

MANAGING WATER RESOURCES

Water is one of the most precious of our recyclable resources, as well as being a source of natural beauty and recreation. The concept of water as a natural resource, which must be carefully managed, is becoming increasingly important as global needs continue to increase. With global demand for fresh water doubling every 20 years, competition for this resource will continue to increase in future years.

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to learn*



Tim Butler collects water

Yet the amount of water used is not our only concern. Water quality has also become a critical issue in recent years. The spotlight has been turned onto the turfgrass industry in recent times, as course managers and greenkeepers are well aware, with some people saying that turfgrass management may be negatively impacting upon water quality.

For golf courses, water quality is often linked to fertiliser and pesticide usage, and any loss of these chemicals into water systems. So what is it that often makes people think negatively about water and water quality in relation to turfgrass management?

Nutrient concentrations at natural levels are essential to maintain diverse aquatic ecosystems. Nutrients are regularly applied onto intensively-managed turfgrass swards, and some people feel that this may be lost through leachate or run-off and contribute to pollution of water supplies.

This negative image has been particularly given to golf courses, because streams, ponds and lakes often border golf course fairways and greens and public perception may be that there is pollution potential. These water features are an important part of the aesthetic component of golf courses and are often used to increase course challenges. Much of this bad publicity is speculation but as greenkeepers are well aware there has been a lot of pressure placed upon turfgrass managers in recent years over this issue.

SO WHAT EXACTLY ARE THE PUBLIC CONCERNED ABOUT?

Probably one of the main concerns that people express is leaching of applied chemicals through soil profiles in water bodies. Sand-based rootzones have become increasingly popular in golf green construction in recent years. These rootzone types are very beneficial to golf courses because they have good drainage properties and resist compaction. However, it is well publicised that sand-based rootzones have low organic matter content, poor buffering capacity and limited water-holding capacity. This has added to the speculation in relation to turfgrass systems as high-polluters.

A term that I am sure you have all heard of in the past is eutrophication, which is the increase in the nutrient load of a water body over time. Eutrophication can occur in water bodies, such as lakes, estuaries, or slow-moving streams, and can cause the growth of plantonic algae and blue-green algae, which will result in a depletion of available oxygen in the water

and thus fish-kills, as well as loss of ecological diversity and foul smells.

Nutrients can come from many sources, such as fertilisers applied to golf courses, agricultural land, home lawns, erosion of soil and sewage treatment plant discharges.

Fear has also been expressed regarding human health issues resulting from polluted water. Of all nutrients, phosphorus and nitrogen are probably the two most widely talked about in water quality issues. Phosphorus is probably the most limiting element for algal growth, since many blue-green algae are unable to utilise atmospheric N_2 . Trials carried out on nutrient leaching from turf at Michigan State University, in the United States, showed that:

- sandy soils are more prone to leaching losses than clay soils
- nitrogen losses can be reduced by applying nitrogen in smaller amounts on a more frequent basis
- in putting green construction, mixing peat moss with sand significantly reduced nitrogen leaching compared to pure sand rootzones during the year of establishment

It is known that large applications of N, particularly from soluble sources, may be leached through golf greens by heavy rains or irrigation before the nitrogen can be taken up or fixed. For the protection of human health, the National Surface Water and Drinking Regulations and the European Union require that nitrate concentrations in raw water intended for human consumption and in drinking water must not exceed 50 mg/L NO_3 (or 11.3 mg/L expressed as nitrogen). Concentrations of phosphorus in most soil solutions should not lead to environmental problems. However, some sandy soils require special precautions to avoid pollution because of low phosphate buffering properties and extensive use of irrigation.

SURFACE RUN-OFF

The water available for surface run-off is the portion of the precipitation which is not lost via evapotranspiration and does not penetrate the surface soil to infiltrate into groundwater. Several factors affect surface-loss of nutrients and pesticides including: (i) amount of precipitation; (ii) soil moisture content previous to rainfall; (iii) time of chemical application; and (iv) fertiliser type applied. Trials carried out by Shuman (2002) showed that: (i) the first rain event after a fertiliser application will produce the great majority of the transport by run-off water both of phosphate and of whatever form of nitrogen was applied; and (ii) the quantity of nitrogen and phosphate transported from turf is linearly related to the rate of application.

Having said all this, I feel that turfgrass facilities, be they golf courses, sports pitches or parks, are vital to protecting fresh water resources. Turfgrass areas are green belts that, particularly in built-up areas, in a sense offer safe environments for many forms of wildlife. Numerous golf courses have strategies in place to protect water quality while consequently maintaining top-class playing surfaces.

By Tim Butler

The general public can forget that turfgrass managers often strive to protect water resources. This is clearly evident with the decline in the amount of nutrients applied to many turfgrass areas in recent years.

Coupled with this there has been a drive to finding ways to reduce required nutrient inputs. Turfgrass and soil scientists have come up with novel nutrient management approaches such as the use of live bacteria and fungi in nutritional programmes, which are claimed to increase nutrient uptake. Turfgrass varieties with pest resistance and tolerance to stress are often used. Integrated pest management through the use of natural predatory insects has become on many golf courses common practice. Some courses have created buffer strips using plants such as reeds along water ways in order to trap sediment and act as natural filters. It is easy for people to forget other management practices that have been implemented by the turfgrass community.

As a PhD student at Michigan State University, I have had the privilege of seeing first-hand some of the strategies that are being implemented in the United States by golf courses in the fight to ensure that they protect the environment by reducing mains and well-water usage. I have visited many courses in the state of Michigan with my supervisor at Michigan State



Filter on wetland

University, Professor Kevin Frank, and have seen how numerous golf courses are actually collecting water run-off from the parking lots and roads in many towns and cities, water which would otherwise end up in sewage treatment plants at an additional expense. The collected water is channelled into very large settling ponds on the golf courses, which can hold millions of gallons of water and are directly linked to large ponds or lakes which the golf courses use for irrigation water.

In fact, I am at present helping Professor Frank to carry out research on measuring the quality of the water in collection ponds on various golf courses throughout the state of Michigan. The goal of the research is to study if the water contains any pollutants from the parking lots, etc, which may negatively impact upon the turfgrass performance.

In Michigan, the weather is normally around 35°C during the summer months, yet many golf courses are able to store enough water during the winter and spring so that well and mains water may not be required up to and including August, with the saving of millions of gallons of water and thousands of dollars in water bills.

I am sure that there may be some people thinking that the water requirements in the UK and Ireland would be much less than, for instance, in Michigan. However, it is very important to remember that as the world population increases, and thus demand increases, more scrutiny on water usage by turfgrass systems will occur.

The turfgrass industry has had its fair share of bad publicity regarding water pollution, yet I believe that properly-managed turfgrass systems are a very important component in the constant struggle to maintain clean, non-polluted water supplies in the future. In fact, research indicates that when fertilisers and pesticides are properly used, the chances for movement of these chemicals into water sources from turfgrass systems is minimal. Many turfgrass managers are doing excellent jobs in preventing pollution of water bodies under their management. However, in my opinion, water usage and regulation will become a critical component in turfgrass management in the years to come.

Tim Butler is carrying out research in the area of turfgrass nutrition for a doctorate degree at both University College Dublin, Ireland, and Michigan State University, USA.



Lake on golf green

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