GEOGRAPHICAL INFORMATION SYSTEMS CAN BE GREAT AID TO GOLF COURSE MANAGEMENT

By Mary Purcell

The use of Geographical Information Systems (GIS) on the golf course is not entirely new, but it is the larger, more-affluent courses that appear to be benefiting from it more than their smaller counterparts – simply due to finances.

GIS technology is built upon a broad range of sciences and disciplines, ranging from planning and ecology to image-processing and computer technology.

Satellites, Global Position Systems (GPS), aerial photos and computer imaging are increasingly being used to construct layered maps of landscapes to take into account the whole system – from soils to interlinking habitats and ecosystems to unique areas such as wetlands and buffer zones – to aid course managers and greenkeepers to come up with unique and optimum management systems designed specifically for their own course.

When used to evaluate the importance of all types of habitats and wildlife populations, GIS allows the course to be managed as an overall, interacting unit rather than as isolated patches.

For the technically-minded, GIS is a computer system capable of capturing, storing, analysing, manipulating and displaying geographically-referenced or spatial data. This data can be captured (and displayed) as points, lines (series of co-ordinates) and polygons (area shapes). GIS can display 2D and 3D characteristics.

Integrated GIS/GPS gives the opportunity to collect data in the field and is gaining a lot of interest. Portable GPS and GIS allow for the speedy capture and analysis of data in the field. Capturing data using GPS (hand-held for field work), hand-tracing or manually digitising points, and scanners are other means of data input into a system.

GIS use

The use of GIS is endless. It can investigate:
- Irrigation
- Topography
- Lake volumes
- Slope analysis
- Feasibility studies
- Soil classification mapping
- Design natural or wildlife areas

Some common uses may include the following:

1. Nutrient planning

Remote-sensing techniques can be used to assess turf nitrogen status, allowing nitrogen to be spoon-fed to the turf to provide sufficient quantities without overloading the soil with nitrates.

Historically, agronomic practices such as fertiliser/pesticide application have been made at field level without taking into account spatial variability of soil or turf properties. The adoption of precision management, whereby turf variability is actively managed, optimises chemical applications and reduces environmental contamination.

2. Drainage construction

Drainage can play an important part in maintaining and improving the turfgrass sward. Turfgrass drainage can be a difficult and complex task, relying on many factors including engineering and environmental parameters, drainage theories and knowledge of the turfgrass industry.

GIS can create simulation models of drainage flows, calculating ideal drainage positions. Storm or flood modelling can also be carried out, aiding drainage decisions.

3. Environmental variables can be combined to understand:

- Species distribution
- Climate
- Habitat factors
- Soils

Spatial variations in soil properties, habitat existence, wetland areas and overall geology of a site affects construction of a new course and alteration tasks on existing ones.

4. Water use can vary widely depending on climate, course design and management practices among others.

5. Modelling weed emergence, using historical weather and biological data to create maps for their prediction. GIS models can be created to predict future happenings to help plan management decisions.

6. Habitat selection

Environmental patterns can be studied and correlations between, for example, vegetation and communities, can be described and delineated to capture the requirements of particular species habitats.

7. Wetland and corridor creation

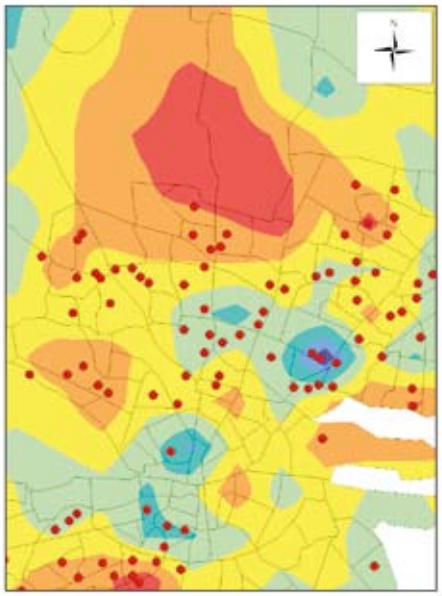
GIS is useful for potential landscape visualisations – testing to see if a potential plan will look natural in the surrounding landscape.

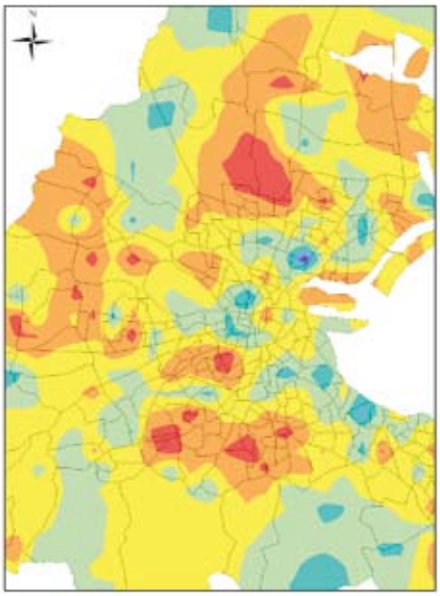
8. Landscape assessment

- Map planning issues – development analysis.
- Aid site selection – water body, woodland areas, etc.

9. Monitoring rainfall and temperatures

Monitoring and documenting climate and micro-climate characteristics can aid course managers and greenkeepers to enhance or alter their management practices and decision-making on a course.





GIS has infinite benefits including:
- Increased efficiency
- Organise day-to-day functioning of course tasks
- Plan new features
- Evaluate the course
- Aid in more precise management over chemicals and irrigation, leading to efficient maintenance costs and environmental benefits.

GIS can be used for producing high-quality maps of vegetation/landcover, habitats, soil types, drainage patterns and so on. These maps can then be used to provide information for course assessment, management and conservation tasks.

GIS software is becoming more user-friendly with the technology becoming quick and effective, allowing for virtual reality models and interactive tools to be created.

Precision management

GIS technologies can offer the potential to reduce costs, optimise resources and outputs on the course. Precision work means there will minimal waste or excess product applications to unwanted areas.

Precision turf management observes, documents, maps and manages golf courses on the smallest reasonable scale to provide optimum performance for the entire golf course environment with the minimum input resources. Characterising and documenting the site in terms of soil type, plants, slopes, out-of-play areas, waterbodies, paths and such like is a major first and useful step in precision management.

Many courses are now using sophisticated geographic information systems to track maintenance resources and bring more precision to their use of resources. Even sensors on mowers can be used for mapping, data collection and diagnostics.

GIS technologies for precision management include:
- Adjustable sprinkler trajectories
- Subsurface irrigation drips
- Tailoring water distribution technologies to suit different microclimates
- Soil moisture measurement tools.

Analysing with GIS

The accuracy of an output to be analysed from a GIS depends on the accuracy or quality of the input data. The ‘tools’ and ‘help’ functions available on most GIS systems provide self-help problem-solving and how to go about optimisating use of the system.

GPS recording is very useful – it gives an overall summary of the site that can be processed into visual, easy-to-interpret maps and statistical analysis. The results can be visually displayed and analysed, allowing increased intreptetion of data.

Progress with GIS

GIS has historically been associated with high-cost software and hardware products, along with difficult usability. But this is changing rapidly. Cheaper, more readily-available products are being introduced quite regularly. Also many clubs are seeing the benefits of this management device and are more willing to spend the money.

Using GIS

Appropriate systems depend on:
- Who is using the technology
- Level of expertise
- Level of experience
- Level of knowledge
- How sophisticated a system is needed
- Finance

It is probably wise to phase-in the use of GIS to a course and start with a simple base map or palette to work from. Having a digital map of the course can prove to be very useful for its optimal management and therefore aid better decision-making. The use of GIS will likely increase in the future in turfgrass management, as a means of having a deeper understanding of the entire course.

And as pressure mounts on turf managers to reduce nutrient inputs, GIS will likely be a huge aid in managing all inputs while maintaining, if not also increasing, the quality of the course. In the future GIS will likely be used to scrutinise every aspect of the course as a means of enhancing its play and feel.

About the author

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