Scottish Rural Land Use Information System Project

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ABSTRACT

This paper provides a description of an important effort in land use data processing in Great Britain. The organization, motivation and technology used in a pilot project are presented and discussed. The results of the research are also presented along with information on how the data can be acquired by interested researchers. The paper does not go into great detail but rather presents a snapshot of the multi-faceted project in order to bring it to the attention of others working in this field.

INTRODUCTION

The prime mover of the Rural Land Use Information System project (RLUIS) was the Scottish Development Department (SDD), an agency charged with the responsibility of overseeing all strategic land use planning in Scotland. The SDD had chaired a standing committee to deal with the particular question of rural land use planning for a number of years. In 1978 it requested the assistance of a consultant from the University of Edinburgh to advise on how the committee could improve the day to day handling of the vast amount of data collected by each of the participating agencies.

The consultant reported to a special working party in March of 1979 and in addition to providing the committee with a thorough description of existing data processing methods, the report also made many suggestions for improving existing practices with particular emphasis given to the need for automation and computerization since few of the agencies were making use of such practices.

The working party acted on this advice and proposed a pilot project to investigate the feasibility and cost of creating a shared data processing system which could provide both statistical and map output. The major problem was, as usual, the funding. It would be limited to approximately $100,000 and would only be available for one year. With these restrictions in mind the working party set out to put a project together that would not be over ambitious but at the same time meaningful.The membership of the working party was as follows:

Scottish Development Department (SDD)
Countryside Commission Scotland (CCS)
Department of Agriculture & Fisheries Scotland (DAFS)
Forestry Commission (FC)
Institute for Geological Sciences (IGS)

Macauly Institute for Soil Research (MISR)
Nature Conservancy Council (NCC)

The first requirement of the working party was to try and use it's scarce time and funds as practically as possible. For that reason it looked to existing facilities and organizations rather than attempting to create something entirely new. The earlier consultant's report had pointed out a recreation planning system which was funded by national agencies and which provided both map and statistical output from a well maintained recreational data base. The Planning Data Management System (PDMS) was contacted and it's sponsors agreed to join the working party in an attempt to broaden it's scope to deal with the wider range of land use data.

The existing PDMS facility did not provide a digital mapping component, only a grid square oriented, line printer produced map. For that reason it was decided that GIMMS Ltd., a company with a computer mapping package which produced more traditional line drawn maps on a plotter, was invited to tender for carrying out improvements to it's software and linkages to the existing software used by PDMS. All work was carried out in the Department of Geography at the University of Edinburgh where PDMS was housed.

The third major contractor to be involved was the Ordnance Survey (OS), the national mapping agency. The OS was involved in the automation of their map production facilities and were just beginning to look at the possibility of broadening their role to provide not only maps but digital data bases to customers. They agreed to participate in the project and to make available their existing data for the study area.

SCOPE AND OBJECTIVES

The scope of the project was limited by the scarcity of time and money. The first step was to choose a study area. The districts of Dunfermline and Kirkaldy in the Fife Region of Scotland were chosen. The land area was only 1/100th of the 79,000 Sq. Km. of Scotland the area was rural and it was under pressure from oil related development and urbanization. The planners in Fife Region welcomed the opportunity to participate in the project and made their data available to the working party.

In addition to deciding on the feasibility and cost of creating a rural land use system for Scotland the working party also had particular requirements which it wanted to have met. The system would have to be able to deal with both the whole of the country but also in detail with particular areas of pressure and development. In particular the participating agencies were interested in the question of the urban-rural fringe and the problems caused by increasing urbanization.

Finally, the working party hoped to achieve an improvement in the way that the participating agencies shared existing data. This would be the necessary first step to take no

matter what technology would evolve from the project.

THE DATA

The participating agencies covered a vast spectrum of land use activities and this was reflected in the data that they collected and injected into the project. It is also true that the PDMS had created and maintained a large data base and this was also at the disposal of the working party. It is not possible to give details of all the data used in the project but the following table identifies the statistical data used in the project.

It should be noted that a very valuable set of data was contributed by Fife Region, the local planning authority. In Britain all proposed development to land and property is controlled by the local planning authority and details of such development are solicited before any approval is given or refused. Fife had point referenced the centroid of each property or land parcel effected by development proposals. The referencing system was the OS national grid and was to an accuracy of 100 meters. This data provided the true measure of actual and potential pressure on the ground and was a vital element when integrated with the more strategic data collected by the national agencies.

Boundary data was submitted to the OS by the participating agencies for digitizing. Before describing this process more fully it should also be noted that the OS also provided data from their own map production data base including the following features:

Coastline
Limit of Sand Mud and Shingle
Lakes
Rivers, Streams, Drainage Channels
Administrative Boundaries
Main Road Network
Main Rail Network
Electricity Transmission Lines
Footpaths
Pipelines
Parks

Unlike the statistical data, which only had to be coded and punched into the computer, the digital or boundary data was a costly element of the system. Most agencies updated maps by hand to reference boundaries of interest to them. The scales and methods of annotating differed from one agency to another. For the purposes of the project it was decided that a common scale would be used (1:50,000) and that agencies would prepare base maps as digitizing documents for use by the OS. Guidelines were provided by the OS and GIMMS Ltd. whose GIMMS mapping package would be used to process the data. Even the OS had to reorganize it's data with reference labels to enable the software to create polygons. The OS in map production work did not become involved in this activity.

This aspect of data collection and validation was by far the

TABLE I

ACQUISITION OF STATISTICAL DATASETS

NO.	DATASET	DATA HOLDING AGENCY	ORIGINAL COLLECTING AGENCY	DATE RECEIVED
DATASETS IN TRIP DATABANK				
11	LANDFORM	PDMS	PDMS	Held by PDMS
15	BEACHES	PDMS	CCS	Held by PDMS
29	NATIONAL TRUST SITES	PDMS	PDMS	Held by PDMS
27	RECREATIONAL FACILITIES	PDMS	TRRU	Held by PDMS
41	POPULATION	PDMS	OPCS	Available to PDMS
48	CCS GRANT - AIDED SITES	PDMS	CCS	Held by PDMS
DATASETS COLLECTED BY RLUIS AGENCIES PRIOR TO PROJECT				
6	GEOLOGICAL BOREHOLES	IGS	IGS	? . 2. 79
23	DERELICT SITES	SDD	SDD	24 . 2. 79
39a.	PROPERTY BY POSTCODE	FIFE	FIFE	4 . 5. 79
44	PLANNING APPLICATIONS	FIFE	FIFE	28 . 6. 79
50	AGRICULTURAL CENSUS BY HOLDING	DAFS	DAFS	27 . 9. 79
46	PLANNING APPEALS	SDD	SDD	5 .10. 79
45	PLANNING REFERRALS	SDD	SDD	5 .10. 79

DATASETS HELD BY RLUIS AGENCIES AND COLLECTED BY OTHER RLUIS AGENCIES PRIOR TO PROJECT

32	MAJOR INDUSTRIAL SITES	SDD	FIFE	? . 3. 79
47	HOUSING LAND AVAILABILITY	SDD	FIFE	11 . 4. 79
49	RESIDENTIAL LAND PRICES	SDD	FIFE	19 . 6. 79

DATASETS HELD BY RLUIS AGENCIES AND COLLECTED BY NON-RLUIS AGENCIES OR DEPARTMENTS PRIOR TO PROJECT

30	ANCIENT MONUMENTS	SDD	NATIONAL MONUMENTS BOARD	18 . 5. 79
42a.	EMPLOYMENT STATISTICS	FIFE	DEPT. EMPLOYMENT	3 .10. 79
43	UNEMPLOYMENT STATISTICS	FIFE	DEPT. EMPLOYMENT	3 .10. 79
17	SCOTTISH WILDLIFE TRUST SITES	NCC	SWT	10 .10. 79

DATASETS HELD AND COLLECTED BY NON-RLUIS AGENCIES PRIOR TO PROJECT

52	TRAFFIC FLOW FIGURES	SDD (ROADS)	SDD (ROADS)	6 . 7. 79
54	CLIMATE	MET. OFFICE	MET. OFFICE	12 . 7. 79
53	WATER SUPPLY FIGURES	SDD (WATER)	SDD (WATER)	24 . 9. 79
53a.	SEWAGE TREATMENT WORKS	SDD (WATER)	SDD (WATER)	24 . 9. 79
21	AREAS OF ABANDONED MINING	NCB	NCB	-
22	AREAS OF INFILL AND SUBSIDENCE	NCB	NCB	-

DATASETS COLLECTED SPECIFICALLY FOR PROJECT

13	LANDUSE 1 KM.	PDMS	PDMS	26 . 3. 79
14	LANDUSE 100 M.	PDMS	PDMS	16 . 8. 79
16	HABITAT	NCC	NCC	22 . 8. 79

most costly element in the project.

THE SOFTWARE

The PDMS software (TRIP) produced statistical output similar in nature to that produced by SPSS or SAS. It also produced grid square (5km or 1km) maps on a line printer. These maps were seen as a valuable tool by the working party in as much as they allowed for an overview or snapshot of the whole of Scotland at the 5 km level or of a whole district or region at a 1 km level. The mapping was functional because all data in the data bank was point referenced to 100 meters or data was collected by grid square. The working party felt that this was a good starting point but that they would require further detail and greater resolution in their mapping needs. They looked at the GIMMS mapping system and felt that it had the basic requirements and that it could be improved to provide the necessary analytical tools they required.

GIMMS Ltd., in response to the requirements of the working party, made substantial improvements to the GIMMS mapping package. Firstly, it provided an OS interface which allowed the software to be used to read the OS data base provided to the project. The topological checking facilities of the software were also improved to reduce the time required to check and validate the digitized data provided by the OS.

The major addition to the software was the adding of spatial search routines that would allow for the location and manipulation of points, lines and polygons in relation to each other by way of distance or data characteristic. This search capability was seen as vital by working party members along with GIMMS capability to provide flexibility of scale when producing map output. The only problem encountered was the need to provide a polygon overlaying technique. This proved impossible within the funding and time limits. However, GIMMS did provide a capability to convert polygonal data to grid data for area comparisons and to provide a link to the TRIP mapping system.

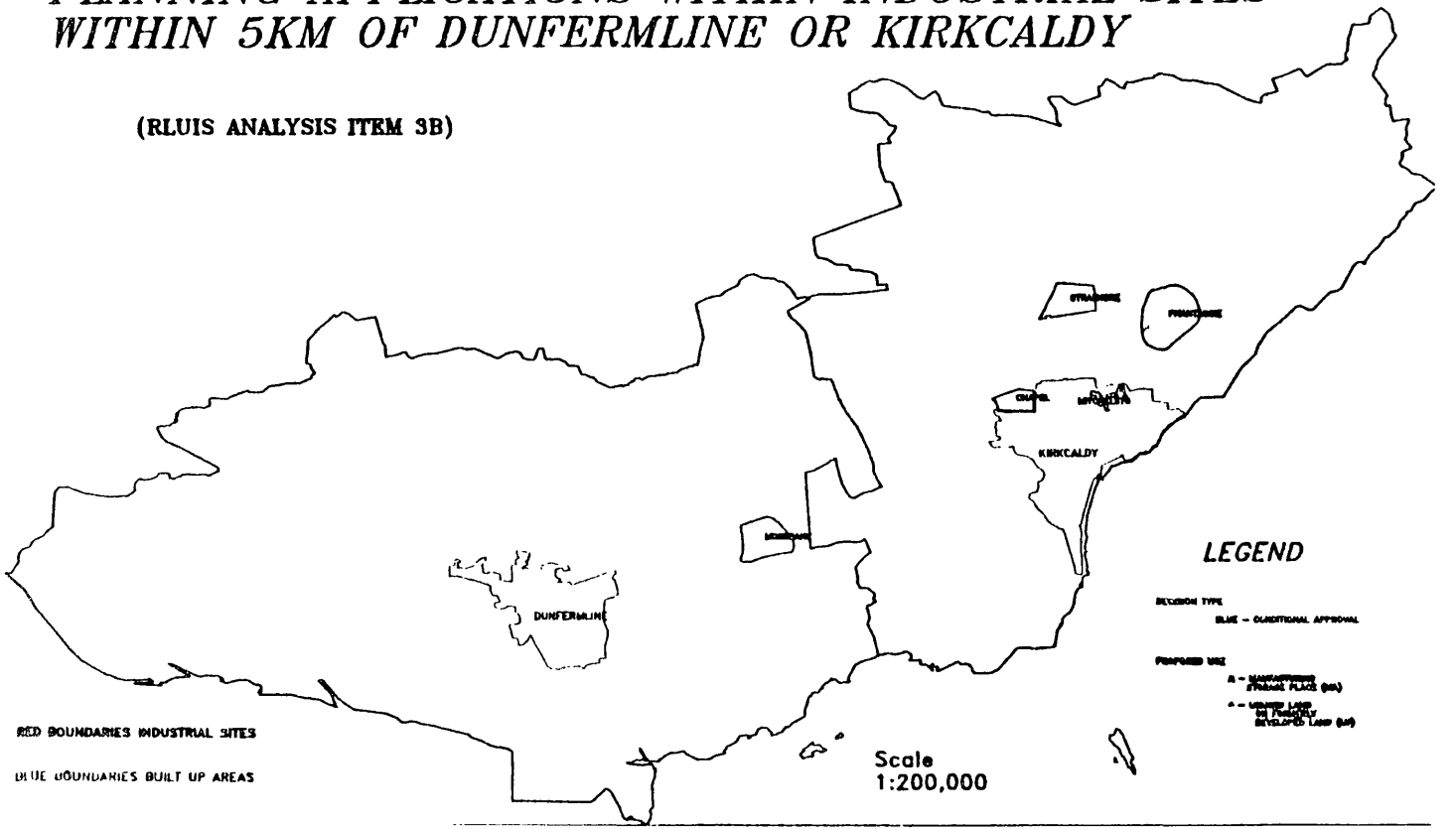
One other feature that should be noted is that of generalization. The GIMMS software included a generalization routine which would reduce the number of co-ordinates in a boundary at the time of file creation. The detail provided by the OS was often greater than was required for the analytical exercises undertaken. The employment of generalization often cut the cost of analyses and maps by as much as 50%.

THE ANALYSIS

The time restraint meant that only a limited number of analyses could be specified by each of the participating agencies. In addition to the more routine statistical analysis produced by TRIP the participants requested both grid square and digital map output. Primarily the requests were of a sieve mapping nature. That is to say that they required a sifting of the data base to meet a number of requirements which could be related to the presence or absence of a particular data characteristic and/or the

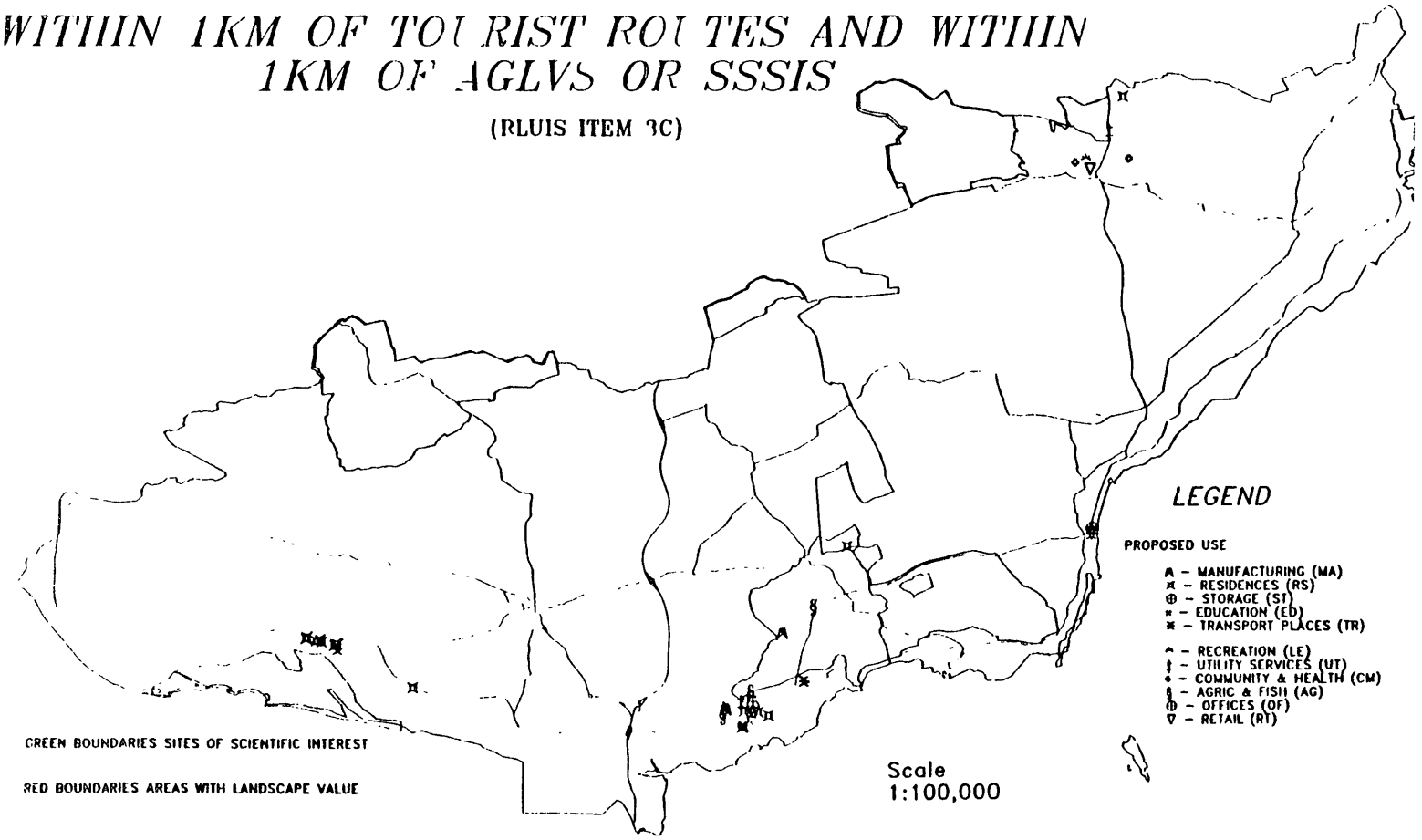
PLANNING APPLICATIONS WITHIN INDUSTRIAL SITES WITHIN 5KM OF DUNFERMLINE OR KIRKCALDY

(RLUIS ANALYSIS ITEM 3B)



WITHIN 1KM OF TOURIST ROUTES AND WITHIN 1KM OF AGLVS OR SSSIS

(RLUIS ITEM 3C)



relationship of data or areas to each other in distance. The following maps provide some example of the type of question that were being asked and the results that were produced.

CONCLUSIONS

The project concluded in August of 1980 with reports from the major contractors and a final report from the working party to the Standing Committee. The analyses were 90% complete within the time scale with only some of the larger digital data sets not processed within that time. The conclusions were that the concept was a good one, the need was great, and that the basis of a rural land use system for Scotland was created. Feasibility was not the question, cost was. The tremendous expense of digitizing the data for the study area was seen as a major road block to extending the system to all of Scotland. Indeed, the costs would not be 100 times greater but were estimated as possibly 1000 times greater given the nature of the data for the rest of the country. The OS used manual digitizing techniques and are still looking at the feasibility of automatic techniques which, if employed, could reduce costs significantly.

The question of scale also required further study since the 1:50,000 scale did not satisfy some agencies with more specific needs for high resolution. The concept of a scale free data base was seen as the objective but again the cost factor was a problem.

Another conclusion was that many agencies needed to improve the way that they collected and annotated data. More coordination would be required prior to data collection to facilitate a greater utilization of the data at the analysis stage. The sensitive nature of some of the data also presented organizational problems. Further thought would have to be given to the operation of such a system. Would it be a central facility or a distributed one? Could it be located in a university or commercial environment or would it have to be run by central government? These questions all required further study.

THE AFTERMATH

Today no further development of the system has taken place. The participating agencies still use the university facilities for further analysis of the existing data or to add to their holdings. The reason for no further action is purely financial as government spending cuts have prohibited further research.

The OS has undergone a review and their role has not been expanded to provided digital data bases to customers. Once again this is a result of the lack of funds to support such an effort. The OS has continued to evaluate other automated techniques for increasing the efficiency and economy of their digitizing effort.

GIMMS Ltd. has incorporated all the improvements inspired by the project into release four of the GIMMS system which it sells throughout the world. Indeed many of the individual

agencies have acquired the GIMMS software to use within their own facilities to carry out analysis and map production.

In conclusion it must be said that the pilot project did achieve a great deal. The achievements were probably greater in the administrative and education aspects than in the technical dimension. That is to say that individuals and agencies who participated finished with a greater appreciation of the capabilities of an automated system as well as an awareness of the fundamental need to have a sound administrative and managerial foundation to establish and maintain data collection, classification, and coding standards. The project provided the opportunity for the many agencies to work in a more coordinated fashion and they did not waste the chance. This will provide many improvements in land use planning in Scotland for many years to come.

Finally, the report to the working party and the contractor's reports as well as the data base are available to any researcher or research organization. To obtain a copy write to:

Mr. Eric Goodwin
Scottish Development Department
New St. Andrew's House
Edinburgh, Scotland U.K.