Finding new sites for golf courses using GIS

by Gursewak S Aulakh and Sotirios G Koukoulas

DEMAND FOR golf courses is increasing in the United Kingdom and more particularly in the south of England. This demand is most apparent at the urban fringe. In view of agricultural food surpluses, golf courses are seen to be an alternative use for agricultural land in many areas (an 18 hole golf course requires an area of 150–160 acres). Research into identifying potential sites for an activity that consumes large parcels of land is timely and has beneficial applications in planning.

In traditional potential surface approaches (sometimes employed in making land use decisions) an attempt is made to combine different characteristics of land to identify surfaces for potential development. For instance when locating new golf course sites many factors, such as accessibility, characteristics of soil, environmental considerations, Areas of Outstanding Natural Beauty (AONB) etc, need to be considered as well as construction requirements. These factors are weighed differently depending upon the viewpoint of the decision maker/s. The weightings given to various factors by decision makers can be used to determine suitability of parcels of land for an activity. All the data is incorporated into one analysis of land suitability. From such an analysis a **surface of combined development potential** is produced in the form of a map. Geographical Information Systems expand the scope of such analyses enormously. In the research detailed below, suitable surfaces for golf courses in the Royal County of Berkshire were produced employing a Geographic Information System.

Questionnaire

Data sources were divided into two categories: spatial and non-spatial. Spatial data included digitised maps which represent planning policy (*eg* AONBs; Sites of Special Scientific Interest, etc) and the physical characteristics (*eg* soil characteristics, vegetation cover) of the area. Non-spatial data included results of a questionnaire survey from three groups of people concerned with golf courses, namely: planners, developers and golfers (questions related to distance from a road, distance from urban settlements, area preference such as reclaimed land from mineral deposits, etc). Individuals in each group were asked to award scores on a scale of 1 to 7 to various factors relevant to the siting of golf courses (*eg* its distance from an urban settlement, or the avoidance of an area of important landscape).

While some factors were favourable others were unfavourable to the location of golf courses. The favourable factors were awarded positive scores and the unfavourable factors negative scores. The questions were asked in such a way that if a respondent considered a factor to be favourable it scored '7' and if unfavourable, '1'. Scores for each question were then totalled for respondents within each group. These scores were used in conjunction with digital mapping to determine the siting of golf courses for the county, individual maps representing different factors. All maps with suitability scores were then overlapped and a final composite map or surface was produced. The composite surface contained a large number of polygons due to the overlapping of all the maps used in the analysis.

Final surface

The scores associated with each polygon in the polygon attribute tables for the final surface were the sum of all the scores from the maps used for overlapping. Therefore, some of the polygons had positive and others negative scores. For instance, a site might have good access, good drainage but be located within an Area of Outstanding Natural Beauty (in the western part of Berkshire). While the first two factors obtain positive scores, the location within an AONB obtains a very high negative score from the planners. Since many factors affect each site, scores ranging from highly negative (unsuitable sites) to highly positive (extremely suitable sites) were produced (see figure 1). This also depended on the magnitude and size (whether negative or positive) of the underlying scores. The final scores were then divided into ranges of 100s within seven zones. Each zone was assigned a distinct colour – reds and yellow (zones −4 to −7) representing negative scores and greens (zones 1, 2, and 3) representing positive scores. The suitability surfaces were produced based on the above zones. The size of the areas of the different zones was also calculated.

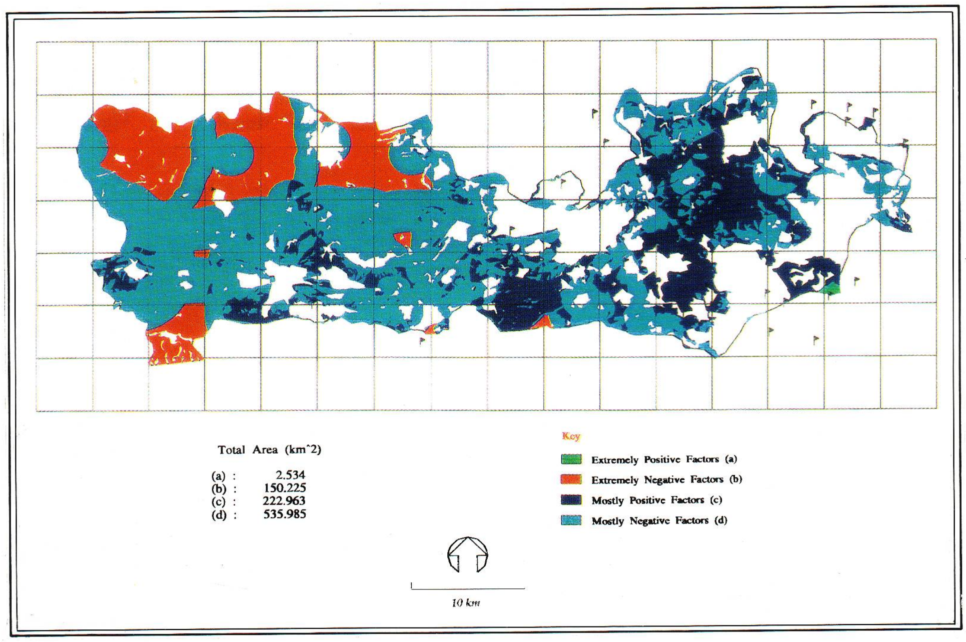

Figure 1. Areas showing negative and positive scores (Planners) – Phase I.

Analysis

The analysis was performed in several successive phases. In each phase some of the factors were further refined and manipulated. In the first phase all grades of high quality agricultural land (agricultural land classifications 1, 2 and 3 – mostly in the western part of the county) were assigned the score given by each group of respondents. In the next phase, however, different grades of agricultural land were assigned varying scores on the assumption that the highest grade of agricultural land would receive the maximum score and a lower grade only a proportion of the maximum. This was also applied to other factors such as accessibility and soil types. This acknowledges that not all sub-categories of a factor are of equal importance in determining land use suitability.

Suitability surfaces from both the golfers' and developers' viewpoint have also been produced. However, the surfaces produced from the planners' viewpoint only are presented here to illustrate the use of GIS (see figures 2 and 3). Further work has been carried out on the robustness of factors by multiplying scores by different multiples and analysing the surfaces produced. The surfaces produced show that there are more suitable areas in the eastern part and very few in the western part of the county. This is because fewer negative factors affect sites in the eastern part compared to a large number of them, such as AONBs and high quality agricultural land in the west of the county. The project

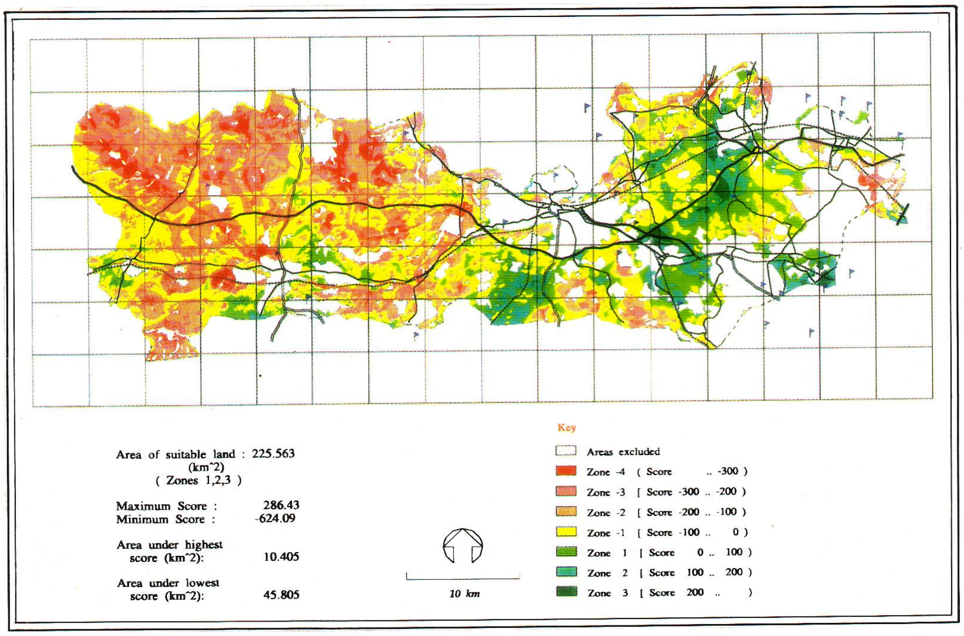

Figure 2. Suitability for golf courses in Berkshire (Planners) – Phase I.

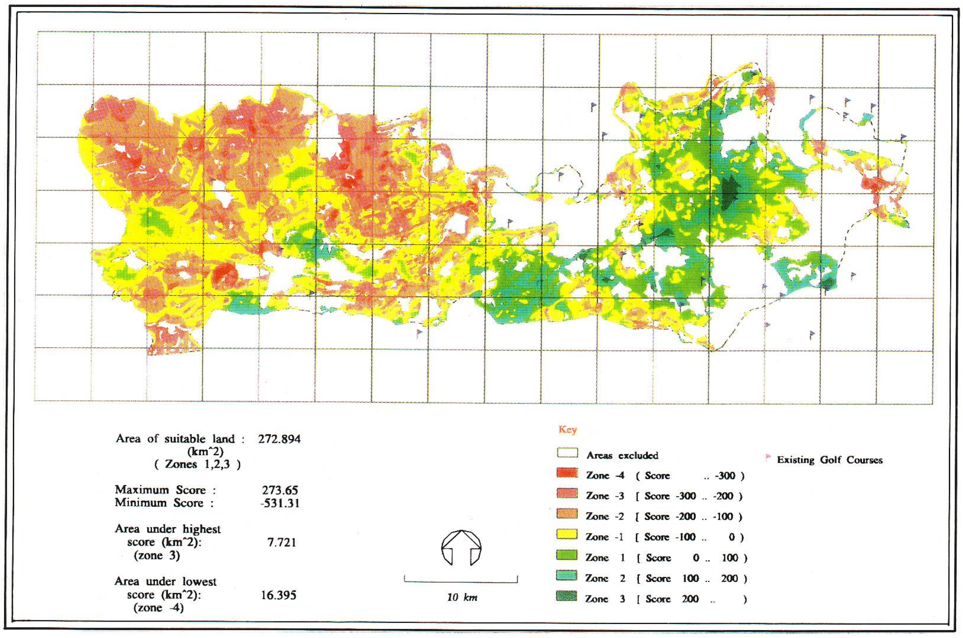

Figure 3. Suitability for golf courses in Berkshire (Planners) – Phase II.

demonstrates that Geographical Information Systems expand the scope of land suitability analysis enormously. The opinions and requirements of varying groups of people can be employed in devising planning guidelines by comparing potential development surfaces for each group.

The software used was ARC/INFO version 6.1 on a Sun SPARC workstation and the maps were produced on a Tektronix Phaser II SDX colour laser printer.

Editor: Golfers amongst our readers may well take issue with planners in that the existence of a golf course can both enhance and protect the landscape – hundreds of examples spring to mind. On the other hand not everyone is a golfer and Areas of Outstanding Natural Beauty should be available to all, and not restricted in any way. For example, only the more affluent golfer can afford to take in the beauty of the King's Course, Gleneagles, Royal Berkshire and Wentworth.

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