food and Agriculture" and "Health". Its objectives are an international exchange of experience and the qualification of specialists and executives from developing countries.

Dialogue and advanced training programmes (conferences, meetings, seminars, training courses etc.), support projects which serve economic and social development. The DSE thereby contributes to an effective, sustainable and wide ranging development process.

Since 1960 the DSE, in cooperation with national and international partner organisations, has given advanced professional training to more than 100,000 specialists and executive personnel from more than 140 countries. An increasing part of the programmes takes place in the developing countries, the rest in Germany

The DSE makes its contribution to development cooperation on the basis of the guidelines of the Federal government's development policy. The institutional contribution donor is the Federal Ministry for Economic Cooperation and Development (BMZ).

The DSE was founded by the Federal and Land governments in 1959 on the initiative of the political parties represented in the German Bundestag as a foundation under civil law. Its main seat is Berlin, and its other locations are Bonn, Bad Honnef, Mannheim, Feldafing, Zschortau and Magdeburg.