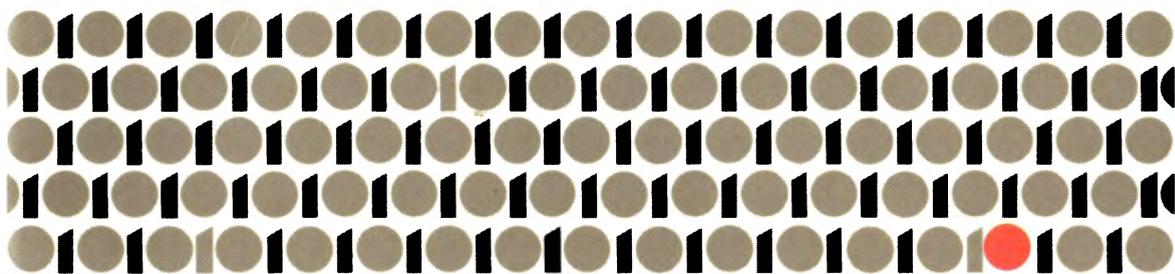




THE ECODISC



BRITISH BROADCASTING CORPORATION



ADVANCED INTERACTIVE VIDEO

USER GUIDE

THE ECODISC

PETER BRATT
and
SOPHIE McCORMICK
with
ROBERT POOLE

BBC ENTERPRISES

THE ECODISC

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FIELD STUDIES
COUNCIL



Slapton Ley Nature Reserve is owned by the Herbert Whitley Trust and is managed by the Field Studies Council as a nature reserve and to promote environmental awareness for all. It is an important centre for field studies as well as being a site of special scientific interest. For further details please contact: The Warden, Slapton Ley Field Centre, Slapton, Nr Kingsbridge, Devon. TQ7 2PN

The producer wishes to express his appreciation of the help and advice given by Peter Armstrong and other members of the BBC Domesday Project team.

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User Guide edited by Meyer Solomon. Designed by David Atherton and Graham Bartram on an Apple Macintosh Desktop Publishing System.

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INTRODUCTION

Side Two of the Ecodisc contains a complete television programme called *Ecology and Conservation* and will give you a general introduction to the subject and the area being studied.

Side One of the Ecodisc is an interactive videodisc which brings together a vast collection of information in the form of photographic stills, film sequences, graphic displays and data, all under the control of a computer program. It is all about a real nature reserve, Slapton Ley in South Devon. The purpose of the disc is to enable you to experience the reserve: to see what it looks like, to find out what lives there and to appreciate the ecological complexity of the area and the problems associated with its management. The videodisc provides you with the tools to explore and experiment almost as if you were actually there.

There are a number of interconnected activities:

- PLAN You can experience the problems related to the management of the reserve by taking the role of the Nature Reserve Manager. There are many different actions you can take within the reserve itself and you have various ways of liaising with local and specialist groups. You have to formulate a plan which safeguards the future needs of the reserve and satisfies as many of the conflicting local demands as possible.
- VIEW You can see various films introducing you to the whole reserve or to various parts of it.
- WALK You can walk backwards and forwards around the area in different directions. You can choose your own route or follow a pre-determined route. You have a map and compass to help and you can look down from the helicopter whenever you want.
- SAMPLE You can find out in more detail about the populations of plants and animals by going into the reserve and sampling. You are able to investigate the vegetation of the woods and reedbed, the fish in the lake and the birds and mammals inhabiting the reserve. You use the most appropriate method of sampling for the species being studied.
- WATCH Whereas WALK lets you see the reserve today, WATCH enables you to look at what might happen over the next fifty years if there is no further active management of the reserve and it is left to follow a natural succession.

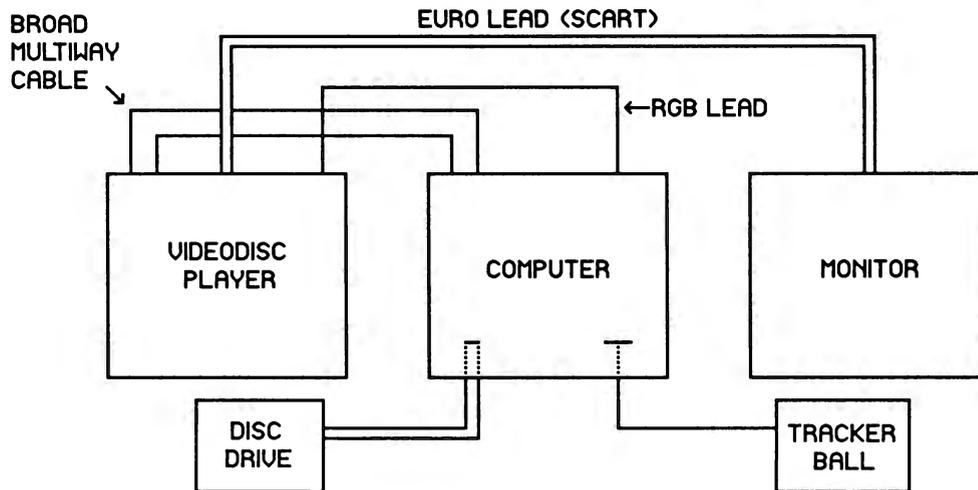
A further function called INFO is available throughout. This gives you the extra information you may need at particular times. Through it you can always obtain HELP on how to use the program and it will EXPLAIN about the surroundings. In some places you can obtain DETAILED views of the surrounding vegetation types. You can also get help with IDENTIFYing the various plants and animals. When you are planning you can get DATA on the various organisms. INFO will be where to look if ever you are unsure about what to do or how to do it, or if you require additional information.

You should take on the role of Nature Reserve Manager. Information about your role is available at the start of PLAN, as is information about the views of various groups who have an interest in the reserve. Various film introductions to the reserve are available in VIEW. As well as listening to the views of the interest groups you should also find out more about the reserve by WALKING around, or by WATCHING or SAMPLING. When you are ready you can put forward a PLAN. That plan will be looked at by everybody involved and they will send you their views. It is up to you either to change your plans or carry them out as they are.

GETTING STARTED

Full details of how to set up the equipment is given in the User Guide supplied with it. The following is intended only as a summary.

The various components of the system should be connected as shown below:



It is best to turn on the equipment in the following order: monitor first, then the computer, and finally the videodisc player.

To use the interactive videodisc program load the disc into the player with the Side One label upwards.

To start the program you should follow the following procedure:

- FIRST** Press the two keys CTRL and Q together. Whilst still holding down these two keys also press the BREAK key. Then release the BREAK key and finally release the CTRL and Q keys.
- SECOND** Press the SHIFT key and whilst holding it down press the BREAK key. Then release the BREAK key and finally release the SHIFT key.

The software will begin to load. It will take about 45 seconds. The Title Sequence will then play automatically. If you do not wish to see all the sequence you can press the Q key and the program will move on to display the first menu. If you do watch to the end of the Title sequence then this menu will be displayed automatically.

Adjusting the Picture Position

It is possible that the computer-generated text and graphics may not be in exactly the right position over the pictures. This will be particularly noticeable in WALK if the pointer does not function exactly over the marked points. The position of the computer-generated material can be fine tuned by a control on the rear of the videodisc player. Locate a small plastic screw set into the rear panel of the player and marked "Horizontal Shift". Use a small screwdriver to turn the screw until the picture is in the correct position. Check the position with the pointer in WALK.

NOTE: The computer should have been set up by your dealer to work with an Advanced Interactive Videodisc system. However, if you are experiencing difficulties it may be because this so-called "CONFIGURATION" has been accidentally changed. This can be checked as follows:

1. At the prompt (the flashing cursor) type:

```
*STATUS [RETURN]
```

This is the way of asking the machine to display its "STATUS" and the result will be a list on the screen.

2. The list should read as follows:

```
Baud 7  
No boot  
Caps  
Data 5  
No Directory  
Internal Tube  
FDrive 1  
File 13  
Hard  
Ignore 10  
Lang 12  
Mode 0  
Tube  
Print 1  
Repeat 3  
Scroll  
TV 255,0  
VFS Dir  
Eject
```

3. If any of these are different they can be changed as follows. For instance if, say, the words "No Tube" rather than "Tube" appear in the list, then type:

```
*CONF. Tube [RETURN]
```

The abbreviation *CONF. stands for CONFIGURE and changes the STATUS of the machine.

If the display has, say, "Lang 13" rather than "Lang 12" then type:

```
*CONF. Lang 12 [RETURN]
```

You can continue in this way, making all the changes as required. You can check the revised STATUS by again typing

```
*STATUS [RETURN]
```

The list should now be revised as required.

HOW TO OPERATE THE SYSTEM

The best way to operate this system is by using a tracker ball (see the earlier section on hardware configurations). However, it is also possible to use the keyboard. You interact with the simulation by moving a pointer on the screen and then pressing the "action" button. This interaction system works throughout the disc. In general terms, if you want to do something, then - "POINT AND PRESS". This is often called SELECT.

Making Choices.

You can choose what you want to do by selecting from a menu of the type:



There are options in the menu bar at the bottom of the screen and options in the menu in the main part of the screen. To choose any option from a menu you move the pointer over the required item and press the "action" button to confirm your choice. All menu choices are SELECTED in this way.

Counting

In some cases you will use the cursor to count. First you put the pointer over the name of the object you wish to count and then press the button. Then you move the pointer into the "counting box". Every time you press the button the count will increase. If you have made a mistake then you can move the pointer into the "uncounting box" and then every time you press the button the count will be reduced.

Measuring

In some cases you will have to measure the length of an object. To do this you first select MEASURE; then you move the pointer to one end of the object and press the button. Then you move the pointer to the other end of the object and press the button again. The length of the object will be displayed. If you make a mistake then you should repeat the above and then the new value will be displayed.

In one case you have to measure an area. To do this you move the pointer around the perimeter, pressing the button at key points. The computer will join these key points with a line. When you have gone around the area you should "close" it by moving the pointer back to the exact original point and press for a final time. The area inside the perimeter will then be displayed. Any area you measure must be enclosed by at least three sides.

"Turning the page"

In some cases there will be more than one page of text or more than one picture for you to see. You can "turn over a page" using the red key f8 and you can turn back a page using the red key f7. Alternatively you can place the pointer over the right- or left-hand side of the screen and press the action button.

Response Time

In certain circumstances the system may not respond instantly and there may be a delay of two to three seconds. This is quite normal and is a consequence of information transfer between the computer and the videodisc player when film is playing.

FINDING YOUR WAY AROUND THE ECODISC

You choose what you want to do by selecting from a menu using the screen pointer as described in the previous section. A menu bar across the bottom of the screen shows the current choices available.

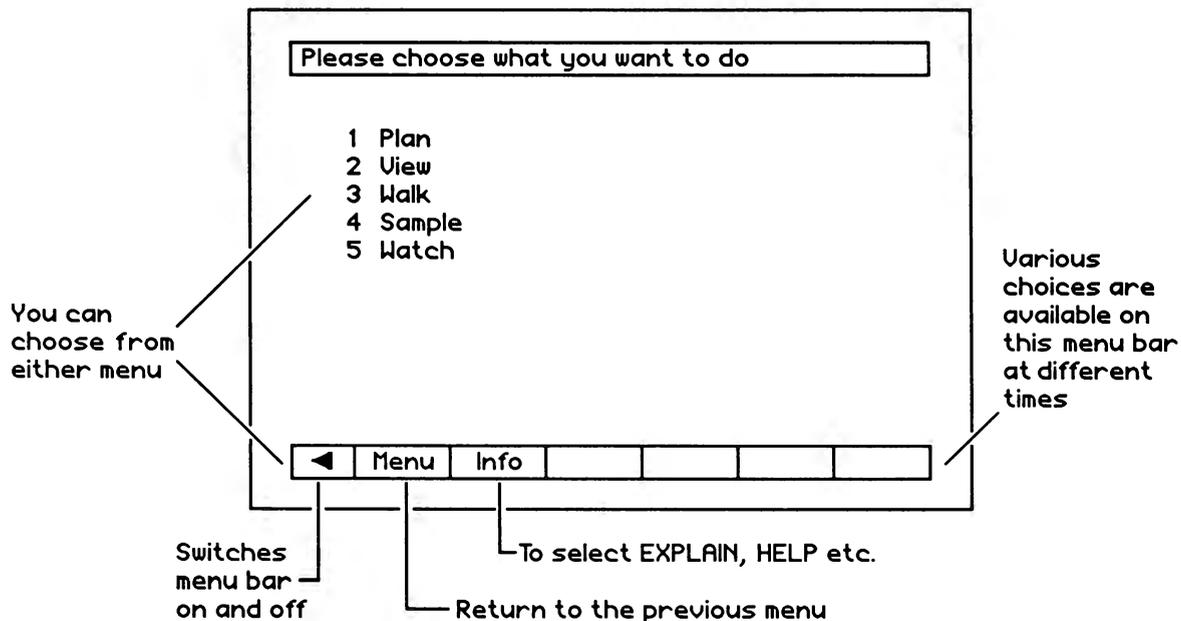
There are three features common to all these menu bars:

- ▶ - Removes or displays the menu bar. Note: the red key f9 removes all the computer generated text. Pressing f9 again will redisplay the material.
- MENU - returns to the last menu choice.
- INFO - provides help, explanations and background information.

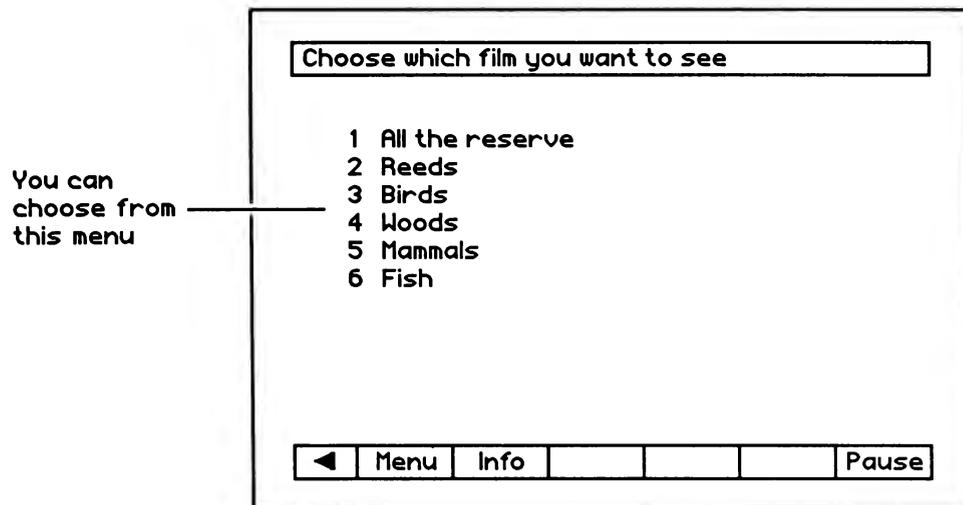
Additional choices are often available from menus on the main part of the screen. Selections are made using the pointer and the action button.

A message bar at the top of the screen will provide additional information from time to time.

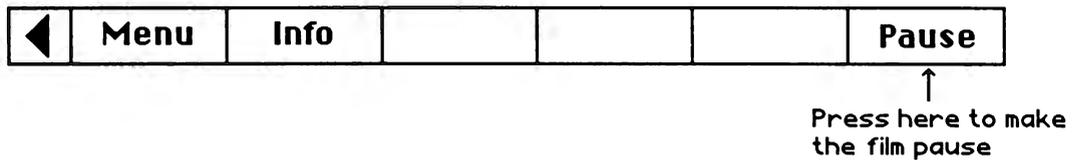
A typical screen might look like the one below. It shows the main menu from which you can choose what you want to do.



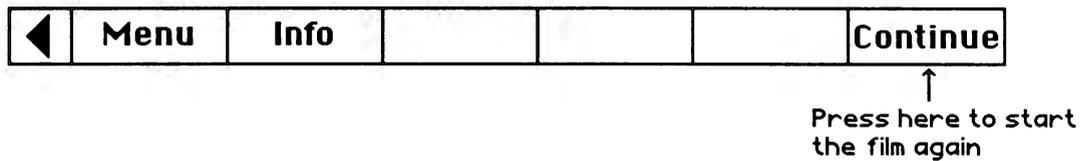
If VIEW is selected the screen display changes to the following:



When a choice is made the film begins. Then the menu bar includes an extra item:



If PAUSE is selected the menu bar will change to:

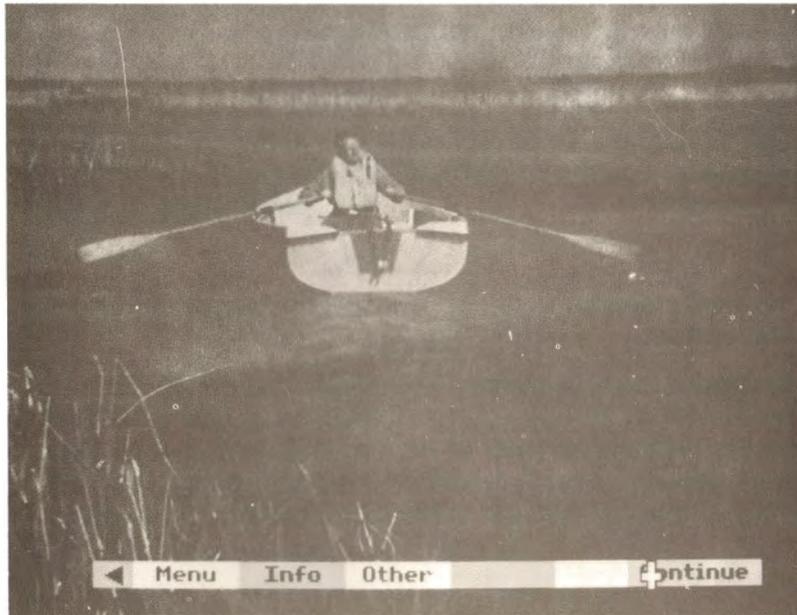


Selecting MENU will take you back to the main menu page (see above) where you can choose a different section.

All parts of the disc work in the same general way, although the range of choices will vary depending on where you are and what you are doing.

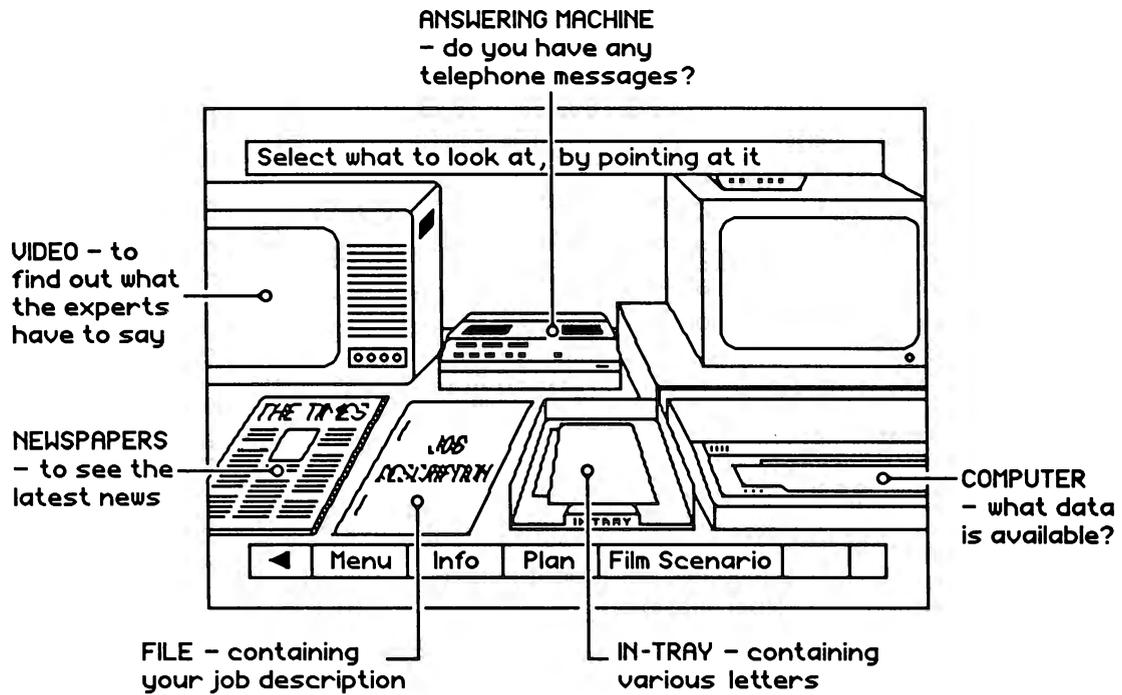
PLAN

If you choose PLAN from the main menu you are able to play the role of the Nature Reserve MANAGER. To do this you must have a long-term aim as to how you want to see the reserve changing in the next ten years. You must also know about the reserve in some detail, what is there and what long-term changes are naturally occurring. You are required to develop a PLAN of actions which you must eventually SUBMIT for consideration. You work from your OFFICE where you have the facts and figures to consider. You can get further information about the reserve by walking around (WALK), by sampling the plants and animals (SAMPLE) and by investigating the likely changes brought about by succession (WATCH). There are also some films about the reserve (VIEW).



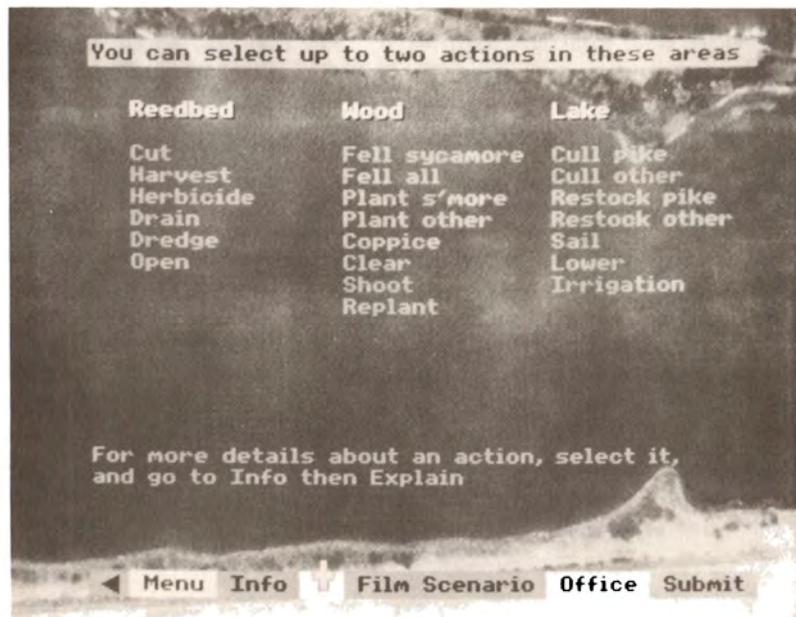
Before you start on your plan you can select SCENARIO. You will then see the presenter who tells you about your job as the reserve manager and about some money problems. He will also tell you about some of the people who are interested in studying or using the reserve.

You can also go to your OFFICE. There you will find letters from the people who want to use the reserve. You will also see some newspaper clippings that might be of interest. There is a television where you can look at video tapes of the various experts. There is a computer to look up the current state of the reserve. Finally there is a telephone answering machine where you might find some interesting messages!



You can look at any of these items in detail by moving the pointer to that part of the screen and pressing the button.

When you select PLAN you will see a screen with all the choices of action. If you move the pointer over an action it will highlight. If you want to choose an action you should press over it and a marker will appear next to the name. If you change your mind you can deselect an action by pressing over it again. You can choose up to two actions in any area. Having selected an action you can get further information by selecting INFO and then EXPLAIN.



When you are happy with your choice of actions you can then SUBMIT your plan. It will then be considered by all the other people who have an interest in the reserve. They will let you know their comments in a number of ways.

If you select REACTIONS after SUBMIT you will again see the presenter but this time he will tell you about both the likely general effects of your plan and the reactions of some of the users of the reserve.

If you select OFFICE after SUBMIT you will find out more about the reactions of various interest groups. They will be available to you as videotapes, in letters, in memos, via the computer and on the answering machine. You can look at them in detail as you did before.

If you are not happy about some of the suggestions you can go back and change any or all of your PLAN and then re-submit it for comments. You can do this as often as you like. Once you have settled on a set of actions you can EXECUTE your plan. There is no going back after this decision and your plan will be carried out - come what may!

After EXECUTE you can ask for a PRINT out of your plan which you can take away and study.

When working on your plan it is advisable to keep a record of what you are doing. You should note your actions and what effects they have on the plants and animals and on the various interest groups. You could use the form on the next two pages. It's a good idea, though, to photocopy them first!

Information for PLAN

Comments from SCENARIO

1. -----
2. -----
3. -----
4. -----
5. -----
6. -----

Letters in OFFICE

1. -----
2. -----
3. -----
4. -----
5. -----
6. -----

Job Specification

1. -----
2. -----
3. -----
4. -----

Newspapers in OFFICE

1. -----
2. -----
3. -----

Telephone messages

1. -----
2. -----
3. -----

Actions and Reactions

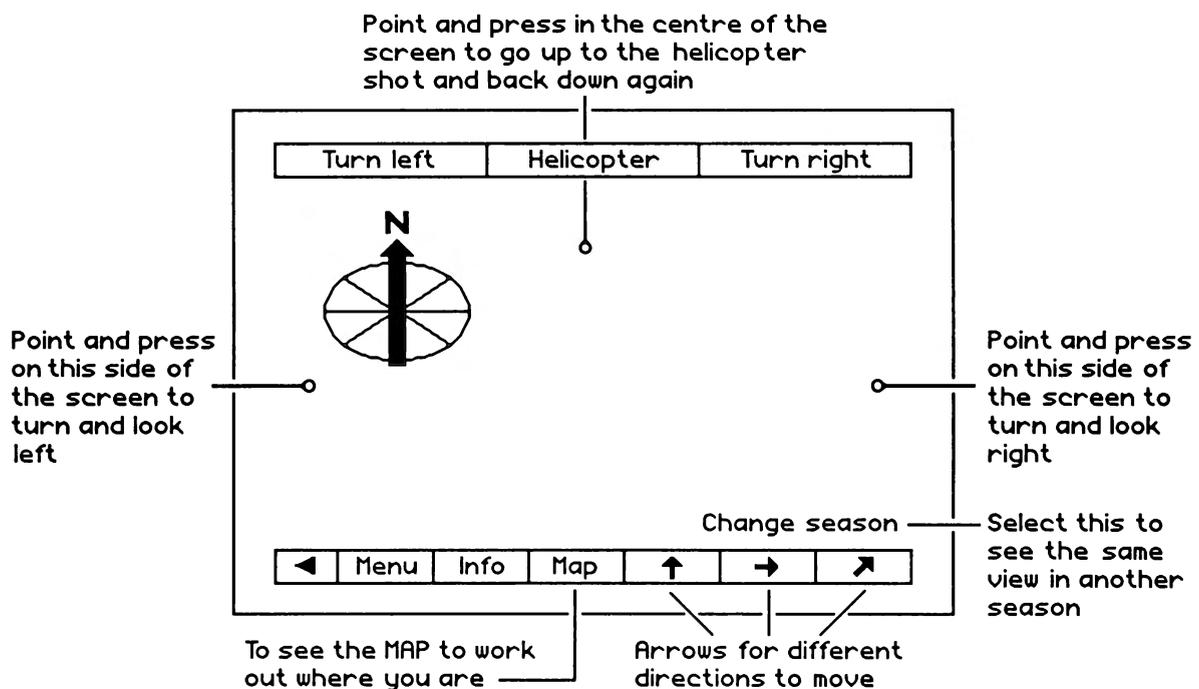
ACTIONS	TAKEN	SPECIES	CHANGE
<p>CUT HARVEST HERBICIDE DRAIN DREDGE OPEN</p> <p>FELL SYCAMORE FELL ALL PLANT SYCAMORE PLANT ALL COPPICE CLEAR SHOOT REPLANT</p> <p>CULL PIKE CULL OTHERS RESTOCK PIKE RESTOCK OTHERS SAIL LOWER IRRIGATE</p>		<p>Ireland Bay reed Ireland Bay wetland Ireland Bay carr Ireland Bay meadow Ireland Bay trees</p> <p>Stokeley Bay reed Stokeley Bay wetland Stokeley Bay carr Stokeley Bay meadow Stokeley Bay trees</p> <p>Total reeds Total wetland Total carr Total meadow</p> <p>Oak Chestnut Sycamore Other trees Open space</p> <p>Bramble Other floor flora</p> <p>Swan Grebe Moorhen Mallard Cetis warbler Reed warbler Water rail Reed bunting Buzzard Cuckoo Woodpecker Tree creeper</p> <p>Rudd Roach Perch Eels Pike - number Pike - size Badger Otter Mink Fox</p>	
REACTIONS			
<p>Shooting Club Sailing Club Tourist Board Woodlands Authority Farm Link</p> <p>Fishermen Arborealists Naturalists Bird Spotters Reed Growers Farmers Local Council Scientists Local residents Tourists The Poacher</p>			
RESERVE "VALUE"			

WALK

If you choose WALK from the main menu you are able to walk around the reserve and find out what it is like.



First you must decide whether you want to stroll around yourself (RAMBLE) or choose a particular route through the woods, reeds or lakeside. Any walk you take is remembered and you can later choose to go round your previous WALK again. The preset walks are controlled in the same way as FILM.



If you choose to RAMBLE you can follow any route around the reserve. As you walk about, you move from one point to another along the path as shown on the map. At each point you can turn full circle and see eight different views in either summer or winter. You can also look down at each point from a height of about 100 metres by selecting HELICOPTER. At the ends of the lake there are "junctions" between the shore path and a boat trip along the lake. At either end of Ireland Bay reedbed there are "junctions" for a walk around the woods.



If you select MAP you will see a plan of the whole reserve. You can "jump" to a new place by simply moving the pointer to where you want to go and selecting. From MAP you can select DATA to get values such as soil moisture, soil pH and the contour and depth lines. If you select AERIAL you will see a view of the reserve from a height of 1500 metres.

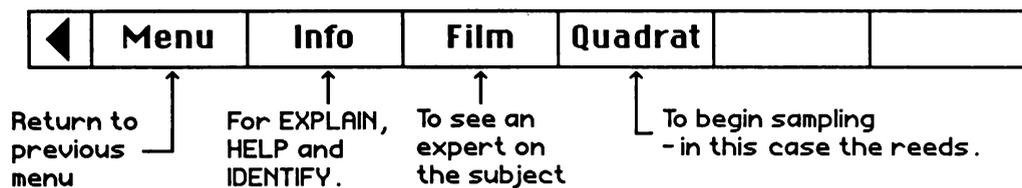
SAMPLE

If you choose SAMPLE from the main menu you are able to use specific sampling methods to collect your own data on the numbers and distribution of the different organisms in various parts of the reserve.

You must choose WHAT you want to SAMPLE:

REEDBED
WOODS
BIRDS
MAMMALS
FISH

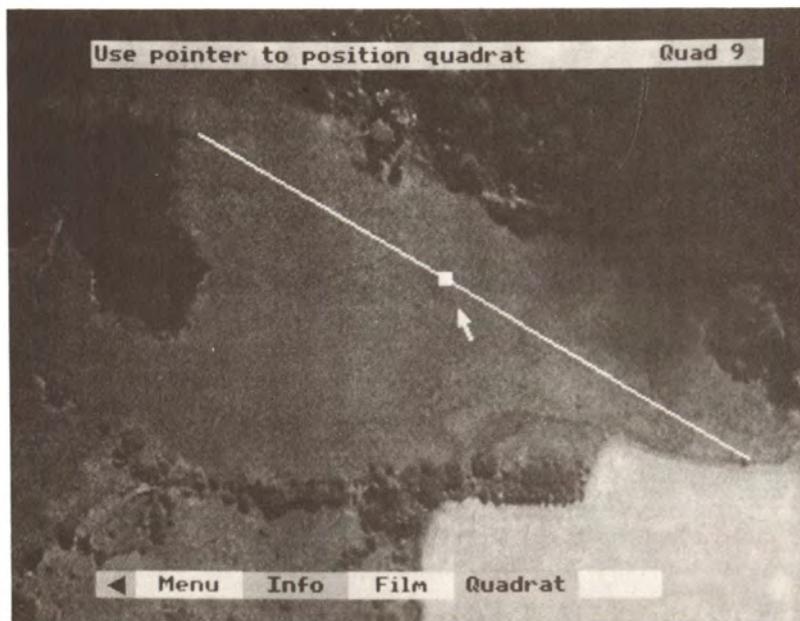
When you have chosen you can begin the particular sampling method; but first it is best to choose FILM to find out about what you are going to do. For example, the menu bar may look like this:



When you are ready to begin sampling, select in this case QUADRAT, then XSECTION and COUNT. When you have collected your results you can actually compare these with the EXPECTED results.

You can refer back to SAMPLE from any other place in the simulation via the main MENU. However, it is worth keeping a more permanent record in written form.

REEDBED

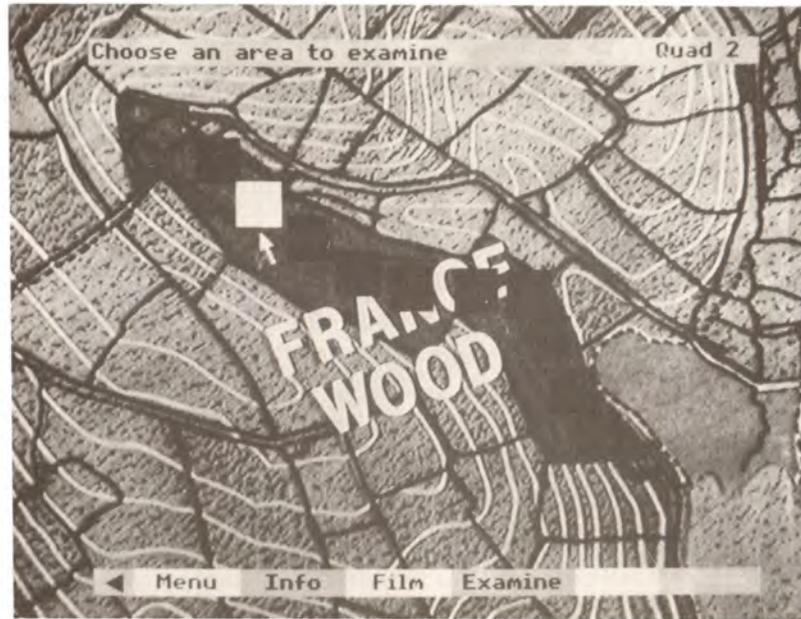


You sample the reedbed by examining up to nineteen one-metre square quadrats along a 190-metre fixed line transect as shown above. To select a quadrat, move the pointer to the required position on the transect. The quadrat number will be displayed in the message bar at the top of the screen. If the pointer is moved away in a downward direction the quadrat will remain in the chosen position.

The menu bar will change as appropriate to offer the following choices:

- FILM - to watch a film about reed sampling
- TRANSECT - to call up the transect and select a quadrat (see above)
- QUADRAT - to examine in detail the selected quadrat shown along the transect
- XSECTION - to obtain a cross-section of the selected quadrat
- COUNT - to count the key species within the selected quadrat (to find out about counting see page 10). Each symbol on the screen represents five plants.
- RESULTS - to display a diagram of your RECORDED results
- EXPECTED - to display a diagram of the EXPECTED results

WOODS

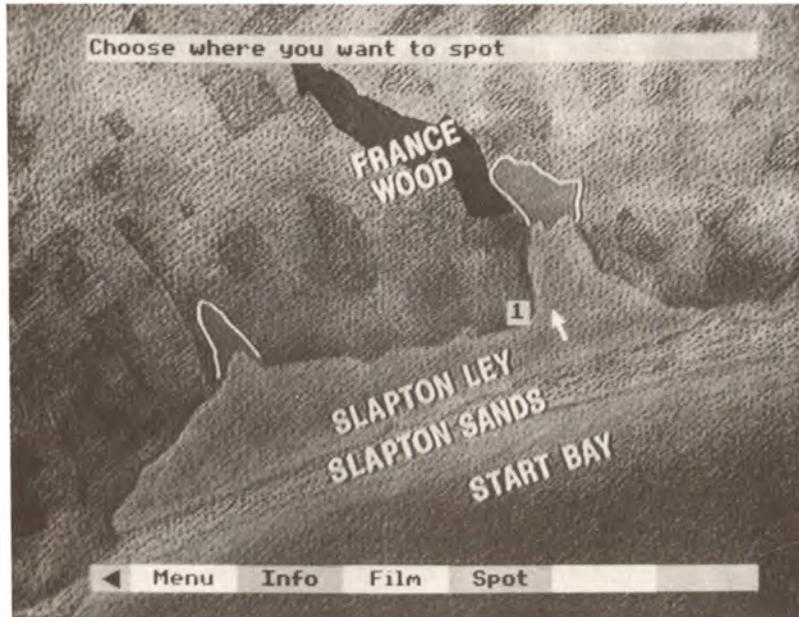


You sample the woodland plants by examining up to ten different fifty-metre square areas in various parts of the woods as shown above. To select a quadrat move the pointer into the desired square and it will highlight. Moving the pointer away in a downwards direction will leave the highlight in the chosen position.

The menu bar will change as appropriate to offer the following choices:

- | | |
|----------|---|
| FILM | - to watch a film about sampling in the woods |
| SITE | - to choose the area to examine (see above) |
| EXAMINE | - to examine in detail the selected 50m area |
| XSECTION | - to obtain a cross-section of the selected 50m area |
| COUNT | - to count the key species in the 50m area; either CANOPY or GROUND (to find out more about counting see page 10) |
| RESULTS | - to display bar charts of the RECORDED numbers of canopy or ground plants |
| EXPECTED | - to display bar charts of the EXPECTED results |

BIRDS



You sample the birds by recording the number of sightings during a set time in a particular spot chosen as shown above. You choose your SITE by pointing to it and pressing. You can only SPOT in certain places. After spotting on one site you can move on to another. You can do this for a maximum of eight sites.

The menu bar continues to update, offering the following choices:-

- FILM - to watch a film about bird spotting
- SITE - to choose a site to stand and spot (as above)
- RESULTS - to display a bar chart of your RECORDED results
- DISTRIBUTION - to display a distribution map of EXPECTED results

When you are spotting on a particular site you will see various birds. To record the sighting you should move the pointer to the appropriate name in the list on the screen and press the button. (It will take about a second or two for the computer to register the result.)

If you don't know the name of a particular bird you can select INFO then IDENTIFY to help you.

MAMMALS



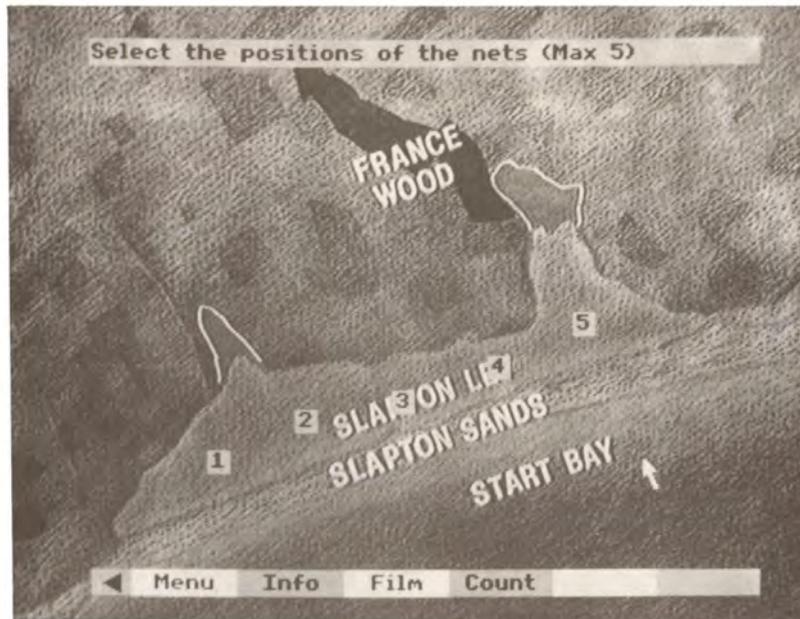
You sample some of the small mammals by three different methods:-

1. By setting a light beam which triggers a CAMERA when the beam is broken. You can set up to eight cameras by moving the pointer to the required position and pressing the pointer.
2. By setting traps and examining their contents. After selecting TRAP you can set the positions of the traps in the same way as you set the positions of the cameras.
3. By fitting a transmitter collar to selected trapped animals and radio-tracking their movements. If both beams are pointing exactly at the mammal then the computer will record the position of the animal at that moment. You can display the position by pressing the action button. You can continue tracking and recording for as long as you like.

The menu bar continues to update, offering the following choices:

FILM	- to watch a film about the small mammals in the reserve
CAMERAS	- to set positions of up to eight beams (see above)
PHOTO	- to see photographs taken at the light beams
RESULTS	- to check the disturbance of the beams over 24 hours
TRAPS	- to set positions of up to eight traps (see above)
CONTENTS	- to examine the contents of the traps
RADIO	- to radio-track mammal fitted with transmitter collar (see above)
EXPECTED	- to display the expected distribution of the mammals

FISH



You sample the fish in the lake by considering one species only: the top predator, PIKE. By using a mark-and-recapture technique you can estimate the total numbers in the lake. You can also measure the length of each pike caught, to estimate the average size.

You can position up to five nets anywhere in the lake by moving the pointer to the desired position and pressing the button.

The menu bar continues to update, offering the following choices:

- | | |
|-----------|--|
| FILM | - to watch a film about sampling fish |
| COUNT | - to count the numbers of PIKE (for more about counting see page 10) |
| NEXT NET | - to examine the next net |
| MARK | - to mark the PIKE caught |
| TOTALS | - to display recorded totals |
| RECAPTURE | - to set the position of five recapture nets |
| RECOUNT | - to count either UNMARKED PIKE or MARKED PIKE |
| ESTIMATE | - to estimate the total population on your recorded results |

WATCH

If you choose WATCH from the main menu you are able to see the expected natural changes in the plants and animals in the different parts of the reserve over the next fifty years (based on the "models", see page 31).

You must choose WHAT you want to WATCH and in some cases WHERE you want to watch. Your choices are:-

WOODS

- REEDS - Total
- Ireland Bay
- Stokeley Bay

FISH

- BIRDS - Lake and Surroundings
- Reeds
- Woods

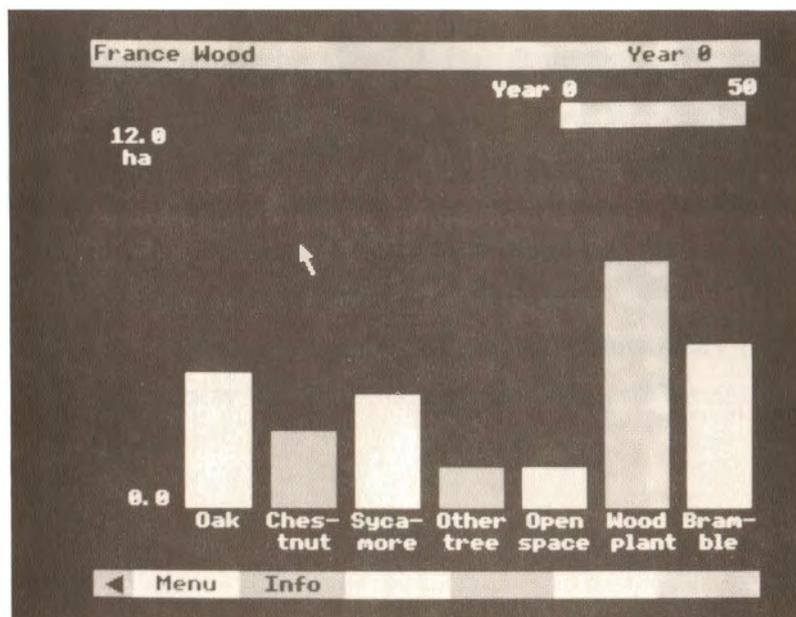
MAMMALS

You can also choose WHEN you want to WATCH by controlling a time bar always present on the screen.



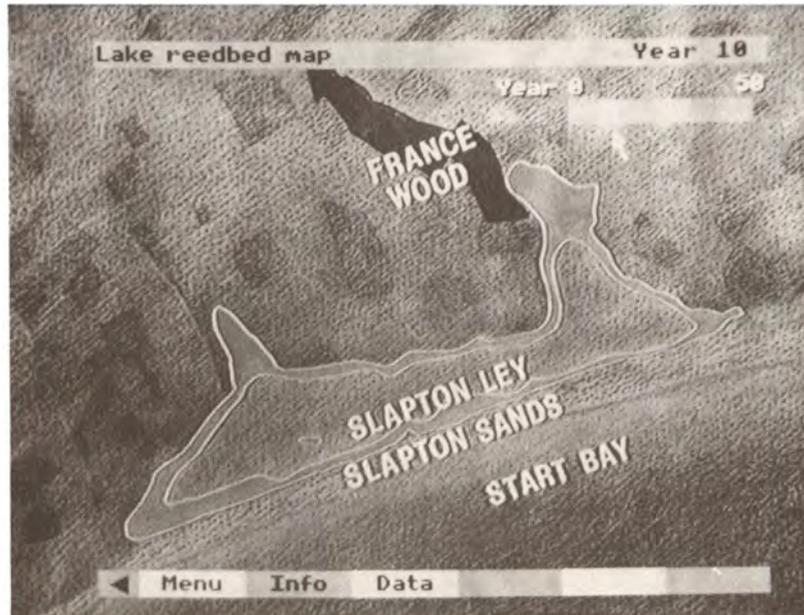
Use the pointer to move the time block to whichever period you want to see, and confirm by pressing the button.

On selecting, say, WOODS the screen would look as follows:



The numbers of the different key species are displayed according to the year selected on the time bar. It is worth keeping a written record of the values if they are to be used again.

When looking at the reeds the changes in the extent of the reedbed can also be seen as a MAP.



INFORMATION

This option provides additional information about the species or area you are considering. It is always available and can be selected from the menu bar in the usual way.

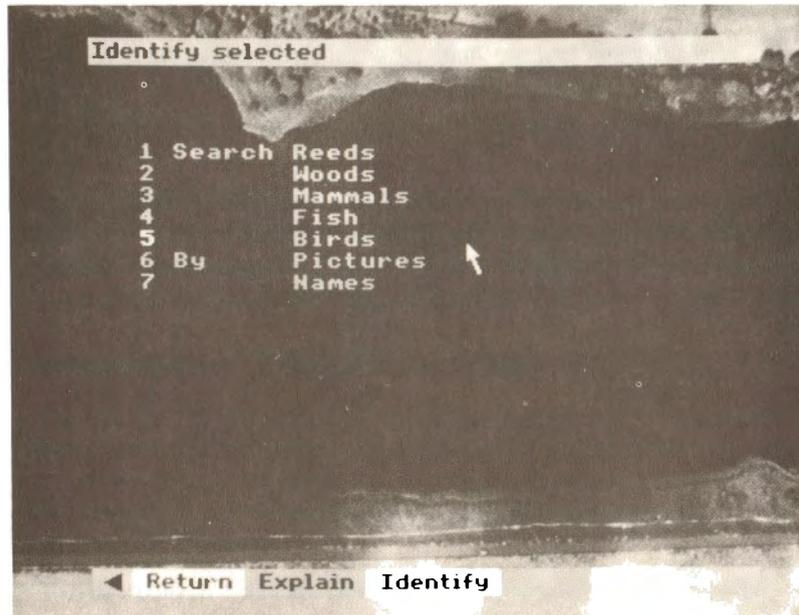


The menu bar will then change to display some or all of the following choices:



- RETURN - takes you back to the point where you selected INFO
- EXPLAIN - gives you pages of text with additional information about the plants or animals or areas you are dealing with.
- DETAIL - is only available during WALK. It shows you close-up pictures of the plants which can be found in the area you are standing in.
- HELP - gives you information about how to operate the disc. It tells you how to use the tracker ball or the keyboard to carry out the chosen task.
- IDENTIFY - will help you with your identification of the various plants and animals in the reserve.

If you select IDENTIFY then you will see the following display:



You must first decide what you want to search (reedbed, woods etc) by selecting the appropriate category. A "marker" will appear by the side of the chosen category. Then you have to decide how you want to search. If you select PICTURES then you will see a series of pictures. If you select NAMES then you will be given a list of names from which you can choose one. Then the appropriate picture will be displayed.

In many of these cases there will be more than one page of text or more than one still picture. You can look through all the pages or pictures available using the two red keys f7 and f8. The f7 key takes you forward and the f8 key takes you back. You can do this as often as you like.

The INFO options EXPLAIN, DETAIL and HELP have been arranged in a particular way. Whenever you call them up they will always display the information relevant to you at that particular time. For instance in WALK, the EXPLAIN option will give you further information about the area you are standing in at the time. If you move to another area then the information will change automatically to that relevant to the new area. In WATCH you will only be given INFO about the species and the time step you are working with at that moment. The HELP option will always be relevant to the task you are carrying out at that moment.

THE “MODELS” IN THE ECODISC

It must be stressed that there is no acceptable model available to explain and predict the changes in an ecosystem of the complexity of the Slapton Ley reserve. Indeed there are no acceptable models for smaller, simpler and less varied ecosystems. Therefore the underlying model for the WATCH section should be seen as the best possible estimate that the authors could make. It is neither right nor wrong, nor is it the only possible model.

From the outset the authors have consulted widely. Opinions were gathered from theoretical ecologists, from experts in the various areas and species under consideration, from local ecologists, and from local people. The body of facts, ideas and opinions produced by this consultancy has been refined and developed by the authors.

The “Model” used in the WATCH section

The underlying idea behind this model is the idea of natural succession. Succession suggests that communities change over time, usually in a directional way. Succession proceeds through a series of stages from the pioneer stage to the climax stage. For most communities these changes over time can be observed but there is limited evidence on the factors which cause the changes.

The present situation is due in part to the current management activity. For the purposes of the WATCH section it is assumed that there is no more management.

Both Stokeley and Ireland bays can be considered as gradually changing from pure reed to reed with other plants, then to willow carr, then to marsh/wetland and then to grass/meadow land. Trees are absent because of the effects of farming. Silt from the streams is gradually accumulating. The area furthest from the lake is drying out and the amount of grass land is increasing and moving forwards towards the water. The same is happening for the marshland and the carr. As the edge of the lake silts up, the reed fringe is slowly moving forward into the lake. The birds primarily associated with the open water or the reed fringe are assumed to decrease under these circumstances. The birds associated with reeds, carr or marsh land increase appropriately.

The numbers of rudd, roach and perch decrease as the reed fringe moves forward and so decreases the size of the lake. In this lake there are special conditions operating as, a few years ago, the parasite ligula appeared (possibly brought in by the grebes). The parasite attacks the roach and their numbers decrease. Correspondingly the numbers of rudd and perch increase. When the roach numbers decrease their average size increases. As there is abundant food the pike size is related to the size of their prey - the bigger the prey the bigger the pike. Pike mainly prey on roach. So when the roach numbers are low and their size high the average pike size increases.

The woods are old and it is assumed that the trees are at or beyond maturity. There is little open space and this will decrease if there is no further management. It is assumed that in turn this will reduce the mixed woodland floor cover. It is assumed that the invading sycamore will take over at the expense of the native trees.

The woodland birds are thought to need both tree cover for nesting, open space to hunt for food and a variety of vegetation for a variety of food. Their numbers are modelled accordingly.

The numbers of mammals are a special case relative to the area. Their numbers are “interpreted” rather than modelled.

The “Model” used in the PLAN section

The changes due to succession, as described in the previous section, are assumed to continue during the PLAN period. Therefore the outcome for any action will incorporate the succession changes. It can be useful to compare the result of an action with the “do nothing” outcome.

In the absence of any action directly affecting an animal species it has been assumed that the presence and population size of any animal species is more or less related to the vegetation in their habitat. Therefore many actions which affect the vegetation will also affect one or more of the animal populations.

The options in PLAN range from taking no action in an area; through taking one action; to taking any two actions in combination. The model has been developed specifically for none, one or two actions. No implications or conclusions should be drawn concerning more than two actions in one area.

REEDBED

CUT.

Cutting the reeds in winter reduces the other plants growing in the bed. It also affects the amount of wetland and carr and influences the otter population.

HARVEST.

This improves the reed quality but affects the otters and birds by disturbance. It also reduces the amount of wetland and carr.

HERBICIDE.

This improves the reed quality but reduces the amount of wetland. It significantly affects the otters, the birds and eventually the fish.

DRAIN.

Digging drainage channels helps dry out the bed which increases the amount of wetland and meadow at the expense of reeds.

DREDGE.

Dredging removes reeds from the front of the bed. It also improves drainage through the bed.

OPEN.

Putting in pathways and picnic sites attracts more people, which means more disturbance and trampling.

WOODS

FELL SYCAMORES.

This helps keep the diversity of trees and creates more space. The woodland birds are also affected.

FELL ALL TREES.

This might reduce the diversity of trees. It does create more space. The woodland birds are also affected.

PLANT SYCAMORE.

Planting can only be done after felling. Planting sycamore will reduce the diversity of trees. The woodland birds are also affected.

PLANT OTHER TREES.

Planting can only be done after felling. Planting other trees will increase the diversity of species. The woodland birds are also affected.

COPPICE.

This will produce timber which is better for sale. Temporarily it creates more space.

CLEAR.

Any open space rapidly fills with brambles, but if the brambles are cleared then other ground flora can develop.

SHOOT.

Shooting creates considerable disturbance in the woods to the detriment of the birds and the mammals.

REPLANT.

In a conifer woodland there are very few birds or mammals and very few ground plants.

LAKE

CULL PIKE.

With fewer pike the average size of the remainder will increase.

CULL OTHER FISH.

With fewer fish the average size of the remainder will increase - including the roach. Pike feed on roach. It is believed that if the roach are bigger then the pike will be bigger.

RESTOCK PIKE.

With more pike the average size will decrease.

RESTOCK OTHERS.

With more fish the average size will go down - including the roach. This could lead to smaller pike.

SAIL.

This creates a disturbance which affects the birds. It is thought that it does not affect the fish in any significant way.

LOWER.

Lowering the level of the lake by altering the height of the outlet weir reduces the amount of open water. This will reduce fish numbers and also affect the water birds and the amount of reed and other vegetation. It also affects the mammals.

IRRIGATE.

A lot of water would be taken from the lake. This would greatly affect the fish and the surrounding vegetation - with the consequent long-term effects.

USING THE ECODISC

The availability of only one videodisc machine and accompanying computer does not preclude the use of this material with a class but it does require some planning.

Although the nature of the interaction involves only one controller at a time, the planning of where to go or what to do next, the analysis of what is happening and the discussion of what it means, is - as with computer software - much more profitably accomplished by groups of pupils than by an individual user. The style and structure of the material would enable the single controller to be the teacher, who provides a class demonstration/discussion. However, the learning objectives are likely to be better fulfilled if the work can be organised so that small groups of pupils can perform specific tasks and report back their findings. This would require the use of the disc to be integrated with other related activities.

Although the material is specifically designed for use with ecological studies, it is hoped it may be found to be of value in other areas such as Geography, Environmental Studies and Computer and Technology courses.

Because the Ecodisc is very complicated, there can be problems when first starting to use it with a class. In these circumstances, it is often better to work with only a small section of the disc. It is also important that the disc is not seen as a replacement for actual field work. This section, therefore, gives suggestions for two introductory investigations and describes a sequence of work both on and off the disc. Firstly, there are detailed suggestions for working through a particular section of the disc and indications of the experiences the students should obtain. Then there are suggestions for follow-up work within the local environment designed to reinforce and, in some cases, extend the experiences of the students.

EXAMPLE ONE: Taking Measurements

The number of fish in the lake can be estimated by what is known as "mark, release and recapture". The technique is a good example of ecological measurement. Activities with the class could follow the pattern described below.

A. Work on the disc

1. Having loaded the disc, the main menu will be displayed on screen. Select SAMPLE. After a brief pause, a new menu will be displayed. Select FISH from this new menu.
2. To set a net, move the pointer to the desired position and press the Action button. A total of five nets can be set in this way.
3. If required, further information about the fish in the lake can be obtained by selecting FILM from the menu bar. Selecting INFO from the menu bar and then EXPLAIN will provide written information.
4. To see the contents of any net, select over the desired site number. The contents of the net will be scanned. The scan will stop if PAUSE is selected and the arrow keys can be used to scan slowly backwards and forwards to the exact position.
5. When a pike is seen, it can be counted by moving the pointer over the "count box" and pressing the Action button. This should be continued until all the pike in the net have been counted. This should be repeated for every net.
6. Selecting MARK at this stage will show an explanation of how the pike are marked.
7. The computer model then assumes that the captured and marked pike are released back into the lake. It further assumes that the marked pike mix freely with the remaining pike population. Any further netting would therefore result in the capture of both marked and unmarked pike. The ratio of marked to unmarked pike can be used to estimate the total population.

8. To carry out the RECAPTURE exercise, place a maximum of five nets in the lake as described above. On selecting RECOUNT, the contents of those nets will be scanned. When a marked or unmarked pike is observed, select in the appropriate box.
9. After looking at all the nets, select TOTAL. The computer will display the numbers from the first capture as well as the numbers from the recapture. On selecting ESTIMATE, the computer will carry out the appropriate calculation.

At this stage the pupils should have an appreciation of the principles of "mark and recapture" and should be aware of the types of methods involved.

B. In the Real World

An application of this sampling method can be undertaken in any pond. Using a net, sweep the surface of the pond and recover any water boatmen or other surface mobile animals. Tip the sample into a white tray and carefully mark the back of each individual of any one chosen species with a dab of enamel paint (the end of a pin is an ideal application method; do not use a brush). Return the sample to the water and re-sweep at a known time interval. You now have data for a sample and a ratio of marked and unmarked individuals. The total population of the pond can now be estimated using the Petersen estimation or Lincoln index.

Estimated total population equals the number of marked individuals in the first sample (m) times the number of individuals in the second sample (c) divided by the number of marked recaptured individuals in the second sample (r).

$$N = mc/r$$

This method is based on the following assumptions:

1. That all the marked individuals from the first sample distribute themselves uniformly throughout the population.
2. That no bias is introduced by the marking technique, such as increasing mortality in the marked individuals.
3. That no recruitment to the population occurs in the interval between first and second catches. More detailed population investigations could be developed using further multiple catches and Bailey's triple catch or Jolly's analysis methods.

EXAMPLE TWO: Exploring and Observing

In any ecological study, it is necessary to look around the area very closely and to make careful observations when and where appropriate. It is often difficult for pupils to appreciate the need for this when they are on their first field trips. The disc can be used to highlight the need for care, which can be further emphasised with the suggested follow-up activity.

A. On the disc

1. Having loaded the disc as recommended, select WALK from the main menu.
2. The next menu offers a choice of three selected walks. You can choose any one of them by moving the pointer to the correct line and pressing the button.
3. The computer will then take you on a predetermined walk, moving from one point to the next at five-second intervals. If you wish to stay longer at any point, select PAUSE from the menu bar. Then, to move on, select CONTINUE. REPEAT on the menu bar will take you through the same walk again.
4. At any point in the walk, you can change from the summer to the winter view and back again by "selecting" over the words CHANGE SEASON in the bottom right of the picture.

5. At any point in the walk, selecting firstly INFO and then DETAIL from the menu bar will show you a selection of the smaller plants living in that particular area. You can look at the various pictures using the red keys f7 and f8. Selecting RETURN will take you back to the walk again.
6. Unknown species of plants can be identified by first selecting INFO and then IDENTIFY from the menu bar. A new menu will be displayed on-screen. You can select a category and then select to search it by stills or by name. You can move through the search using the red keys f7 and f8. Once more, RETURN will take you back to the walk.
7. Selecting MENU will allow you to choose another of the selected walks and carry out the above operations in different locations.

At this stage the pupils should have an appreciation of the complexity of a natural ecosystem and an awareness of the range of plants. They should also have an appreciation of the need for careful observation when exploring a new system.

B. In the Real World

These observation skills can be developed further using the following investigation:

1. Find a holly tree *Ilex aquifolium* and select any one branch.
2. From the growing tip, follow the branch down until you find a ring of scars; tie a piece of wool around this point. Continue down the branch until you have isolated two to three scar lines. (Do not follow outside branches.)
3. From the growing tip to the first piece of wool is the current year's growth; to the next piece of wool is the the second year's, etc.
4. Now you have isolated the leaves for each year's growth, you can investigate the effects of the Holly Leaf Miner *Phytomyza ilicis* and follow the insects' fate.
5. Using the life cycle chart on the next page, parasites, predation and emergence of miners can all be predicted.
6. Using the data collected from the number of leaves, the following parameters can be identified:
 - Number of attacked leaves
 - Number of eggs laid
 - Number of diseased larvae
 - Number of early parasite-attacked larvae
 - Number of successful larvae
7. From this sort of data, life tables and density-dependent and mortality factors can be investigated. (To predict any of these, convert your data to per-thousand leaf values.)
8. To develop this investigation, the following assumptions are made:
 - On average, females lay 89 eggs
 - The number of males equals the number of females
 - There is no emigration or immigration in the population

SUMMARY

The above examples are just two ways of using the Ecodisc and its application in ecological measurements in the real world. There are many opportunities to make similar links; for instance, in quadrat sampling of reeds, bird spotting, radio-tracking mammals and any of the other sampling techniques. The classroom activity can be set up in advance in consultation with the earlier part of this book. The real world studies can be selected from one or more of the publications in the recommended reading list.

LIFE AND DEATH OF THE HOLLY LEAF MINER (*Phthomyza ilicis*)

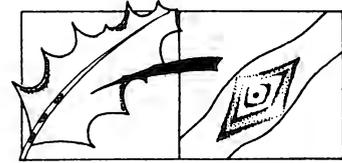
EGG LAYING (May-June)

The adult flies mate and the females lay eggs singly in the underside of the midrib of the year's young leaves. (Why not the older leaves?)

After about two weeks, the eggs hatch and the larvae feed within the midrib. Eggs and young larvae die from climatic or other extremes.

EGG LAYING CLUES:

- i. Small raised pimple on the underside of the midrib (only).

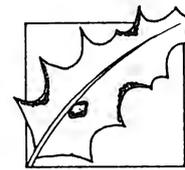


MINE INITIATION (September-October)

The larvae of the leaf miner start to feed between the upper and lower epidermis of the leaf lamina. At this stage they may die from climatic extremes or infection ('DISEASE')

DISEASED MINER CLUES:

- i. Small (< 0.5cm) mine, often blackened.
- ii. No emergence hole.
- iii. Inside may be found small mealy particles / decayed remains, best described as black and white grot!

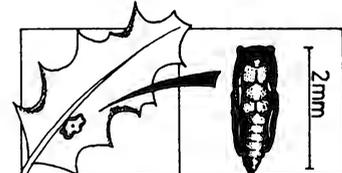


EARLY PARASITE ATTACK (October-November)

The young miner larvae may be parasited by tiny parasitic-wasp larvae.

CLUES:

- i. Small mine (0.5-0.8cm).
- ii. Small, round emergence hole (of adult wasp) may be found in upper or lower epidermis.
Note: this hole looks like a pin prick and can, therefore, be distinguished from that of the miner.
- iii. Inside may be found shiny, metallic black remains (eg. leg fragments) of the parasitic pupa.

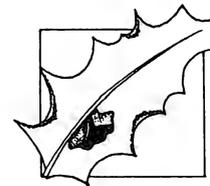


WINTER PREDATION (January-February)

In times of food shortage, foliage-hunting birds, such as the blue-tit will break into the mine to remove the miner-larva.

CLUES:

- i. An obvious V-shaped tear.
- ii. Inside - no contents!

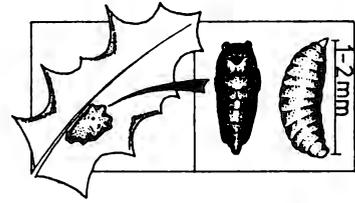


LATE PARASITE ATTACK (March-April)

The full grown larva or pupal stage of the leaf miner may both be attacked by parasitic wasp larvae.

CLUES:

- i. Mine relatively large (> 1.0cm).
- ii. Small, round hole, like a pin prick, on the upper or lower epidermis through which the adult wasp emerges.
- iii. Shiny, black pupal skin of parasite may be found inside the mine. The live parasite larva (yellow) or pupa may sometimes be found.
Note: these may be inside or outside the leaf miner pupa, when present - look carefully.

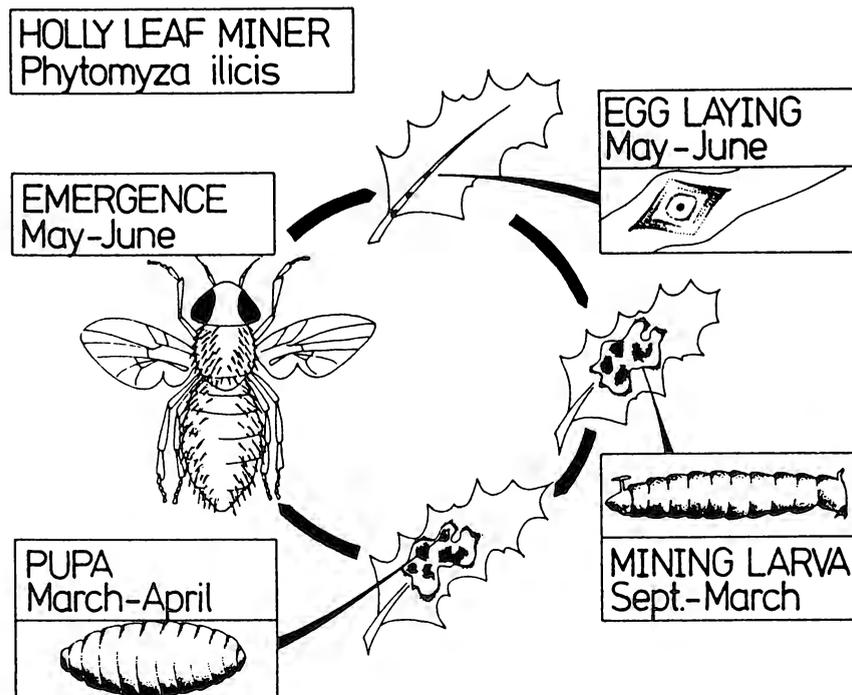
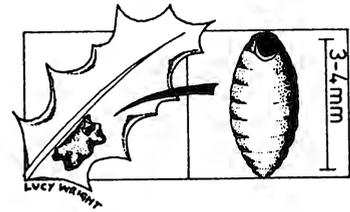


EMERGENCE OF MINER (May-June)

The metamorphosed holly leaf miner emerge.

CLUES:

- i. Relatively large mine (> 1.0 cm).
- ii. Emergence hole of miner on upper or lower epidermis. This differs in shape to that of the parasite, the miner's emergence hole being larger (1mm. diameter), often triangular and usually with a small flap.
- iii. Inside is the empty (check for parasite pupa!), brown puparium of the leaf miner.
Note: this usually lies directly below the emergence hole.



THE ECODISC IN SECONDARY SCIENCE COURSES

The Ecodisc has been specifically designed to be used with 4th, 5th and 6th year secondary science pupils in conjunction with ecological studies. However, it will be of value to a wider age range and in other subject areas.

The Secondary Science curriculum is undergoing a dramatic change in terms of balance, breadth and emphasis. The introduction of new courses with the shift towards the development of scientific skills and processes (Science 5 - 16, A Statement of Policy, DES, Welsh Office, HMSO, London 1985) requires the evolution of new teaching methods and approaches and, in turn, the production of new types of classroom resources. The Ecodisc has been developed to explore the potential of the interactive video medium within the secondary science classroom. Although its content is particularly relevant in a biological context, its style and structure does not restrict its use to only specific biological teaching aims. It attempts to provide an exploratory environment which could be used in many different ways for purposes as various as are relevant to the age, ability and experience of the pupils.

The new GCSE Combined Science Courses include these stated aims:

- to stimulate curiosity, interest and enjoyment in science, its interrelationships, applications and methods of inquiry.
- to encourage an awareness of, and respect for, the interrelationships between people, living organisms and the physical world.
- to explore and stimulate interest in, and care for, the environment.

It is intended that the Ecodisc may be of relevance to such aims. However, its specific objectives are to:

- provide an open-ended exploratory experience in a real environment.
- observe in detail in a range of habitats.
- use various sampling methods to measure population size and distribution of key species.
- identify patterns and relationships from collected data.
- predict consequences of specific actions.
- formulate a management policy.
- appreciate the implications of any policy in social, economic and environmental terms.
- access, analyse and use stored data available.

Exploration

The Ecodisc provides a unique opportunity to explore a real place. It is designed in such a way that you can go and look around, listen to what people tell you, read about it, look up background and historical information or take actual measurements. There is no need to follow any particular sequence since it can be a general collection of information. You gain an overall impression just as if you actually went to the place for a day or so.

It is, of course, not intended to be a substitute for a real field trip but it provides an opportunity to see somewhere different; a somewhere which is ecologically different from many of the usual destinations such as a rocky shore, salt marsh or river. The nature reserve is a particularly interesting example since it includes a number of different habitats, the lake itself, the reedbeds and the woodlands. Exploring the area using the disc enables you to look around much more quickly in both winter and

summer and so offers the opportunity of comparing the habitats and the relationships between them more readily. The ability to look back and think forwards provides a time element not always present. The human interest factors such as fishermen, bird watchers etc. add a level of local colour and reinforces the fact that this is a real place with real problems.

Observation

On field trips, pupils often gain a general impression of an area and develop expertise in certain ecological methods but it is often more difficult to learn to observe carefully - to notice the detail and the changes. The vast array of still photographs, particularly in the WALK section, can encourage pupils to see as well as look. Using the switch between summer and winter, the map and the aerial functions, and referring to the identification data file in the information section, can allow close analysis of what is being seen. Observing with still photographs, images fixed in a moment of time can provide valuable practice for field observations and general qualitative analysis. Inevitably any ecological study of an area requires some identification skills; even if these are just seeing the differences between species if not knowing the names of them. The sampling section requires the user to distinguish between certain key species of fish, birds, mammals and reed and woodland vegetation. In conjunction with the identification information this can be used to consider distinguishing features and what to look for. In particular, when sampling birds the different types must be recognised either visually in the air, or at rest, or by sound alone.

Measurement

Ecological investigations usually involve finding out about the patterns and numbers of organisms and the physical conditions in particular localities so as to estimate population sizes and distribution. The Ecodisc provides the opportunity to use many different sampling methods. Some of these are illustrated below:

Area quadrats	- Woodland vegetation
Belt transect	- Reedbed vegetation
Mark, Release and Recapture	- Fish
Area "sightings"	- Birds
Light beam distribution	- Mammals
Traps	- Mammals
Radio Tracking	- Mammals

The reasons for adopting, and the suitability of using, the different methods is an important area for discussion. The collected observed results can also be compared with expected results, so introducing issues related to the accuracy of such methods in estimating total numbers.

In the real environment, actual measurements would be taken to find out about the abiotic conditions and relate these to the distribution of organisms. Certain data on this has been provided:

The topography of the lake and surroundings
Soil moisture
Soil pH

This is mainly available in the WALK section.

It is also possible to do some direct measurement of the size of the pike to estimate average length.

Patterns and Relationships

The essential part of ecological investigation is to find out about the interrelationships of the organisms and the environment. The Ecodisc enables the study of three apparently discrete habitats - reedbeds, woodland, and a lake - each bounded by specific physical conditions, yet all interdependent through, for example, the movement and activities of animals including man.

The reedbed provides a classic example of a succession from the wet reed fringes on the edge of the lake to dry meadow land. The data on soil moisture levels show the drying-out process. A walk through the area shows the general transition from one type of vegetation to another. And sampling using a line transect provides qualitative data of actual numbers. Details in INFORMATION provide further facts about the adaptations and characteristics of particular organisms.

In and around the lake the range of associated organisms can be seen through reed, fish, bird and mammal sampling and general observations. Underwater shots illustrate the complexity of the food chains. An interesting relationship to follow up is the comparison between the number of pike at any time and their average size.

Predictions

Understanding environments involves recognising change in the balance of the ecosystem and attempting to identify the contributory factors, so that natural progressive changes and the consequences of certain unexpected occurrences or man-made events can be predicted. This involves understanding the system, what lives there and why, and under what conditions. The Ecodisc provides ample opportunity to do this. Recognising progressive change is difficult when observing and measuring at one point in time. Yet using WATCH in the Ecodisc provides a time scale. Showing what has happened often gives a chance to see what trends are underway and what might happen. Such a thorough understanding of a system is necessary before any changes can be imposed. The problem lies in the fact that not even the experts completely understand the interplay of factors in most natural environments. In ecological terms, predictions are all too often no more than informed guesses. The user, however, can gain the knowledge to make such informed guesses.

Management Strategies

The PLAN section of the Ecodisc is to encourage pupils to make use of their acquired knowledge of the area and apply their predictions to formulating a management strategy for the next ten years as a manager in charge of the nature reserve. To undertake this task reasonably competently some time should have been spent on observing and sampling the area.

This is a role-playing activity and a course of action must be decided. There are various different actions that can be taken in the reedbed, woods and lake. The strategy has to be formulated not only in the knowledge of the local area and the ecological issues involved but also under pressure from local interest groups such as fishermen, with requests from various organisations such as the Tourist Board, and clubs such as the sailors; and in the light of newspaper articles and telephone messages.

The Nature Reserve Manager has an office to work in where letters, papers and messages are received and additional information is available through a video and a computer. The plan can be considered and modified in the light of feedback received from interested people but eventually submitted for future action.

Slapton Ley is a real place and it would be misleading to suggest the consequences of certain actions or combinations of actions can be accurately predicted. The results of adopting the user's chosen strategy plan are described in terms of likely general trends and the expected implications of these on the various parts of the ecosystem.

Social, Economic and Environmental Implications

The planning process is intended to introduce pupils to the concept of environmental control. They are placed in a powerful role in that they can manage the reserve for whatever ends they wish, although they need to know enough about the system to do this successfully. They can choose to attempt to maintain a quiet natural reserve; but since the system is in a continual state of change, maintenance requires positive action. There are many conflicting interests and any course of action usually involves compromise. The reserve is a local feature and the interests of the local people cannot be ignored. Likewise, management of the reserve costs money, and financial arrangements with various concerns could be advantageous. The interplay between these social, economic and environmental pressures could be clearly emphasized by setting up and trying out various different aims. Some examples might be:

- To protect the environment from man's disturbance. (This is the most important.)
- To create a reserve for nature watchers.
- To encourage visitors and help increase the local tourist trade.
- To accumulate reserve funds for long-term environmental projects.

Handling Data

The new technology brings with it the facility to store and selectively access large quantities of data. The videodisc enhances the type and quality of the data that can be stored. A very important learning aspect from the use of this material is that pupils gain experience of the use of such data within a relevant context and that they access naturally a range of different forms of data for the purpose of finding out specific information that they need.

Data is available in several forms. There is visual data such as still photographs and film sequences. There is text of various types including that of the INFORMATION bank. There are also audio sound tracks. There is also data in the form of stored numeric values. For example, there are sizes of populations as in WATCH; expected values and distributions as in SAMPLE; or likely consequences of actions in PLAN. Through the use of the disc, pupils gain familiarity with this type of data to find out, compare and analyse the environment of Slapton Ley Nature Reserve.

BACKGROUND READING

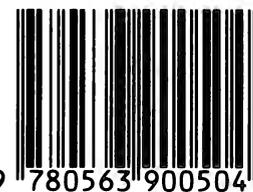
1. "The Natural History of Slapton Ley Nature Reserve", Vols I - XV, The Field Studies Council.
Obtainable from:
Field Studies
Nettlecombe Court
Williton
Taunton
Somerset
TA4 4HT
2. "Ecology. The Experimental Analysis of Distribution and Abundance", Charles J. Krebs, Harper and Row, 1978.
3. "Introducing Ecology. Nature at Work", The British Museum (Natural History), Cambridge University Press, 1982.
4. "Theoretical Ecology. Principles and Applications", ed Robert M. May, Blackwell Scientific Publications, 1981.
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