

GOLF COURSE 2030 SCANDINAVIA

R&A

Sterf



INTRODUCTION

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.

Fifteen years ago, Scandinavian golfers acted as both initiators and early adopters when they decided to contribute €0.5/year to research on sustainable golf, a decision that has been recognised all over the world. This farsighted decision to invest in ready-to-use research is today an important contribution by the golf sector to guarantee golf courses of high standard, minimising factors affecting climate change, stopping the accelerating loss of biodiversity and meeting the increasing need for sustainably managed green areas in the urban landscape.

Ready-to-use research is an important tool to help prevent negative impacts on the planet and new knowledge is necessary to change the mind-set and attitudes of people worldwide. A global agenda is needed to guide this work. The best available agenda at present is the United Nation's 2030 Agenda for Sustainable Development with its 17 Sustainable Development Goals (SDGs), which was adopted in 2015 (sustainabledevelopment.un.org.)

STERF's (Scandinavian Turfgrass and Environment Research Foundation) activities contribute to the fulfilment of eight of the 17 SDGs in Agenda 2030. These are presented in six categories:

1. Sustainable use of natural resources and chemicals (SDGs 6, 12, 14, 15).
2. Ecosystem services and enhanced biodiversity (SDGs 14,15).
3. Adapting to a changing climate and minimising factors affecting climate change (SDG 13).
4. Sustainable cities and communities (SDG 11).
5. Healthy lives and well-being for people of all ages (SDG 3).
6. Partnership for sustainable development and for new regulations (SDG 17).

These categories and goals are closely related to the golf and turfgrass industry's everyday challenges and to STERF's programmes, projects and dissemination efforts. To achieve maximum impact from the golf and turfgrass sector's sustainability work in the future, it is of the utmost importance to establish international interdisciplinary collaborations, where all stakeholders make efforts to cooperate and align their resources and efforts using Agenda 2030 as a global steering document.

Information about STERF programmes, projects and activities can be found at www.sterf.org

Information on Golf Course 2030 can be found at www.randa.org/en/sustainability/golfcourse2030

GOLF COURSE 2030

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.



SCANDINAVIAN TURFGRASS AND ENVIRONMENT RESEARCH FOUNDATION

Scandinavian Turfgrass and Environment Research Foundation (STERF) is an independent research foundation that supports existing and future R&D efforts and delivers 'ready-to-use' research results that benefit the golf and turfgrass sector. STERF was initiated and set up as a Scandinavian research foundation in 2006 by the golf federations in Sweden, Denmark, Norway, Finland, Iceland and the Nordic Greenkeepers' Associations. Research financed by STERF should be carried out at universities or research institutes (or equivalent) where most relevant research capacity is concentrated.

STERF helps to strengthen research capacity by encouraging and supporting networks and collaborating actively with international key organisations in the field of turfgrass management. STERF receives funding from participating golf associations, which can be complemented by funding from other sources.

STERF's vision is to be the leading international centre of expertise in high quality and sustainable golf course management.

To achieve the vision STERF focuses on:

- Making the golf and turfgrass industry in the Nordic countries a role-model regarding responsibility for sustainable development, i.e. to produce managed turfgrass areas of a high standard while at the same time ensuring the sustainable use of natural resources, contributing to functioning ecosystems and providing recreation areas that are open to the public and to outdoor activities.
- Ensuring Nordic turfgrass research and development focuses on internationally important areas where concerted research and industrial effort is required. These include the pressures from government demands for greater environmental regulation, the increasing pres-

sure on natural resources (notably water, energy and land), the emerging role of turf management in supporting ecosystem services and enhancing biodiversity, the continued need to promote integrated pest management, and the looming challenges posed by a changing climate, and urgent need to adapt. Activities within the focus areas contribute to the fulfilment of seven of the 17 SDGs in Agenda 2030.

- Establishing a successful international research and development collaboration, including research facilities and expertise in all five Nordic countries. STERF will continue to initiate inter and multi-disciplinary research and support collaboration in Europe, Canada, USA and China, involving both researchers and stakeholders interested in land used for managed turfgrass areas.
- Developing and expanding the STERF industrial scientific partner programme by collaborating with leading international companies within the sector to further strengthen the strategy that research and development should be integrated from producer to end-user.
- Taking a lead in making research results and new knowledge easily accessible to end-users and to provide support to implement changes, a prerequisite for achieving improvements in the sustainable management of golf courses and ensuring high playing quality.

This programme is created in collaboration with the golf and turfgrass industry and, thus, STERF brings industry stakeholders in Scandinavia together as required by Golf Course 2030 (See list of stakeholders and organisations on page 15. STERF also arranges innovation workshops to help identify the golf and turfgrass industry's future research needs, where researchers, greenkeepers and industry representatives contribute to the planning process.



BACKGROUND

Managed turfgrass areas such as golf courses, sport fields, landscaped amenity areas and public parks all provide an important social, environmental and economic resource for both urban and rural communities. These areas serve a multifunctional purpose by offering valuable open spaces for recreation, helping to improve the health and quality of life for individuals and, when designed and managed appropriately, enhancing biodiversity and supporting regulatory targets for environmental protection. Conversely, where turfgrass management practices are inadequate or inappropriate, their services to society are reduced, and their impacts on the natural environment can be damaging and costly.

The challenges for the future of turfgrass and golf course management are many and diverse, and focus on increasing demands on natural resources (notably land use, water resources, nutrient resources and energy) driven by economic development and population growth, coupled with government demands for greater environmental protection are creating conflicts at the interface between land management (including turfgrass) and the environment. The situation is particularly acute in peri-urban areas where the majority of managed turfgrass facilities are concentrated. Population growth, migration and climate change will exacerbate the current situation, by increasing the competition for resour-

ces between individual sectors, including agriculture, urban development, tourism and the environment.

Many golf courses, sport facilities and stadia are under financial pressure. For example, in many countries there has been a decrease in the number of registered golf players. It is common for golf courses to base their financial stability based on a constant inflow of members rather than a static membership. However, they are now facing the challenge of balancing this approach against the new concept of members and new conditions in a more variable and more competitive market.

The key for golf course and turfgrass management will be to increase resource use efficiency, reduce maintenance costs and minimize the environmental impact. In this context, the protection and enhancement of ecosystem services will need to be fully integrated into the planning, design, construction and management of all golf and turfgrass facilities.

The Nordic golf federations have approx. 900 000 members, playing golf on more than 1000 courses that cover a total area of more than 65 000 ha. Any societal activity as significant as golf must take responsibility for building knowledge through research and development (R&D). There are several important reasons why Nordic R&D is necessary. In Central Scandinavia, Oslo, Stockholm and Helsinki lie at the same latitude as the southern tip of Greenland (~60°N). This provides a unique climate resulting from a combination of factors such as light, temperature and precipitation during the playing season and particularly during the winter season. The Nordic climate creates conditions for plant growth and the construction and management of golf courses, sport fields etc. that are not found anywhere else in the world.

R&D is, and will continue to be, a necessary and strategically important investment for the Nordic golf sector in achieving economically and environmentally sustainable golf facilities of a high standard and in establishing the credibility of golf as an environmentally friendly sport. Golf facilities that are already using new knowledge are achieving cost savings through more efficient management strategies, while also enhancing the golf course, raising the profile of the golf facility and improving the environment.

The financial resources allocated to R&D in each country are very limited and the number of scientists actively

working within each priority R&D area is also quite limited compared with agricultural and forestry research. The financial resources and efforts of these researchers should therefore be coordinated to optimize R&D within the golf and turfgrass sector

VISION

The Nordic golf sector's vision with respect to golf course quality and the environment is:

To promote high-quality golf courses, whilst guaranteeing that ecosystem protection and enhancement are fully integrated into golf facility planning, design, construction and management.

The aim of STERF is to support R&D that can help the golf sector fulfil this vision. The activities of STERF are intended to lead to improvements in golf course quality, as well as economic and environmental gains. The strategic objectives for STERF funded R&D activities include:

- The design, construction, management and administration of golf courses to provide optimal conditions for playing quality, degree of utilisation of the course and management inputs.
- The design, construction, management and administration of golf courses is economically and environmentally sustainable, for example with respect to plant nutrient requirements, water and energy use, drainage and control of weeds and plant diseases.
- Golf courses contribute to production of biological diversity, the conservation of natural and cultural environments and the retention and expansion of ecosystem services, and to improving the conditions for good quality of life and health e.g. through providing a broader active outdoor life, experiences of nature and better climate adaptation in the everyday landscape.



DRIVERS FOR ADAPTATION – CHALLENGES AND OPPORTUNITIES

Over the next decade, the golf and turfgrass industry faces a number of major challenges, including providing a high quality arena for golf and other sports, and at the same time responding to increased environmental regulation, rising pressure on natural resources and rising operating costs of key inputs including labor, energy, fertilizers and plant protection products.. The industry also needs to plan for adaptation to climate change and play a credible part in minimising factors affecting climate changes. These factors will also present opportunities for the enhancement of golf facilities and their contribution to nature and communities.

National and international regulations

European governments and society are seeking to achieve greater levels of environmental protection. All sectors including turfgrass management will inevitably be subject to increasing levels of environmental regulation and monitoring. As a consequence, golf and turfgrass facilities are under scrutiny to demonstrate compliance with national and international regulations, including for example, the EU Directives relating to Pesticides, Habitats, Water, Soil, Nitrates, Phosphorous and Chemical pollution. Although there are many examples of best practice within specific turfgrass sectors (e.g. golf), there are also well publicized

examples of mal-practice, and hence significant opportunities to improve existing levels of management, knowledge and awareness across the broader turfgrass industry. The golf and turfgrass industry should take a lead in research and development, training, knowledge transfer and dissemination of best practice, not only for existing venues and but leading innovation in the design and management of new golf- and sportsturf facilities.

High quality playing surfaces and Integrated Pest Management (IPM)

The production of healthy turf while safeguarding environmental quality and providing a toxin-free environment is a high priority within the European Union. In this context, the golf and turfgrass industry must play its part by providing high playing quality and at the same time reducing dependence on chemical plant protection products. The EU Directive has introduced an integrated approach to pest and disease management as the driving force for producing healthy turf and to reduce the use of and dependence on pesticides. The main focus of IPM is a decision making process utilizing all suitable techniques to produce high quality turf and to minimize pest damage and pesticide use below those causing economically unacceptable damages or loss. The implementation and success of IPM requires increased focus on education and development of documentation tools. In addition, research and development will be key.

Natural resources and climate change

The downward pressure on our natural resources and capital, including land, water, nutrients (phosphorus) and energy is of major global concern. Reducing resource consumption and increasing resource efficiency will be key. From a golf and turfgrass industry perspective, it also makes business sense to reduce costs and waste through efficient consumption of water, energy, materials and fertilisers . New knowledge and research results can help the sector become more efficient and hence reduce consumption of natural resources.

Changes in climate will have significant and profound implications for the turfgrass industry which relies on natural resources and co-existence with the environment. For turfgrass facilities investing in new infrastructure, many will need to factor in the costs of a changing climate, and

develop appropriate adaptation strategies to cope with greater uncertainty and extremes in rainfall and temperature. Climate change will also influence turfgrass growth and agronomy, with impacts on pest and disease control, and the need for irrigation and drainage.

Ecosystem services and biodiversity

The living conditions of people are influenced by our ability to co-exist with ecosystems and utilise them without over-exploitation. To halt the loss of biodiversity and the degradation of ecosystem services, the sustainable management of both the natural environment and cultural landscape needs to be achieved. From an ecosystem management perspective, golf courses represent a promising measure for restoring and enhancing biodiversity in ecologically simplified landscapes, such as agricultural and urban lands. Golf courses could offer real potential to be designed and managed to promote critical ecosystem services, such as for pollination and natural pest control, providing an opportunity for joint collaboration between conservation, restoration and recreational interests. Golf courses could also have the potential to contribute to supporting wetland fauna, particularly in urban settings where they could contribute significantly to wetland creation.

Golf courses include large areas of land that are not used for the game of golf. Therefore there could be potential for better use of the land in order to provide new opportunities for active outdoor life for other groups in addition to golfers.

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 and 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.





R&D PROGRAMMES AND GAPS IN KNOWLEDGE

It is apparent that the golf and turfgrass industry faces a number of local and international challenges, all of which will need concerted and collective solutions, underpinned by robust, applied science. To meet the challenges the sector has to face STERF has created four international and trans-disciplinary R&D programmes:

- Integrated pest management;
- Sustainable water management;
- Turfgrass winter stress management, and;
- Multifunctional use of golf facilities and ecosystem services.

Progress in these programme areas will collectively lead to improvements in the quality of golf courses and managed turfgrass areas as well as economic and environmental gains for the industry. The key objectives of the programmes are to coordinate design and running of R&D activities, and to manage the effective dissemination of outputs (new knowledge) through channels and formats which are easily accessible to end-users. STERF shall play a key role expanding the programmes on an international level. All programmes are presented at www.sterf.org

These programmes form the priority issues for Golf Course 2030 Scandinavia. Main themes with key actions have been defined for each programme. STERF needs to consider how best each of these industry priorities can be addressed through a combination of targeted research (applied), supported by dissemination of best practices drawing on existing (international) evidence.

Integrated pest management (SDGs 12, 13, 15)

New regulations at national, and international levels related to the golf and turfgrass industry are becoming more demanding. A good example is the EU Directive on sustainable use of pesticides including strategies for integrated pest management. STERF together with the Nordic park and golf sector, universities, research institutions and authorities takes responsibility for ensuring that R&D activities that are important for integrated pest management are coordinated and executed and that new knowledge is delivered.

Three research areas most highly prioritized by the industry are: (1) Evaluation of turfgrass species and varieties suitable for IPM; (2) Control of turfgrass diseases, and (3) Fertilization practices.

Based on the FAO's (Food and Agriculture Organization of United Nations) IPM definition and the seven principals for IPM related to turfgrass management STERF have identified the following main themes with key actions:

www.fao.org/agriculture/crops/thematic-sitemap/theme/pests/ipm

Breeding, evaluation and management of turfgrass species, varieties and mixtures to create more disease resistant, stress tolerant and weed-competitive turf

- a) Evaluation and development of turfgrass species, varieties and seed blends/mixtures
- b) Management practices on Poa greens
- c) Fertilizer types, fertilization practices and biostimulants for stronger and more resistant turfgrass plants
- d) Replacement of peat to compost

Research into identification, biology and proliferation of harmful organisms

- a) Tools for early identification / improved diagnostics of turfgrass diseases
- b) Dollar spot and other new diseases
- c) Prediction models and forecasting of insect damage and outbreak of diseases
- d) Phytosanitary requirements and invasive species
- e) Weed biology

Research related to more efficient and safer use of pesticides

- a) Routines for compilation of reliable statistics on pesticide use for golf
- b) Continued testing of new active ingredients and formulations for various types of turf and under different climatic conditions.
- c) Risks for surface runoff
- d) Risks for human exposure
- e) Alternative products

Sustainable water management (SDGs 6, 12, 13, 14)

Water is essential to secure the future of the golf and turf industry and the livelihoods of many rural communities that depend upon it. Working with industry and leading research institutes, STERF's goal is to provide science-based information to practitioners and stakeholders on integrated water management in turf. This will improve management practices relating to both irrigation and drainage systems; help protect environmental water quality and support the industry to adapt to future changes in rainfall and climate variability on water resources.

Three main themes with key actions have been defined for the water strategy for golf.

Managing irrigation and drainage infrastructure

(including application equipment, distribution systems and drainage network);

- a) Understand and quantify the links between poor irrigation application uniformity, turf growth and turf quality;
- b) Improve the efficiency of irrigation application equipment (energy and water) to reduce the carbon and water footprints;
- c) Evaluate new and emerging technologies to improve irrigation water use efficiency and reduce energy consumption;
- d) Improve understanding of the potential for water harvesting and water re-use options for golf course irrigation, and the risks to their implementation.
- e) Assess the impacts of turf irrigation management practices on performance of drainage systems and the risks associated with nitrate and pesticide leaching;
- f) Assess the impacts of a changing climate on irrigation and drainage infrastructure

On-course soil and water management, scheduling

(including methods and technologies to control turf growth and quality)

- a) Improve information on the optimum irrigation schedules for specific parts of the golf course (including monitoring and auditing water use);
- b) Improve soil management to understand the agronomic links between soil heterogeneity (variability), soil water availability and turf survival/growth/disease risk;
- c) Support the development of improved innovative scheduling technologies coupled with new approaches to scheduling (e.g. deficit irrigation) to improve turf quality and reduce dependence on water.

Managing water resources (including abstraction, storage, monitoring, regulation and water policy).

- a) Improve knowledge of the impacts of new national and European water regulation on water availability and reliability for golf;
- b) Improve knowledge of the impacts of golf course irrigation on diffuse pollution including nitrate leaching and pesticide losses;
- c) Improve knowledge of the risks associated with using low irrigation water quality on golf turf surfaces;
- d) Improve knowledge on alternative water sources (e.g. grey/waste water) its impacts on water quality and suitability for golf.

Turfgrass winter stress management (SDGs 12, 13)

Winter damage is the foremost reason for dead grass, reducing the aesthetic and functional value of turf. UN-IPCC climate scenarios predict that due to high precipitation and unstable temperature, ice and water damage will become the most important cause of winter damage in the future. This is a complex but high priority area for STERF, as it has been estimated that about 70% of Nordic golf courses suffer from winter damage each year, and that the associated average annual costs per golf course are €35 000-40 000. STERF will take responsibility for developing strategic expertise and new knowledge to avoid and manage such damage.

The following important gaps in knowledge and research needs have been identified:

- a) Up-to-date information about actual economic losses and the environmental consequences of winter damage for golf courses.
- b) Understanding of the acclimation processes in plants
- c) Improve knowledge of stress alleviation, there are several techniques and products that can be used to reduce the impact of stress and there is a need for more knowledge from an environmental perspective using these products.
- d) Understanding the spring transition poses special challenges.
- e) Improve knowledge of re-establishing dead turf
- f) Support development of monitoring and modelling for decision support
- g) Field evaluation of turf grass species and new varieties at sites representing various winter conditions



Multifunctional use of golf facilities (SDGs 3, 11, 15, 17)

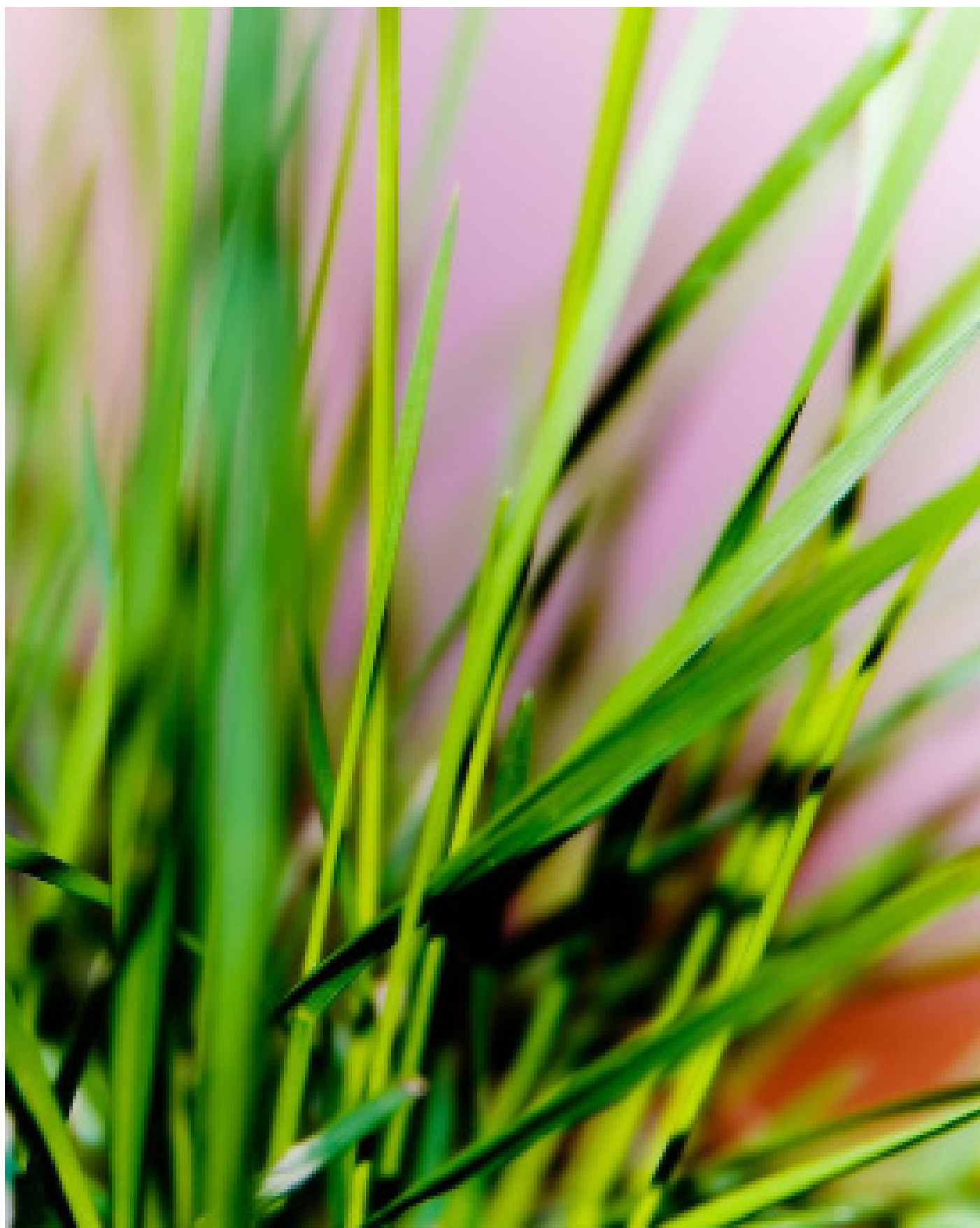
Multifunctional golf courses can contribute to the achievement of international and national environmental targets and help improve people's health and quality of life by providing facilities for active outdoor recreation. Through STERF's R&D programme within multifunctional facilities, the Nordic area can become a model region as regards multifunctional golf courses and collaborations between different interests in society.

STERF has identified four key areas to increase expertise on the multifunctional use of golf courses:

1. Green areas and green spaces in the sustainable urban community and educational land use
2. The natural and cultural environment, ecosystem services, and biodiversity
3. Dialogue, interactions, and cross-border partnerships
4. Business promotion

The following themes are important to study and develop further:

- a) How can multifunctional golf courses be designed and made accessible so that recreational values can be provided in a safe way for different groups, for example golf players, the elderly, walkers and joggers, horse rider to share at the same time;
- b) How can golf courses be used and improved as a resource in the work on biological diversity and be an important actor in the work on green infrastructure, and at the same time protect and reveal cultural values;
- c) There is a need for good examples of external partnerships and cooperation and on how a long-term process can be maintained when, for example, political decisions change or key individuals leave a project.



INTERNATIONAL COLLABORATION AND IMPORTANT PARTNERS

Research is an international endeavour. STERF's involvement in international R&D partnerships aims to promote and foster international contacts, so that we can exchange new ideas and recent advances in knowledge. Arranging and participating in these international exchanges and R&D networks enables STERF to continue to guarantee that our own R&D maintains a high international standard. In addition to this international R&D network at the administrative level, individual researchers should be encouraged to develop international contacts that could benefit their own project, as well as STERF in general.

STERF has established a successful international research and development collaboration, including research facilities and expertise in all five Nordic countries. STERF has also initiate inter and multi-disciplinary research and support collaboration in Europe, Canada, USA and China, involving both researchers and stakeholders interested in land used for golf and managed turfgrass areas.

Universities and research facilities involved in STERF's on-going projects

- Norwegian Institute for Bioeconomy Research, NIBIO
- Norwegian University of Life Sciences
- Agricultural University of Iceland,
- University of Copenhagen-IGN, Denmark
- Århus University, Denmark
- Swedish University of Agricultural Sciences
- Spetsa, Linköping University, Sweden
- Gothenburg University, Sweden
- Luke, Finland
- Cranfield University, UK
- The Turf Disease Centre /UK
- Technical University Munich
- University of Applied Sciences, Osnabrück, Germany
- Asian Turfgrass Center, Bangkok, Thailand
- Northeast Agricultural University, Harbin, China
- University of Guelph, Canada
- Agriculture and Agri-Food Canada
- Systematic Mycology & Microbiology Lab, Department of Agriculture /USA
- University of Massachusetts.
- University of Minnesota

STERF has developed and expanded the STERF industrial scientific partner programme by collaborating with leading international companies within the sector to further strengthen the strategy that research and development should be integrated from producer to end-user.

Examples of important industrial partners supporting STERF's initiatives

- Syngenta
- DLF
- COMPO
- Toro
- Aquatrols
- Bayer
- John Deere
- BASF
- SYMBIO
- Richter Rasen
- Melspring

Other organisations involved in and supporting STERF's activities

- International Turfgrass Society
- European Turfgrass Society
- The Royal Swedish Academy of Agriculture and Forestry
- Stockholm Resilience Centre
- Dutch Turfgrass Research Foundation
- Canadian Turfgrass research Foundation
- The R&A
- The European Institute of Golf Course Architects
- United States Golf Association
- European Golf Association
- Federation of European Greenkeepers' Associations
- GEO Foundation
- Swedish Society for Nature Conservation
- DOF-Birdlife Denmark



READY-TO-USE RESEARCH

STERF's ambition is to take a proactive lead in making new research results and knowledge easy accessible to end-users and to provide support to implement changes, which is a prerequisite for achieving improvement in the sustainable management of golf courses and other turfgrass areas. This places great demands on effective communication of R&D activities and the results these produce. STERF ensures that R&D projects result in the formulation of practically useful programmes of measures and recommendations. Research findings obtained within projects funded by the STERF are made available to all interested parties.

An effective dialogue between researchers and practitioners is necessary to identify research priorities in new fields and to ensure that newfound knowledge is transferred into practice. Seminars, workshops and conferences are arranged by STERF to facilitate this dialogue. To guarantee continuous

implementation of new knowledge, managers of STERF-funded project must appoint, when applicable, a reference group of scientists, experienced practitioners and agronomists from at least two of the Nordic countries for each project or research area.

Results from ongoing STERF-funded research projects are continuously presented in scientific publications; handbooks, fact sheets, and videos with practical advice and recommendations; popular scientific articles, newsletters; and made available on the STERF website. These results are updated at least annually and also presented in the STERF yearbook. Demonstration trials could play a vital part in making research findings easily available to interested parties. Demonstration trials could be the last stage of a project or a group of projects.

ORGANISATION AND OPERATIONS

STERF Board, Advisory committee and Director

The Board is the governing body for STERF and has representatives from all five Nordic golf federations, two scientific representatives not representing any particular country and one representative of the Nordic greenkeepers' organisations.

The Advisory committee and the committee sub-groups are responsible for evaluating and prioritizing research proposals for funding. The Committee includes representative researchers, agronomists and practitioners, including one representative from each of the national greenkeepers' organisations. The Board appoints the Committee members every year.

The Director participates in all meetings of the STERF Board and chairs the Advisory Committee.

Details on the STERF board, advisory committee and director can be found on www.sterf.org

Programme coordinators

Programme coordinators appointed by STERF are, together with STERF board and director, responsible for developing STERF four R&D-programmes.

Overarching duties to be fulfilled by the programme coordinators are:

- to be a 'Champion' or nominal lead for their programme and to ensure that strategic issues within the field are dealt with;
- to make sure that the programme has a suitable mix of activities and to initiate, meetings, workshops, media outputs, et cetera;

- to participate in relevant project reference groups meetings;
- to take 'ownership' of the activities/initiatives that need to be developed over the next 3 years.

Innovation workshops and survey

STERF arranges regular innovation workshops to help identify the golf and turfgrass industry's future research needs, where researchers and industry representatives contribute to the planning process. STERF also regularly invites club managers, greenkeepers and other representatives of golf clubs in the five Nordic countries to participate in an internet-based survey about research and development priorities.

Call for proposal

STERF issues a call for applications for funding for new research projects once every three years. The call is announced in good time on the STERF website. The applications are assessed by STERF's advisory committee, which consists of representatives of the Nordic greenkeepers' associations, the golf federations' course consultants, golf course architects, researchers and other experts within the sector.

Ongoing project decided by STERF can be found in STERF yearbook for 2018 at www.sterf.org

PRACTICAL ACTION

Guiding Principles for resilient and sustainable golf courses

The main objective of Golf Course 2030 is the production of 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 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 is offered as a guide to those in decision-making positions.

1. Plan over the longer-term and operate under consistent policies, which are documented.
2. Prepare for future challenges. Consider the predicted impact of the changing climate (such as flooding, coastal erosion or drought), the availability and costs of vital resources and the constraints placed by regulation.
3. Recognise 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 are going to be increasing issues for golf. 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 non-potable 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 is for increasing pressure on pesticide availability and use. It is likely that they will continue to be removed from 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. Fertiliser use is 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. Excessive organic matter accumulation creates weak turf, prone to stress and susceptible to disease infection, pest attack and weed ingress. Management practices used to control organic matter accumulation, e.g. various forms of scarification and top dressing, cause stress to turf. 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, fertiliser and pesticide inputs to correct. 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. Disposal of waste to landfill will become increasingly expensive and socially unacceptable. Course design, construction and maintenance should focus on preventing waste and maximising reuse and recycling.
13. Biodiversity loss is a major global concern and golf courses have the 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.
14. Golf has a responsibility to wider society and the design, construction and maintenance of 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.
15. Objective assessment of the condition of playing surfaces, particularly the putting surfaces, on the golf course is required to monitor the impact of the challenges facing greenkeepers, the implementation of research outcomes and adaptations in management. This could include firmness, smoothness, trueness, reliability, speed, etc.
16. The recording of key resource metrics for course management, e.g. water, chemicals, energy, waste and biodiversity. Sustainability reporting on course operations is required on a facility, country, region and international level. This is necessary to monitor the impact of the challenges facing greenkeepers, the implementation of research outcomes, adaptations in management and compliance with regulations.

Written in cooperation with:



Information about the R&A can be found at www.RandA.org



STERF (Scandinavian Turfgrass and Environment Research Foundation) is the Nordic golf federations' joint research body. STERF supplies new knowledge that is essential for modern golf course management, knowledge that is of practical benefit and ready for use, for example directly on golf courses or in dialogue with the authorities and the public and in a credible environmental protection work. STERF is currently regarded as one of Europe's most important centres for research on the construction and upkeep of golf courses. STERF has decided to prioritise R&D within the following thematic platforms: Integrated pest management, Multifunctional golf facilities, Sustainable water management and Winter stress management.

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