Building A Sustainable Game:
USGA Science, Research and Innovation

Rand Jerris, Ph.D.
Senior Managing Director, Public Services

USGA

Fundamental Principles

The **United Nations** Brundtland Commission (1987) defined **sustainable development** as "meeting the needs of the present without compromising the ability of future generations to meet their own needs."

Three Core Components

Social
Environmental
Economic

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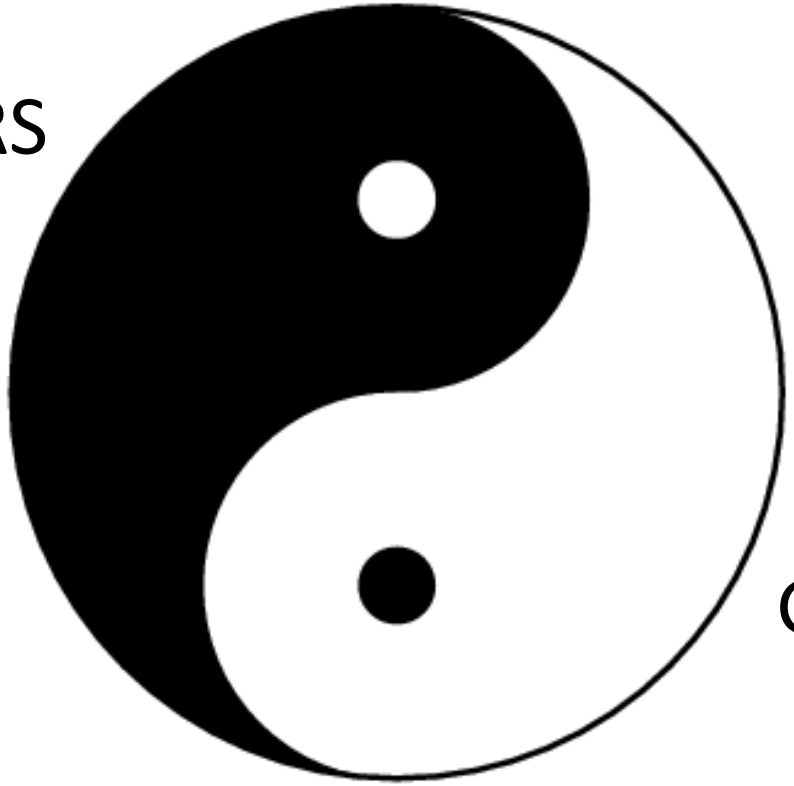
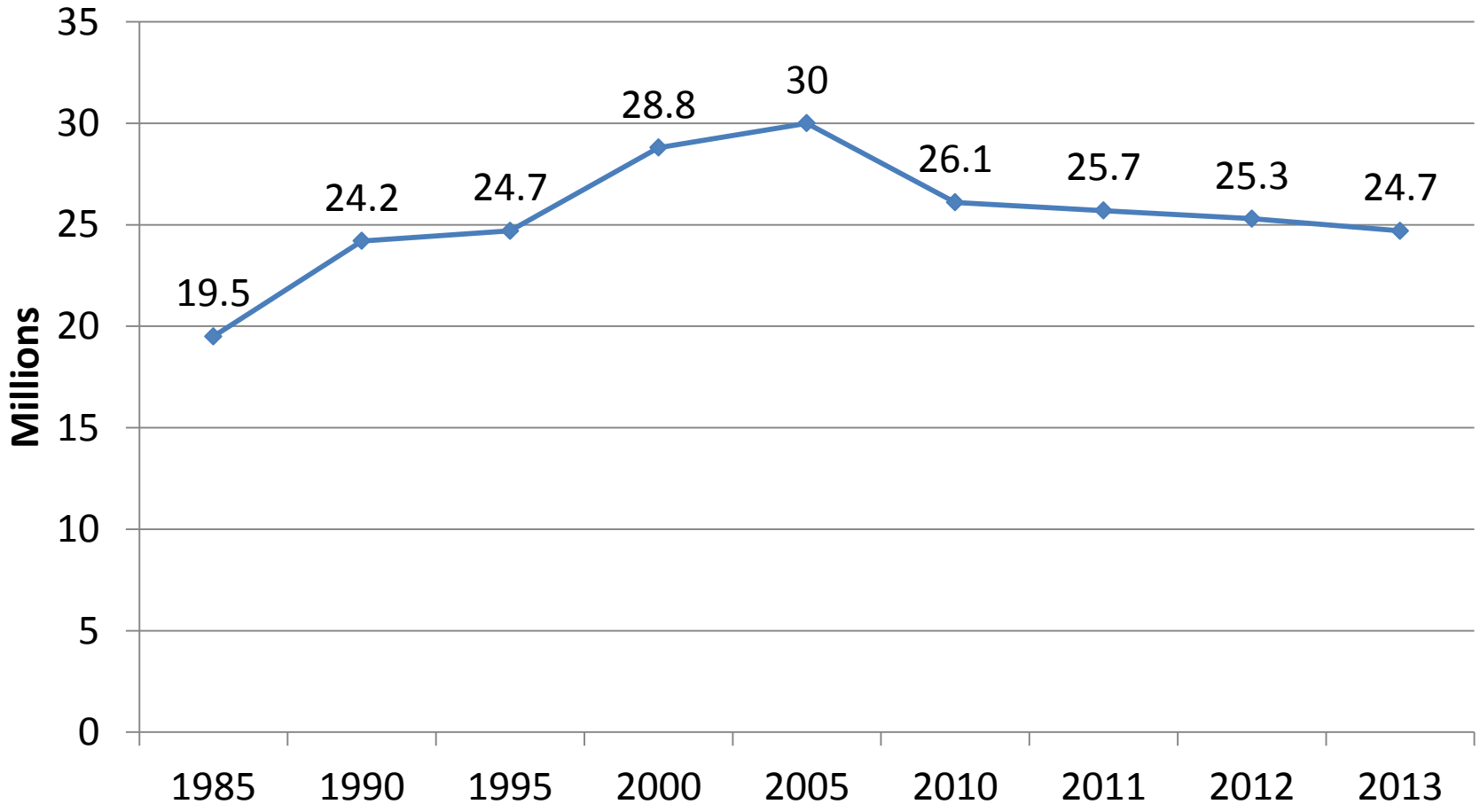
Golf's ecosystem

GOLFERS



GOLF COURSES

Golf participation



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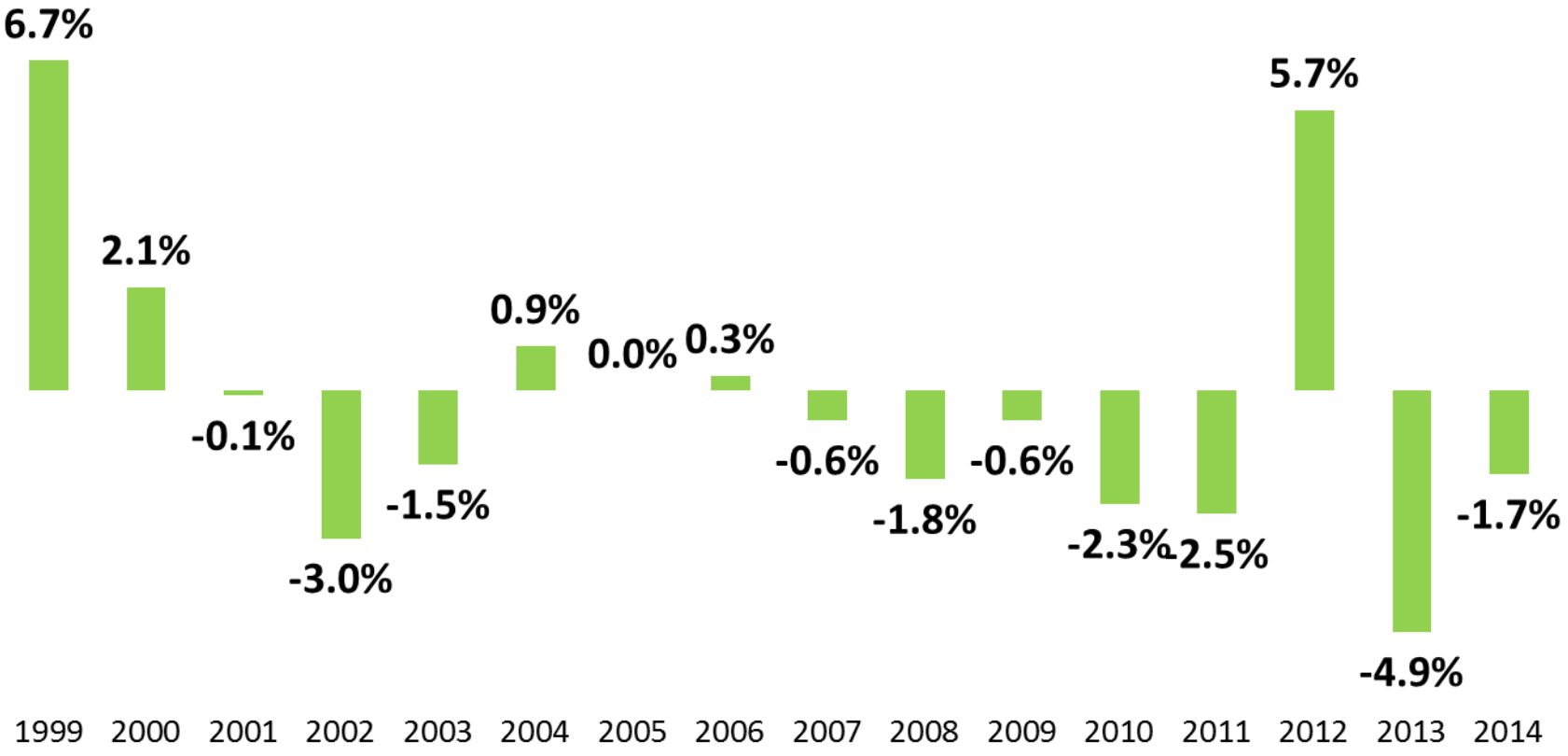
Rounds volume (year/year change)



Source: Coalition National Rounds Played Report in cooperation with PGA PerformanceTrak and the NGF; Based on a sample of approximately 4,000 reporting facilities

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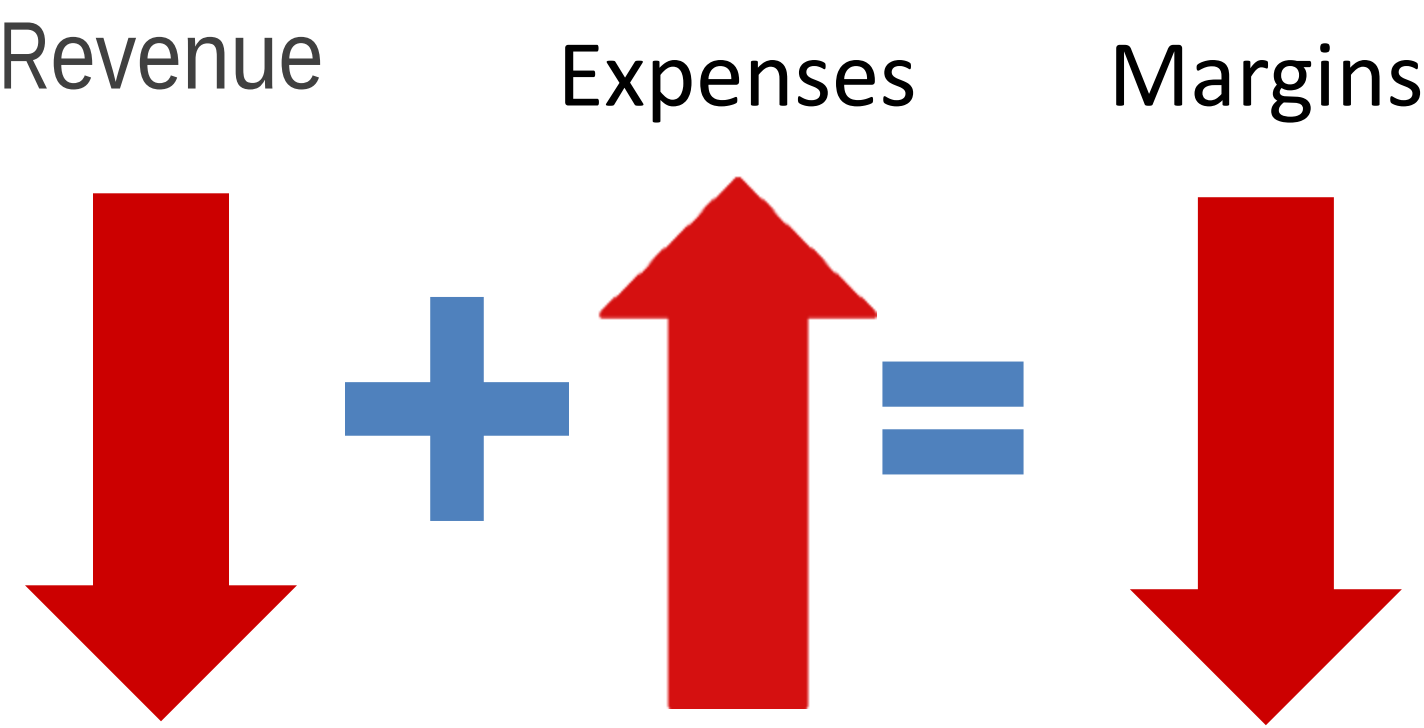
Macro trends



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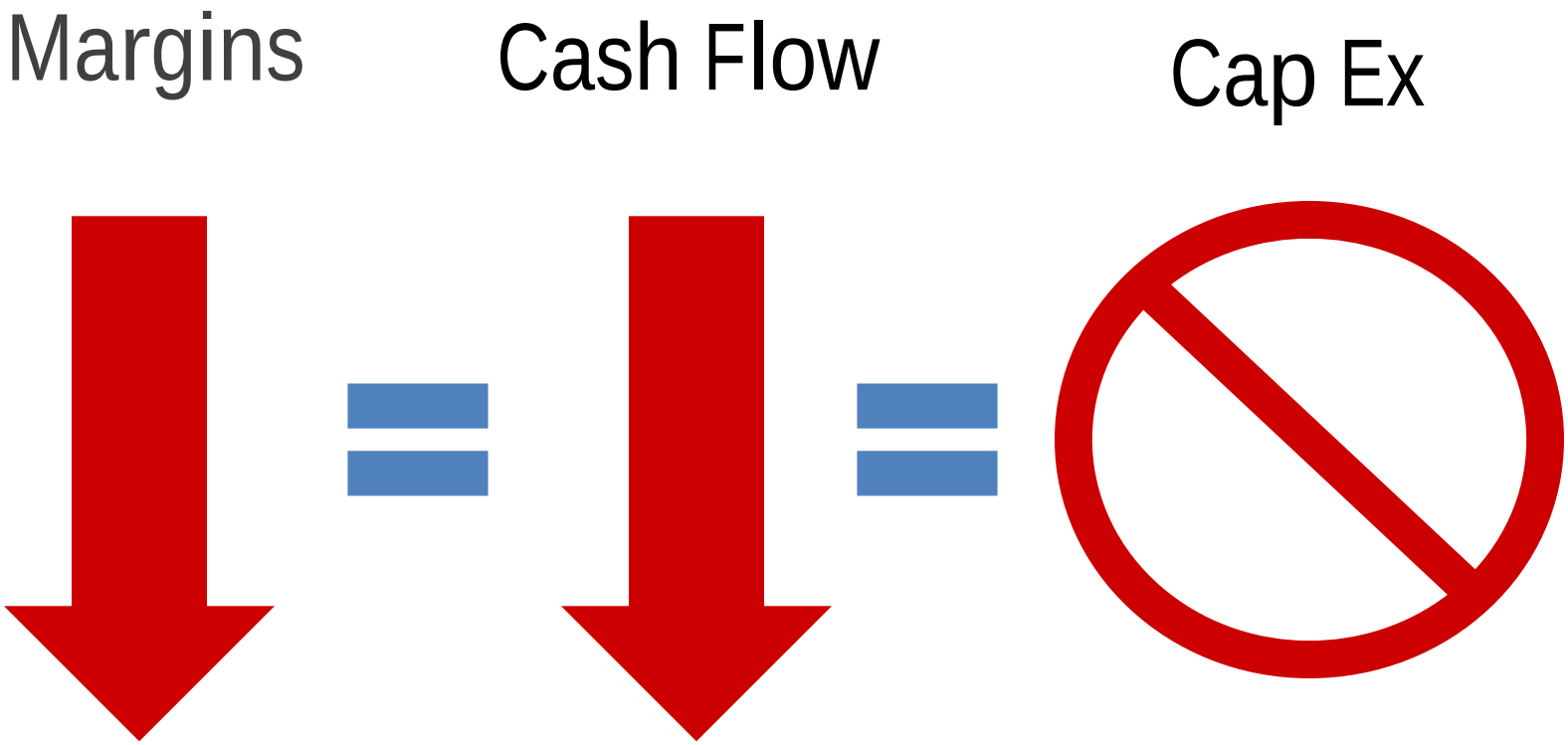
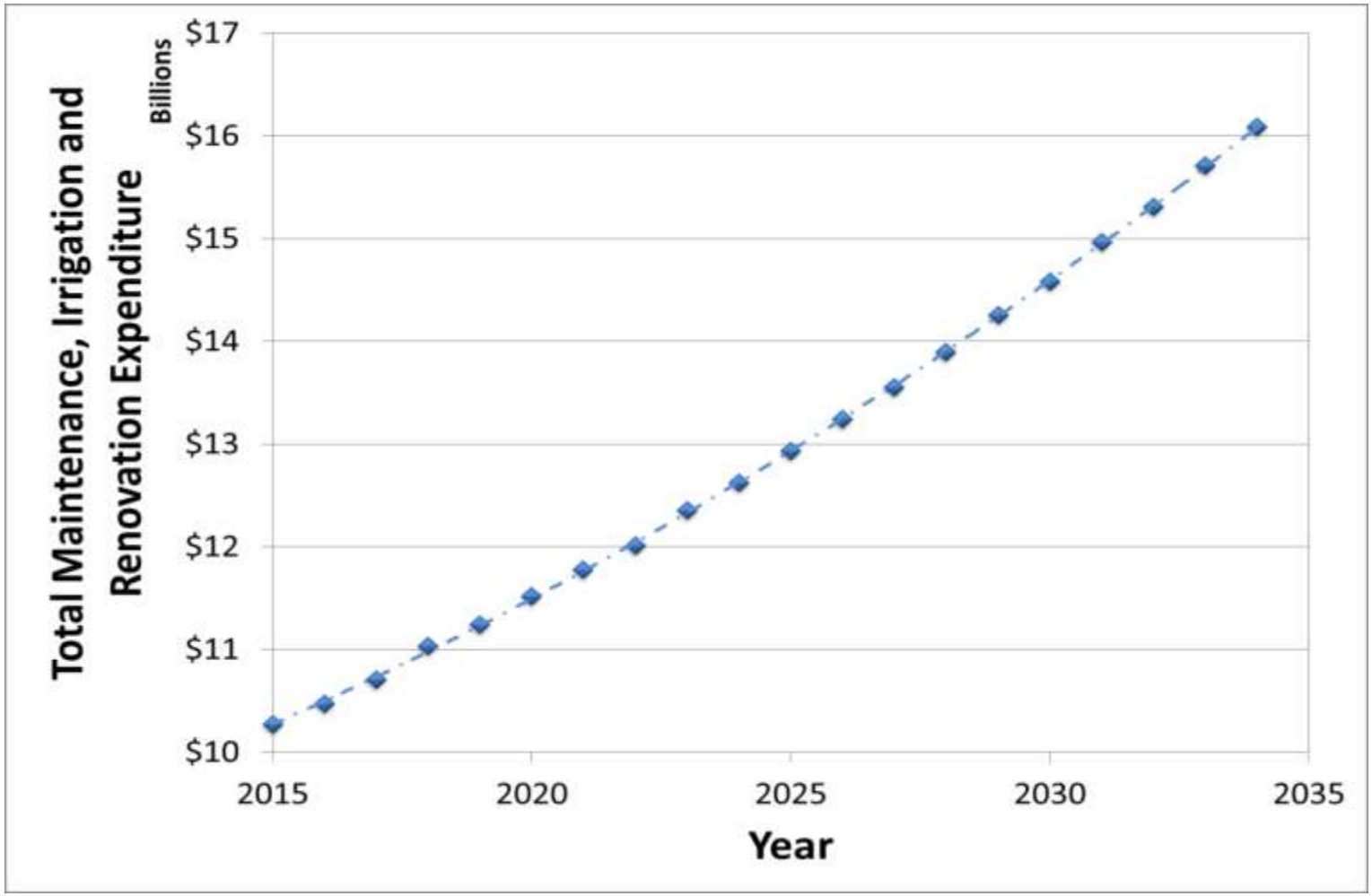


Golf course maintenance expense

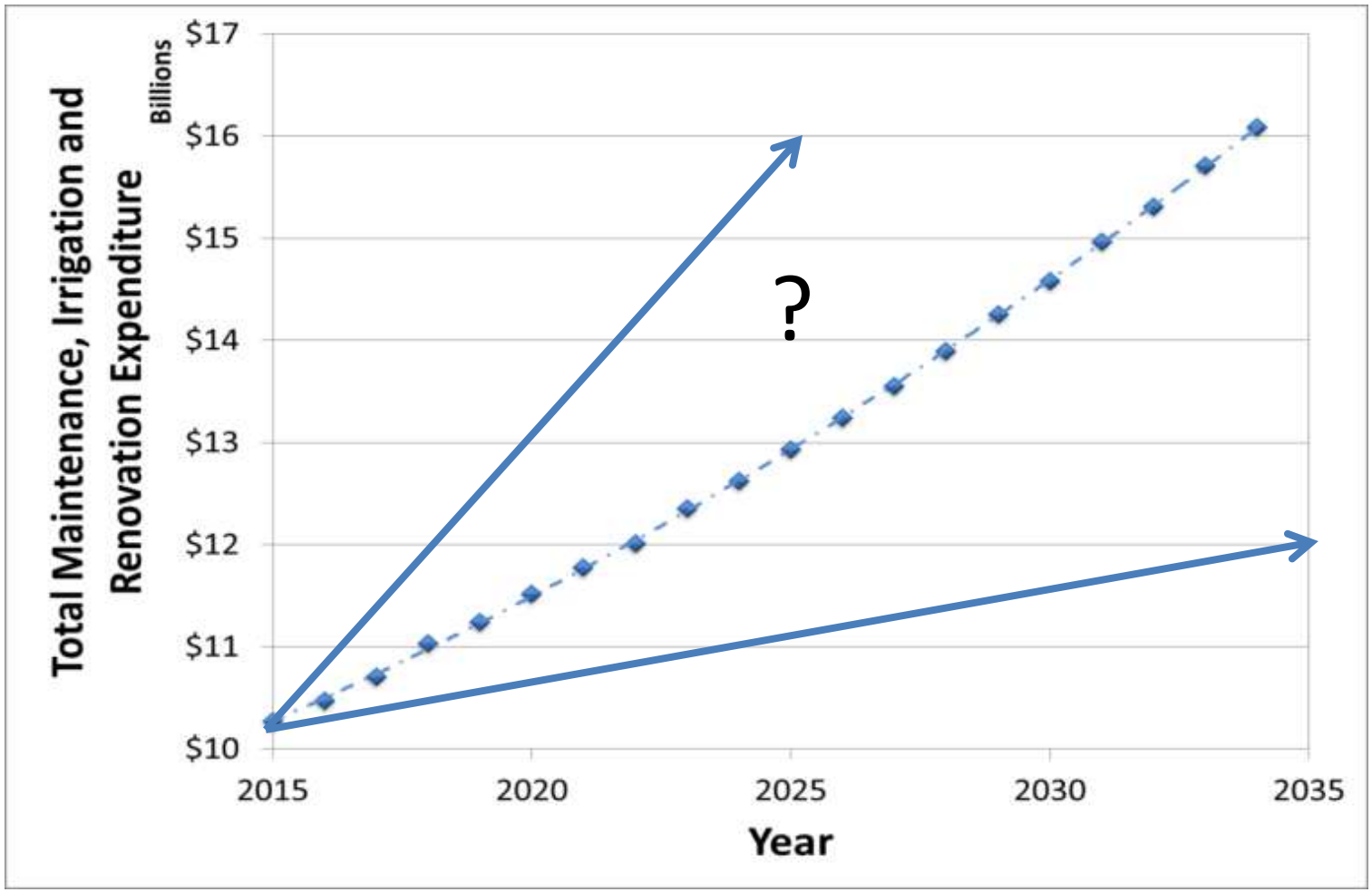


Cost escalation – 2012-2015

- Water – 38% (11.4% annualized)
- Nutrients – 15.9% (5.0% annualized)
- Energy – 11.4% (3.7% annualized)
- Chemicals – 6.9% (2.2% annualized)
- Equipment - -14.9% (-4.9% annualized)

Source: Golf Course Industry Magazine, January 2015

Projected expense growth



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Water: The Greatest Challenge

Of all golf's challenges, issues of water quantity and quality pose the most significant threats to the game's long-term viability.

Cost Increase -2011-2014

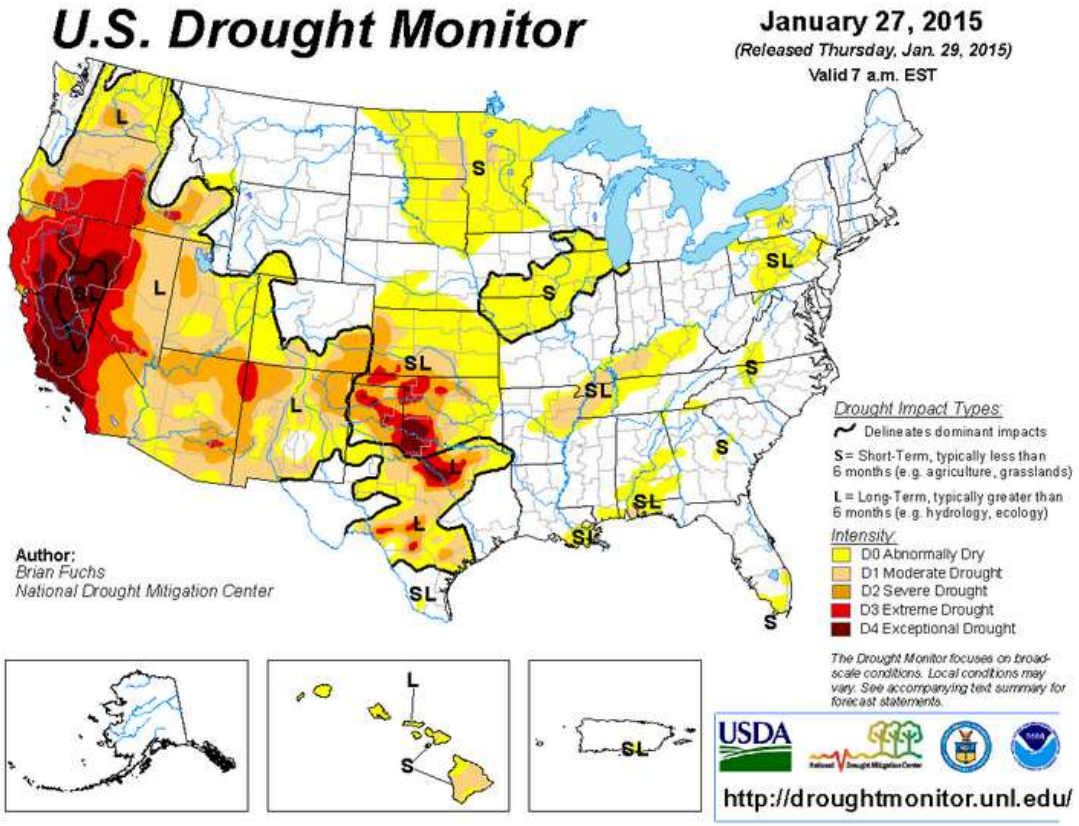
Water – 38% (11.4% annualized)
Nutrients – 15.9% (5.0% annualized)
Energy – 11.4% (3.7% annualized)

Extraordinary Challenges

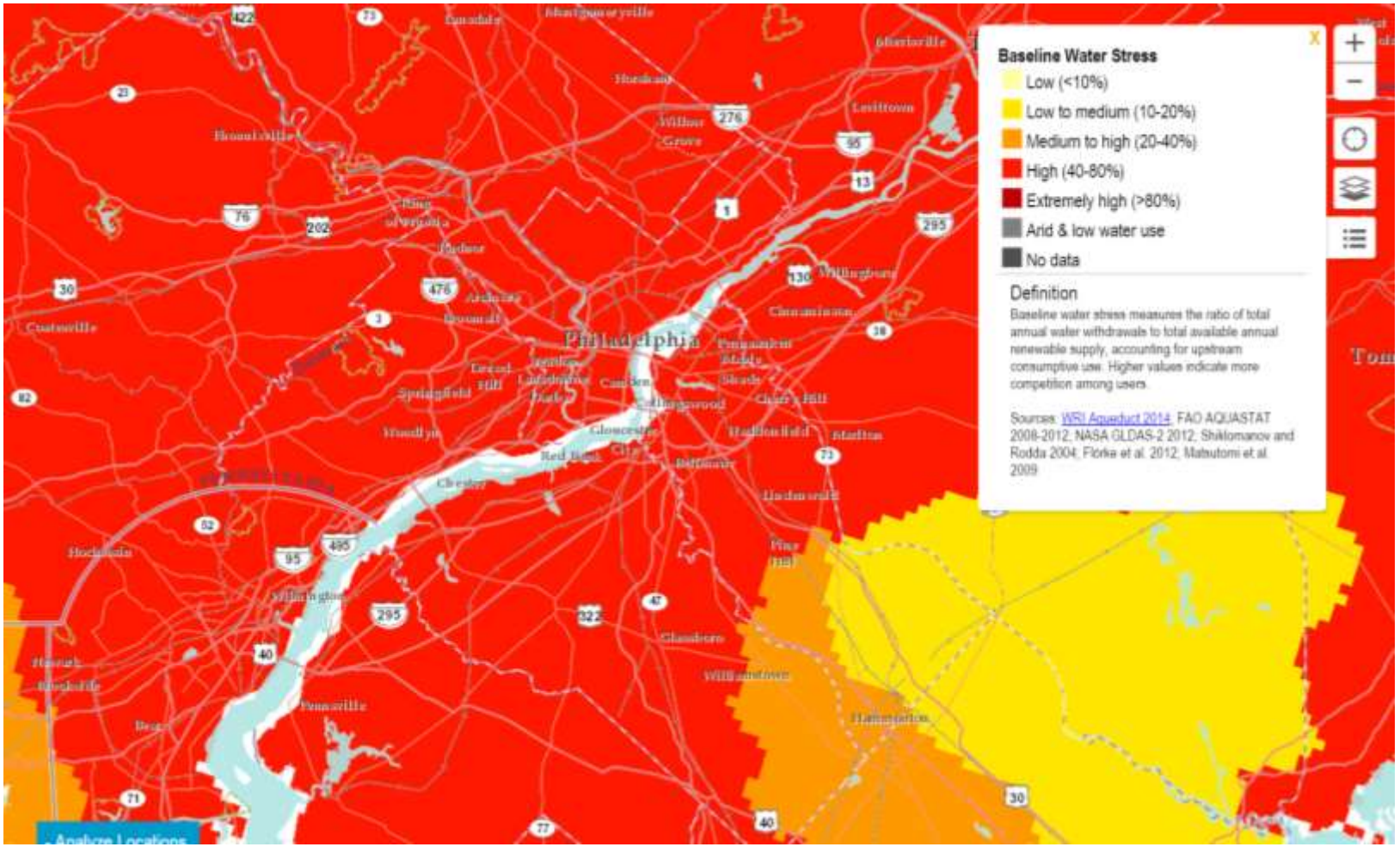
Some facilities in Southern California are now spending more than $2M annually on water.

There are regions in Arizona, New Mexico and Texas where water rates have more than doubled over the past 5 years.

Water supply infrastructure is deteriorating in many regions and costs to repair will be passed along to users.



Water stress



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Legislative challenges

- The implementation of WOTUS places additional regulation and cost – potentially significant – on golf course operations
- 13 states have enacted legislation to restrict nutrient and chemical use; many more states have similar restrictive legislation in the pipeline (Great Lakes Restoration Initiative, Gulf of Mexico Hypoxic Zone cleanup and lawsuit; Chesapeake Bay Watershed cleanup)
- Efforts to revise the H2B visa program could deprive golf facilities of a significant labor force
- EPA and White House initiatives to protect agricultural workers and pollinators
- There remain continued efforts to label golf as a “sin” industry (together with dog tracks, massage parlors and tanning salons)

Changing trends

	Labor	Water	Nutrients	Chemicals	Energy	Impact to Players
Increased Green Speed	Significantly higher	None	Lower	Significantly higher	Higher	Longer rounds Higher scores
Lower Fairway Mowing Heights	Higher	None	Lower	Higher	Higher	Difficult to elevate ball; yips
Longer, uniform rough	Higher	Higher	Higher	Higher	Higher	Lost balls Longer rounds
Color and Aesthetics	Significantly higher	Higher	Significantly higher	Higher	Higher	None
Overseeding	Significantly higher	Significantly higher	Significantly higher	Significantly higher	Higher	None
Increased Length	Significantly higher	Significantly higher	Significantly higher	Significantly higher	Higher	Increased Length
Increased Footprint (various factors)	Higher	Higher	Higher	Higher	Higher	Longer rounds

Pebble Beach, 1977

Pebble Beach, 2014

What golfers* tell us

Contributors to Overall Enjoyment

- Conditioning of Golf Course: 76%
- People You Play With: 75%
- Cost: 72%
- Access to Tee Times: 71%
- Pace of Play: 67%

For the first time, our 2015 research shows that cost supersedes time as a barrier to participation

* Source: 2015 USGA Programmatic Tracker (national sample of 2,150 golfers, distributed across age and participation segments, public and private)

What facilities* tell us

What they are doing:

- Less than 20% of golf facilities have a best management practices plan
- Less than 17% of golf facilities have a written water management plan

What they are seeking:

- 68% want to better understand golf course maintenance labor issues
- 57% are seeking a better understanding of water management best practices
- 55% are seeking a better understanding of improved energy utilization practices

Sources: GCSAA, *Golf Course Environmental Profile: Water Use and Conservation Practices on U.S Golf Courses*, 2nd edition, 2014/2015 (1,950 golf facilities; geographic representation across for U.S. census regions; municipal, daily fee and private); *2015 USGA Programmatic Tracker* (475 golf facility owners, operators and superintendents; geographic representation across for U.S. census regions; municipal, daily fee and private with stratification by fee structure)

The Burning Platform

There is a substantive opportunity to create a more compelling experience for golfers through technology and enhanced facility operations.

More than 4,500 of 15,500 golf courses in the United States were constructed between 1985 and 2005 and have reached or soon will reach their expected lifespan and require significant renovation.

Golf courses in the United States and worldwide face unprecedented pressures to remain environmentally and economically viable.

Declining revenues and accelerating input costs pose substantive threats to many golf facilities, which traditionally operate with low margins and limited cash flow.

The most significant disruptive threats come from the rising costs of water, restrictions on access to water, and aggressive efforts to protect water quality.

Mitigation strategies

The industry must identify, prioritize an develop opportunities to mitigate excessive resource consumption that are grounded in science, research and data.

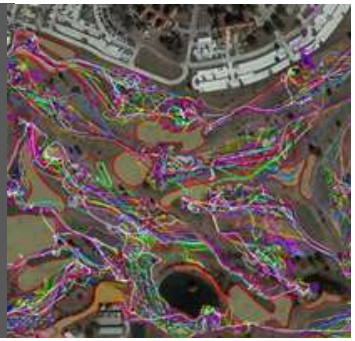
The most effective mitigation strategies include:

- Reduce maintained and irrigated acreage
- Leverage E/T data to manage irrigation practices
- Utilize moisture sensors
- Embrace new turfgrass cultivars
- Reduce maintenance of bunkers and rough

Core Processes

Theoretical and Applied Research

Product Development



Education

Measurement

Research

We believe that the best approach to studying golf's challenges is rigorous scientific research and that the best solutions will be grounded in real data.

$40 million+

Since 19, the USGA has awarded more than $40 million in grants to research universities across the United States. This research has led to the development of 38 turfgrass cultivars with improved heat and drought tolerance.

126,750

1,950 facilities across the United States responded to a joint USGA/GCSAA survey about water use on golf courses. More than 126,750 individual data points provide insight into conservation methods and results.

9,127

The USGA used GPS devices to track more than 9,000 rounds of golf at 196 different events in 2014-2015. More than 27.3 million data points are now being analyzed against a multitude of golf course and golfer variables.

Research

Partnerships with major universities will help expand our owned resources and accelerate and enhance our research programs.

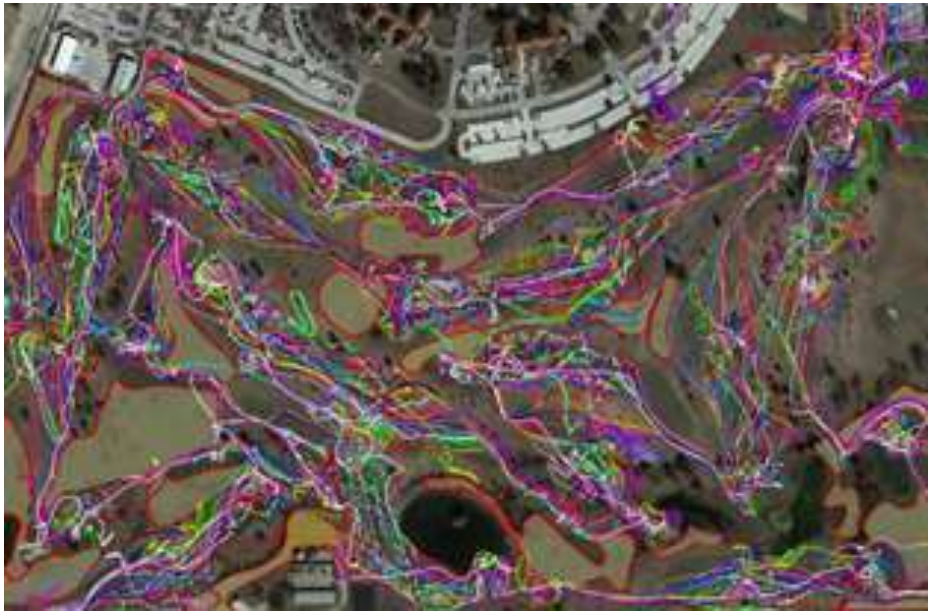
University of Minnesota

On November 1, 2015, we announced a five-year master research agreement with the University of Minnesota to study and advance solutions to golf's present and future challenges. The partnership will allow us to leverage the full assets of the university, recognized as one of only five comprehensive research universities in the United States. The partnership will leverage the university's Les Bolstad Golf Course as a living laboratory and classroom for demonstrating best practices in course design, maintenance, and operations.

Product Development

We are committed to providing facility operators with the information, tools and technologies they will require to better manage sustainable facilities.

Resource management tool utilizes GPS technology and satellite imagery to identify areas of a golf course that are not utilized but still maintained. Reducing maintained and irrigated acreage results in significant resource and cost savings.



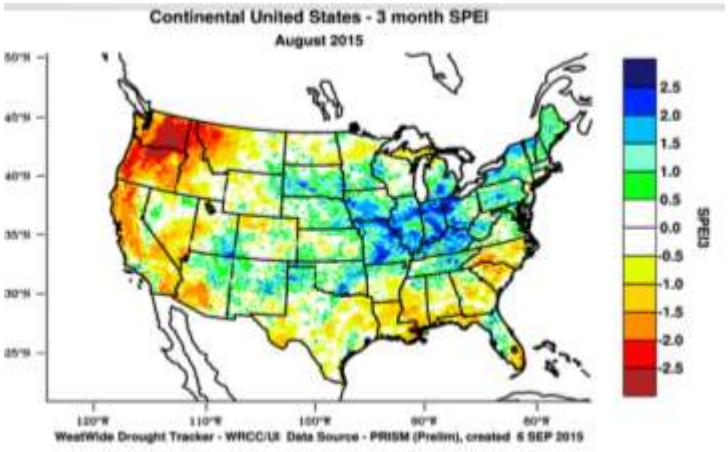
Instrumented flagstick tool helps golf course operators improve the golfer experience by tracking the flow of play and minimizing delays.

Product Development

We will initiate research and development for two products in 2016.

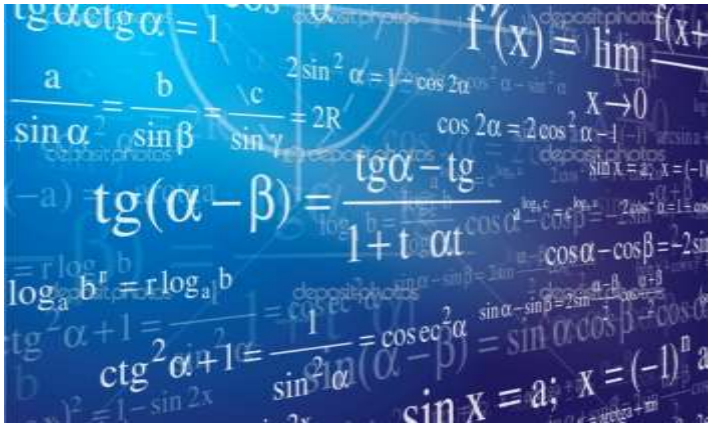
ET Monitoring Network

Evapotranspiration data are critical for optimizing turfgrass irrigation, yet many superintendents don't have ready access to accurate data, as monitoring stations are specialized and expensive. Our objective is to establish a nationwide network of ET stations to provide localized data that can be accessed freely by any facility. The benefits will extend beyond golf facilities to agriculture and homeowners.



Pace of Play Calculator

An online tool for committees and facility managers that predicts pace of play based on course yardage, size of field, format and starting intervals. Users may change variables to calculate the effect on expected hole-by-hole playing times. The tool will help managers and committees to optimize field size and starting-time intervals, set accurate pace expectations and establish pace policies.



Education

We believe that the exchange of information is central to driving change across an ecosystem that comprises more than 50,000 independent businesses.

80,000+

The USGA's Course Consulting Service has completed more than 80,000 visits to golf courses in North America, providing expert evaluation to help improve playing quality, environmental sustainability and economic efficiency.

4 million

The USGA's Green Section Record is published 24 times a year and distributed digitally to more than 17,000 individuals worldwide. Collectively, GSR articles are viewed more than 4 million times annually.

Education

New and expanded programs for 2016 will highlight the value of innovation in the proactive management of golf facilities.

Site Improvement Grants

This new program for 2016 provides grants to publicly accessible facilities to pay for site visits by ASGCA architects and USGA agronomists who will evaluate the design, agronomics, and efficiency of their operations, and recommend solutions that will enhance the quality of the experience they offer to golfers. Emphasis will be placed on the implementation of innovative principles and solutions that will enhance the overall economic and environmental viability of these facilities.

Innovation Symposium

Inaugurated in 2013, the USGA's annual Pace of Play Symposium has become the premier venue for the presentation and discussion of research and scholarship focused on pace of play. In 2016, the symposium will move to Pasadena, Calif., and the content will expand to look broadly at the overall quality of the player experience. Particular emphasis will be placed on innovative approaches to golf course management that optimize pace of play while conserving resources.

Measurement

The USGA is leveraging data to drive continuous improvement across the golf industry. We believe that a cultural shift toward objective decision-making is critical for the long-term health of the game.

GOLF 20/20

In 2015, the USGA and GCSAA leveraged our positions on the executive board to expand Golf 20/20's strategic plan to include a third pillar focused on sustainability (in addition to pillars focused on participation and the image of the game). Working with Steve Mona, we also drafted a scorecard for 20/20 that contains many of the same metrics that we have adopted for our joint work. These efforts will insure consistency in focus and investment on the changes that we believe are most critical to the health of golf's ecosystem.

LEED for GOLF

The U.S. Green Building Council's LEED (Leadership in Energy & Environmental Design) is a green building program that recognizes best-in-class strategies and practices. To enable golf facilities to benchmark their operations against best-in-class standards and practices, we envision the creation of a LEED-equivalent program for golf. In 2016 in partnership with the University of Minnesota, we will assemble a team of researchers and industry specialists to initiate the framework for a golf-specific system.

Key outcomes

Results-driven, we hold ourselves to an high standard to ensure meaningful and measurable outcomes that can be quantified on behalf of the game.

14.3 billion

Since 2005, 3,200 golf courses in the United States reduced total maintained and irrigated acreage. The estimated net decrease of 14,430 acres reduces annual water use by 14.3 billion gallons.

$150 million

Golf course water use decreased by 21.8% between 2005 and 2014. Last year, the total cost savings associated with water conservation practices could be valued at $150 million.

Potential Return on Investment

Proof of Concept (Source: GCSAA/USGA Water Profile, 2015)
3,200 facilities have reduced acreage since 2005 (21% of U.S. facilities)
Water consumption reduced by 21.8% between 2015 and 2014 (2.5% annualized)
2015 Value of water reduction (vs. 2005): **$150M**

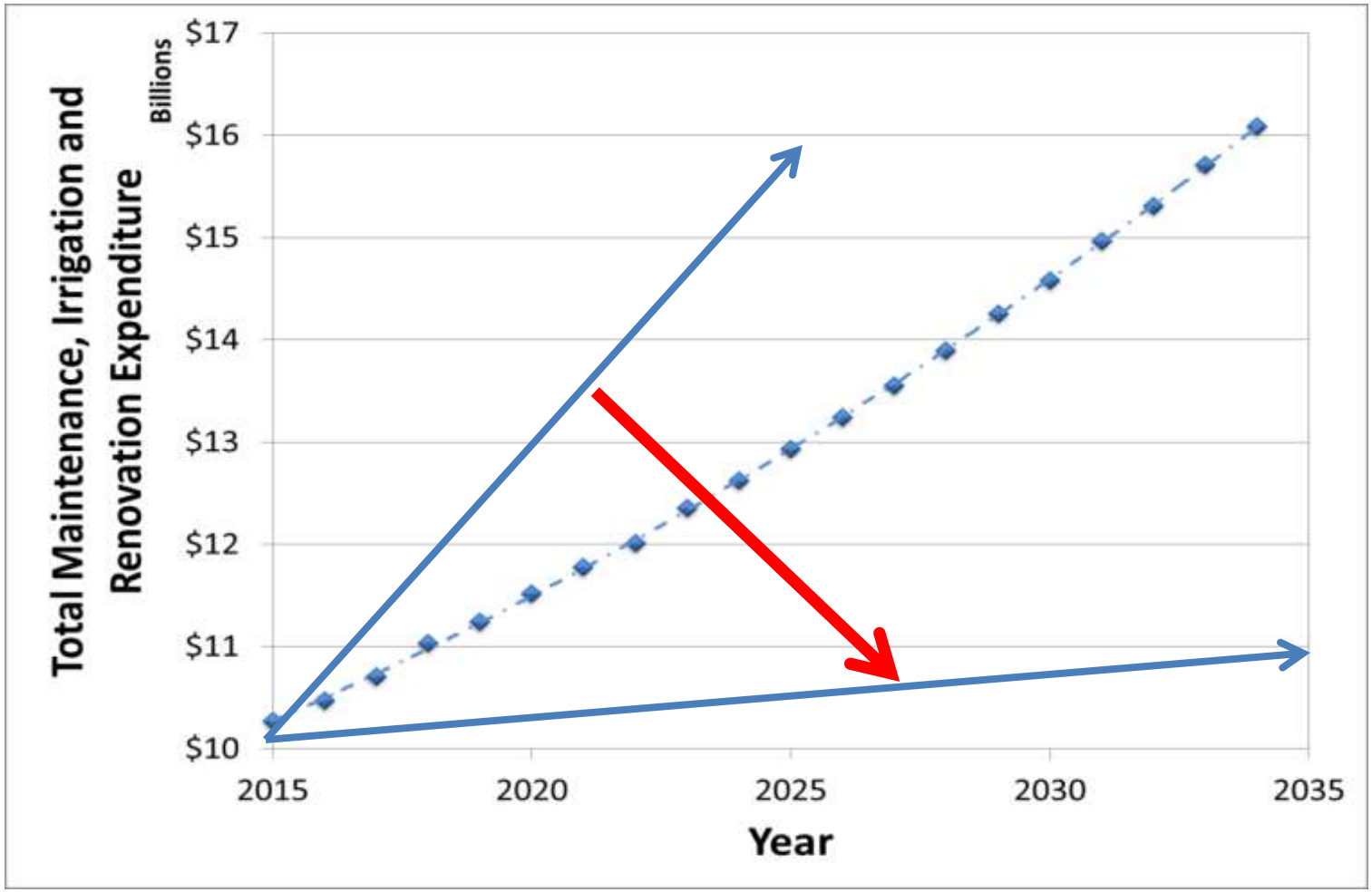
Scenario 1: Expand acreage reduction to an additional 3,200 facilities
2020 Value of water reduction (vs. 2005): **$300M**

Scenario 2: Reduce overall resource consumption by 1% annually (10% over 10 years)
2015 Value of Maintenance, irrigation and renovation: $10.4 billion (Source: USGA)
2020 Value of resource reduction (vs. 2015): **$510M**

Scenario 3: Increase rounds played on public golf courses by .5% (1 per day)
2015 Value of green fees on public golf courses: $10.8 billion (Source: Golf Datatech)
2020 Value of incremental revenue: **$60M**

Stretch Goal: Realize 10% savings on maintenance and irrigation by 2025: $1.4 billion

Bringing the ecosystem into control



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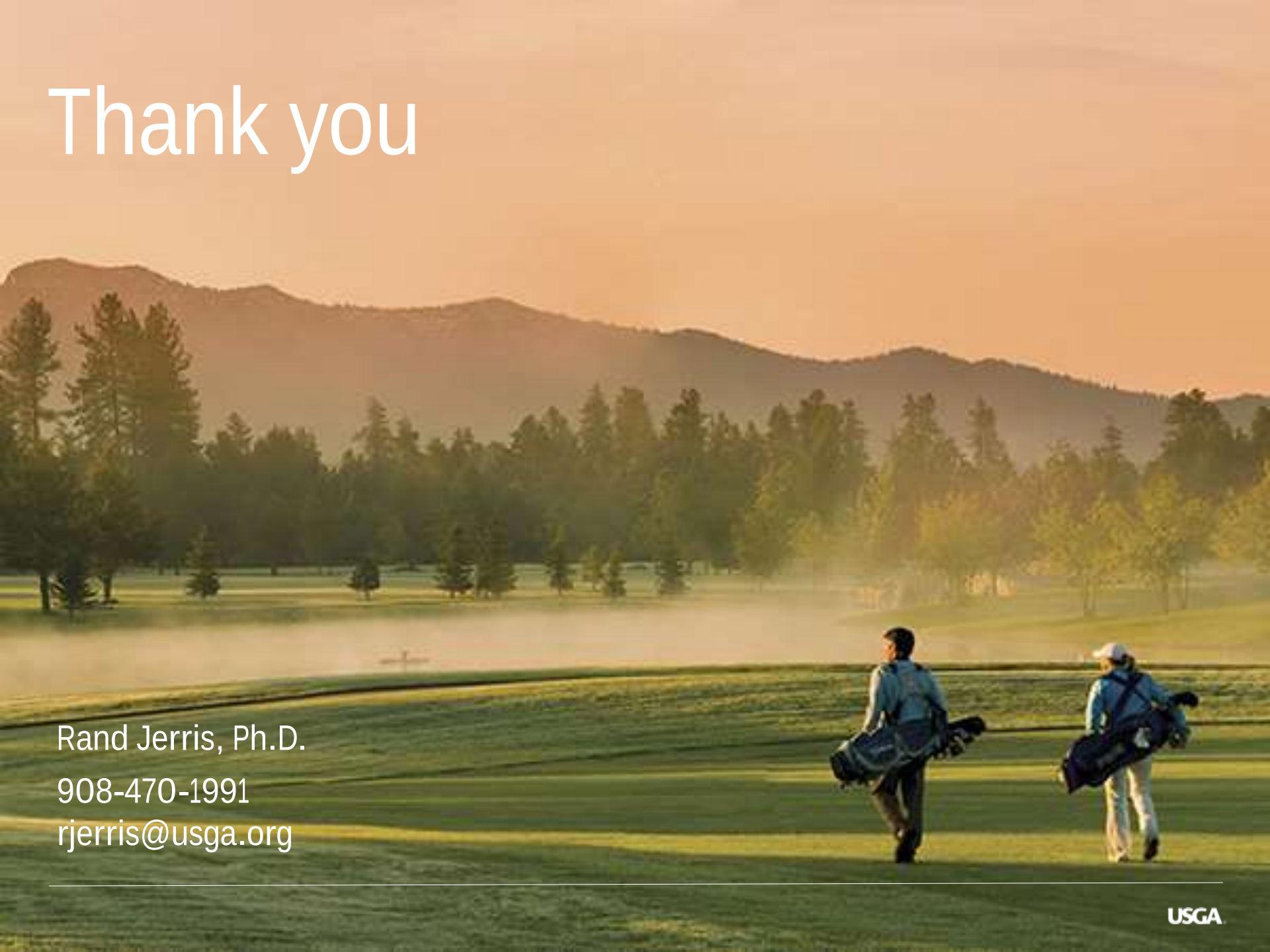

Rand Jerris, Ph.D.
908-470-1991
rjerris@usga.org

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