

January 13, 1999



**A REVIEW AND INTRODUCTION
TO THE**

SCHOOLS IN COMMUNITIES

AGENDA 21 NETWORK

A SYSTEM TO ENCOURAGE COMMUNITY 'SCHOOLING'

IN ENVIRONMENTAL APPRAISAL AND

NEIGHBOURHOOD PLANNING

FOR A SUSTAINABLE FUTURE

Part of the Community Programme of the National Museum and Galleries of Wales

Sponsored in Wales by Texaco, Data General, The Countryside Council for Wales, BHP Petroleum
and Cardiff Bay Development Corporation

National Partners

Conservation Management System Partnership
RSPB

Institute of Terrestrial Ecology
British Trust for Ornithology

Institute of Grassland and Environmental Research
International Programme for Recording Childhood Allergies

January 13, 1999

CONTENTS

1 WHAT IS SCAN

2 NEIGHBOURHOOD ENVIRONMENTAL APPRAISALS

3 SCAN'S HISTORY

4 THE CHILDREN'S AGENDA 21

5 SCAN FOR SCHOOLS

6 SCAN FOR 'VILLAGERS'

7 SCAN AND ECO-SCHOOLS

8 EDUCATION FOR SUSTAINABILITY

9 SCAN ON-LINE

10 OVERVIEW OF SCAN IN THE CURRICULUM

11 SUMMARY OF EDUCATIONAL ADVANTAGES

12 COMMUNITY 'PLEDGE LISTS'

1 What is SCAN?

1.1 In 1992, world leaders at Rio de Janeiro produced a global plan for environmental protection, which, as the "Local Agenda 21" is now being acted upon by local government. Councils are asking people to help them survey the local use of materials and energy, and define problems which affect the quality of neighbourhood life. Based on these surveys, families are expected to reduce their demands on the environment, get involved with environmental improvements, and inform their council about problems that are too big for them to handle.

1.2 The conclusions of the Rio Summit are about moving the world towards sustainable development. Our government's response to Rio in 1994 defined sustainable behaviour as actions which help maintain a supply of local jobs, and at the same time:-

- reduce the need for non-renewable resources;
- make use of renewable resources;
- reduce demands on nature as a sink, or dump, for wastes and surpluses;
- adjust demands on nature to match its ecological productivity;
- reduce the need for civic clean-up operations;
- improve the visual appearance of the neighbourhood.

1.3 Each community will have its own pattern of unsustainable behaviour that has to be put right. Baselines have to be determined for each environmental issue, and monitored by people living there, who thereby 'do their bit for Rio'. Participation in the Local Agenda 21 requires learning to see everyday life from new perspectives and acquiring new skills to help. The necessary 'schooling' has to come from within the community*. The UK strategy for sustainability envisages people, communities and local authorities linking up to form citizen's environmental networks transmitting know-how, and exchanging concerns. The need for networking these 'schools in communities' to help with surveys, and spread ideas and good practice, led to the invention of SCAN- the 'Schools in Communities Agenda 21 Network.

1.4 SCAN is an organisation rooted in communities for learning with a purpose. It can be based in an actual school, where pupils help the people it serves. It can be based in a neighbourhood group of families - a village, a ward or a street. By making an appraisal of the local quality of life and producing a small environmental management plan, a 'class' can plan to put things right. Tasks are separated into those that can be tackled locally, and those that are the responsibility of others. Year to year monitoring provides a check that things get done. It is an educational innovation that is sensitive to what is happening in the surrounding culture; the flow of ideas to and from a community is not a one-way street, and there are opportunities for people to get together with others engaged in similar activities.

January 13, 1999

1.5 Knowledge being learned by questioning the local environment is continuous with world culture. There is a lot to talk about, and there are important things people can do. In a democratic society everyone has the right to have views, and make them known. Our elected leaders need to know our opinions if they are to act on our behalf. Such activities are likely to be most effective if our opinions are well informed, and channelled through the Local Agenda 21. Politicians are also accountable to us, and we can check up on their actions, which should emerge as action plans for sustainable development and biodiversity in the Local Agenda 21.

2 Neighbourhood Environmental Appraisals

2.1 The need to generate an educational climate for civic involvement with planning has been an unattainable lodestone of local government, and educators, for at least a century. Planners are agreed that some form of ongoing environmental appraisal carried out within the community is the key. SCAN is an innovation to take community appraisal into the school. It helps young people take on a role of local surveyors of 'place' and its 'issues'.

2.2 In making plans for the future of a neighbourhood it is important to start with the things that make it special. These fall broadly into the following categories:-

- the physical features and boundaries;
- the biological features;
- the built structures;
- routes for communication;
- the notional value-layer to landscape;
- local problems, issues and challenges.

2.3 Through the procedures of evaluation, people become involved in protection and management: checking on trends in jobs, services and natural resources. Comparisons with elsewhere are important to determine what is missing, and what is worth promoting.

2.4 A new initiative to carry environmental appraisal into schools was made in 1995, as part of an interactive environmental education programme funded by Dyfed County Council, the Countryside Council for Wales, and Texaco. This group organised a teacher-led pilot to create and evaluate a system for carrying out neighbourhood environmental appraisals, and networking the findings from school to school. The scheme is now known as SCAN (schools in communities Agenda 21 network). SCAN's aim is to promote the use of the neighbourhood served by the school as an interactive curriculum resource for studying 'place' (geographical, biological, and notional), and, at the same time, help the community promote its own plans for environmental improvements.

2.5 Teachers, in principle do what they normally do, but work with a focus on problems, issues and challenges of local economic development. An important aim is to keep alive the idea of their neighbourhood being distinctive, with features of cultural value worthy of protection and enhancement in the face of economic change. SCAN

January 13, 1999

thereby meets one of the main aims of the local Agenda 21, which has the role of planning economic development, with its need for new job skills, whilst maintaining a sense of community.

2.6 In practice this planning strategy is expressed in the Local Agenda 21, which is a package of environmental campaigns led by local councils to discourage actions which:-

- are unnecessary (e.g. driving where you could easily walk);
- are extravagant (e.g. using 100 w bulbs where 25 w would do);
- are anti-social (e.g. allowing your dog to foul the pavement);
- are destructive (e.g. uprooting amenity planting);
- are divisive (e.g. development without community consultation);
- are hazardous (e.g. using insecticide where pests could be removed by hand);
- cause problems for others (e.g. leaving gates open in the countryside).

2.7 The campaigning role of the Local Agenda 21 is to increase awareness of this 'bad' behaviour, and recommend, or actively promote, 'good' actions. Behaviour can only be changed if people are able to make comparisons with appropriate norms. Beneficial actions, and the visual results of 'good' behaviour have to be defined. In order to make an effort to move from 'bad' to 'good' behaviour, people have to see their position, and how it changes over the years, on some kind of scale. These home/community 'markers' to measure improvements are called 'indicators of sustainability'.

Examples are:-

- a family 'pledge-list' of actions taken to consume less;
- use of bottle banks;
- trends in the use of fuel and power by the local council;
- number, and health, of trees in the street;
- level of crime against persons and property;
- vandalised civic amenities;
- number of local shops;
- number of homeless people.

2.8 A general indicator which sums up a person's commitment to the Local Agenda 21 is 'pride of place'. Without pride of place, campaigns, for example, against littering and excessive energy consumption, tend to be a constant drip into a social sponge. In this respect, the Local Agenda 21 is fundamentally about encouraging a feeling that the local patch is special, and a place where most people are doing their bit for Rio.

2.9 The end point, or deliverable, of a neighbourhood appraisal, is some kind of presentation, a bulletin board, a book, video, computer display etc. It summarises all information collected by the appraisal to answer questions about 'who we are', 'where we live', and 'what we do':-

January 13, 1999

- defining what is good and bad about the neighbourhood;
- saying what should be done to improve the bad, and preserve the good.

2.10 There should be a system for communicating the appraisal to other communities, to spread ideas and good practice.

2.11 A neighbourhood appraisal should also include a plan for action saying what the community should do, and what others should do with regard to problems that are too big to handle locally.

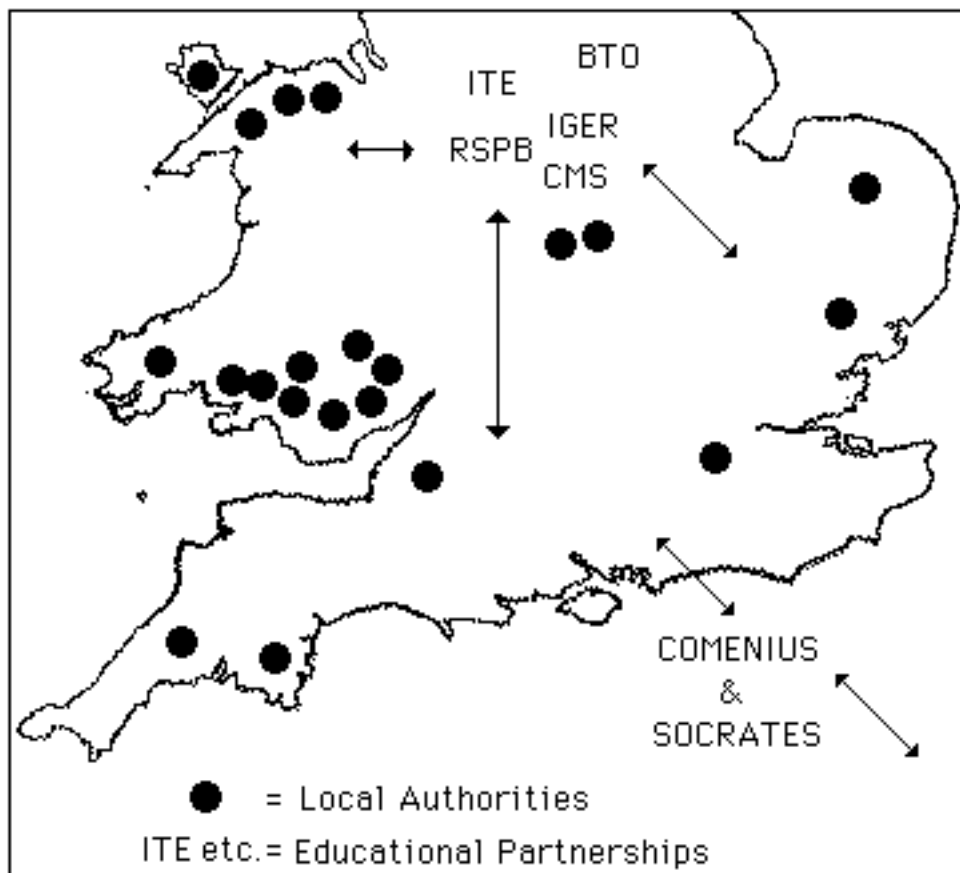
2.12 Finally, there should be a procedure to revisit the appraisal on a regular basis for updating and checking that its findings are acted upon.

3 SCAN's History?

3.1 Time Line

- 1995-6 SCAN was invented and tested by advisors and teachers in Dyfed County Council's education resource centre as part of an award-winning programme to develop interactive resources for environmental education.
- 1996-7 A primary resource pack was produced with a sponsorship from Texaco.
- 1997-8 SCAN was adopted by the National Museum of Wales, as part of its community programme. It is staffed by 1 full-time national co-ordinator, currently funded by the Countryside Council for Wales, and a part-time manager, funded mainly from service-level agreements with local authority partners of SCAN.

3.2 The wider network March 1998



January 13, 1999

3.3 Achievements

- In 1997, SCAN was extended beyond West Wales, and currently over half of the 22 Welsh Local Authorities have incorporated SCAN into their Local Agenda 21 schemes for community consultation. The growing Welsh network has over 100 schools. Fifteen English councils have joined through random contacts across the border.

- SCAN On-Line has established an e-mail system for pupils to discuss the problems, issues and challenges of economic development, promote their SCAN surveys and Agenda 21 action plans through the web pages of their schools, and join SCAN's on-line curriculum development teams.

- Apart from the 'real-experience' of quantifying 12 neighbourhood quality of life issues, notable achievements of individual schools in the network have been:-
 - designing and siting a safe recreation area for mothers with young children;

 - establishing a school-community litter management scheme;

 - organising a community programme to monitor the incidence of asthma;

 - successfully lobbying for road-crossings and traffic calming;

 - organising a 6th form conference to debate what politicians, business and local authority officers are doing for Rio;

 - developing pollution surveys to aid local authority monitoring programmes;

 - local weather forecasting to help neighbourhood businesses manage energy;

 - carrying out home energy surveys, and devising quality of life indicators;

 - stimulating local businesses to do their bit for Rio.

4 The 'Children's Agenda 21'

A New Focus for Issue-based Environmental Education

4.1 In 1994 a children's edition of Agenda 21* was published from the input of children from over 100 countries. Basically it says everyone has the power to make, and keep, personal pledges to manage their behaviour in relation to the following 6 issues.

Consumption

- Shift balance of personal spending from 'wants' to 'needs'
- Lower individual economic horizons
- Travel at the lowest cost to the environment
- Think about how much your leisure costs planet Earth
- Resist pressures to consume more

Waste

- Reduce your contribution to waste
- Help manage clean-up
- Use renewable/recyclable resources
- Make more efficient use of your energy and materials

Poverty

- Become knowledgeable about the root causes of poverty
- Support fair trade and lobby for fair debt

Health

- Be aware of the sources of environmental diseases
- Crusade against addictive drugs
- Be sceptical about cost-benefits of mass-produced food

Destruction

- Campaign against human conflict
- Help create and conserve wildlife habitats
- Take a soft approach to 'weeds' and 'pests'
- Support land-use schemes that prevent soil degradation
- Work to reclaim derelict land for community use
- Campaign against vandalism of public amenities

January 13, 1999
Communication for action

Use your right to be heard
Keep up to date with your Local Agenda 21
Get connected with children of other communities
Do something to improve your neighbourhood and tell others about it

* 'Rescue Mission Planet Earth' Kingfisher Books

5 SCAN for Schools

5.1 The SCAN system

SCAN, provides up to date curriculum packages of survey methods, and educational software, for SCAN schools to monitor the local quality of life, and managing plans for improvements. Survey forms are being produced in partnership with local authority departments with the aim of gathering information which is relevant to their needs. The objective is to encourage children to produce local environmental management plans to help their communities develop the local Agenda 21. These plans quantify local problems, define what should be done, identify what the school will do, and say what their local authority should do in the context of the council's strategy for sustainable growth. It is being developed from the National Museum of Wales as a national local authority network in partnership with Mendip District Council. Mendip Council was the first local authority to establish a network with its communities through schools, and has incorporated school/community surveys into its Agenda 21 plans for sustainable development, and biodiversity.

5.2 SCAN:-

- builds upon the work of two national campaigns 'Jigso' (Wales) and 'Enviroscope' (England), which promote environmental awareness at community/family level;
- is driven by teachers who have developed successful classroom exemplars;
- is supported by their advisors and local authorities;
- harnesses the national curriculum to the workings of local government and its plans for sustainable development emanating from the Rio environment summit;
- provides a stimulus for teachers to use the local environment and its problems and issues, as challenging educational resources;
- makes what schools already do within the National Curriculum more meaningful, and, although not prescriptive, provides a standard IT structure for schools to communicate their findings, plans, and feelings about the future of their community, to local government;
- models best practice in environmental management to help schools make and operate action plans for neighbourhood improvements in the context of the Local Agenda 21.

January 13, 1999

5.3 SCAN has been enthusiastically received by local authorities, schools advisors, examiners, teachers, students, environmental agencies and business. It fills an important gap in the local network necessary to turn a council's environmental action plans into community management plans

5.4 The current work programme involves:-

- encouraging teachers to produce exemplars of their surveys and actions;
- carrying out information/training visits to schools, and groups of schools, to develop and bolster a local authority-wide network with its supporters;
- training local evangelists, either in individual schools, or as part of the local teacher-supply service, to maintain and spread SCAN membership within the authority;
- working with local authorities and business to produce educational materials and information routes that encourage schools to interact with the local planning process as a learning experience.

5.5 Each school is networked by :-

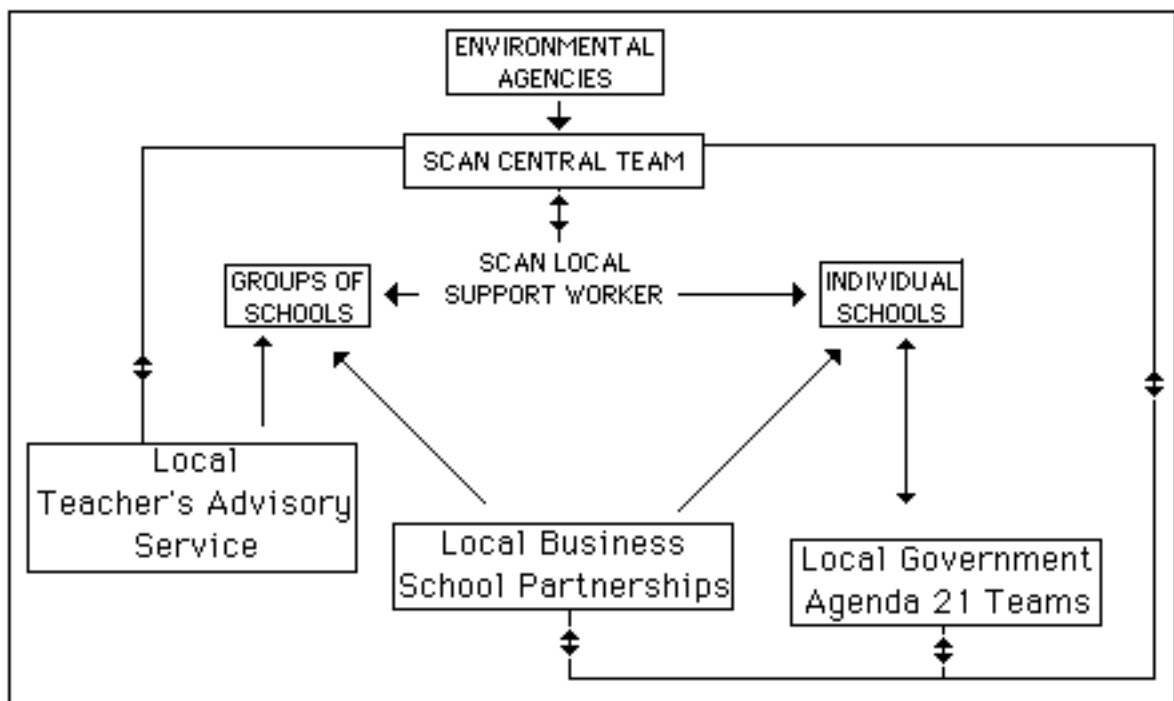
- providing an information pack on standard appraisals and classroom procedures, compatible with national curriculum objectives, for reporting on the local quality of urban and rural life. in the spirit of Rio;
- demonstrating how to derive local environmental management plans from the data;
- defining routes to channel their concerns to their local authority;
- helping the implementation of projects for environmental/social improvements;
- establishing a central database of survey data, management plans, achievements, and information on the local Agenda 21, and biodiversity action plans, open to all member schools and their local authorities;
- training local support workers who will respond to requests from schools to develop and maintain the county/ district network;
- registering the schools in a national/European network,;
- spreading best practice between schools in 'education for environmental management' at the community/local government/business interface.

January 13, 1999

5.6 SCAN's methods for environmental survey are suitable for taking 'sustainable development' as a focus for curriculum development from Key Stages 1 to 3 (science, geography), and to consolidate the cross-curricular themes of 'environmental education', 'economic and industrial understanding'; and 'education for citizenship'. Backup resources are provided, as interactive computer help-files, and simple databases, to assemble an electronic library, organise school-based schemes for local environmental improvements, and enter a communication network with other SCAN schools.

5.7 SCAN makes what teachers already do for the national curriculum more interesting to pupils, more relevant to local problems, and more challenging in that it prompts youth to management in the real world. In this way it is possible for a school to realise the idea of a 'citizens environmental network' by rooting an environmental information system within the community, and working through SCAN to spread the ripples. The necessary networking between all players is set out in Fig 1

Fig 1 The network



5.8 Studying biodiversity

One of the Rio resolutions was that action should be taken to stop the world-wide loss of biodiversity: i.e. the variety of living things we see around us. Education has a role to play through practical work which helps children recognise and value common plants and animals, which are increasingly in need of care and protection. In this context, schools are well placed to produce inventories of local

January 13, 1999

biodiversity, monitor changes long-term, manage local improvements, and submit reports to aid their council's biodiversity action plan. Measuring local biodiversity is not about seeking rarities, but about checking up on the common plants and animals which give the community a sense of place.

'BIOSCAN' provides a topic menu to guide curriculum work on local biodiversity to produce reports called 'bioscopes'. Making bioscopes helps increase awareness and the value of common wildlife in playgrounds, parks, roadsides and gardens. Each topic offers routes for action, either to improve biodiversity, or add information to a national or local databases.

Current bioscopes are:-

- Time-SCAN- How to keep a nature diary and collect local reminiscences.
- Tree-SCAN- How to record neighbourhood trees as individuals.
- Grass-SCAN- How to use a school lawn to model environmental management.
- Air-SCAN- How to record weather and make simple measurements of air pollution, and relate these appraisals to surveys of the incidence of childhood asthma.
- Bird-SCAN- How to study local birdlife in the context of a world of birds.
- Minibeast-SCAN- How to set up a simple system to study soil, and animals that roam its surface.
- Grid-SCAN- How to create a local geographical information system to map local wildlife and study the factors affecting its distribution c
- Work-SCAN- How to set up classroom 'mini nature-business', and study organisations that affect, or protect, the local environment.
- Council-SCAN- How to approach a council to examine its policies and actions that affect local biodiversity
- Water-SCAN- How to use 'water' as a focus for community projects.
- Place-SCAN- How to present local interactions between people and nature which give a community a special character, and are a cause for celebration or concern..

January 13, 1999

- Microcosm-SCAN- How to set up simple aquatic ecosystems based on filamentous algae to study the biological process of water-purification.
- SCAN Skeleton Soils- How to use piles of stones or rocks to investigate soil formation, and the interactions between plants and soil in the context of land reclamation.

5.9 Links between curriculum and citizenship

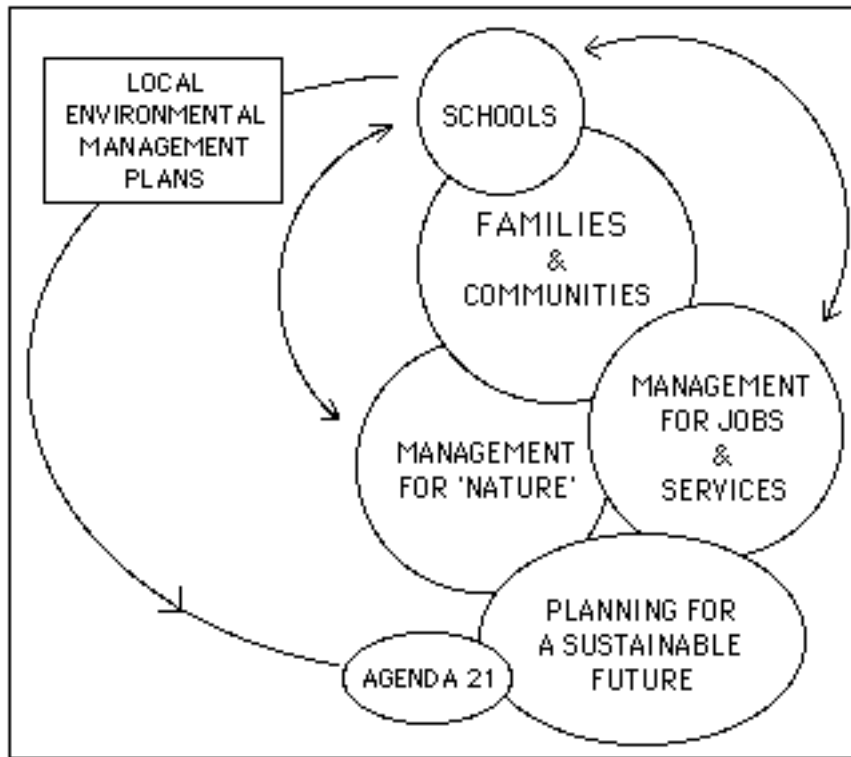
SCAN's protocols encourage the study of the environmental ethos and operations of countryside management as a constantly developing holistic interplay between environment and local economic planning. This important knowledge system is difficult for schools to access. On the one hand it resides in the science and practice of nature conservation, and, on the other, it is locked into the local planning department, and the policies of the elected representatives. SCAN fills this gap by providing a teacher training package, and classroom resources, which focus on the duties and grass roots tasks of site managers, and planners, and their connections with local government and the communities they serve. Here, SCAN encourages attitudes and qualities necessary for everyone growing up in a world dominated by concerns about the environment, and who eventually, as voting citizens, will have to take a stand on local and national problems, issues, and challenges of world development.

Schools who are members of SCAN are finding ways to delineate curriculum objectives which bear on government plans for sustainable development. A start can be made with the school community by asking which of its activities are unsustainable. This may be followed by surveys of community life, business, local services, and the biodiversity of parks and gardens.

For children to understand local issues they have to participate in the local planning process. The Local Agenda 21 is about balancing management of the environment to support jobs and on the one hand, and to preserve community services and enhance local biodiversity, on the other. A school taking part in SCAN enters this planning arena, interacting with families and communities which depend on the planning process to maintain jobs and services in equilibrium with nature (Fig 2).

January 13, 1999

Fig 2 Schools in the Agenda 21 'planning arena': checking out management of the local quality of life.



Environmental management plans saying what the school will do, and what others should do, are the civic outcome of this interaction. These can be passed on to local government, business, and the environmental agencies.

A succession of pupils taking up the same approach from year to year ensures that a local checking and monitoring system remains in place. The year to year progression also provides an interactive environment for learning how local government works, and gaining confidence to participate, and if necessary, make a fuss.

5.10 SCAN and Information Technology.

To get the most out of SCAN requires a good communication system to publicise local findings, hear about the concerns of other SCAN schools, and help refine best practice. From these viewpoints, SCAN is an ideal project to make meaningful cross-curricular use of IT, not only to collect data that has real meaning, but also to get the best out of a school's e-mail system and web site. Schools software is available to hold, and transmit, data from environmental surveys in a variety of IT formats. for sharing and comparing in a national context.

January 13, 1999

SCAN is developing an on-line service because:

- it is a partnership network linking schools, educational advisors, local authority Agenda 21 planners, businesses, and environmental agencies: meeting targets and deadlines depends upon efficient communication;
- it is a system for collecting and sharing data which uses spreadsheets, computer graphics, and word processed documents, as information carriers, ;
- it transmits data and best practice from school to school;
- it organises teacher teams, involving groups of schools, widely separated geographically, to develop environmental projects with partners in the public and private sector;
- it encourages pupils to discuss their work on problems issues and challenges of local development across administrative and geographical boundaries;
- it provides resources for data collection and reference as computer files;
- it is being taken up by schools which communicate with SCAN by E-mail, and are setting up SCAN web pages, because SCAN gives staff and pupils an intellectual and practical framework for asking good questions, thinking about what they want the world to see, and why the world will want to see it;
- it provides Help Files as library resources for particular topics using hypertext mark-up language (HTML) which is the standard approach to on-line training;
- it is currently promoted, and backed, with paper media, and face to face contacts with schools or groups of teachers, a process that would be made more cost effective by integration with an ancillary on-line information service.

The importance of computers in providing explanations and predictions about dynamic phenomena makes them of fundamental importance to teach people about environmental management. Learners have two basic approaches, they can either use explanations provided by others, or seek to develop explanations for themselves. The former produces some level of understanding quickly. The latter has the potential for producing a deeper and more lasting understanding by 'ownership of knowledge' through 'discovery'. Preparing a SCAN management plan to deal with school litter, or sustain a patch of wild flowers, are, again, real applications of IT, which give ownership of knowledge and require thinking about the system of resources of which the plan is only one component. A computer database makes it easier to trace dynamic behaviour patterns of the whole system, and predict effects of management on its future condition. By encouraging the creation of school environmental management plans SCAN promotes systems thinking. Finally, computers can make cross-curricular learning resources about

January 13, 1999

environmental management easier to use if packaged as self-indexing help-files (electronic books and documents). SCAN provides backup of this type.

5.11 The educational experience

The core of the famous carnival in Rio de Janeiro is a twelve-hour-long procession of song, dance and street theatre. One troop of players after another presents its piece. Usually, the piece is a social comment dramatised through music and dance. The processions are not spontaneous. Preparing them as well as performing in them are important parts of Brazilian life. Every group prepares separately- and competitively- in its own learning environment, which is called a 'samba school'. These are not schools as we know them: they are social clubs with memberships that may range from a few to many hundreds. Each club owns a building, a place for dancing and getting together. Members of a samba school go there most weekend evenings to dance, to drink, to meet their friends. As they dance everyone is learning and teaching as well as dancing. Even the stars are there to learn their difficult parts. There is a great sense of social cohesion, a sense of belonging to a group, which is part of a community of groups, and a sense of common purpose.

The samba school* represents a set of attributes that every learning environment should, and could, have. Learning is not separate from reality. The dance samba has a social purpose and learning is integrated into the school for this purpose. Novice is not separated from expert, and the experts are also learning.

SCAN is also a 'school' for learning with a purpose. By producing a small environmental management plan a class can see what is involved in planning to put things right. Tasks can be separated into those that can be tackled by pupils and those that are the responsibility of others. Year to year monitoring provides a check that things get done. It is an educational innovation that is sensitive to what is happening in the surrounding culture; the flow of ideas from community to school is not a one-way street, and there are opportunities for youth to get together with others engaged in similar activities. Knowledge being learned by questioning the local environment is continuous with world culture. There is a lot to talk about and there are important things young people can do. In a democratic society everyone has the right to have views. and make them known. Our elected leaders need to know our opinions if they are to act on our behalf. Such activities are likely to be most effective if our opinions are well informed, and channelled through the Local Agenda 21. Politicians are also accountable to us, and we can check up on their actions, which should emerge as action plans for sustainable development and biodiversity in the Local Agenda 21.

* The samba school was chosen as an educational metaphor by Seymour Papert to promote educational methods that do not need continuous support once they take root in an actively growing mind

6 SCAN for 'Villagers'

6.1 Community delegates at Rio saw their on-going role in local development as:-

- defining a sense of place in their neighbourhood;
- discovering local problems, issues and challenges of economic development;
- evaluating specific concerns;
- defining what they can do to improve things;
- alerting others to act on problems that are beyond their capability;
- checking that things get done.

6.2 SCAN for Villagers* is a practical response to Rio driven by families and young people, and is related to the need to foster a sense of place in the neighbourhood. A 'neighbourhood' is defined by the people living there as a place with its own social identity. It is complementary to SCAN as a classroom activity, and may use the same methods. The aim is to foster community cohesion, and increase a community's information capability, by eliciting from families, in conjunction with local government, a vision for the future of their neighbourhood. A particular objective is to encourage everyone to see, and evaluate, the commonplace features which they pass everyday but do not see.

6.3 The first two practical stages of SCAN for villagers are:-

- (i) Make community postcards, or write letters, with personal messages about what is good and bad in the neighbourhood, and get everyone to fill in a 'community issues' tick box questionnaire. These simple actions form the basis for an Agenda 21 bulletin board for the community. This will produce a list of local concerns, from which people should identify what they can do to improve things, and what others should do.
- (ii) Individuals and groups then harness their particular skills and passions to make an inventory of all features, physical, biological and social, past and present, which make their neighbourhood a special place. The inventory, a kind of 'domesday', is used to produce a vision of what should be the future of their patch. Action plans are then produced to target future developments, and check that things get done.

6.4 At this point, SCAN will have roots, and will grow if nurtured, and self-supported by the entire community. In particular, a SCAN management team needs a place to

January 13, 1999

meet, and facilities to manage its records, receive feedback and new ideas, and organise work plans from season to season and year on year. The local appraisal system should then have a life of its own.

Neighbourhoods communicating with each other become part of the 'citizen's environmental network' envisaged in the government's Rio strategies for sustainable development and biodiversity. It is important to tell the school serving the neighbourhood about SCAN if they do not already know about it, and explain how, your community is using its ideas to do its bit for Rio.

Schools have a great potential to help with information handling. SCAN for the classroom has been designed by teachers to meet curriculum targets, but its chief objective is to get children and their families organised to make local environmental improvements. A SCAN partnership between a school and the community it serves is a powerful force for cohesion and progress.

**SCAN incorporates the global village metaphor which is commonly used to summarise the working philosophy of education for sustainable development. In other words, our planet is really a very small place, and everything we do as it's villagers will have some influence on Earth's future.*

7 Relationships Between SCAN and Eco-Schools

7.1 These two national environmental education programmes are complementary. They both focus on environmental management, with seven elements that schools can adopt to raise the profile (and get involved) with education for sustainability (EFS). These are compared and contrasted below. The main strategic difference is that SCAN starts with work done for the National Curriculum by individual teachers and their pupils, whereas Eco-Schools is based on a pupil/teacher committee approach to school management. Operationally, SCAN concentrates on pupils working with the community served by the school, and its local council, to improve the local quality of life/biodiversity, and increase the information capability of pupil's families. In contrast, Eco-Schools aims to involve all members of the school community working together to improve the school's environmental performance. SCAN's unique feature is that it provides a national network, in the context of the Local Agenda 21, for teachers to work together to develop and share best practice of environmental appraisal applied to EFS.

SCAN

- 1 Neighbourhood appraisal built into a teacher's classroom strategy.
- 2 A class identifies issues for quantitative appraisals in geography .. and science
- 3 A class produces a neighbourhood management plan to make environmental improvements
- 4 Year on year checks to see how things change, and to ensure things get done.
- .5 Neighbourhood appraisals* of quality of life and biodiversity to meet specific curriculum targets at Key Stages 1-4
- 6 Home-surveys to collect data in relation to indicators of sustainability and biodiversity. Families involved through open days, press coverage etc. Local council involved through the Agenda 21 team receiving reports about neighbourhood problems and concerns too big for the school/community to handle.

ECO-SCHOOLS

- A school committee
- Review of school's environmental impacts
- Whole school action plan, with targets.
- Monitoring and evaluation of committee's targets
- Curriculum work which integrates environmental issues into lessons
- Informing and involving the wider community through displays, assemblies and press coverage.

January 13, 1999

7 Pupils and their families make pledges to
adopt sustainable ways of living.

Eco-code for the school

* Practical methods suitable for Eco-schools' curriculum topics:- litter and waste; waste minimisation and recovery; water; transport; energy; and school grounds.

8 Education for Sustainability

8.1 What is Sustainability?

(i) 'Development that meets the needs of the present without compromising the ability of future generations to meet their own needs' (Our Common Future; Brundtland Report '87)

(ii) 'Improving the quality of human life, while living within the carrying capacity of supporting ecosystems'. (Rio '92).

8.2 What Aspects of Life does Sustainability cover?

Sustainable behaviour is not just about green issues. The following statements about sustainability focus on quality of life. They bring together a wide range of aspects of sustainability - social and economic as well as environmental and are a good starting point for developing Local Agenda 21 plans.

1. Resources are used efficiently waste is minimised and materials are recycled.
2. Pollution is minimised to levels which do not cause damage to natural ecosystems.
3. The diversity of nature is valued and protected.
4. Where possible local needs are met locally.
5. Everyone has access to adequate food, water, shelter, and fuel, at a reasonable cost
6. Everyone has the opportunity to undertake satisfying work in a diverse economy. The value of unpaid work is recognised, and payment for work is both fair and fairly distributed.
7. Health is protected by the creation of safe clean and pleasant environments, and of services which emphasise prevention of illness as well as care for the sick.
- 8 Access to facilities, services, goods, and other people, is not achieved at the expense of the environment or limited to those with cars.
9. People live without fear of personal violence from crime or persecution because of their personal beliefs, race, gender, or sexuality.
10. Everyone has access to the skills knowledge and information which they need to play a full part in society.

January 13, 1999

11. All sections of the community are empowered to participate in decision making.
- 12 Opportunities for culture leisure and recreation are readily available to all.
13. Buildings, open spaces, and artefacts, combine meaning with beauty, and utilities and settlements are human in scale and form; diversity and distinctiveness of architecture and landscape are valued and protected.
14. Co-operative links are developed with other parts of the world.

8.3 Strategies and Action Plans

(i) The Earth Summit and Agenda 21

In 1992 the United Nations held the Earth Summit in Rio de Janeiro. At this conference 179 nations endorsed an action plan for the 21st century called Agenda 21 . This is a blueprint on how to make development environmentally sustainable while including social progress and economic growth.

The global Agenda 21 calls on governments to adopt national strategies for sustainable development. In 1994 the UK Government published its national strategies for sustainable development and biodiversity, which should be addressed through local government action plans, in which everyone is called upon to do their bit.

(ii) Local Agenda 21

In 1997 the UK government called for all local councils to have a Local Agenda 21 strategy in place by 2000.

Local Agenda 21 embodies the concept of thinking globally and acting locally. It is important that it is devised and agreed by the people whose lives it will affect to involve and empower everyone. Also vital, is that individuals and communities have the information they need to make good decisions for their futures.

A sustainable community lives in harmony with its local environment and does not cause damage to distant environments or other communities - now or in the future. Quality of life and the interest of future generations are valued above immediate material consumption and economic growth. ('A Framework for Local Sustainability' Kent CC).

January 13, 1999

8.4 Role of Education

(i) Global Agenda 21

'Education is critical for promoting sustainable development, and improving the capacity of the people to address environment and development issues. Education is also critical for achieving environmental and ethical awareness, values and attitudes, skills, and behaviour consistent with sustainable development, and for effective participation in decision-making.' (Agenda 21 Chapter 36 1992).

Children and families should be consulted in the production and development of the Local Agenda 21, and they should set up citizens' environmental networks to ensure good ideas and worthwhile actions spread within, and between, communities (UK Strategy for Sustainable Development)

(ii) Environmental Education and the National Curriculum

'Environmental education has an important contribution to make to the work of schools in promoting the spiritual, moral and cultural development of pupils and of society, and preparing pupils for the 'opportunities, responsibilities and experiences of adult life' as required by the Education Reform Act ;1988 (Teaching Environmental Education Through the National Curriculum (SCM, 1996)).

The main strands of Environmental Education are:

Education ABOUT , IN, THROUGH, and FOR the environment.

Generally schools concentrate on the first three aspects, and give less weight to the last one.

Education for Sustainability (EFS) brings together the main strands of Environmental Education under one set of guiding values i.e. points the curriculum towards sustainable lifestyles and a sustainable society: It also emphasises the importance of working *for* the environment, which promotes CRITICAL ENQUIRY and provides local relevance for curriculum work.

Especially important in EFS are:

ASKING QUESTIONS, THINKING, REFLECTING, ENQUIRING, and EVALUATING, the quality of the neighbourhood served by the school in a CRITICAL way. It encourages pupils to make connections about WHERE WE FIT (as individuals and communities) in the cause of the environmental problems, issues and challenges, and the key to solutions. It is a life-long skill which should cultivate careful and critical surveillance of environmental attitude & values.

January 13, 1999

Throughout Agenda 21 the vital role of education in achieving sustainable development is seen as crucial, particularly, but not exclusively for children and young people. A school carrying out a system of year on year local environmental appraisal of the quality of life and biodiversity with the objective of making local improvements is thereby educating the community served by the school in its path to sustainable development.

8.5 Essentials of EFS

The following behaviours and attitudes are at the centre of education for sustainability.

- informed concern;
- individual and collective responsibility;
- compromise and co-operation;
- balanced judgements through listening to & reflecting upon actions of others;
- active participation in resolving environmental problems;
- positive environmental attitudes;
- global citizenship;
- lifestyles and alternatives;
- understanding of the complexity of issues with no easy answers;
- informed decision making is vital to solve environmental problems.

8.6 How can schools get started?

School management

(i) Identify which aspects of school life are covered by EFS. e.g. curriculum, management, school grounds, resources, ethos, local community and business links, international links, etc.

(ii) Identify what is happening already in school which contributes to EFS. Bringing everything together helps explain what sustainability is, inspires people to do more, exposes the gaps, enables monitoring, and gives 'good news' stories about young people and schools' achievements.

(iii) Involve pupils in:-

- auditing and managing the school's environmental impacts through- resource use; minimising & managing waste: water conservation; energy conservation; rationalising transport.
- implementing an equal opportunities policy; a behavioural policy; an environmental education policy.
- links with local people, with local businesses, with local places.
- utilising school grounds for specific purposes.
- keeping in touch with developments in environmental education and sustainability issues.

January 13, 1999

- telling other people about what you are doing: parents; governors; local residents; the local council.

Classroom management.

Take every opportunity to use neighbourhood environmental problems, issues and challenges as educational resources at all Key Stages.

Agenda 21 and sustainable behaviour towards the environment involves getting down to managing some aspect of the way local natural resources are being used, or neglected. The main subjects which can focus directly on the operational management level of the Local Agenda 21, and which could be applied to make action plans, are **geography** (quality of life) and **science** (biodiversity). However, notional values about features of the environment are also important in initiating plans for conservation or making improvements. This area brings forward questions of **art**, and **religion**. Also, the evaluation of features which make a community requires the communication of both facts and feelings, and in this context **numeracy** and **literacy** become targets very relevant to each pupil's ability to inform and influence.

By adopting SCAN's methods and networking, a class can participate in the local Agenda 21 in a very effective way, meet a wide range of targets of the curriculum, and spread its ideas, actions and concerns locally, and within a 'global democracy of children'. The latter was the aspiration of the children who came together immediately after the Earth Summit to produce 'the children's Agenda 21'.

This section is based on a paper produced by Allison Wood, Environmental Advisor for Suffolk, to initiate a SCAN network in the county.

9 SCAN On-Line

An educational platform for schools to use the Internet
with the purpose of engaging in the Local Agenda 21

9.1 The Vision

"Like the Internet itself, if SCAN serves its purpose, it will live and grow through the minds and actions of teachers and pupils'.

SCAN On-Line is the first flexible national school network, invented and controlled by teachers, that brings communities together with the emphasis on information currency, rather than information capital. As such it promotes exchange of ideas and best practice from classroom to classroom. At the same time it offers routes to children and their families for local authorities, sponsors, and information providers to receive and deliver information about what they are doing for the environment. The latter benefit from feedback about the relevance of their information, and gain access to national databases of environmental appraisals. From this aspect, SCAN will root into the educational system with a minimum of central control and co-ordination, which concentrates on developing new ideas, and providing national updates of methods and the results of environmental appraisals.

9.2 Advantages of SCAN On-Line

- it is a partnership network linking schools, educational advisors, local authority Agenda 21 planners, businesses, and environmental agencies where meeting targets and deadlines depends upon efficient communication;
- it is a system for collecting and sharing data which uses spreadsheets, computer graphics, and word processed documents, as information carriers;
- it transmits data and best practice from school to school;
- it organises teacher teams, involving groups of schools, widely separated geographically, to develop environmental projects with partners in the public and private sector;
- it encourages pupils to discuss their work on problems issues and challenges of local development across administrative and geographical boundaries;
- it provides resources for data collection and reference as computer files;
- it is being taken up by schools which communicate with SCAN by E-mail, and are setting up SCAN web pages, because SCAN gives staff and pupils an intellectual and practical framework for asking good questions, thinking about what they want the world to see, and why the world will want to see it;

January 13, 1999

- it provides Help Files as library resources for particular topics using hypertext mark-up language (HTML) which is the standard approach to on-line training;
- it is a more efficient, cost-effective system of promotion compared with paper media, and face to face contacts with schools or groups of teachers.

9.3 Requirements and commitments

For schools:-

- an e-mail capability with appropriate hardware, software, and access to a reliable Internet Service Provider;
- a user friendly 'cyberspace' environment, or tool kit, to assemble the pages of a web site, and keep them up to date;

For SCAN at NMW

- a web site offering a comprehensive resource package for promotion, sign-up, e-mail messaging and conferencing, and the two way shipment of files containing forms, data, interactive training programmes, and a backup library;
- part-time/contract staff as follows
 - a systems operator;
 - a resource compiler;
 - a development officer to make external points of communication with advisors, partners and sponsors.

SCAN On-line: Pembrokeshire

Texaco and Data General are sponsoring the development of a dedicated SCAN network (Fig 1) which will be available by the end of September 1998. The server will be sited and managed within Pembroke Comprehensive School. It will have 13 Primary school 'galleries' for pupils to display their SCAN surveys and offer files for downloading to other schools. There will also be a bulletin board with e-mail conferencing. It will be a model for duplication/expansion as an integral part of setting up the Pembrokeshire County Council's national grid for learning.

January 13, 1999

9.4 Advantages of SCAN On-line for Sponsors

Education sponsors are increasingly concerned about the efficient use of money it devotes to education. The issue was summarised in 1993, at the end of the National Education Business Partnership Conference" in the following questions:-

What are the educational resources needed for?

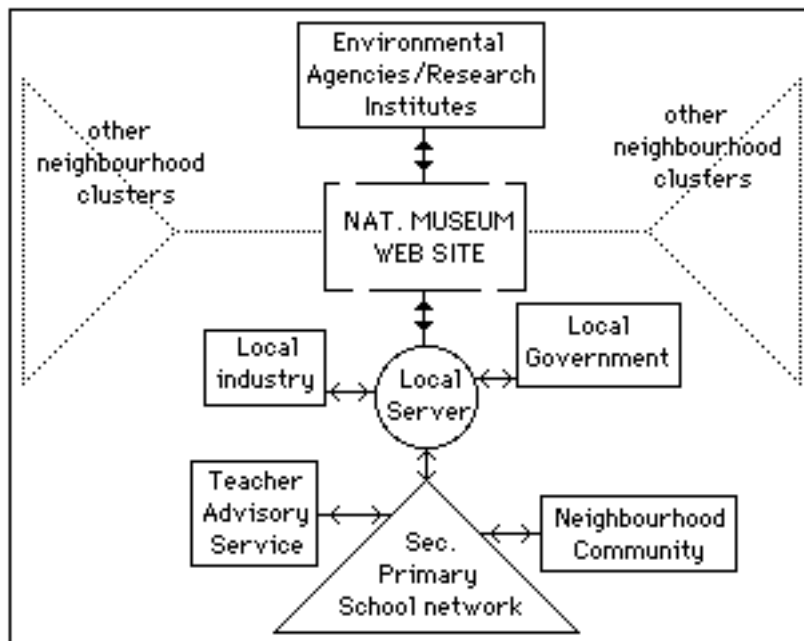
Where can they come from?

How will the resources be controlled to ensure?

- avoidance of duplication;
- delivery to where they are needed;
- regular updating;
- incorporation of feedback from users.

A particular concern was the high cost of producing paper media, which often duplicate other efforts, do not get to the people in need, are difficult to handle on a classroom scale, and rapidly become out of date.

Fig 1 The Pembrokeshire SCAN IT SCAN cluster model.



Answers have not been forthcoming over the intervening years .

January 13, 1999

Question 4 is fundamental to the others and can only be profitably addressed by harnessing information technology: i.e. using SCAN On-Line to make links with local industry to discuss working practices, environmental issues, and job opportunities.

9.5 SCAN On-Line: general specification

NMW On-line services

1 NATIONAL PROMOTION

- 1.1 Production and dissemination of information
- 1.2 Signing up local authorities
- 1.3 Signing up schools

2 NATIONAL OVERVIEW

- 2.1 Central bank of survey data
- 2.2 Exemplars of reports and actions
- 2.3 News bulletin
- 2.4 Reviews of new opportunities for national surveys

3 CURRICULUM DEVELOPMENT OPPORTUNITIES

- 3.1 Assembly and testing new appraisals through teacher-led development teams
- 3.2 Initiating partnerships with national organisations for gathering and/or disseminating environmental information.

9.6 Face-to-face promotion and training

1 LOCAL PROMOTION, TRAINING, AND SUPPORT

- 1.1 Embedding SCAN in the Local Agenda 21 strategy
- 1.2 Embedding SCAN in the educational support services
- 1.3 Seminars and training to define SCAN's role in education for sustainability.
- 1.4 Organising local sponsorships to help fund local SCAN websites.

10 Overview of SCAN in the Curriculum

10.1 SCAN promotes the use of the neighbourhood of the school, and the community served by the school, as educational resources for studying those elements of the curriculum that have a bearing on sustainable development. The approach is to get answers to questions which quantify the local quality of life and neighbourhood biodiversity. In this sense, SCAN's approach is that of socio-biological environmental appraisal, and the communication of the local character of 'people' and 'place', from school to school.

10.2 This approach first becomes feasible in a fully integrated IT context at Key Stage 2. This is why SCAN's starter pack is presented at this level. It links survey sheets firmly to targets in programmes of study in the National Curriculum, and stresses that problems have to be quantified, and checked from year to year, in order to manage plans for improvements. At Key Stage 1, simpler, less structured ways of eliciting responses from children about their environmental concerns, such as pictures with simple messages, are more suitable. It is important to bear in mind that confidence and achievements, which SCAN has never failed to produce at Key Stage 1, raise expectations of more to come in later years.

10.3 Key Stage 3, is characterised by more specialised idiosyncratic practical approaches to information gathering. For pupils at this level, who have never experienced environmental appraisal, the Key Stage 2 pack will meet the basic requirements of geography, but generally, the practical work is more variable and opportunistic. The choice of community problems to study, particularly concerning local wildlife, depends largely on the teacher's interests, personal initiative, and availability of problems.

10.4 Feedback from secondary teachers indicates that it is more important to develop a support-format which stresses opportunities for local curriculum development. Indeed, some primary schools are using SCAN in this context. That is to say, practical work emerges from programmes of study at all levels appropriate to issues in their Local Agenda 21. Practical work increases knowledge and understanding of sustainable development through opportunities in the curriculum for community input to local economic plans. For many teachers, this alone seems to be a very worthwhile achievement.

10.5 Some teachers, both primary and secondary, encourage creativity through the production of worksheets, with individualised essay-type reports which evaluate the class results. In this respect, the basic Key Stage 2 forms may be regarded as models for customisation, and emulation.

10.6 It now very unlikely that the old cross-curricular themes of 'Environmental Education', Education for Citizenship', and 'Economic and Industrial Understanding' will be made mandatory. Now, the rallying point for environmental education to focus

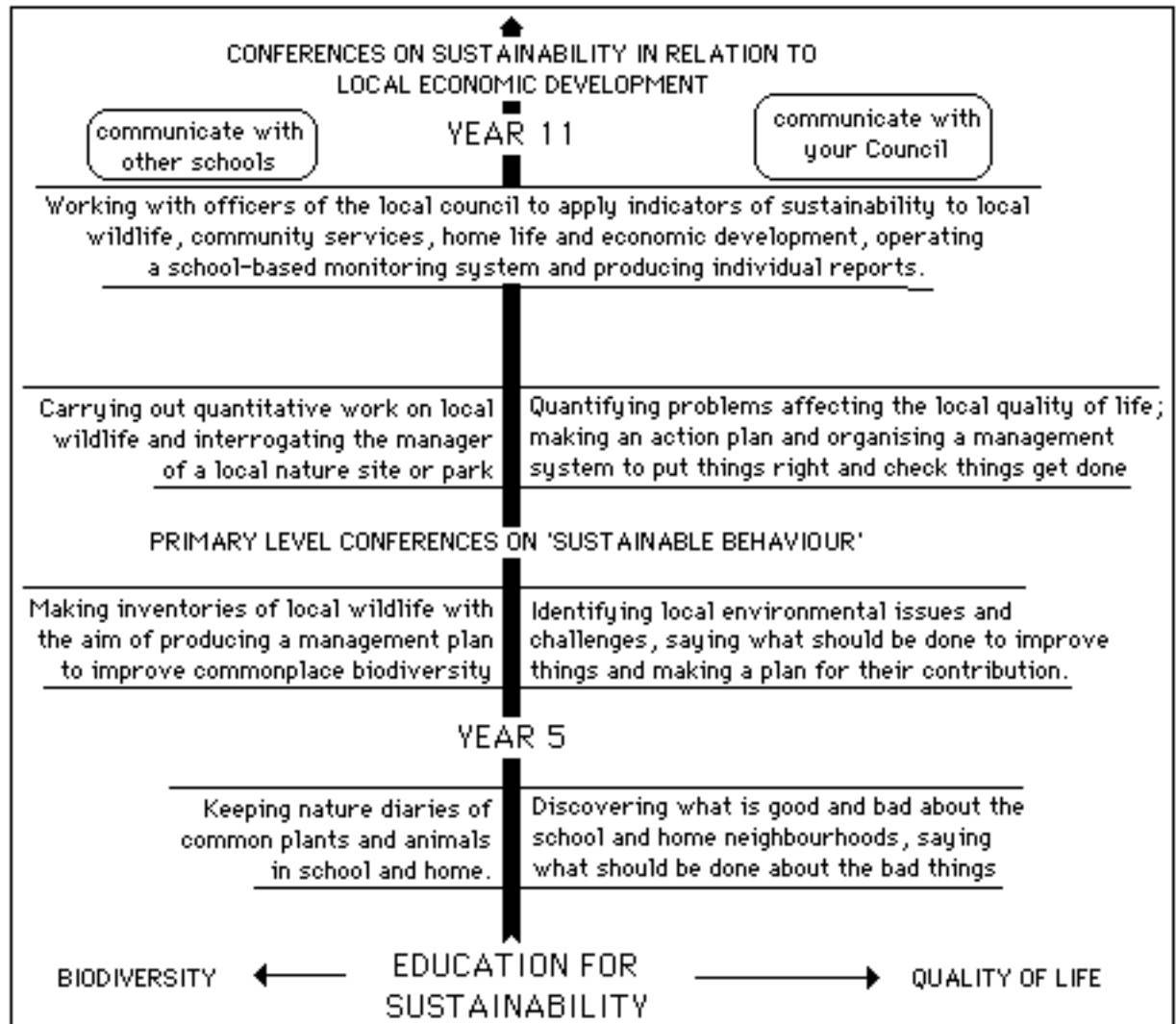
January 13, 1999

subject curricula is 'Education for Sustainability' (EFS). In this context SCAN's unique role at all key stages is to provide a network for dissemination of practical exemplars that are local expressions of EFS programmes of study, cross-curricular topics, and schemes of work. The aim is to stress continuity of a Post-Rio syllabus, from Key Stage 1 through practical connections with the on-going development of the Local Agenda 21. These are the exciting ways in which SCAN is being moulded, and driven by teachers, to educate *about* , *for* , and *through* the environment.

January 13, 1999

10.7 Progression of SCAN in the context 'education for sustainability'

The following diagram indicated the central practical spine for promoting interactions of pupils and their families with the Local Agenda 21; Years 4 to 12. It is being developed by several of SCAN primary/secondary clusters to promote a progressive development of environmental appraisal in the National Curriculum.



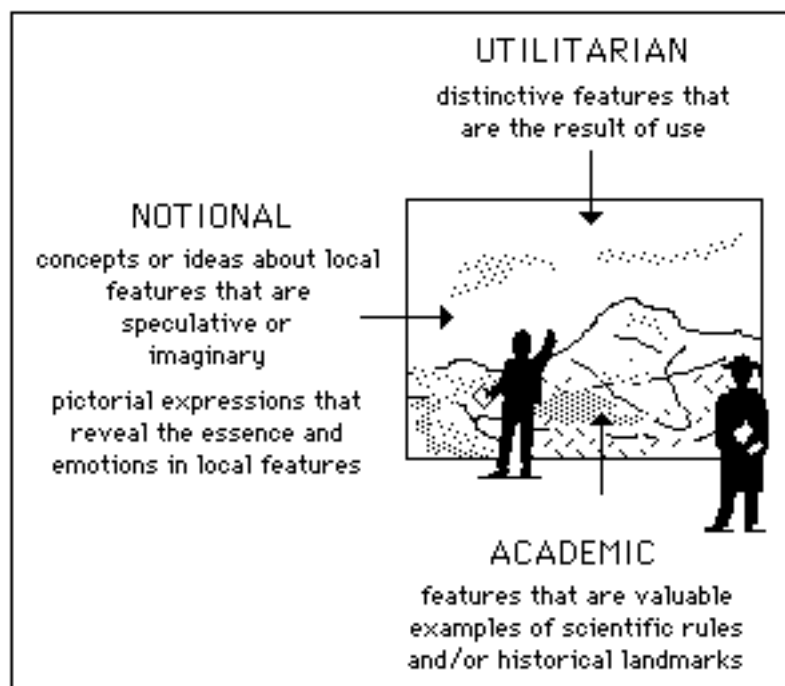
11 Summary of the Educational Advantages of SCAN

11.1 SCAN develops skills of environmental appraisal needed to use the neighbourhood of the school as a resource to gain knowledge and understanding **about the environment**.

11.2 SCAN orientates the collection of knowledge **in, and through, the environment** to introduce experiences and responsibilities of active citizenship related to the needs and wants of society.

11.3 SCAN promotes critical enquiry to connect individuals and communities to their chains of consumerism, with the aim making plans to reduce the environmental costs of their day to day actions, whereby they work **for the environment**.

11.4 SCAN offers Cross-curricular educationa windows into neighbourhood appraisal



January 13, 1999

11.5 SCAN highlights consumerism as a focus for environmental work

consumeristics- (noun)

a group of related subjects, including geography, geology, biology and history, concerned with the study of the human use of natural resources to maintain the necessities of life.

consumerate- (adjective)

able to trace the impact of purchasing, or partaking of goods, on the natural resources which produced them.

consumeracy- (noun)

ability to trace the impact of purchasing, or taking goods, on the natural resources which produced them. (i.e. numeracy and literacy)

natural economy- (noun)

the management of natural resources for human production

political economy- (noun)

the government of people for human production

11.6 SCAN promotes 'management'

Agenda 21 is about **managing** our behaviour as consumers to reduce our demands on the environment.

To manage anything requires targeting an issue and making an **appraisal** of it in order to:-

- identify a problem;
- produce a vision of the future when the problem has been resolved;
- define the issues which are the main obstacles to producing a solution;
- create strategic objectives which overcome the obstacles;
- produce operational management plans to meet the strategic objectives;
- monitor the outcome of the operational plans in relation targeting the vision of the future.

January 13, 1999

11.7 SCAN is a flexible platform to develop practical education for sustainability

In carrying out an environmental appraisal an individual or a group has to:-

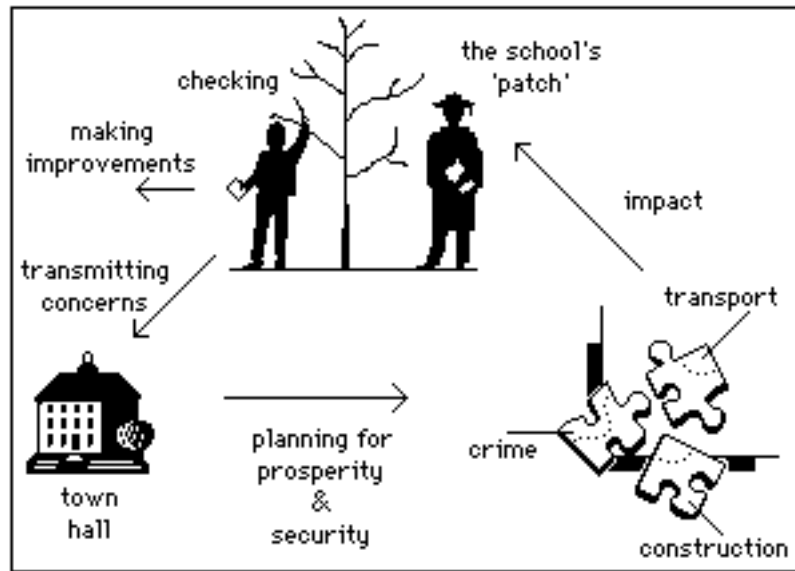
- develop skills required to use the neighbourhood as an educational resource to gain knowledge and understanding about local consumer systems;
- be introduced to the experiences and responsibilities of active citizenship related to curbing the needs and wants of consumers;
- make practical connections to chains of consumerism, with the aim of reducing the environmental costs of day to day actions.
- define routes for passing on problems too big to handle to those who can, and should, deal with them.

This is '**education for sustainability**', which encourages confrontation with the problems, issues and challenges of neighbourhood consumerism. If the findings of environmental appraisal are applied by a person, group or community to plan, and manage, the consumption of environmental resources, environmental education actually works **for** the environment .

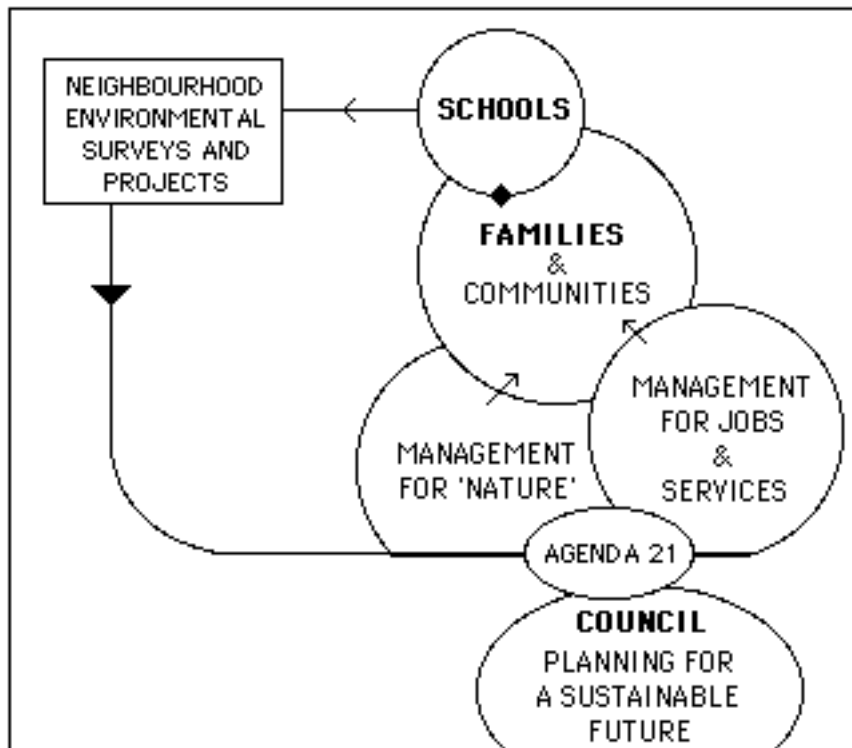
11.8 SCAN Stimulates Education for Citizenship

SCAN helps establish a broader picture of our actions as consumers by promoting environmental appraisals to highlight **connections** between our purchases and the use of nature as a source, sink, or dump for the wastes of their production and transport. Links are thereby established between people and planners who are looking to the future of our planet. This knowledge system helps, and encourages, participation in the democratic framework of the **Local Agenda 21** so everyone may have a say in council plans that are going to affect their neighbourhood. Year to year school surveys check out the problems within a jigsaw of issues such as crime, transport and construction. The aim is to launch community projects to make improvements, and ensure the council is aware of problems that are too big for the community to handle.

January 13, 1999

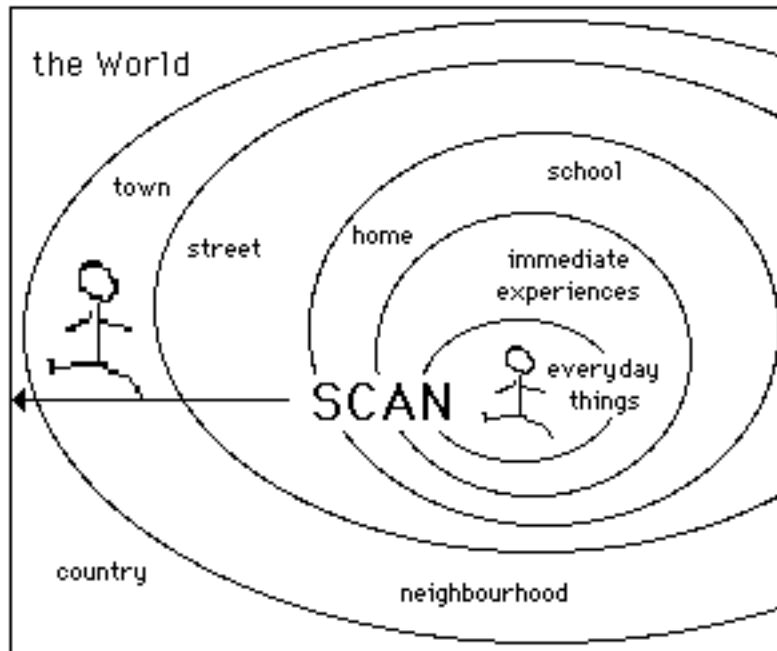


11.9 SCAN opens and maintains neighbourhood communication channels in a national context



January 13, 1999

11.10 SCAN provides educational resources for the 'Concentric Model' of child development



12 SCAN'S COMMUNITY PLEDGE LISTS

12.1 Saving materials, energy and money

Bathroom (65% of residential water use; 40% for toilet flushing)

- For existing toilets, reduce the amount of water used per flush by putting a tall plastic container weighted with a few stones into each tank, or buy and insert a toilet dam made of plastic and rubber; bricks also work but tend to disintegrate and gum up the water.
- In new houses, install water-saving toilets or, where health codes permit, waterless or composting toilets. Flush only when necessary, using the advice found on a bathroom wall in a drought-stricken area: "If it's yellow, let it mellow—if it's brown, flush it down."
- Take short showers—showers of less than 5 minutes use less water than a bath. Shower by wetting down, turning off the water while soaping up, and then rinsing off. If you prefer baths, fill the tub well below the overflow drain.
- Use water-saving flow restrictors, which cost less than a pound and can be easily installed, on all faucets and showerheads.
- Check frequently for toilet, shower, and sink leaks and repair them promptly.
- Don't keep water running while brushing teeth, shaving, or washing.

Laundry (15%)

- Wash only full loads; use the short cycle and fill the machine to the lowest possible water level.
- When buying a new washer, choose one that uses the least amount of water and fills up to different levels for loads of different sizes.
- Check for leaks frequently and repair all leaks promptly.

Kitchen (10%)

- Use an automatic dishwasher only for full loads; use the short cycle and let dishes air-dry to save energy. When washing many dishes by hand, don't let the tap run. Instead use one filled dishpan for washing and another for rinsing. Keep a jug of water in the refrigerator rather than running drinkable water from a tap until it gets cold enough to drink. While waiting for tap water to run hot, catch the cool water in a pan and use it for cooking or to water plants. Check for sink and dishwasher leaks frequently and repair them promptly. Try not to use a garbage disposal or water-softening system—both are major water users. Instead, try to compost your food wastes.

Outdoors (10%, higher in dry areas)

Don't wash your car or wash it less frequently. Wash the car from a bucket of soapy water; use the hose only for rinsing. Sweep walks and driveways instead of hosing them off. Reduce evaporation losses by watering lawns and gardens in the early morning or in the evening, rather than in the heat of midday or when windy. Better yet, landscape with pebbles, rocks, sand, wood chips, or native plants adapted to local average annual precipitation so that watering is not necessary. Use drip irrigation systems and mulch on home gardens to improve irrigation efficiency and reduce evaporation. To irrigate plants, install a system to capture rainwater or collect, filter, and reuse normally wasted gray water from bathtubs, showers, sinks, and the clothes washer.

Transportation (50% of average personal energy use)

- Walk or ride a bike for short trips (100% savings).
- Use a car pool or mass transit as much as possible (50% or more)
- Use a bus or train for long trips (50% or 75%).
- Buy an energy-efficient car (30% to 70%).
- Consolidate trips to accomplish several purposes (up to 50%).
- Keep engine tuned and replace air filter regularly (20% to 50%).
- Obey speed limits (20% or more).
- Accelerate and brake gently and don't warm up the engine for more than a minute (15% to 20%).
- Use steel-belted radial tires and keep tire pressure at recommended level (2% to 5%).

Home Space Heating (25%)

- Build a superinsulated or highly energy-efficient house or retrofit an existing house (50% to 100% savings).
- Dress more warmly, humidify air, and use fans to distribute heat so that thermostat setting can be lowered without loss of comfort (saves 3% for each F decrease).
- Install the most energy-efficient heating system available (15% to 50%).
- Install an electronic ignition system in furnace, have furnace cleaned and tuned once a year, and clean or replace intake filters every two weeks (15% to 35%).
- Install stack dampers in the furnace or boiler flue (variable).
- Insulate heating ducts that pass through unheated spaces (2% to 5%).
- Do not heat closets and unused rooms (variable savings).
- Insulate attic ceiling or floor, all outside walls, and floors over unheated spaces (20% to 50%).
- Caulk and weatherstrip cracks (10% to 30%).
- Use insulated steel or wood doors with magnetic weather stripping or install storm doors, storm windows, or insulated shutters, or, best, install modern superwindows (5% to 25%).

January 13, 1999

- Extinguish heating pilot lights during summer or, best of all, install an electronic ignition system (variable).
- Do not use electricity for space heating (30% to 50%).

Hot Water Heating (9%)

- Install the most energy-efficient system available, such as active solar, instant tankless, or high-efficiency-gas water heaters (15% to 60%).
- Turn down thermostat on water heater to 110°-120°F (5% to 25%).
- Insulate hot water pipes or use anti-connection valves loops and insulate water heater (10% to 15%).
- Use less hot water by taking two- to five-minute showers instead of baths, washing dishes and clothes only with full loads, washing clothes with warm or cold water, repairing leaky taps, installing aerators on taps, using low-flow showerheads, and not letting water run while bathing, shaving, brushing teeth, or washing dishes (10% to 25%).
- Do not use an electric water heater.

Cooking, Refrigerating, and Other Appliances (9%)

- Buy only the most energy-efficient stove, refrigerator, and other appliances available—ideally powered by natural or LP gas, not electricity (25% to 60%).
- Use a gas stove instead of an electric stove.
- Install electronic ignition systems on all gas stoves and other appliances (10% to 30%).
- Use a chest freezer rather than an upright model to prevent unnecessary loss of cool air when door is opened, and keep it almost full (variable).
- Do not locate refrigerator or freezer near a stove or other source of heat and keep condenser coils on back clean (variable).
- Don't use oven for space heating (very expensive).

Cooling, Air Conditioning, and Lighting (7%)

- Buy the most energy-efficient air conditioning system available (30% to 50%+).
- Increase thermostat setting (3% to 5% for each °F).
- Close off and do not air condition closets and unused rooms (variable).
- Use small floor fans, ceiling fans, and whole-house window or attic fans to eliminate or reduce air conditioning needs (variable).
- Close windows and drapes on sunny days and open them on cool days and at night (variable).
- Close bathroom and laundry room doors and use an exhaust fan or open window to prevent transfer of heat and humid air to rest of house (variable).
- Try to schedule heat- and moisture-producing activities such as bathing, ironing, and washing during the coolest part of the day (variable).
- Cover pots while cooking (variable).

January 13, 1999

- Use compact fluorescent and other energy-saving bulbs wherever possible (50% to 75%).
- Use natural lighting whenever possible (variable).
- Turn off lights and appliances when not in use and reduce lighting levels by using dimmers and lower wattage (variable).
- Disconnect air conditioners at the circuit breaker during winter—otherwise a small heater in the compressor runs year-round.

12.2 Understanding and Sustaining the Earth

Resources, Pollution, and Environmental Degradation

Resources are limited and must not be wasted; there is not always more (principle of limits). Most wastes and pollution are either resources we are too dumb to use or are so dangerous they shouldn't have been produced (no-waste-in-nature principle). To reduce pollution and resource use and waste, recycle or reuse mineral resources (principle of recycling and reuse). Recycling mineral resources takes energy, which in being produced and used causes pollution and environmental degradation (recycling-is-not-theultimate-answer principle). To reduce resource waste and resource supply interruptions, get as much as possible of what we need locally, and dispose of or recycle wastes locally (principle of localism). To reduce pollution and resource use and waste, use resources primarily to meet vital needs and use these resources as efficiently as possible (principle of moderation). Stress the use of perpetual and renewable resources, and use renewable resources no faster than they're replenished by natural processes (principle of sustainable yield). Try to get resources from many sources; don't put all your eggs in one basket (principle of resource diversity). Everyone is downwind or downstream from everybody (principle of the global commons).

Matter and Energy

- We cannot create or destroy matter; we can only change it from one form to another. Everything we think we have thrown away is still here with us in one form or another; there is no away (law of conservation of matter).
- Organized and concentrated matter is high-quality matter that can usually be extracted, processed, and converted into useful resources at an affordable cost; disorganized and dispersed matter is low-quality matter that often costs too much to convert to a useful resource (principle of matter quality).
- Don't dilute, disperse, or mix matter products or wastes that can be recycled (principle of affordable recycling).
- We cannot create or destroy energy; we can only change it from one form to another. We can't get energy for nothing; it takes energy to get energy (first law of energy, or law of conservation of energy).
- Organized or concentrated energy is high-quality energy that can be used to do things; disorganized or dilute energy is low-quality energy that is not very useful (principle of energy quality).

January 13, 1999

- In any conversion of energy from one form to another, high-quality, useful energy is always degraded to lower-quality, less useful energy that can't be recycled to give high-quality energy; we can't break even in terms of energy quality (second law of energy, or law of energy-quality degradation).
- Everything runs on moderate- to high-quality energy that can't be recycled, so choose and use energy resources wisely (principle of energy use and flow). Don't use high-quality energy to do something that can be done with lower-quality energy; don't use a chain saw to cut butter or electricity to heat a house or household water (principle of matching energy quality to energy tasks).

Ecology

- In nature we can never do just one thing; everything we do creates effects that are often unpredictable (first law of ecology, or principle of ecological backlash.)
- Everything is connected to and intermingled with everything else; we are all in it together (second law of ecology, or principle of interrelatedness).
- Any chemical that we produce should not interfere with any of the earth's natural biogeochemical cycles in ways that degrade the earth's life support systems (third law of ecology, or principle of chemical noninterference).
- The earth's life-support systems can take a lot of stress and abuse, but there are limits (law of limits).
- Each species and each individual organism can tolerate only a certain range of environmental conditions (range-of-tolerance principle).
- No population can keep growing indefinitely (principle of carrying capacity).
- Nature is not only more complex than we think but more complex than we can ever think (principle of complexity).

Economics

- The market price of anything should include all present and future costs of any pollution, environmental degradation, or other harmful effects passed on to society and the environment (principle of internalizing all external costs).
- Try to get more output of goods and services from less resource input; do more with less (principle of increasing efficiency and productivity).
- Some forms of economic growth are harmful; don't produce harmful goods (principle of economic cancer).
- Don't waste resources trying to produce harmful goods more efficiently (principle of wasteful efficiency).
- Short-term greed leads to long-term economic and environmental grief; don't deplete capital and mortgage the future (no-free-lunch principle).
- The more things you own, the more you are owned by things (principle of over consumption and 'thing' tyranny).
- Don't give people subsidies and tax breaks to produce harmful goods and unnecessarily waste resources; either eliminate all resource subsidies or reward only producers who reduce resource waste, pollution, and environmental degradation (principle of economic and ecological wisdom).

January 13, 1999

- We cannot have a healthy economy in a sick environment (economics-as-if-the-earth-mattered principle).

Politics

- Human population growth ultimately makes democracy and individualism impossible (principle of freedom erosion).
- Anticipating and preventing problems is cheaper and more effective than reacting to and trying to cure them; an ounce of prevention is worth a pound of cure (prevention, or input control principle).
- Every crisis is an opportunity for change (bad-news-can-be-good-news principle).
- Think globally, act locally (principle of change).
- Don't ever call yourself a conservative unless what you want to conserve is the earth (principle of true conservatism).

Worldview and Ethics

- We are part of nature (principle of oneness).
- We are a valuable species, but we are not superior to other species; all living beings, human and nonhuman, have the same inherent worth (principle of humility).
- Every living thing has a right to live, or at least struggle to live, simply because it exists; this right is not dependent on its actual or potential use to us (respect-for-nature principle).
- Our role is to understand and work with the rest of nature, not conquer it (principle of cooperation).
- The best things in life aren't things (principle of love, caring, and joy).
- Something is right when it tends to maintain the earth's life-support systems for us and other species and wrong when it tends otherwise; the bottom line is that the earth is the bottom line (principle of sustainability and ecocentrism).
- It is wrong for humans to cause the premature extinction of any wild species and the elimination and degradation of their habitats (preservation of wildlife and biodiversity principle).
- We have a right to protect ourselves against harmful and dangerous organisms, but only when we cannot avoid being exposed to such organisms or safely escape from the situation; in protecting ourselves we should do the least possible harm to such organisms (principle of self-defense).
- We have a right to kill other organisms to provide enough food for our survival and good health and to meet other basic survival and health needs, but we do not have such rights to meet nonbasic or frivolous wants (principle of survival).
- When we alter nature to meet what we consider to be basic or nonbasic needs, we should choose the method that does the least possible harm to other living things; in minimizing harm it is in general worse to harm a species than an individual organism, and still worse to harm a biotic community (principle of minimum wrong).

January 13, 1999

- It is wrong to treat people and other living things primarily as factors of production, whose value is expressed only in economic terms (economics-is-not-everything principle).
- We must leave the earth in as good a shape as we found it, if not better (rights-of-the-unborn principle).
- All people must be held responsible for their own pollution and environmental degradation (responsibility-of-the-born principle).
- No individual, corporation, or nation has a right to an ever-increasing share of the earth's finite resources; don't let need slide into greed (principle of enoughness).
- We must protect the earth's remaining wild ecosystems from our activities, rehabilitate or restore ecosystems we have degraded, use ecosystems only on a sustainable basis, and allow many of the ecosystems we have occupied and abused to return to a wild state (principle of ecosystem protection and healing).
- In protecting and sustaining nature, go further than the law requires (ethics-often-exceeds-legality principle).
- To prevent excessive deaths of people and other species, people must prevent excessive births (birthcontrol-is-better-than-death-control principle).
- Everything we are and have or will have ultimately comes from the sun and the earth; the earth can get along without us, but we can't get along without the earth; an exhausted earth is an exhausted economy (respect-your-roots or earth-first principle).
- Don't do anything that depletes the earth's physical, chemical, and biological capital that supports all life and human economic activities; the earth deficit is the ultimate deficit (balanced-earth budget principle).
- Love thy species and other species today and in the future as thyself (principle of species love and protection).
- To love, cherish, and understand the earth and yourself, take time to experience and sense the air, water, soil, plants, animals, bacteria, and other parts of the earth directly; learning about the earth indirectly from books, TV images, and ideas is not enough (direct-experience-is-the-best-teacher principle).
- Learn about and love your local environment and live gently within that place; walk lightly on the earth (love-your-neighborhood principle).