Countryside Information System

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Countryside Survey 1990 (CS90) was a major survey of the status of the British countryside (Barr *et al.* 1993) and builds on two earlier surveys carried out in 1978 and 1984. The project, partly funded by the Department of the Environment (DoE), was undertaken by ITE and the Institute of Freshwater Ecology. It provides information on the stock and change in landscape features in Great Britain that is necessary for DoE and other Government agencies to help formulate environmentally sensitive policy and identify areas of concern. DoE's experience with other projects undertaken in the 1980s, which investigated changing rural landscapes (eg Huntings Surveys and Consultants Ltd 1986), had proved difficult to assimilate when presented as paper reports and tables. An improvement in the methods of communication was considered essential for CS90 and a more effective and efficient method of access to results was planned using a computer-based system.

The potential of computer technology to provide policy-makers with access to data and assistance in interpretation was explored in the late1980s as part of the Environmental Consequences of Land Use Change (ECOLUC) project, also partly funded by DoE (Bunce *et al.* 1993). Demonstrator systems were developed to show the potential of expert systems, hypertext and information systems. Issues such as identifying the environmental impacts of forestry at the national level and the establishment and management of herb-rich meadows were used as examples. However, discussion and demonstration with the people who need the information, the policy advisors, led to the specification of the system being refined. Of the trial systems developed, the most suitable was a flexible and general information system, which could link easily to other systems available to policy advisors. The prototype, written in Microsoft Windows, was developed in a subsequent project, funded by DoE, and has become the Countryside Information System (CIS) (Howard *et al.* 1994).

Development from the prototype took place between September 1991 and March 1993 with successive modification and periodic review (*cf* Dunn & Harrison 1991). In this way a group of users, the Steering Group, had effective control on system development. The design of the system reflected not only the potential offered by computing, but also the Group's requirements and its level of understanding of the technology; all three developed throughout the project. Throughout the development work the goal has been to create a system which:

- presents the policy advisor with data which describe the rural environment in a way relevant to national policy concerns and which can be correctly interpreted;
- can be used within a realistic timeframe for the normal process of policy appraisal (ie hours or days, rather than weeks or months); and
- requires no specialist training other than that which is expected to use standard modern office computer packages.

CIS was developed using the guidelines set for the development of Windows packages (screen layout, menu structure, command terms and abbreviations) and consequently looks similar to many packages. People who use Windows packages feel they can use CIS intuitively, and information (both maps and tables) can be passed between packages using the clipboard. The system runs on a standard office Personal Computer with Intel processor chips (80386 or better), and is compatible with the range of hardware and software tools normally available to the policy advisor.

One of the features of CIS is its capability of producing distribution maps of the elements in question. The capability often draws comparison with geographical information systems (GIS); although there are now a range of commercial Windows-based GIS packages, none can present and qualify the CS90 data in the same way. CIS is much more of an information system with some spatial capability, and should be judged more on its decision support capability.

In an ideal world, the policy advisor would have access to information covering every aspect of the environment for the whole country at a range of scales. However, such complete (census) data are often unobtainable, expensive or too time-consuming to collect. Sample data can provide the necessary information and need not be less reliable than census information. Indeed, sample data are easier to qualify with measures of accuracy, but the user must be made aware of the appropriateness of different styles of data for different questions. CIS presents both census- and sample-based data, along with descriptions and qualifiers to assist interpretation. The system allows the different data structures

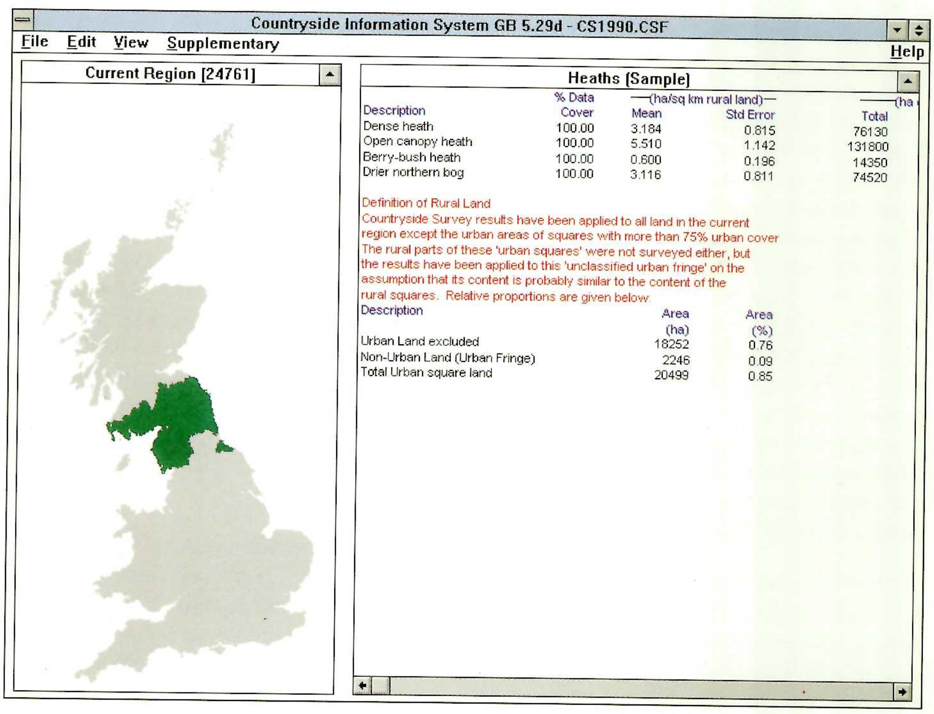

Figure 8. CIS screen showing a selection of counties (identified in the map screen) and the projection of Countryside Survey 1990 field results for heaths for the region

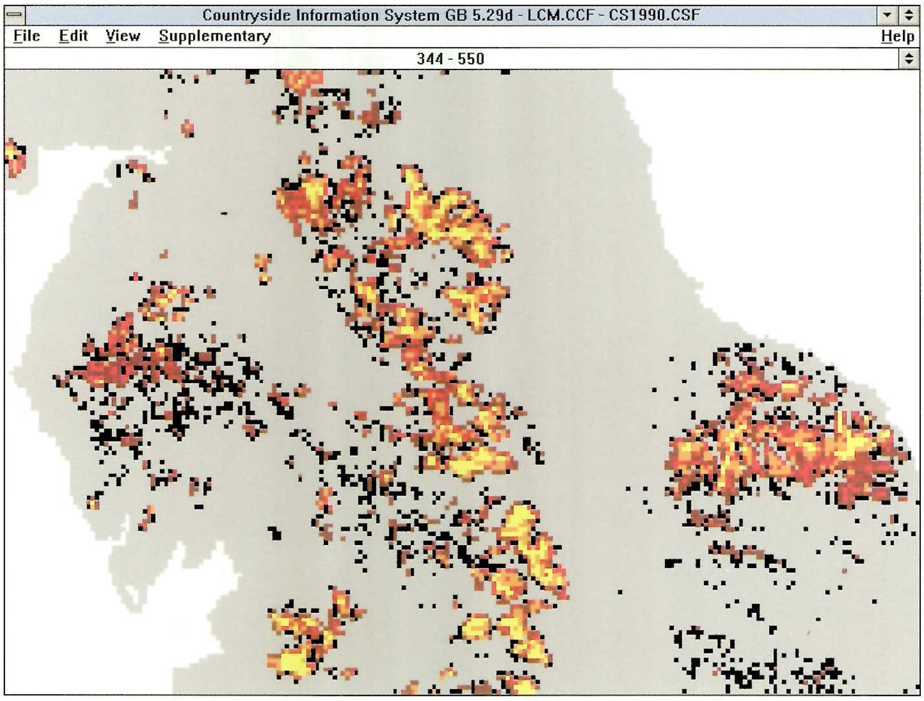

Figure 9. CIS presentation of the Land Cover Map of Great Britain, showing an analysis of dense heath in northern England

(sample and census) to be presented and compared, thus providing a more rounded, integrated description.

Data from the three Countryside Surveys (1978, 1984 and 1990) are held as sample-based information within the CIS. All three surveys were structured using the ITE Land Classification, which was created to provide a sampling framework for national surveys (Bunce *et al.* 1995). The ITE Land Classification uses the 1 km × 1 km cells of the GB National Grid, and these form the basic spatial units on CIS. The Land Classification assigns every 1 km square to one of 32 land classes which serve as a sample stratification for field survey. The land class system conforms to the classical principles of statistical design, in that it reduces sample variability by stratifying a sample according to some of the known underlying characteristics of the population.

For presentation the detailed land cover types mapped in the field have been aggregated into 58 variables considered appropriate for work at the national policy level. They are held on the system as mean and standard error values for each land class. Any geographical area composed of 1 km squares can be selected within the system and will be shown as a map in a window on the screen. The land class distribution of the area is automatically calculated and the number of squares in each land class is multiplied by the average for each feature; the totals are presented in the window next to the map (Figure 8).

A satellite-derived Land Cover Map was also generated within CS90. Although the information was captured and is held at a 25 m pixel resolution, it has been interpreted and summarised at a 1 km square level, dividing land cover into 17 categories. CIS allows the data to be presented and interrogated for different parts of the country (Figures 9 & 10). Care has been taken to ensure that the categories used to report the satellite data not only are relevant in policy terms, but also relate easily to sample-based data available through the field survey component of CS90.

Although the CIS was conceived originally as a means of providing access to CS90 data, as the system developed its potential as a tool for presenting other environmental data available was recognised. Thus, the requirement to hold additional information on the system has been added to the original objectives. The system is capable of holding a range of census-based information at national scales where 1 km squares of the National Grid are used as the basic spatial unit. A dataset leased by NERC and DoE from the Ordnance Survey describing land cover features, such as altitude, roads, buildings, lakes and woodland, is now available in CIS format. Other datasets are also being prepared for inclusion in CIS and cover a wide range of topics.

CIS is now commercially available under agreement with DoE, being marketed by NERC and supplied by the Software Development Section of the Institute of Hydrology. Yvonne Parks should be

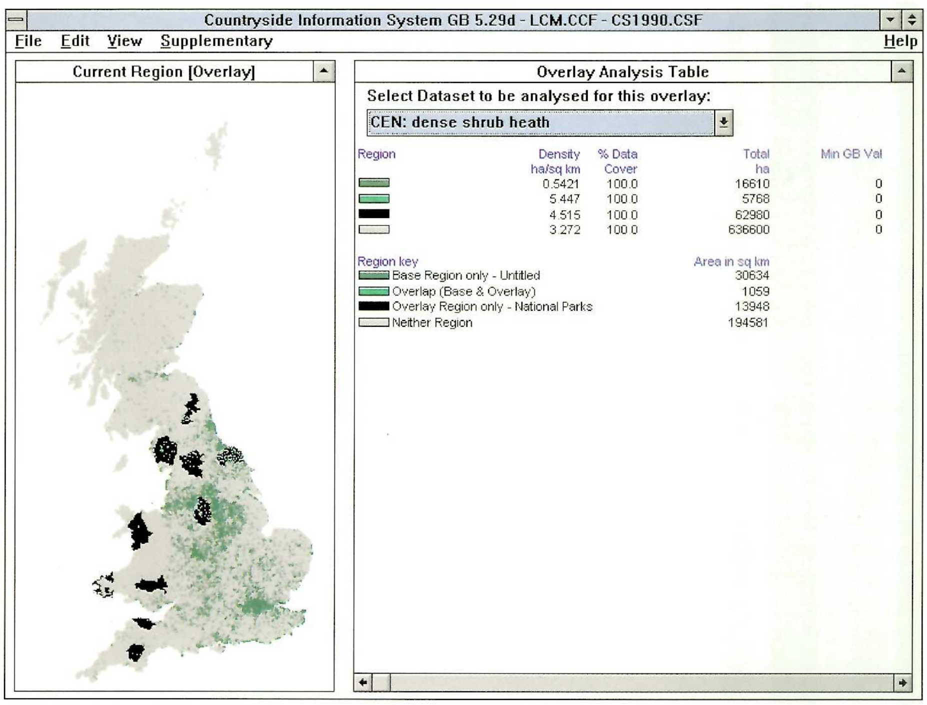

Figure 10. CIS presentation of a selection from the Land Cover Map of Great Britain (urban land) overlayed with National Parks

contacted for further details. Datasets will also be available, advertised on the system in an environmental catalogue which identifies points of contact. Work to extend the system is continuing under a new contract for DoE, entitlted Access to Data and Dissemination Services (ADDS).

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Decision modelling: land use policy evaluation

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A difficulty when making decisions about complex issues, such as land use, is that the human mind cannot entertain more than about seven points at the same time (Fechner 1860). The information available is always incomplete, varying in reliability from hard facts to unsubstantiated intuitions. And, generally, there are conflicts of interest, so that

Plate 7. The Dee valley west of Kincardine O' Neil, showing the type of landscape in which the pilot study was done

conclusions involve compromises between different viewpoints.

'Harmony is a blending and combination of opposites' (Aristotle 384–322 BC)

Such complexity offers opportunities for skilful advocates to press for the interest groups which they represent. Alternatively, we report here how decision theory can provide an objective and transparent basis for reaching consensual decisions. ITE has developed a quantitative and transparent system for integrating available information into decisions about land use, and an impartial mechanism for generating compromises between divergent interest groups.

Approach

The approach adopted examined the costs and benefits of alternative land uses, both separately and in combination. Costs and benefits can be financial, social or ecological, involving aesthetic and ethical as well as financial considerations. Rather than attempting to convert spiritual values into financial ones, we chose a psychometric modelling technique based on decision theory, using 'strength of expert opinion' as currency.

A computer model has been developed that is a general tool for integrating all types of available information into predictions about the likely costs and benefits of a range of alternative management strategies. It is a general framework for making policy decisions and has the following characteristics.

- All relevant issues are given due weight.
- Time is not wasted on irrelevant matters or personal antipathies.
- Accurate records are kept of the issues considered and the weight given to them.
- Input is allowed from knowledgeable people who are not necessarily fluent in the niceties of committee room debate.
- An impartial mechanism is provided for recording and resolving conflicts of interest quickly and with minimum friction.
- The consequences of varying the weight given to each issue can be ascertained quickly and simply.
- It is quantitative, allowing input in any currency (eg money, measurements of any sort, good, pleasure, etc).
- The end product is a cost score and a benefit score for each of the management strategies considered. The mechanism by which these scores are reached is recorded. The scores can be disaggregated to see what created them, and input can readily be altered to see the effect on the scores and the overall robustness of any conclusions.