The Impact of Golf Courses on Soil Quality

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Objectives:

1. Study the construction of a golf course in a grassland ecosystem.
2. Quantify indicators of soil quality and follow their change during the construction and establishment of a golf course on a natural grassland site.
3. Changes to soil quality indicators will be described, quantified, and used to predict areas where future golf construction and/or management actions may require special attention to minimize their negative environmental impact.

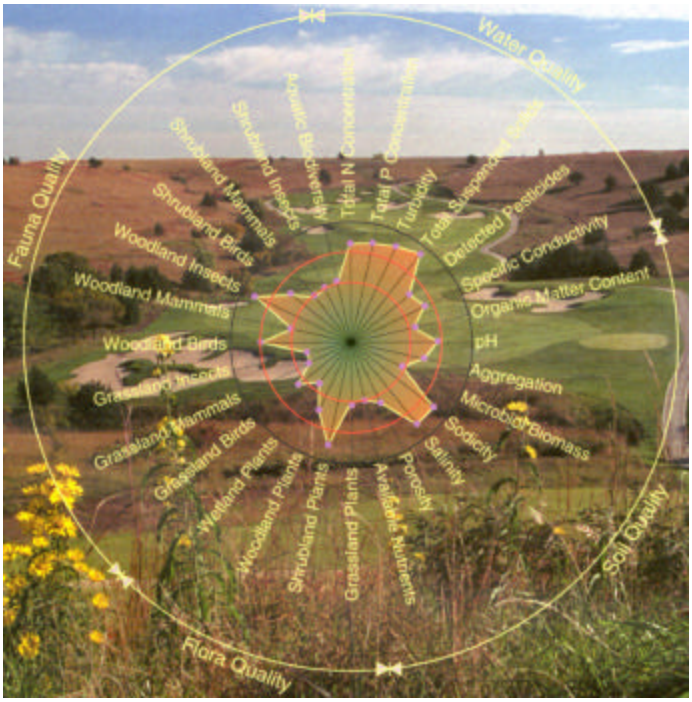
Start Date: 1998
Project Duration: 5 years
Total Funding: $50,000

A method for evaluating environmental quality of large-scale landscapes that bridges scientific research and public use is in great demand. Resource managers, industry and community planners, government policy-makers, and scientists all support an improved environment, but connections between ecological processes, remediation, and management aren't always readily available or understandable. This research seeks a simplified, but science-based, system for making environmental quality assessments and linking outcomes to remedial management strategies.

In Manhattan, Kansas, a grassland ecosystem was selected as the site for Colbert Hills Golf Course. A multi-disciplinary research team studied the area before construction and has continued the study during course construction and operation.

Environmental quality is an assessment of indicators that evaluate essential ecosystem functions. That process has been divided into seven steps that present a conceptual scheme for implementing an environmental quality evaluation and management program.

In this grassland/golf turf ecosystem, soils are assigned critical functions in plant growth, soil tilth, environmental buffering, soil life, and natural cycling functions. Several indicators may be necessary to adequately assess each function, or one indicator may be useful in evaluating several functions. For example, one indicator of carbon cycling might be soil organic matter content.



A spider radar graph used to evaluate multiple environmental indicators (same as Fig. 2 in USGA Green Section Record article).

The key to this step lies in setting appropriate and acceptable target boundaries delineating sustainability and degradation. Control limits can be established with the assistance of research, literature surveys, management experience, model predictions, consultants, regulations, or other sources.

For example, a minimum soil organic matter (SOM) content of 1% might be selected as a lower control limit for some soils based on diminished soil tilth or water holding capacity. Likewise, maintaining organic matter content above 3% may prove economically unfeasible on many soils and so would establish an upper control limit.

Here indices from any number of quality control charts are normalized onto a "spider radar" graph. This format produces an easy-to-understand, visual representation of environmental quality showing whether indicators fall inside or outside their acceptable ranges.

Computerized remediation databanks or websites can offer appropriate management steps for improvement. Long-term monitoring of essential indicators will illustrate how environmental quality responds to natural disruptive events or management programs.

Summary Points

- Identified critical functions of an ecosystem.
- Selected appropriate indicators to evaluate these functions.
- Measured indicator status through sampling and analysis.
- Established acceptable ranges for indicators.
- Transformed multiple indices into environmental quality evaluation graphs.
- Selected appropriate remedial management for degraded indicators.
- Evaluated graphs summarizing which indicators, and hence, which ecosystem functions, lie outside their sustainable limits and are contributing towards the degradation of the ecosystem.