

CLIMATE CHANGE ...A CLOSER LOOK

Climate change is happening and humans are contributing to it.

How can greenkeepers become more environmentally friendly but still have the resources to be prepared for the freak weather conditions they are facing more and more frequently?

Land degradation and desertification is itself a contributor to climate change, responsible for about 30% of the world's greenhouse gas releases, as well as alterations in the water, temperature and energy balance of the planet.

In the press...

AS THE DROUGHT BITES, GOLF CLUBS TOLD: LET THE GREENS GO BROWN

The Independent 10/07/06

Greens are to become browner in a drive to make golf kinder to the environment. In a revolutionary move, the rulers of golf are telling courses around the world to become more environmentally friendly, in order to head off criticism and cope with global warming.

HOT SUMMERS DRY UP YOUR MONEY

Telegraph 17/10/06

Water shortages will cost British home owners and businesses billions of pounds a year as climate change causes summer temperatures to soar, a leading financial expert has warned.

WORST OF DROUGHT IS OVER?

Surrey & Berkshire Newspapers Ltd 23/06/06

The first glimmer of hope that the worst effects of the summer drought could be over came this week with the news that some local sports clubs are being allowed to turn their sprinklers back on.

SPORTS CLUBS CAN JUMP FOR JOY AS WATERING BAN EASED

SurreyOnline 7/06/06

Sports clubs in Dorking and Leatherhead are allowed to water pitches and greens, thanks to restrictions on them being eased.

DROUGHT ORDER TERMINATED

Enfield Independent 13/11/06

The drought order imposed by Sutton and East Surrey Water Company will cease to be valid from November 15 but the hosepipe ban will remain in place.

A spokesman for the Environment Agency said: "We do not know whether we are going to have another dry winter and the boreholes are still very, very depleted."

WATER COMPANIES LIFT HOSEPIPE BAN

BBC News 18/01/07

Four water firms in the south east of England are lifting their hosepipe bans after months of above average rainfall. Thames Water, Southern Water, Three Valleys Water and Sutton and East Surrey Water have lifted the ban, which affected more than 1.3m customers.

ENVIRONMENT AGENCY

02/01/08

The Environment Agency's flood experts are working across the region inspecting flood banks and defences to make sure they are ready for the winter months.

COPING WITH A TOUGH SPRING

The Independent 23/04/08

It has been a very difficult spring for grass growth. Rainfall was well above normal in March and the first weeks of April. With day temperatures below normal and night frost last week, grass growth hardly stirred.

SPAIN SUFFERS WORST DROUGHT

CNN 21/04/08

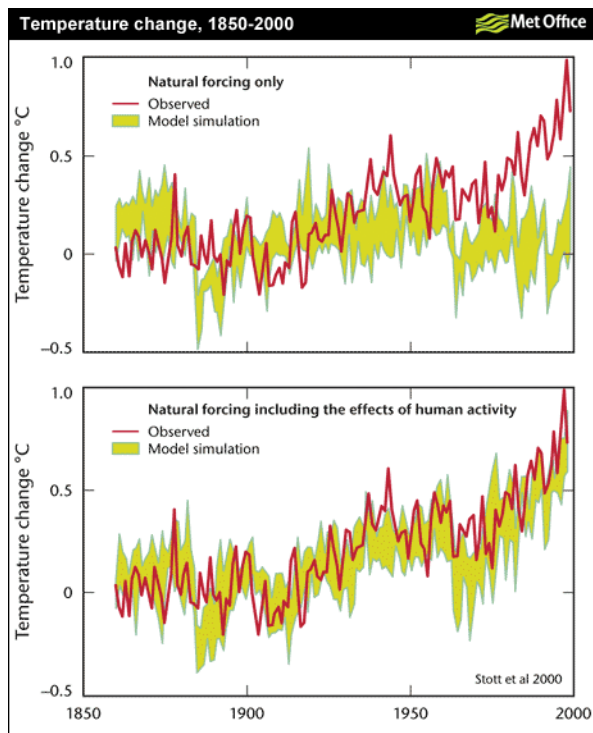
Madrid, Spain (CNN) - Spain is reeling from its most severe drought in 70 years with the nation's reservoirs on average just half full, the Environment Ministry reports. Rainfall has been less than half of what's considered normal for the last six months...

PARK THE MOWER AND PLANT A PALM

The Sunday Times 04/05/08

The Met Office is to warn gardeners to plan for a warmer climate by cultivating drought-tolerant plants such as palms, olives and Mediterranean herbs to resign themselves to the death of the traditional lawn. It believes this year will be one of the hottest on record.

CLIMATE CHANGE: THE FACTS



Crown copyright Source: MET Office

The MET Office explain...

Temperatures provide the clearest evidence that the climate is changing and globally the average temperature has risen by more than 0.7 °C over the last 100 years.

The natural greenhouse gas effect keeps Earth much warmer than it would otherwise be, without it Earth would be extremely cold. Greenhouse gases such as carbon dioxide, methane and water vapour behave like a blanket around Earth. These gases allow the Sun's rays to reach Earth's surface but impede the heat they create from escaping back into space.

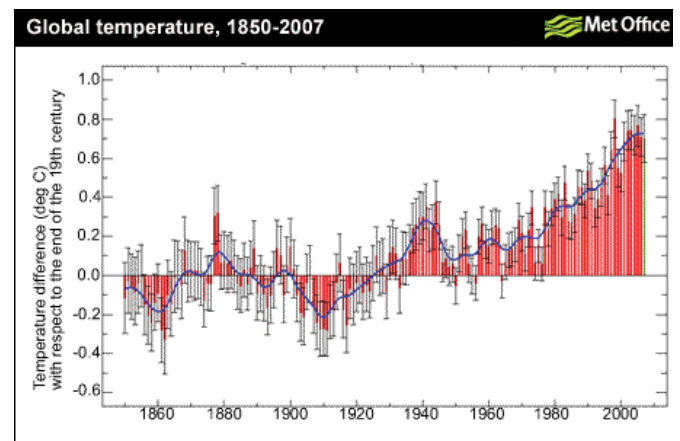
Any increases in the levels of greenhouse gases in the atmosphere mean that more heat is trapped and global temperatures increase - an effect known as 'global warming'.

There is indisputable evidence that this observed global warming is predominantly caused by increases in greenhouse gas concentrations. Concentrations of CO₂, created largely by the burning of fossil fuels, are now much higher, and increasing at a much faster rate, than at any time in the last 600,000 years. Because CO₂ is a greenhouse gas, the increased concentrations have contributed to the recent warming and probably most of the warming over the last 50 years.

TEMPERATURES ARE CONTINUING TO RISE...

The rise in global surface temperature has averaged more than 0.15 °C per decade since the mid-1970s. Warming has been unprecedented in at least the last 50 years, and the 17 warmest years have all occurred in the last 20 years. This does not mean that next year will necessarily be warmer than last year, but the long-term trend is for rising temperatures.

A simple mathematical calculation of the temperature change over the latest decade (1998-2007) alone shows a continued warming of 0.1 °C per decade. The warming trend can be seen in the graph of observed global temperatures. The red bars show the global annual surface temperature, which exhibit year-to-year variability. The blue line clearly shows the upward trend, far greater than the uncertainties, which are shown as thin black bars. The recent slight slowing of the warming is due to a shift towards more-frequent La Niña conditions in the Pacific since 1998. These bring cool water up from the depths of the Pacific Ocean, cooling global temperatures.



Crown copyright Source: MET Office

THE CURRENT CLIMATE CHANGE IS NOT JUST PART OF A NATURAL CYCLE...

Earth's climate is complex and influenced by many things, particularly changes in its orbit, volcanic eruptions, and changes in the energy emitted from the Sun. It is well known that the world has experienced warm or cold periods in the past without any interference from humans. The ice ages are good examples of global changes to the climate, and warm periods have seen grapes grown across much of Britain.

Over the several hundred thousand years covered by the ice core record, the temperature changes were primarily driven by changes in the Earth's orbit around the Sun. Over this period, changes in temperature did drive changes in carbon dioxide (CO₂). Since the Industrial Revolution (over the last 100 years), CO₂ concentrations have increased by 30% due because to human-induced emissions from fossil fuels.

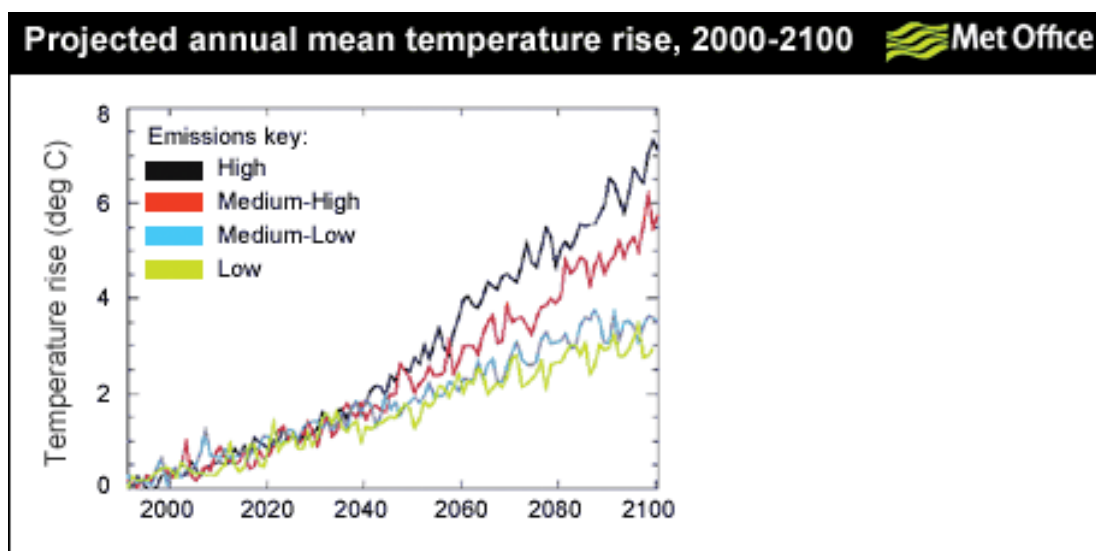
The bottom line is that temperature and CO₂ concentrations are linked. In recent ice ages, natural changes in the climate, such as those due to orbit changes, led to cooling of the climate system. This caused a fall in CO₂ concentrations which weakened the greenhouse effect and amplified the cooling. Now the link between temperature and CO₂ is working in

the opposite direction. Human-induced increases in CO₂ are driving the greenhouse effect and amplifying the recent warming.

If we continue emitting greenhouse gases this warming will continue and delaying action will make the problem more difficult to fix.

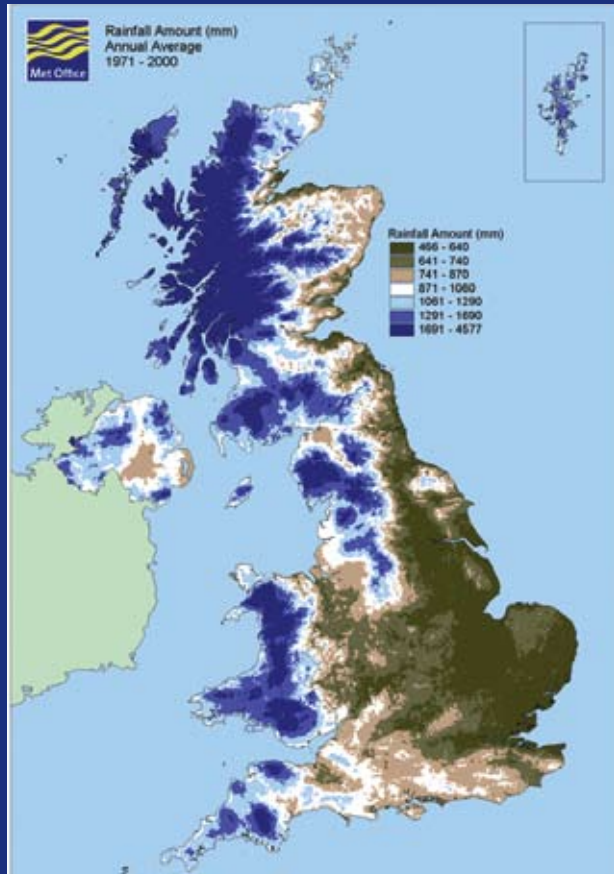
The global average temperature will increase by 2 to 3 °C this century – according to one of the Intergovernmental Panel on Climate Change's (IPCC) mid-range estimates (blue line on the graph below). This rise in temperature means that the Earth will experience a greater climate change than it has for at least 10,000 years and it would be difficult for many people and ecosystems to adapt to this rapid change.

These temperature increases are likely to result in an increased frequency and severity of weather events such as heatwaves, storms and flooding. Rising levels of greenhouse gases in the atmosphere could set in motion large-scale changes in Earth's natural systems. Some of these could be irreversible – the melting of large ice sheets will result in major consequences for low-lying areas throughout the world.



Crown copyright Source: MET Office

WETTEST AND DRIEST



The wettest and driest places in the world are generally regarded as:

Highest average annual total: 11680 mm (460 inches) at Mount Wai-ale-ale, Hawaii
Highest in one year: 26461 mm (1042 inches) at Cherrapunji, India from 1 August 1860 to 31 July 1861
Highest in one calendar month: 9300 mm (366 inches) at Cherrapunji, India in July 1861
Highest in 24 hours: 1825 mm (72 inches) at Fac Fac, La Reunion Island, Indian Ocean
Highest in 12 hours: 1350 mm (53 inches) at Belouve, La Reunion Island, Indian Ocean
Driest place: for the period between 1964 and 2001, the average annual rainfall at the meteorological station in Quillagua, in the Atacama Desert, Chile, was just 0.5 mm

Crown copyright Source: MET Office



Orpington Pond, Kent, 2006
Copyright Environment Agency



Bewl Reservoir, 2006
Copyright Environment Agency

WHAT THE R&A SAY – BE PREPARED FOR CHANGE

By Steve Isaac, Director – Golf Course Management, The R&A



The R&A promotes greater sustainability in the way we develop and maintain our golf courses. One of the key elements toward achieving this aim is the ability to be able to adapt to changing circumstances and climate change is, probably, one of the greatest challenges facing the game around the world. In the UK, we are unlikely to witness the most severe extremes that climate change may bring about elsewhere, e.g. the desertification of southern Europe, but the predictions suggest that we will witness warmer and drier summers, wetter and milder winters and more storms. What strategy can courses in the UK adopt to try and counter these effects?

One of the best means of combating any form of turf stress, and wildly fluctuating weather patterns certainly produce this, is to promote healthy turf. This means working on the growing environment to produce dry, firm surfaces with ample access to light and air movement. Links tend to benefit from nature's gifts in this regard and the short DVD, "Come rain, come shine", which is available to view at www.bestcourseforgolf.org, demonstrates how

perfecting firm surfaces which drain well helped present courses fit for an Open Championship despite the opposite extremes of weather witnessed at Hoylake in 2006 and Carnoustie in 2007. Improving drainage to create drier turf is feasible in most situations, through construction and maintenance techniques. This will require greater investment for some than for others but the very survival of courses which do not currently perform well in wetter weather may depend on positive action in this regard. Drier courses mean more play and less damage from traffic, bringing in greater revenue. Drier turf generally means better turf, in terms of its health, resistance to disease, and species composition. The type of turf you can develop to drier surfaces will not only survive wet periods in good order but will also tolerate drier conditions without recourse to heavy irrigation, and water scarcity and cost could well impact on your ability to irrigate in future heatwaves. Courses may have to be more inventive when it comes to dealing with Biblical-scale rains, looking to architectural changes to susceptible parts of the course to provide water holding ditches and ponds and utilising the spoil to raise in-play areas, this water circulation process providing a valuable source for irrigation in drier times as can storm water collection. Case studies on water management systems are available on the R&A website.

The R&A is developing systems that will help course managers to monitor, predict and proactively address the challenges that lie ahead:

- The benchmarking service at bestcourseforgolf.org which helps the course manager assess the impact of changing weather on the course and the effect maintenance has on dealing with problems, in terms of turf quality, playing quality and cost. This service is available now, free of charge, to courses registered to the site. It can be used as part of a risk assessment analysis, protecting the course and its management against the changing climate and regulations whose impact will be climate-related, e.g. water and pesticides
- Tools to objectively measure sward composition and playing quality so that you can monitor performance and adjust maintenance procedures to ensure that the playing experience is the best it can be, whatever the weather

No-one can guarantee what weather we are going to experience in 20, 50 or 100 years time. The best predictions suggest that we will see much greater extremes of heat, drought and rainfall at various times of the year, and we are already witnessing more unpredictable weather. Prepare for change and you will be in a better position to present the golf course well, sustaining your business in a more environmentally sound way and, thereby, securing the future of the game for generations to come.

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SAVING THE ENVIRONMENT ...REDUCING YOUR CLUB'S CARBON FOOTPRINT

By Melissa Jones

Robert Nutt and his brother John, are proprietors of The Oaks Golf Club and Spa in Aughton, near York. Nearly 12 years old, the club opened its doors to the golfing community in June 1996. Four years ago when they unveiled The Spa at The Oaks, this opened up another market for them – one that they wanted to run as environmentally friendly and cost effectively as they could.

Within two to three years the club hope to be fully self-sufficient, but in the meantime they're not far off the mark and their efforts are helping to reduce the clubs carbon footprint.

Electricity is generated at the club and spa during peak usage - from 8am until 9.15pm then automatically reverts back to mains electric during the evening. "A lot of golf and country clubs put in place energy saving measures but compromise the experience that they are giving their customers, for instance by reducing the hours the saunas and steam rooms operate. We took the decision to be as cost effective and environmentally friendly as we could without compromising



the members' experience which has come about by reducing energy costs," said Robert.

The partners also had to consider the amount of power cuts that the area suffers from. "Consequently we were going to have to look at setting up a back-up generation system anyway. We have people travelling from miles away for golf and pamper days and we couldn't have the power cutting out. In the past we have had to close the premises and give everyone their money back, hopefully this situation has now been overcome," explained Robert.

FUEL...

The brothers, who also farm in Aughton, took the decision just over year ago to generate electricity by using rapeseed oil derived from homegrown rapeseed and the heating on wood chips sourced locally.

"Because farming has been very depressed up until late last summer, we had around 300 acres of land available on the farm to produce rapeseed.



It seemed mad buying fuel for the golf club when we had our own potential source. We've always grown rape and that seed offered us the oil. The seed itself is about 40-45% oil and you are able to create electricity by running a diesel engine generator on the oil crushed out of rapeseed," enthused Robert.

The partners had planned to then burn the oil and use the meal that was created as their heat source for the bio-mass boiler. However, as the system was being set up and the necessary equipment being installed, the price of oil seed rape went through the roof. Prices had started to rise last August but by November their increase in cost proved for it to not be financially viable for club to burn the meal as it's still of a very high feed value for feeding livestock. It had out priced itself of burning.

Not one for giving up, Robert explained: "We then had a look around and actually sourced some reclaimed woodchip to feed into the boiler."

The Nutt's plan to plant Willow on their farm as soon as weather conditions allow: "It may take two to three years before we get a viable yield to start supplying our own wood. Once we are able to use the Willow, in effect we will be totally self-sufficient with fuel – oil for electric and wood for heat," gleamed Robert.

COST...

The system cost approximately £150,000 to set up and the club is looking at, and on target for, a three year payback - depending on how much fuel costs rise the payback could come around even sooner.

As The Oaks uses a generator consisting of a diesel engine converted to run on 100% rapeseed oil, the brothers are able to claim credits back from Ofgem, regulators of the electricity and gas markets in Great Britain, for producing carbon-free energy.

"It's quite a complex procedure. Carbon credits have a value of £50 per megawatt, which for us amounts to an extra £50 a day payback," explained Robert.

"On the heating side, last year our heating cost amounted to £32,000 for kerosine (32p a litre), this cost would have risen to in the region of £50,000

this year taking in to consideration the rise in the price of kerosine. In comparison to this the cost of the woodchip we have used to heat the club this year will have amounted to less than £10,000."

Of course once the one off cost has been repaid and the willow planted to generate wood chippings, the full benefit will be realised, "I think it will take around 10 hectares to become self-sufficient - costing £1000 a hectare. Because willows re-generate that is a one off cost. We just have to be patient for those couple of years getting going and maintain our current supply of woodchip from the open market," Robert explained.

ENVIRONMENTAL ISSUES...

It's not just off the course that Robert and John have taken extra measures to enhance the clubs contribution to the saving the environment.

"We've planted a further 35 acres of trees on top of what was already on the land the course was built upon. With the variation in habitat from younger trees, to mature trees to gorse etc, we've actually improved and maintained various habitats' which was actually a major interest of ours anyway. There's a more diverse habitat and species down here than there ever was when it was farmed.

"You do actually read, and there's a lobby against golf clubs, that golf courses cause problems for habitats but that's not the case here and I'm sure that's not the case in many places – we've actually enhanced and diversified habitats," enthuse Robert.

The last piece of the puzzle for The Oaks is addressing their water issues. "We have a borehole for the spray irrigation on the greens and this is currently been looked at for its suitability for supplying the drinking and showering water," commented Robert.

A considerable amount of time was necessary to fully research the systems available and their viability, this now seems to be paying off. The philosophy of The Oaks is to provide first class facilities that are competitively priced for the members to enjoy. Leaving the members committees to plan and organise their golf competitions while the proprietors take responsibility for strategy and the day-to-day running which obviously include all environmental aspects.



WHAT AN INDEPENDENT CONSULTANT SAYS...

Alan Hopkins BSc, MPhil, CEnv, MIEEM works as an Independent Consultant, specialising in grassland and related areas of agriculture and amenity land use, prior to this he worked for the Institute of Grassland and Environmental Research for 30 years.

Melissa Jones asked Alan how he felt climate change would affect our greens...

"I guess the specific issues of climate change (in terms of 2020s/ 2050s MH scenarios*) are that the length of growing season is favoured by warmer conditions in spring and autumn, plus some CO2 forcing, (exactly as for agricultural grassland) which golf greenkeepers might find encouraging. But more frequent and intense summer dry periods could have greater consequences on greens where there is shallow rooting, especially where sprinklers are used, exacerbated by frequent cutting and any surface fertiliser dressings. There must also be a question over availability of irrigation water in the future in many parts of the UK, not just cost but availability."

How can we plan for the future?

"If I were planning golf course management for the future I would be focusing on anything that improved soil structure, including building up soil organic matter thus improving soil available water capacity. This requires an improved soil fauna so greenkeepers will have to learn to love earthworms and deal with worm casts if they get in the way of play. I would also suggest installing



rainwater holding systems (think about how much winter rain lands on a golf clubhouse roof).

"Longer term, and where frosts are less likely we could be looking at alternative species like paspalum or bermuda grass (plenty of overseas experience to draw on). A number of weeds are able to thrive under the conditions where swards get damaged by drought (flat weeds and anything with tap roots) and timing of any spot spraying is critical to avoid damage to a short turf. I think there could be some grass disease issues especially in warm damp autumns, so grass varieties that are less susceptible and the insurance value of complex mixtures are considerations. There is also the question of more frequent windy weather: planting wind breaks is cheap but they may take 20 years to mature."

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* The UKCIP website gives numerous reports on climate change and they mostly use future scenarios rather than predictions, as used by climate change scientists. These are based on timescales and CO2 emissions levels (low, medium, medium-high, high etc for the 2020s, 2050s, 2080s) and the impacts of climate change associated with such emissions over that time scale. A medium-high emission scenario is assuming no great reduction in CO2 emission, and 2020s-2050s is the medium term and within most peoples' life expectancy.



DISEASE PRESSURE HOTS UP



Turf diseases are attacking more aggressively and for longer in warmer conditions – with some new diseases rarely seen in the UK now causing damage. Turf managers need advance warning of new risks, and to be ready to take action, advises Syngenta Technical Manager, Simon Barnaby.

With temperatures rising year on year and a marked reduction in seasonal variation, a series of unusual diseases have been appearing on fine turf areas up and down the country over recent years, creating new challenges for turf managers. Disease pathologists agree that many of the incidences are a consequence of changes in prevailing environmental conditions that are more conducive to the diseases.

Autumn and spring are typically severely truncated; we seem to go from winter straight into summer. Furthermore, the rain events tend to be more intense but of shorter duration. All of which can lead to greater levels of disease and put turf under stress that makes it slower to recover.

There are also increasing reports that turf grass diseases are getting more aggressive. Fusarium Patch seems to have been particularly severe in the late autumn early winter period over the last few years. Brown Patch has begun to appear with increasing regularity. Dollar Spot, which was an isolated problem on some courses in the south west, can now be found on fine turf across the country. The risk from Take-All, which was always a mid-summer problem, can occur from May to October.

Better Prepared

Looking back at the historical disease records on the GreenCast website – www.greencast.co.uk – highlights the intensity and frequency of localised disease pressure now encountered on golf courses across the country. Armed with this information, coupled with the website's up-to-date local disease forecasts for the coming five days, turf managers can be better prepared to tackle disease more effectively.

With the greater severity of turf disease attacks, prevention is more important than ever. Independent STRI trials have proven that using the GreenCast decision support system to optimise the timing of Heritage



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