AFGOLF
ASSOCIATION FRANCOPHONE BELGE DE GOLF

ROYAL BELGIAN GOLF FEDERATION

Golf Vlaanderen

GOLF 2030 Belgium

BUILDING TOGETHER A SUSTAINABLE FUTURE !

R&A

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GOLF2030

Golf Course 2030 is an R&A led initiative looking to mitigate the impact of climate change, resource constraints and regulation on golf course condition and playability. This objective will be achieved by finding practical, workable solutions to address these serious challenges through a programme of research, education and communications.

An industry roadmap addressing challenges from, and taking opportunities presented by, the changing climate, resource constraints and regulation to secure optimal golf course condition and playability for current and future generations.

INTRODUCTION

GOLF COURSE 2030 was initiated by The R&A in 2018. The R&A governs the sport of golf worldwide, outside of the USA and Mexico, on behalf of over 36 million golfers in 143 countries and with the consent of 156 organisations from amateur and professional golf. The R&A is committed to investing in developing golf and supports the growth of the sport internationally, including the development and management of sustainable golf facilities. The R&A continues to lead the Golf Course 2030 initiative, supporting stakeholders to develop the initiative in their own country or region and investing in research, education and other activities to prepare the sport for what may be challenging times ahead.

The main objective of GOLF COURSE 2030 is for industry stakeholders to agree on a roadmap that secures optimal golf course condition and playability for current and future generations by addressing challenges from, and taking opportunities presented by, the changing climate, resource constraints and regulation. The roadmap needs to meet strategic needs at regional, national and local level, and the operational needs at golf facility level.

The remit for GOLF COURSE 2030 is the condition and playability of the main in-play areas on the golf course, from tee to green, including fairways, bunkers, green approaches and surrounds, and the primary rough. However, the roadmap will also need to highlight any impact of outcomes on biodiversity, the local community and the multi-functional capacity of the green space.

GOLF COURSE 2030 seeks to bring the golf industry together to clearly identify the challenges and opportunities facing those developing, designing, building and managing golf courses with regards to the changing climate, increasing resource constraints, and the regulations agenda.

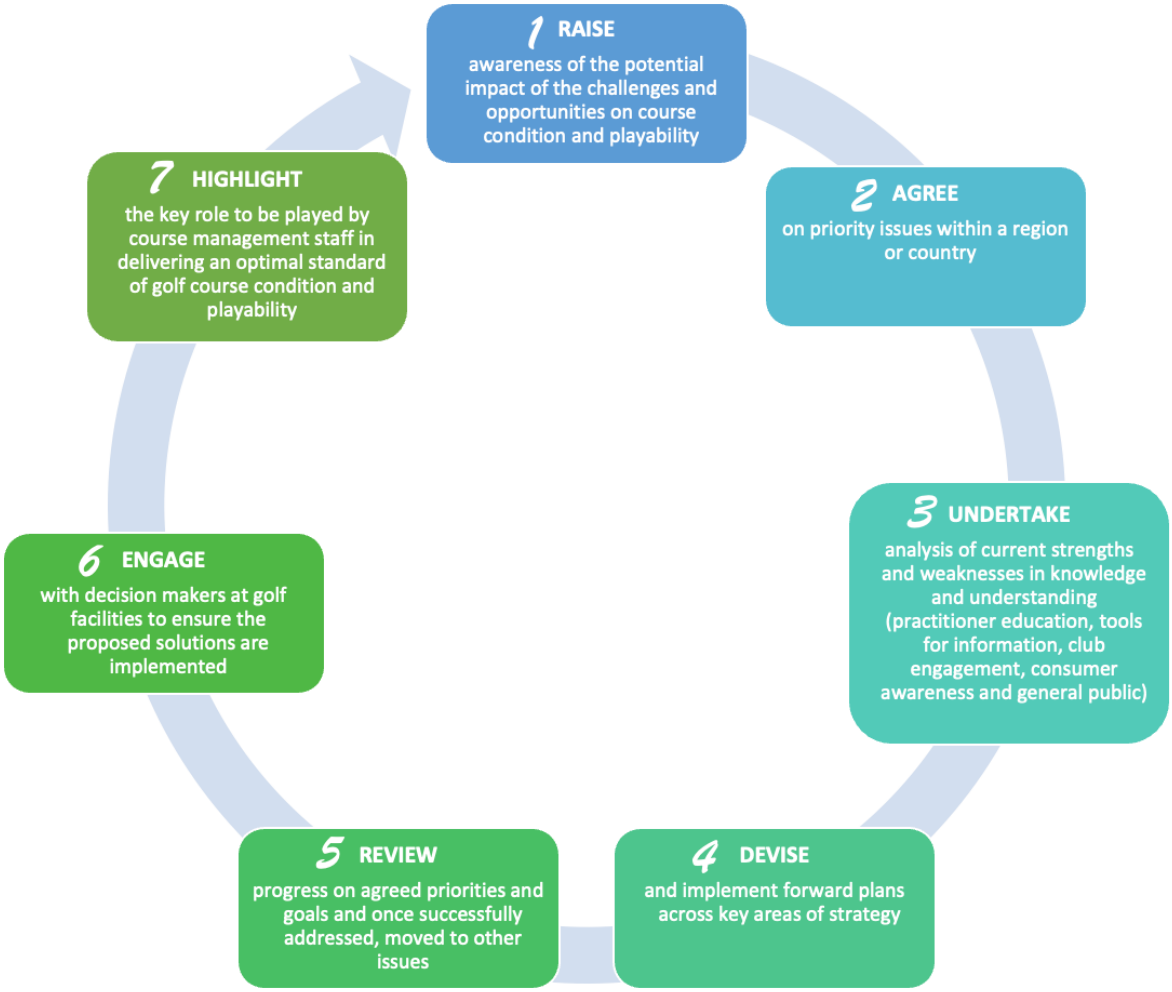
GOLF COURSE 2030 centres on a range of realistic scenarios, from business as usual to, effectively, a doomsday prediction of disruption from extreme weather, water scarcity, high resource costs and limited chemical availability. In this challenging environment it is impossible to see how we can maintain the playing conditions we enjoy today without technological breakthroughs, and changes in attitudes and behaviours amongst many of the sport's stakeholders, including golf club owners, golfers, managers and greenstaff.

OBJECTIVES

In this way, GOLF COURSE 2030 will build upon and guide the future development of existing industry solutions and association initiatives, including those that:

- Disseminate engaging messages & raise awareness
- Engage and support clubs through the provision of best practices, analytical tools, golfer engagement materials and recording of key performance data
- Enable credible reporting of evidence of industry best practice and industry progress
- Facilitate knowledge sharing
- Recognise credible leadership activity in course management

The process for achieving the objective golf course 2030 will bring stakeholders together to:



OPTIMAL COURSE CONDITIONS AND PLAYABILITY

Optimal course condition and playability is a subjective and variable term. It reflects the potential for any golf course to provide year-round access to firm playing surfaces which are fit for purpose. The potential of any course will be limited by many factors. Optimal condition and playability could be considered as:

Optimal course condition and playability = Potential x [Site conditions + Design + Construction + Resources (machinery, manpower, materials) + Quality of Decision-Makers/Management + Weather + Golf Objective + Amount of golf/maintenance traffic + Revenue + Regulation]

The Golf Objective in this equation reflects the target market of the course and this can range from Championship standard (challenging), through Recreational standard (appealing to all golf handicaps), to Beginner standard (introductory level to the sport, with limited challenge), or any combination of these standards.

Optimal performance delivers the potential of a course for as much of the year as possible and as consistently as possible. The optimal performance in terms of the condition and playability of any golf course will vary through fluctuations of the limiting factors, e.g. seasonal weather. Different types of courses will be more or less prone to some of the fluctuations, e.g. thanks to their natural drainage qualities, links will tend to retain greater consistency in terms of optimal performance than will parkland through periods of wetter weather.

GOLF COURSE 2030 STAKEHOLDERS

The Belgian golf sector stakeholders to be engaged in the Golf Course 2030 process can be divided into 'core' and 'supporting' groups :

CORE STAKEHOLDERS:

National Governing bodies
Regional Governing bodies

Royal Belgian Golf Federation (RBGF)
Association Francophone belge de Golf (AFGOLF) – French speaking golf association for Wallonia
Golf Vlaanderen – Dutch speaking association for the Flanders

The R&A
Geo foundation

Greenkeepers Association of Belgium (GAB)
FEGGA (Federation of European Golf Greenkeepers Association)

Golf club owners/ directors/ managers/ presidents of associations

European Golf Association

Professional Golfers' Association of Belgium (PGA)

SUPPORTING STAKEHOLDERS:

Agronomist and consultants
Golf architects
Golf industry suppliers
Golf medias
Universities and public institutions partners involved in R&D projects

The initiative also needs to engage with external stakeholders, such as other sports (including the Olympic movement), Government, national and international NGOs, the general public and non-golf media.

MAIN DRIVERS OF CHANGE

There are considered to be three main drivers impacting on our ability to secure optimal golf course condition and playability for current and future generations; climate, resources and regulation. Golf Course 2030 must assess how the impacts of climate change, availability of resources and increasing depth of regulation will affect day-to-day operations at the golf facility.

CLIMATE

Changes in the climate and more climatic extremes cause problems for course managers. Turf does best in an environment with limited variability, and changes in weather patterns will result in the need for course management to adjust to such circumstances.

Climate predictions for Belgium suggest that there will be changes to our weather patterns, more specifically:

- ***Annual rainfall on the rise***

The total volume of annual rainfall is expected to increase over time and differences will be mostly felt at the seasonal level. From a temperate climate characterised with relatively uniform rainfall volume throughout the year, winters are expected to become significantly wetter and, on average, no or only a slight drop of total volume of rainfall is expected over the summer season.

- ***Hotter and drier summer***

Increase in the number of hotter and drier summers with new record high temperature and a reduction in rainfall volume by up to 30%. As such, having a sustainable source of water for irrigation to will become increasingly important to allow golf to increase their resilience against seasonal droughts.

- ***Milder and wetter winter***

This will bring two main side effects. On one hand, increase in winter precipitation will lead to a rise in river flows, which, in turn, increase the risk of flooding and other associated turf management problems occuring under extreme wet conditions. On the other hand, milder winters will drive longer growing season leading to changes the rhythm of diseases, pest and weed incidence.

- ***More extreme weather events***

An increase in the frequency and intensity of extreme weather events, such as torrential extreme rainfall has already been observed and their frequency is only expected to rise

further. These, in turn, augment the risk of related incidents such as floods, soil erosion, water damages and disrupt the smooth management of golf facilities.

Not only the frequency of storm rainfall is expected to rise, their intensity also increases. Since 1981, there has been a significant average increase of +2 % per decade in the contribution of extreme rainfall (defined as more than 20 mm falling over a 24-hour period) as shown on figure 1.

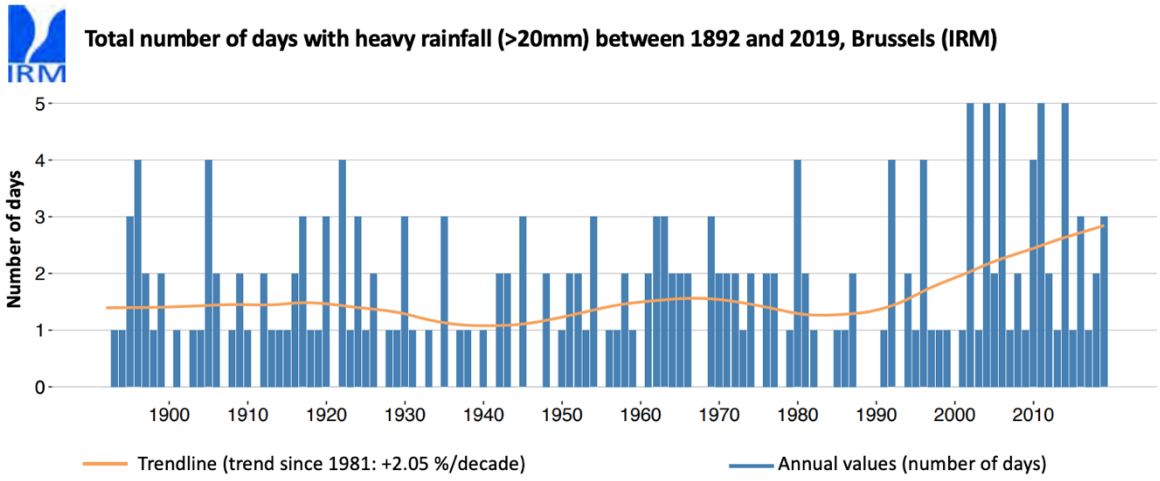


Figure 1

In addition, while hourly rainfall extremes have been stable for the last 150 years, since 1981, an increase in the hourly intensities of rainfall has become notable with an average increase of +3 mm per decade.

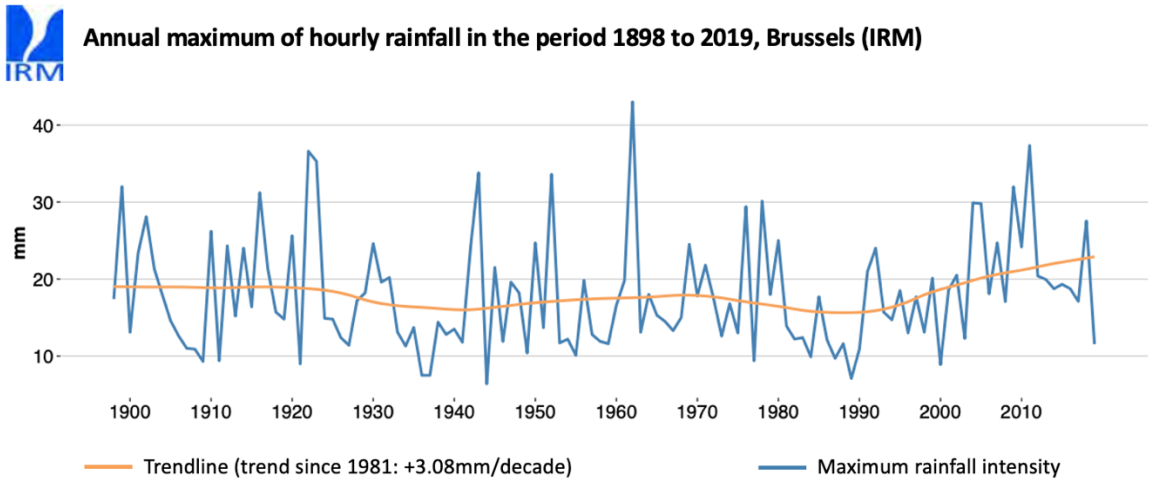


Figure 2

- ***Rising temperature, increasing sunlight causing higher evaporation rates and seasonal droughts***

An increase in average temperatures and sunlight exposure combined with low humidity levels during the spring and summer seasons have led to higher evaporation rates and brought conditions favouring seasonal droughts.

Since 1981, we observe nationally an average warming of the temperature by 0.38°C per decade alongside an increasing number of 'summer days' (days with temperature reaching 25 °C or more) and significant increase in the extreme high temperatures.

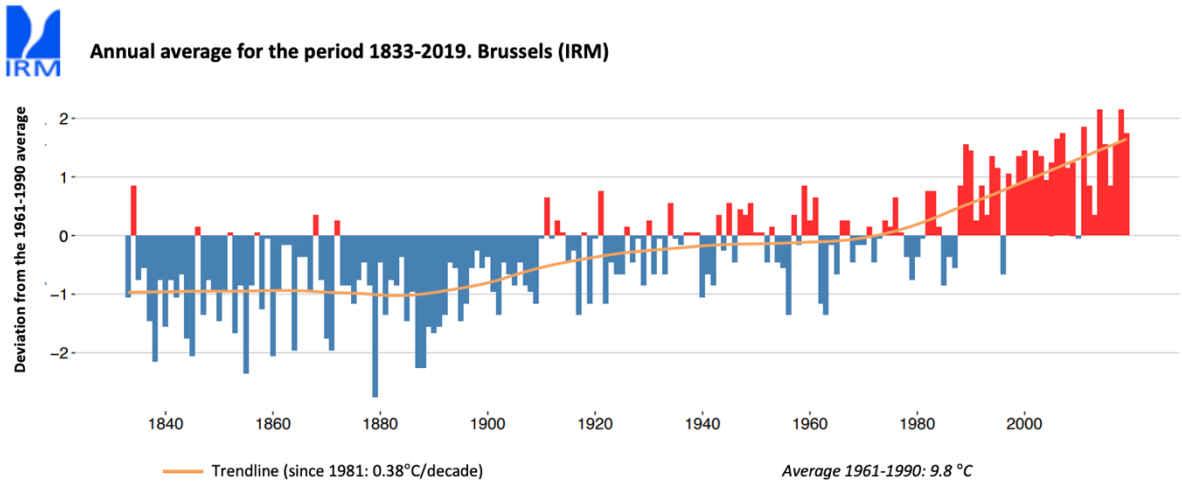


Figure 3

The rising trend of maximum annual temperature can be seen on figure 4 with a new record temperature reached in 2019 as the temperature rose to 39.7 ° C on July 25th. As shown, until then, the highest temperature ever recorded in the country was 36.8 °C which had been observed in 1947.

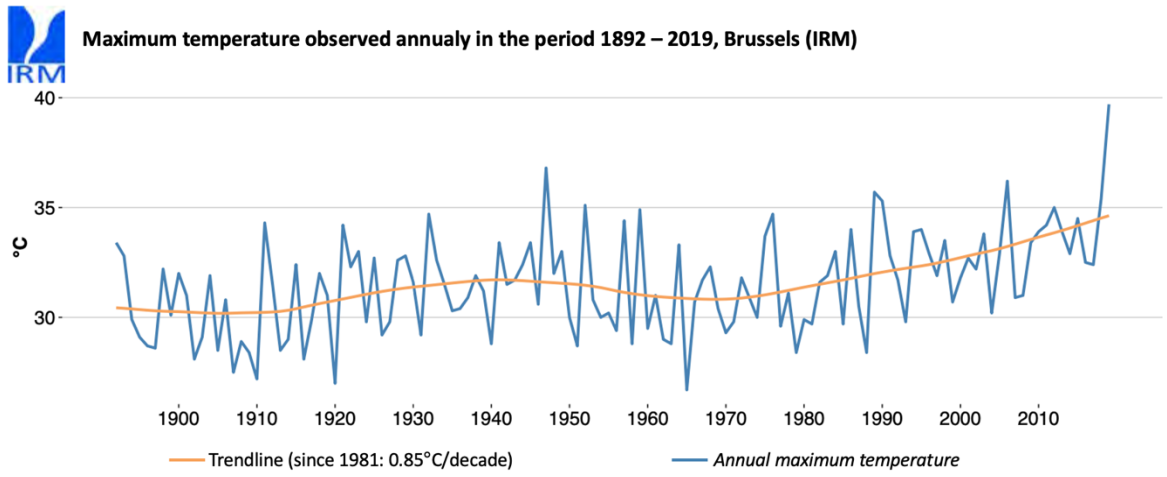


Figure 4

In addition, since 1981, there has been a significant trend towards an increase in the number of sunshine hours, with an average increase of +58 hours in sunshine duration per decade. In the preceding period even though variation in yearly sun exposure can be observed no significant trend is reported.

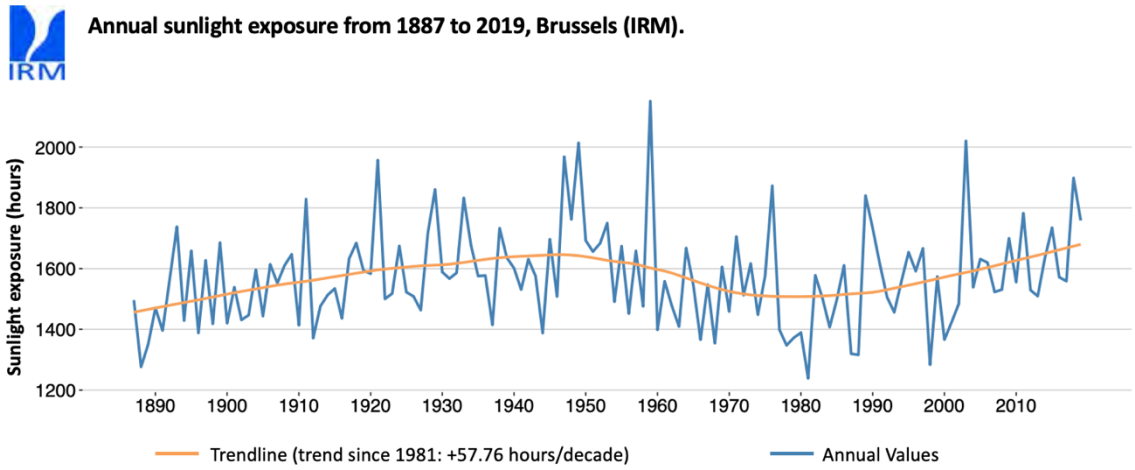


Figure 5

These increased temperature and rising quantities of annual sunlight exposure combined with low humidity levels drove evaporation rates to new highs increasing the risk of seasonal droughts.

As way of illustration, in 2020 the country experienced the greatest amount of sunshine exposure since the start of measurements in 1887. The total duration amounted to 740h 46min of sunshine (compared to average of: 463h 58min). In addition, the relative humidity level was low over the spring months. More than 25% of the time, the average daily humidity was below 50% at the observed site. Low relative humidity and very high sunlight led to significant evaporation. As such, meanwhile the cumulative precipitation during the three months of spring was still close to normal in many regions, drought hit the country throughout the summer months mainly led by the high evaporation rates.

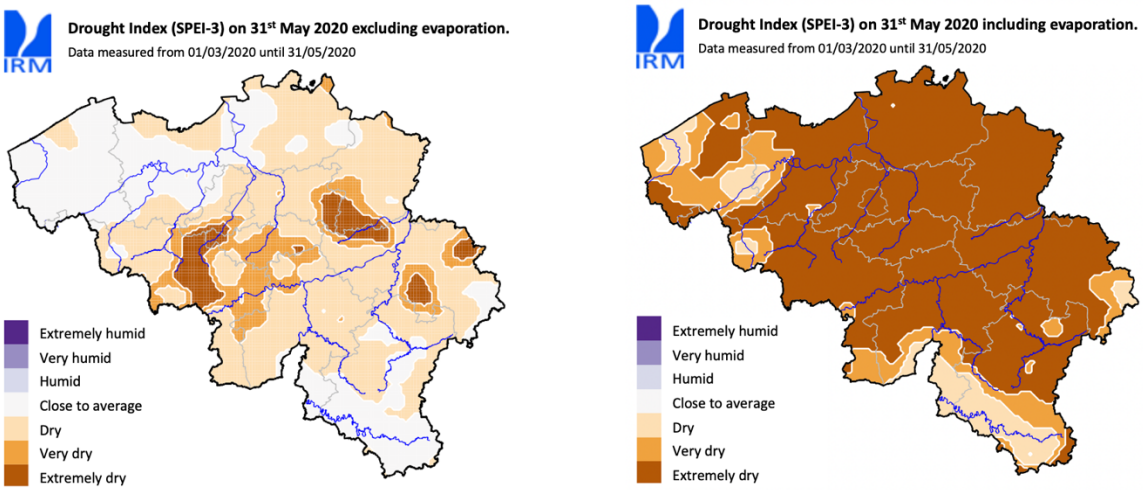


Figure 6

- ***Sea-level rise and increased risk of coastal flooding, which will impact on coastal golf courses***

According to the WWF Belgium, seawater has already risen by more than 10 cm and the Belgian coastal plain are threatened by sea-level rise with an estimated threatened population of up to 300 million people. Estimates for this century forecast a sea-level rise of 60 cm up to around 2 meters. To avoid damages and infrastructure destruction, golf clubs located alongside coastlines should evaluate their risks and implement adequate mitigation strategies.

Figure 7

Staying up to date with the R&A Golf Course 2030 Coastal Change Action Plan (https://www.randa.org/~/media/files/sustainability/golf-course-2030/action-plans/coastal-change-action-plan-may-2019-final.ashx?la=en) represent a key component of the national strategy and will be a key element to ensure the clubs are given the right tools to implement best practices and limit risks.

Pressure on the supply of irrigation water, damages from floods and soil erosion and changes in turf disease patterns are some of the main challenges golf management teams will face. Different types of courses will not be affected the same and variations will be observed on the different areas of the golf course (greens, surrounds, fairways, tees, bunkers and rough). Increased costs in trying to mitigate effects or reduced revenues from unsuited weather conditions are also expected. The changing climate will require adaptation in how golf courses are managed. Well-trained greenkeeping staff and the implementation of climatic resilient course management plans will be key for golf clubs to thrive in the future.

Golf clubs must become informed resilient structure ready to adjust to changing local conditions. Golf clubs are thereby advised to make a solid assessment of their situation and develop accordingly individual solutions to maintain the quality of their courses and ensure future optimal course conditions and playability.

RESOURCES

The resources considered essential for today's golf course are likely to become scarcer and cost more. This applies to water, pesticides, fertilisers, sand, energy, labour, etc. Resource use on the golf course varies dependent on the type of course, e.g. links, heath- or parkland, and on the intensity of management related to the area of the course being treated.

The greens (1 on image) are the most intensively managed part of the golf course, yet only take up around 1 hectare of the 60 hectares of an average 18-hole golf course.

Fairways (2) are less intensively managed but cover around 15 hectares, so any single input will amount to a greater quantity than a similar application to greens.

The teeing grounds (3) and green approach/surround (4) are each of a similar area as the greens and generally receive an intermediate level of management between that of the greens and that of the fairways.

The bunkers (5) are a sand-filled hazard, whose number can vary on any individual golf hole.

The maintained rough (6) receives very limited management, mainly mowing.

Up to 50% of the area of a golf course can be natural habitat, providing a haven for wildlife.

Under this driver,

the golf facility itself needs to be considered as a resource in how it contributes towards issues such as community (multi-functionality), health/wellbeing, and biodiversity.

In Belgium, the resources whose limited availability or quality might impact on golf course condition and playability in the future include, in order of importance:

REGULATION

Nationally only products nationally recognised for golf usage may be used on golf course. These products are recognised nationally and may be found on the federal government website: www.phytoweb.be.

Sports areas along waterways: prohibition

For sports, there is a general ban on the use of pesticides within 6 meters of surface water. It is possible to deviate from the ban if there really is no other option, but the conditions are strict. Within a zone of at least 1 meter along a watercourse, it is in any case forbidden to use pesticides. There are no derogations from the ban granted.

Of course, the conditions of use of the product itself also apply, which are stated on the packaging and on the package leaflet. For certain pesticides, there is an additional requirement for surface water. This is always at least 1 meter, but in theory, can be much wider. Products that require you to stay more than 10 or 20 meters from surface water are not uncommon.

Regional-led regulations

While some aspects of the golf industry are governed at the national level, when it comes to matters of the environment, climate change, pesticides usage and water supply, regional governing bodies and their laws must be considered. In Belgium, these matters are dealt with via independent regulations defined by each regional governing authority. As such, legislation in the three regions – Wallonia, Flanders, Brussels-Capital – must be considered when assessing impacts on course condition, playability and cost and in devising potential solutions to regulation-led limiting factors.

As described below, the main regulation-led limiting factors impacting the golf industry and courses conditions and their playability belong to the sphere of pesticide and water usage.

PESTICIDES USAGE

Wallonia

"Zero phyto" Act – Decree of the 10th of July 2013

As of the 1st June 2018, after a transition period, the decree prohibits the use of all pesticides on golf courses – synthetic or organic in the region of Wallonia. No substances – of organic or synthetic nature, is to date authorised to maintain turfed sport fields in the region. Club managers and greenkeepers have been faced with rising difficulties seeing the quality of their courses deteriorating over time. Under these new circumstances, greenkeepers are faced with a technical incapacity to adapt and answer the quality requirements associated with good conditions and playability.

With all substances forbidden, including substances authorised in organic farming and of natural composition, golf clubs have been stripped from any defence mechanism against pests and diseases incidences. This calls for urgent support from national bodies and any other relevant influencing actor to support the industry as Wallonia stands as the only place in the world that has been forbidden to use any substances on its golf courses.

It is also worth noting that the approach of authorising substances as the 'last resort solution' as per recommended by integrated pest management best practices and adopted by most other countries throughout Europe such as France, the Netherlands, Germany and Sweden is in Wallonia strictly forbidden.

Golf courses have been since struggling with maintaining good turf conditions and playability with some golf being invaded by diseases most typically, the dollar spot and fusarium patches. To tackle this issue, the regional golf association (AFGOLF) started a working group, GREENCARE, with the objective to attempt dialogue with governing bodies as well as with the ambition to advance research and bring solutions to clubs throughout the region ensuring the future of the sector.

As such, to secure the future of the golf sector in Wallonia, this limiting factor must be addressed. The present work is hope to foster new research initiatives at the regional, national as well international level bringing various actors together, facilitating knowledge sharing and bringing coherent, sound and high-quality information to golf club managers and greenkeeping teams.

Brussels-Capital

Similar to Wallonia, as of the 31st of December 2018, no pesticides of any sort are allowed to be sprayed on golf courses located in Brussels-Capital. As such the same problematic as described above and same hope for solutions are applicable in the region.

Flanders

In Flanders, regulations on pesticides are different. As of the 1st of January 2015, the use of pesticides on all land used for a public service or belonging to a building has been forbidden. A sports field of the municipality that is managed by a club, rent or used in any other way also falls under this law. For sites that are privately owned a minimum use requirement applies. This means that the use of pesticides must decrease and that pesticides may only be applied locally. Where possible, non-chemical alternatives should be chosen.

Requests to deviate from the pesticide ban due to disproportionate costs can be made by following "Procedure 5 – Problem Area" as described in the legislation. Maintenance experts state that pesticide-free maintenance is much more expensive in certain situations or is not possible without pesticides.

As such and in consultation with experts from various networks, five situations have been selected where a limited use of pesticides is justified as one of the steps of an extensive maintenance plan. These are:

- Natural grass – all sports except golf
- Natural grass – golf
- Plastic – all sports
- Artificial grass dry – all sports
- Artificial grass water field – hockey

For golf, derogation may thus be requested for:

- Tees and greens: against fungal diseases, grubs and leatherettes at >1m from surface water
- Fairways: selectively once a year against unwanted plants at >6m from surface water

Derogation will only be given for products recognized for golf usage (federal government: www.phytoweb.be).

Flanders has also a number of groundwater abstractions laws for the production of drinking water. To protect the quality of the groundwater from these abstractions, drinking water protection zones have been demarcated around abstractions points. There was already a restriction on the use of pesticides. A sports field in a drinking water protection zone must be managed without exception without any pesticides.

Finally, anyone who uses pesticides for maintenance must maintain or report the following records: the place of use, the product name, the approval number or authorization number, the amount used in that year.

The VMM can always request the usage data, so this record must be kept up to date. Using pesticides on publicly owned property means reporting annually by April 1 of the year after use. Pesticides on a completely private property means that you keep the data, collected per year of use, for a period of 5 years.

WATER USAGE

Water is precious! Not only in terms of price for the consumer, but it is also valuable for nature and the environment.

Wallonia and Brussels-Capital

While sustainable irrigation practices are encouraged in both Wallonia and Brussels-Capital no particular regulations address the use of water on golf course. However, more generally, water permits for groundwater extraction and tax contribution on certain extraction volumes for both groundwater surfaces and surface water are required and are governed independently by the local administration in place.

Water extraction of underground, non-potable water via pumping points that are greater than 3,000 m3/year, and non-potable surface water points that are greater than 100,000 m3/year are subject to a usage contribution. The income from the usage tax and contributions is allocated to an environmental-protection fund: “water protection” section.

Flanders

With the current water pressure existing in Flanders, proper maintenance and operation are required for clubs. As such water management is part of existing strategy planning to ensure long-term availability, raise awareness amongst golf clubs and encourage sustainable irrigation practices across the sector with a 'circular water plan' as the most important action point. More details can be found in the brochure: https://www.golfvlaanderen.be/uploads/files/Golf-en-Water-2020.pdf.

In terms of regulations and constraining factors on water usage, water permits, annual reporting and tax on extraction volumes for groundwater and surface water is applicable across the region in various extent and should be consulted for each particular site. Information may be collected from Golf Vlaanderen and Flanders database available at: https://www.dov.vlaanderen.be/portaal/?module=verkenner.

GOLF 2030 AND THE SUSTAINABLE DEVELOPMENT GOALS

GOLF COURSE 2030 also has to take a global perspective and its objectives are aligned with the UN's 2030 Agenda for Sustainable Development. The United Nations Sustainable Development Goals (UN SDGs) provide a valuable reference and golf can contribute directly to the following goals:

PROCESS

As mentioned, the main objective of Belgium Golf Course 2030 roadmap and action plan is to help those developing, designing, building and managing golf courses to address the challenges and opportunities from the changing climate, increasing resource constraints, and the regulations agenda facing the industry today and over the coming decade.

A number of steps are involved in the production of such plan. Once the strategy established cooperation between all actors of the industry is paramount to ensure its success.

1. ***Bring stakeholders together***

To ensure the relevance of the plan at the national level, the members involved in the process must balanced with strategic and technical representation of people focussed on the long-term interests of the sport's future.

2. ***Identify Priority Issues***

Stakeholders identify the challenges and opportunities and agree on priority issues to be addressed over the next 3-5 years.

3. ***Write an action plan to address priority issues***

Undertaking a review of the literature, current best practices and technology, an Action Plan should be produced providing a clear pathway for the sector to meet the challenges and address the priority issues.

4. ***Implement***

The Action Plan is to be taken forward over an agreed time period (3 to 5 years is suggested), with regular (annual) review. Progress should be monitored via Key Performance Indicators.

5. ***Communicate and educate***

All stakeholders should be made aware of the implementation plan and monitoring process. Education and interim communications as, and where necessary, should be produced and actively shared within the industry to achieve stakeholder buy-in.

6. ***Reporting***

Report on progress and level of success in addressing priority challenges. If the priority challenges have been addressed at the end of implementation, return to Step 2.

Actions to address challenges, opportunities and identify gaps in knowledge for identified issues:

- Raising general awareness and greater knowledge sharing
- Guidance on current knowledge and best practices
- Research to plug gaps in knowledge, innovation and R&D
- Practitioner education and integration of knowledge into club support
- Monitoring and reporting of progress/trends in practices and performance
- Recognition and promotion of demonstration sites
- External relations – public and government

FUTURE SCENARIOS

To produce a roadmap that secures optimal golf course condition and playability for current and future generations, there needs to be a consideration of what might be. The drivers for adaption pose many potential scenarios.

Presented here are three 2030 scenarios, from business as usual to a potential doomsday prediction of extreme weather, water scarcity, high resource costs and no chemical availability. These scenarios should be related to the current optimal performance of golf courses. It should also be borne in mind that there is a sliding scale between the two extremes cited in scenarios 1 and 3:

Scenario 1

Limited change from the environment that now exists as alternative technologies, management solutions and behavioural change address the challenges posed by climate, resources and regulations such that optimal golf course condition and playability is secured.

Course condition and playability is comparable to that available today. Drivers for change are weak and opportunities to enhance the potential of golf courses, their performance and environment will not be realised. There could be extra costs for golf businesses that position themselves as early adopters of new technologies, which may be passed on to the customer, so golf could be more expensive.

Scenario 2

Severe restrictions in the availability and use of synthetic chemical plant protection products, together with 50% less water being available for irrigation compared with current levels. Alternative technologies, management solutions and behavioural change partially address the challenges posed by climate, resources and regulations.

More months of the year will see greater course closure due to extreme weather events, notably flooding, and more damage and scarring to turf from water and pesticide restrictions, related to hotter summers and wetter winters.

The condition and presentation of surfaces will see periodic troughs, with golfers having to accept a different style of golf and course performance, notably in terms of reduced green speed. There is also the prospect that course condition will improve as turf naturally adapts and firmer surfaces become the norm. Golfers will appreciate and enjoy the seasonal change in course appearance and playability.

There will be increasing pressure on golf facilities to survive as the cost of maintenance increases. This will lead to opportunities for a greater flexibility in course design, e.g. fewer holes, less maintained turf, and an increase in diversification to provide multi-functional green space.

Golf businesses will need to spend more on new technologies and more expensive resources to sustain course condition and playability. Golf will be more expensive to play. Golf facilities will also see a decline in income as deteriorating conditions reduce the attractiveness of the sport, though those that embrace the opportunities for a different type of golf and diversification of land use will thrive.

There will be some course closures, notably those wholly reliant on water and synthetic chemical plant protection products to keep a grass cover, and this will impact on the contribution of golf to the local, regional and national economy.

Scenario 3

The banning of all chemical plant protection products and fertilisers, together with 75% less water being available for irrigation compared with current levels. Alternative technologies, management solutions and behavioural change fail to address the challenges posed by climate, resources and regulations.

There will be longer periods of course closure, damage from extreme weather events and disease/pest/weed incidence and the high cost of resources results in loss of customers and permanent closure of many facilities. There are serious consequences for the contribution from golf to the local, regional and national economy.

The combination of hotter summers and less water being available means that only those with sustainable sources of water for irrigation can retain a reasonable cover of grass. Only those that can afford course renovation, a secure water supply and significant levels of extra labour or automation of certain maintenance practices will be able to cope with these pressures and, even in such situations, golf will be regularly played on inferior surfaces compared to what we enjoy today.

The use of artificial turf increases for those that can afford it as the problems in managing natural turf become insurmountable

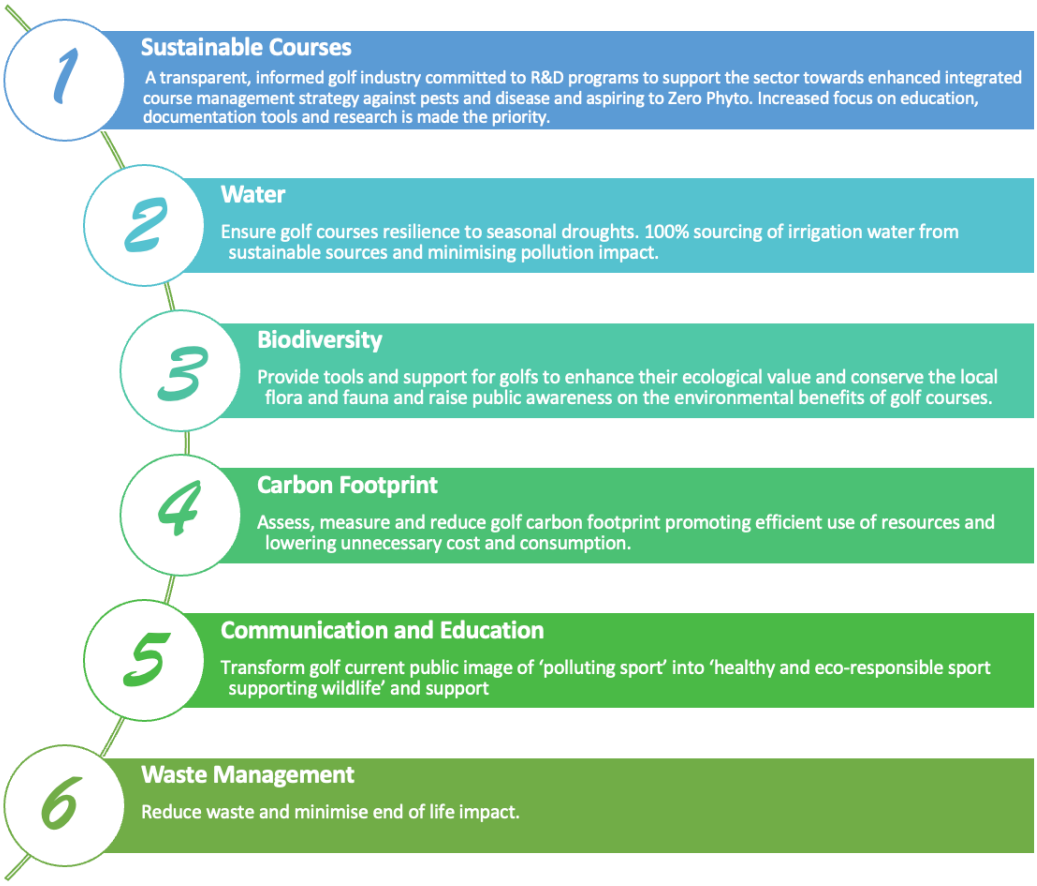
GAPS, STRENGTHS AND WEAKNESSES ANALYSIS

Preparing for the future means, thinking of how to face challenges and opportunities and think about the perception and enjoyment of golf game today. To conserve today's playing surfaces and anticipate the adaptation to climate change, resource scarcity and regulations, gaps in knowledge and current strengths and weaknesses of the current approach should first be identified. Consequently, such information should be used to inform and design solutions. Designed solutions may include, best known practices, technological innovation, ecological adaptation, stakeholders' behavioural approach, social behavioural changes, research, communication, education…

Such a process has to include the assessment of different scenarios over the next 50 years and result in a list of priority. The strengths and weaknesses analysis can enlighten the industry and put into perspective: innovation paths, research, behavioural change and education but also permanent development paths of supporting programs for clubs, role and responsibility of all stakeholders.

PRIORITY ISSUES

Following analysis, Belgium priority issues for the next decade have been identified in order of importance.



BEST PRACTICES FOR PRACTICAL ACTIONS

The main objective of Golf Course 2030 is establishing an industry roadmap that secures optimal golf course condition and playability for current and future generations by addressing challenges from, and taking opportunities presented by, the changing climate, resource constraints and regulation.

There are, however, a number of fundamental, universal practical principles for golf course development, maintenance and management which extend across the decision-making culture, agronomic practices, and broader considerations of golf's impact on and contribution to nature and local communities.

The following guidelines are offered as a guide to those in the decision-making positions and should be celebrated as part of Belgium national sustainable strategy:

1. Plan over the longer-term and operate under consistent policies, which are documented.

2. Prepare for future challenges considering the predicted impact of the changing climate (such as flooding or drought), the availability and costs of vital resources and the constraints placed by regulation.

3. Recognize the professionalism of well qualified course managers and their staff. They will play a vital role in securing optimal course condition and playability.

4. Safeguard the reputation and well-being of employees, employers, golf facilities and the sport itself through strict compliance with the law. Decision makers at golf facilities must support their greenkeepers in adhering to this policy.

5. Create the right environment to produce healthy turf, which is fit for purpose, with adequate access to light and air, and good drainage and a biologically rich growing medium. Select and manage for grass species best adapted to local conditions.

6. Water scarcity and cost for water are growing issues for golf clubs, golf courses should be designed, built and managed to conserve water, using the least required to produce healthy turf and firm playing surfaces. Where feasible, water for irrigation should be generated in situ, through recycling drainage, rainwater harvesting, irrigation reservoirs and other technologies. Where feasible, water derived from nonpotable sources should provide the irrigation source. Grass selection should be targeted at species which are fit for purpose, but which require the least amount of irrigation water.

7. The trend points to increasing pressure on pesticide availability and use, eliminate reliance on pesticides, identify and transition to alternative solutions to prevent and manage disease, pest and weed problems. Select and manage for grasses which are

fit for purpose and which have the greatest natural resistance to disease infection, pest attack and weed ingress.

8. Fertilizers are likely to be regulated as part of pollution prevention measures. Select grasses which are fit for purpose with minimal nutritional input and use products which offer the greatest protection to the environment.

9. Avoid excessive organic matter that provides for an accumulation of weak turf, prone to stress and susceptible to disease infection, pest attack and weed ingress should be avoided. Select and manage for grasses which are fit for purpose, but which have a slow natural rate of organic matter accumulation and implement management practices, i.e. irrigation and fertiliser, responsibly in a manner which minimises organic matter build up.

10. Cutting height has a major influence on turf health and the requirement for maintenance, with over-close mowing inducing turf stress which requires greater water, fertilizer and pesticide inputs to correct. Thus, mowing heights should be implemented to sustain grasses which are fit for purpose, but which are inherently healthy.

11. Energy derived from fossil fuels is going to become more expensive and golf facilities should be transitioning to cleaner, renewable sources of energy. Course design, construction and maintenance should be focused on energy efficiency, utilising grasses which are fit for purpose, but which require the least input of maintenance resource.

12. Combat biodiversity loss and promote golf courses to maximise their potential to conserve and protect wildlife. Golf courses should be designed and managed to provide quality habitat for as wide a variety of native wildlife as possible and should cooperate with forest and agriculture area protection to improve on biodiversity.

13. Recognise golf responsibility to wider society. The design, construction and maintenance of their facilities should focus on making a positive contribution to local communities, such as by providing a multi-functional venue for wider community integration and recreation.

14. Assess objectively the condition of playing surfaces, particularly of the putting surfaces, to monitor the impact of the challenges facing greenkeepers, the implementation of research outcomes and adaptations in management. This may include firmness, smoothness, trueness, reliability, speed, etc.

15. Augment the recording of key resource metrics for course management, e.g. water, chemicals, energy, waste and biodiversity. Sustainability reporting is required on course operations on a facility and at the country level to monitor the impact of the challenges facing greenkeepers, the implementation of research outcomes,

adaptations in management and compliance with regulations. Encourage continuous improvement and the sharing of best practices through benchmarking.

16. Educate golfers actively to ensure the winover acceptance of changes in playing conditions. Work together with those responsible for the organization of PGA, regional and nation-wide events and encourage Professionals and top amateur Golfers to act as role models.