



Golf Course Environmental Profile

Phase III, Volume III

Land-use and energy practices on US
golf facilities

Golf Course Superintendents Association of America

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Phase III, Volume III

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The third phase of the Golf Course Environmental Profile was conducted by the Golf Course Superintendents Association of America.



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Property study reports continued reduction in manicured acres

It's hard to look at a golf course and not be in awe of the natural beauty. How this land is used and what management practices take place on them are at the heart of why GCSAA began the Golf Course Environmental Profile in 2006.

The information gained from the GCEP surveys is vital to how we communicate with regulators, legislators and the public. On behalf of the board of directors, I want to thank everyone who participated in this study and gave us a window into their facilities and practices.

The total acres of U.S. golf facilities declined by 12% from 2005 to 2021. Much of this reduction from 2.4 million acres to 2.1 million was likely the result of facility closures.

Similarly, from 2005 to 2021, the projected acres of maintained turfgrass declined by 14%. While much of this reduction can also be attributed to course closures, the median maintained turfgrass acreage declined by 3% indicating efforts are being made by golf facilities to reduce their footprint.

While a significant portion of the reduction in total acres and maintained acres may have been caused by factors outside of the superintendent's control, we continue to see an increase in practices that reduce the environmental footprint of the golf industry. More golf facilities used cleaner energy sources, such as natural gas and solar-electric, and fewer golf facilities used gasoline and diesel in 2021 than in 2005.

The evidence is clear that GCSAA superintendents are essential to the success of golf and the long-term future of the game.



Kevin P. Breen, CGCS
2023 GCSAA President

Executive Summary

Land-use and energy practices on U.S. golf facilities were measured for the first time in 2006 and 2008, respectively (Lyman et al. 2012; Lyman et al. 2007). In order to measure change, these surveys were repeated in 2015 (Gelernter et al. 2017a; 2017b).

The objective of this third survey was to document changes in land-use and energy practices since the first surveys.

Land Use Facility Acres

In 2021, the projected total acreage of U.S. golf facilities was 2,131,838 acres, which was a 12% reduction from 2005 (Table 1). The median acreage of an 18-hole golf facility was 146 acres, which was equivalent to the golf facility acres in 2005 and 2015 (Figure 1). The North Central region reported the greatest facility acres (158) and the Pacific region

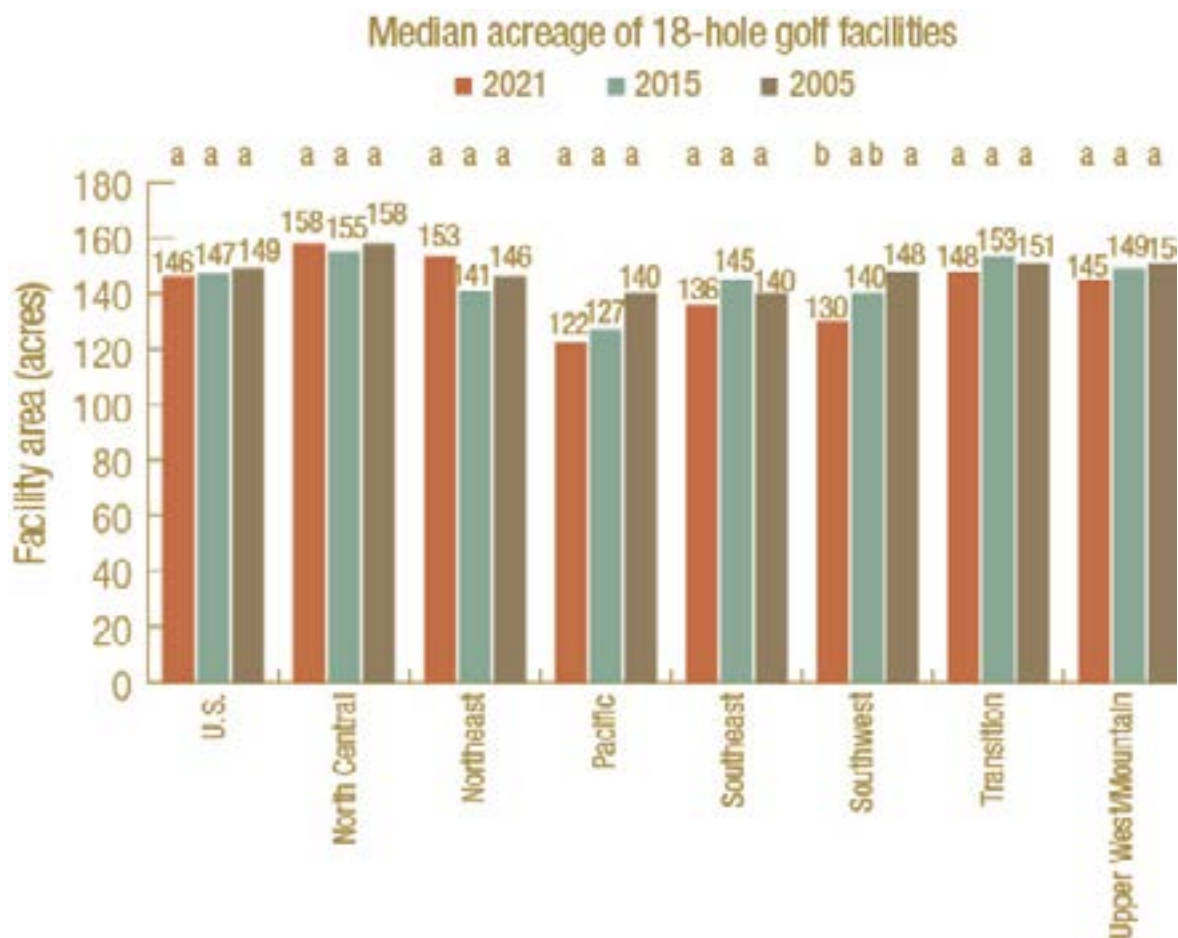


Figure 1. Median acres of 18-hole golf facilities in the US and by region in 2005, 2015, and 2021.



reported the least facility acres (122) in 2005, 2015, and 2021. The Southwest region was the only region that reported a reduction in facility acres (18 acres) between 2005 and 2021.

Nationally in 2021, land-use of an 18-hole golf facility was allocated as follows:

- 95 acres of maintained turfgrass (Figure 2)
 - 49 acres of roughs (Figure 3)
 - 27.1 acres of fairways
 - 5.9 acres of practice areas
 - 3.3 acres of greens
 - 3.1 acres of tees
 - 1.7 acres of clubhouse grounds
 - 0.8 acres of turfgrass nursery
- 23.3 acres of natural areas
- 5.7 acres of water features
- 2.2 acres of parking lots
- 2.2 acres of bunkers
- 2.1 acres of building

Note: The sum of individual components may not equal overall totals due to the use of median values.

Turfgrass Acres

- The projected acres of turfgrass declined by 14.2% since 2005 (Table 3).
- The median acres of maintained turfgrass declined 3% since 2005 (Figure 4).
- Nationally, the reduction of maintained turfgrass occurred on fairways, practice areas, clubhouse grounds, and nursery (Figure 3).
- Acres of greens increased from 3.1 in 2005 to 3.3 in 2021 (Figure 3).
- The Southwest region reported a 16% reduction in maintained turfgrass from 2005 to 2021 and was the only reported reduction among regions (Figure 4).

Turfgrasses

- When pooled across all regions and course features, the proportion of warm-season to cool-season turfgrasses has remained unchanged from 2005 to 2021 with cool-season grasses accounting for 65% of turfgrass acres and warm-season accounting for 35% (Figure 8).
- Bermudagrass remained the most common turfgrass accounting for 31% of all maintained turfgrass acres

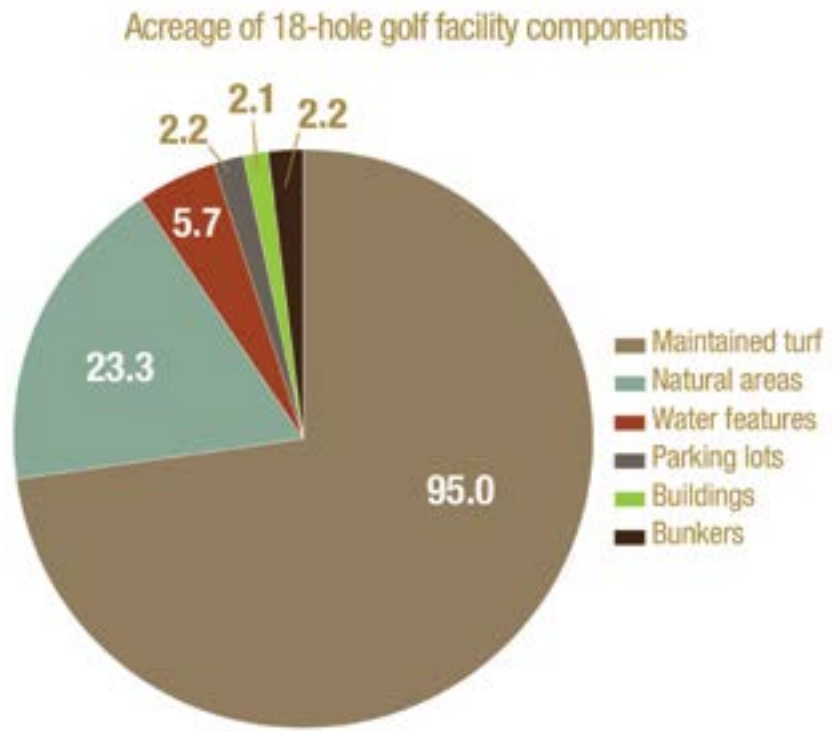


Figure 2. Median acres of 18-hole US golf facilities by facility features in 2021.

Maintained turfgrass by course feature

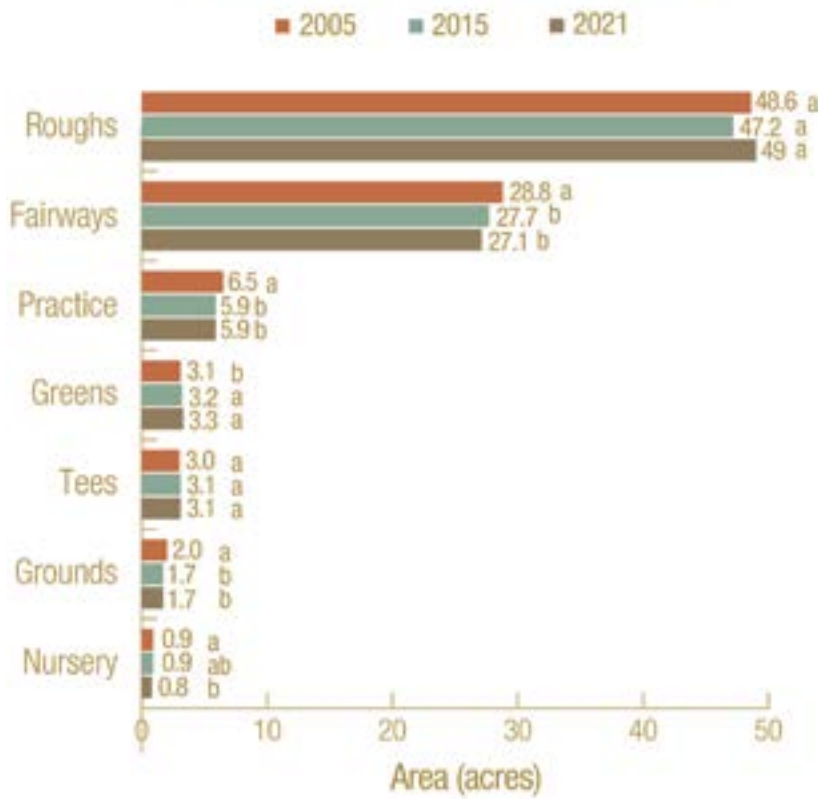


Figure 3. Median acres of maintained turfgrass by turfgrass feature on 18-hole US golf facilities in 2005, 2015, and 2021

Median acreage of maintained turfgrass

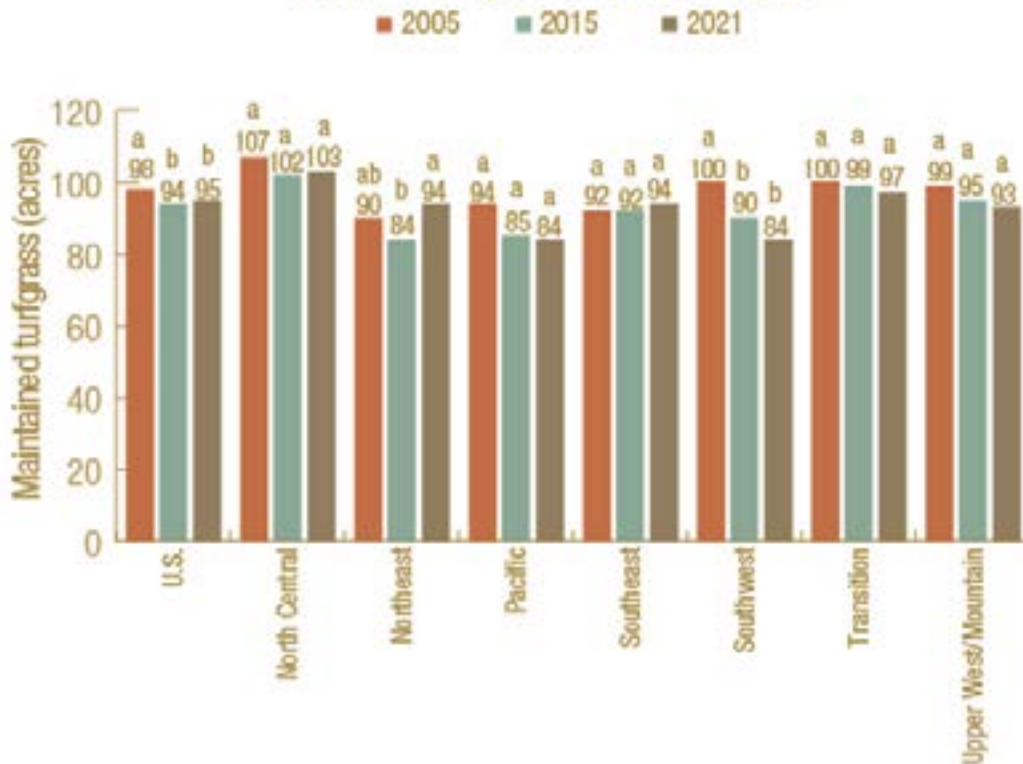


Figure 4. Median acres of maintained turfgrass on 18-hole golf facilities in the US and by region in 2005, 2015, and 2021.

in 2021 (Figure 9). Kentucky bluegrass and annual bluegrass accounted for 23% and 11% of maintained turfgrass acres, respectively. These projected percentages were consistent with those reported in 2005 and 2015.

Environmental Practices

- Total projected acres of overseeded turfgrass declined 60% from 2005 to 2021 (Figure 5).
- The percentage of golf facilities that added or improved most environmental practices within the last five years slowed down from 2005 to 2021 except recycling (which remained equivalent to 2005), wild pollinator habitat increased to 20%, and apiaries increased to 8% from 2015 to 2021 (Table 10).

- The percentage of golf facilities that reported using gasoline and diesel fuel declined from 98% to 95% and from 95% to 89%, respectively, from 2005 to 2021 (Table 11). Whereas the percentage of golf facilities that reported using natural gas and solar-electric increased from 21% to 44% and from 1.3% to 5.2%, respectively. Geothermal, hydro-electric, and methane power sources also resulted in a minor but significant increase between 2005 and 2021.

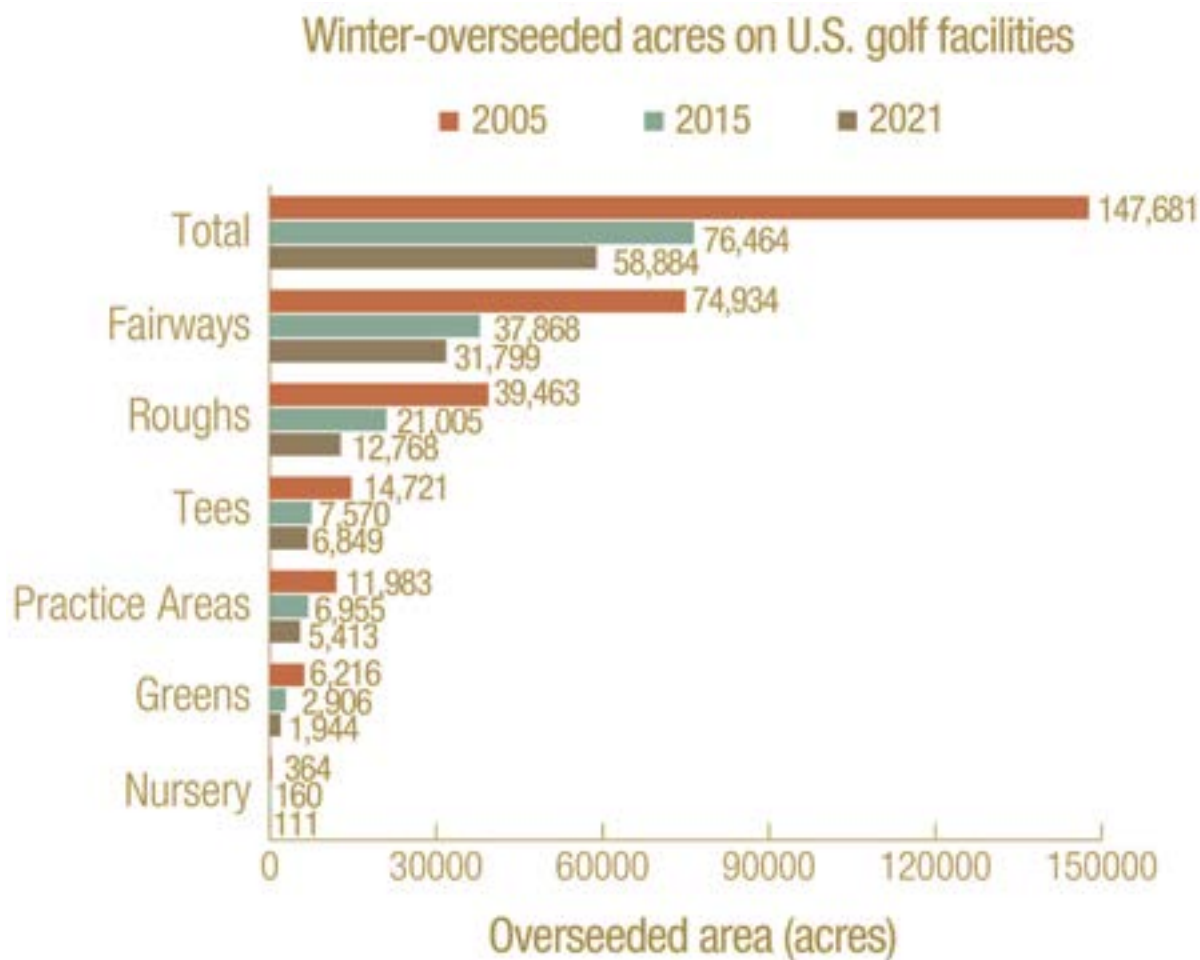


Figure 5. Projected acres of overseeded turfgrass on US golf facilities by course feature in 2005, 2015, and 2021.

% of U.S. golf facilities with winter-overseeded turfgrass

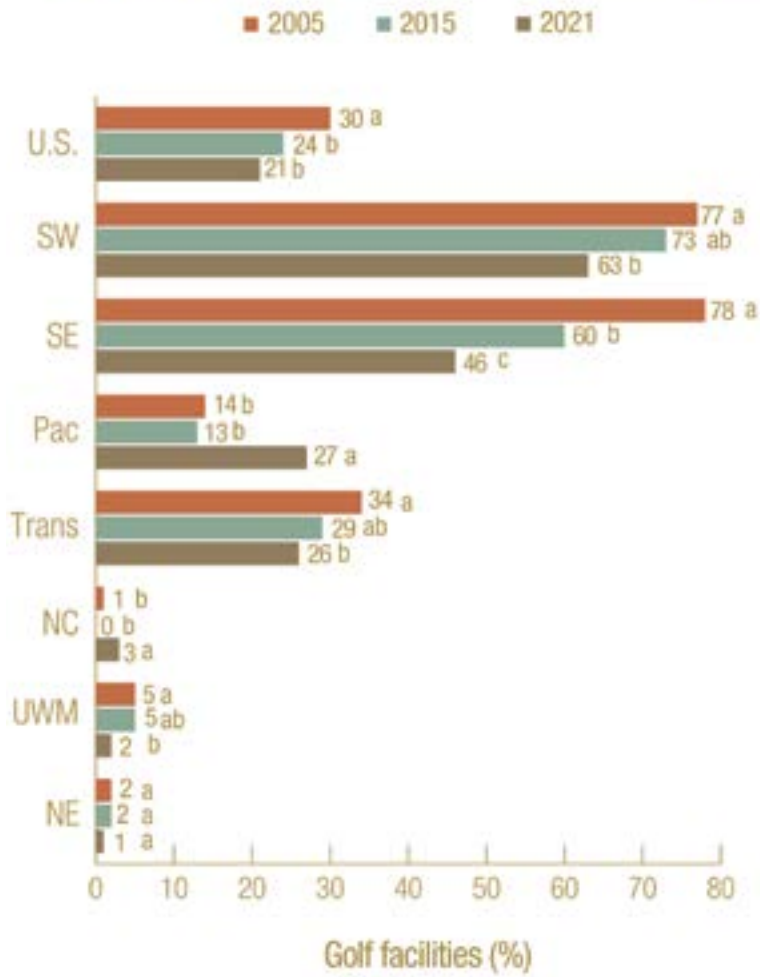


Figure 6. Percentage of US golf facilities that overseeded at least one feature in 2005, 2015, and 2022.

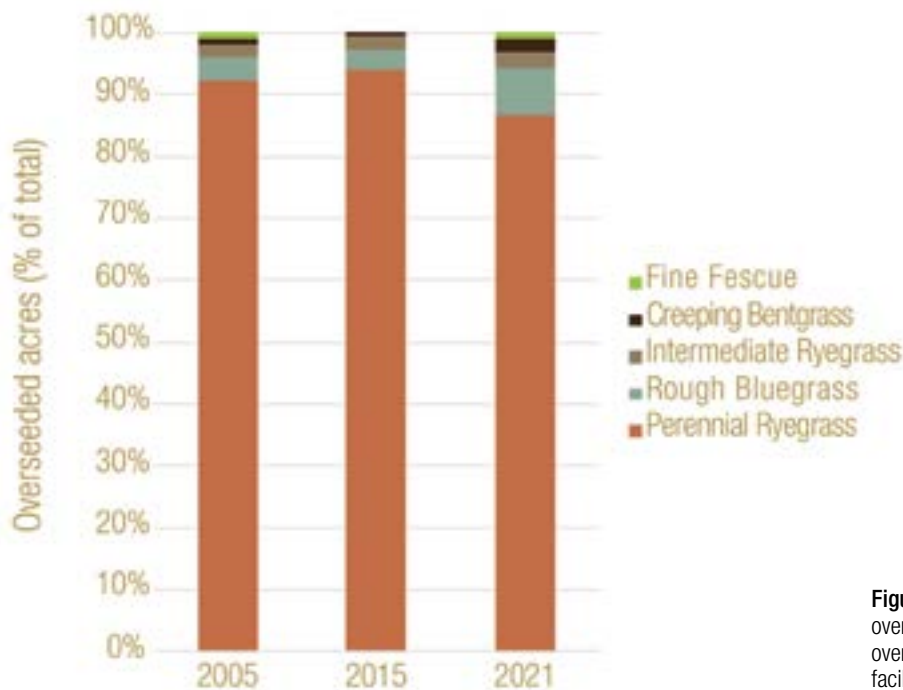


Figure 7. Turfgrass types used for overseeding as a percentage of total overseeded turfgrass acres on US golf facilities in 2005, 2015, and 2021.

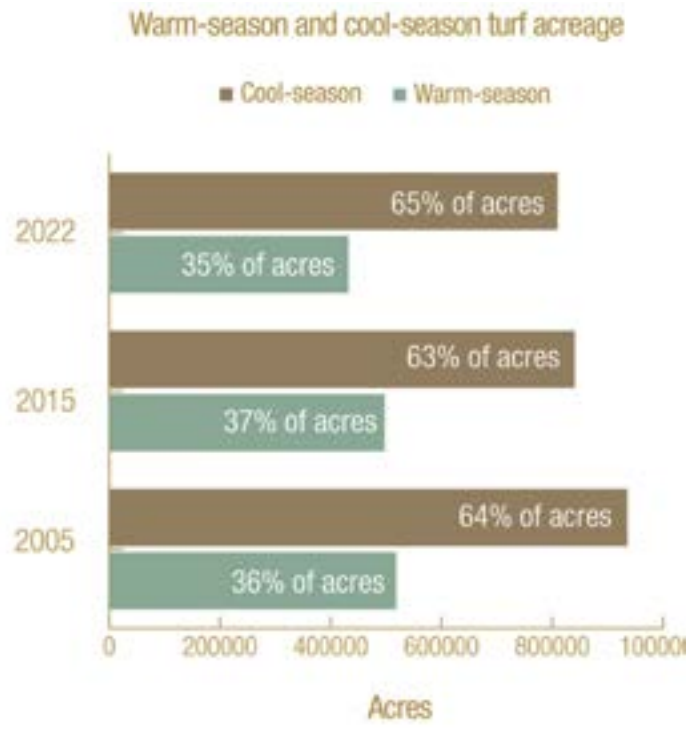


Figure 8. Projected acres of warm and cool-season turfgrasses on US golf facilities in 2021. Percent of total.

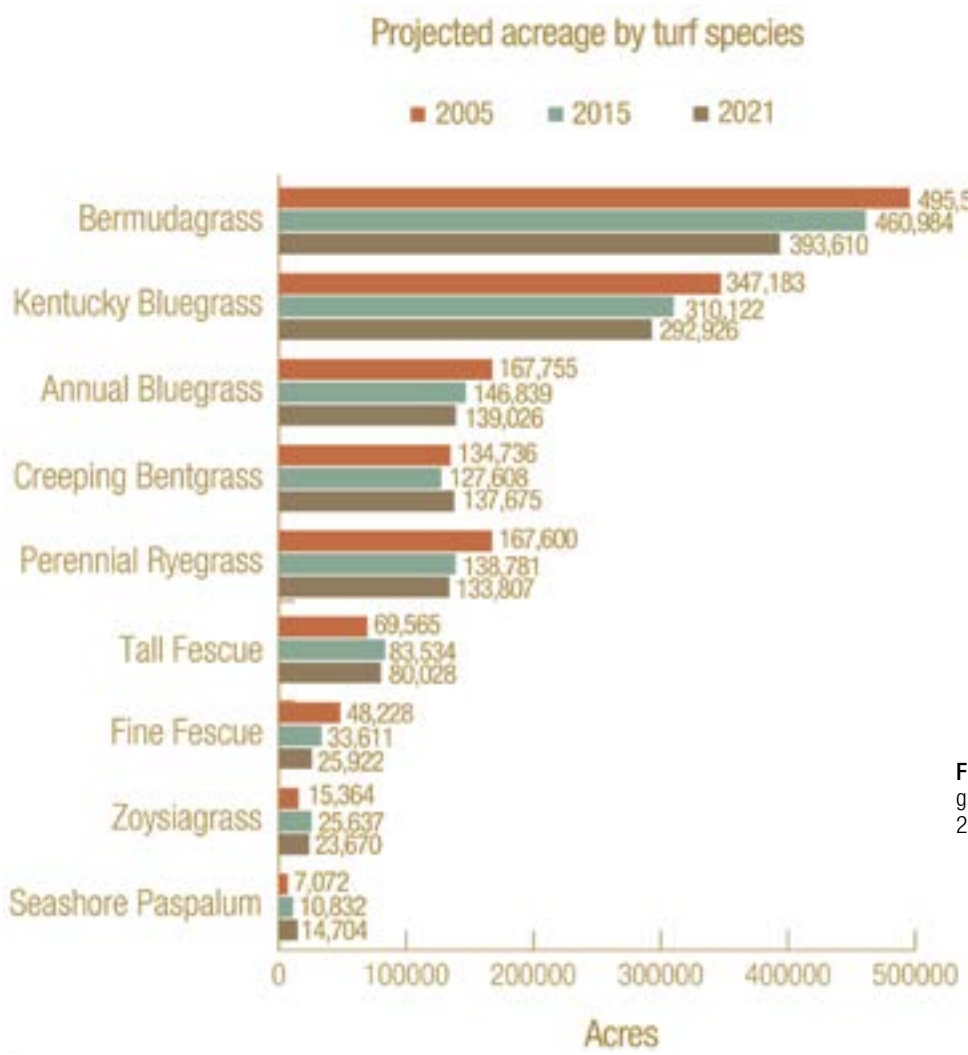


Figure 9. Projected acres of turfgrasses on US golf facilities in 2005, 2015, and 2021.

Introduction

The U.S. golf industry's total economic impact in 2016 was \$84 billion with total wage income measuring \$59 billion for approximately 2 million US jobs within the golf industry (Ozawa et al. 2016). Comparatively, the total value-added contribution of the “green industry” (landscape, florists, nurseries, etc.) in 2018 to the Gross Domestic Product (GDP) was \$190.98 B, including labor income contributions of \$121.55 B, from direct employment of 1.6 million full-time and part-time individuals (Hall et al. 2020). The economic impact of the golf industry is derived, in part, from the large land area and assets needed to accommodate the game's needs.

Golf facilities are often comprised of a variety of areas and structures that may have varying amounts of influence on environmental risk such as turfgrass, parking lots, buildings, etc. In addition, golf facilities require energy to operate, which includes everything from fuel for machines to electricity for office equipment. Human behavior and facility design that govern energy-use can have an environmental impact or environmental risk. The vegetated sites often necessitate inputs of water, nutrients, and pesticides also resulting in potential environmental risk.

To enhance best management practices and to identify areas where resource conservation goals can be set, it is critical that the land-use and energy practices of golf facilities are periodically measured. The first known assessment of US golf facility land-use was conducted in 2006 (Lyman et al. 2007) and then reassessed in 2015 (Gelernter et al. 2017a). Similarly, the inaugural assessment of energy-use on US golf facilities was conducted in 2008 (Lyman et al. 2012) and then reassessed in 2015 (Gelernter et al. 2017b). In the decade between the first and second land-use survey, significant acreage reductions in maintained turf were reported along with reductions in overseed and irrigated turf. Gelernter et al. (2017a) attributed these changes primarily to voluntary reductions in acreage and a net decrease in the number of golf facilities in the US. Pertaining to energy-use on US golf facilities, Gelernter et al. (2017b) reported an 8.3% decrease in annual energy use on 18-hole facilities between 2008 and 2015. The authors

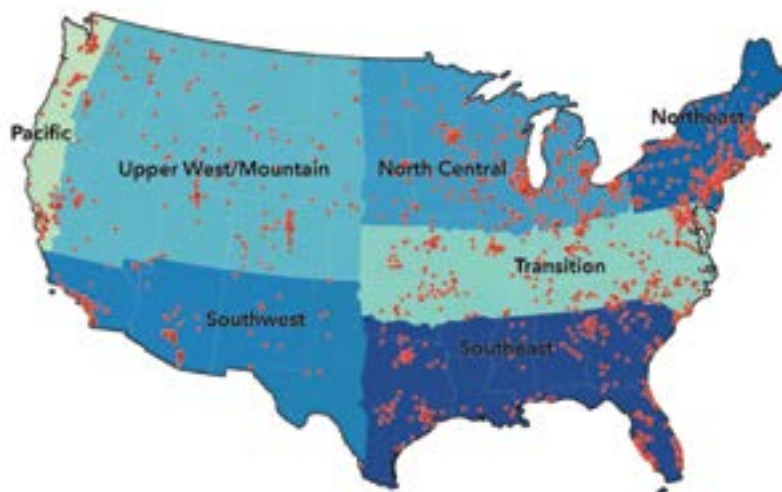


Figure 10. Distribution of 2021 survey and the seven agronomic regions.

attributed this decrease to reduced consumption of electricity linked to the adoption of behavioral and physical or design features for the purpose of energy conservation, increased use of onsite solar panels, adoption of written energy plans, and the use of energy audits.

The land-use and energy practices surveys have proven to play an integral role in education and advocacy. To further document the trends in land-use and energy practices on US golf facilities, a third iteration of the Golf Course Environmental Profile (GCEP) survey series was conducted. Unique to this third round of surveys is an in-depth analysis of turfgrass species use in each of the seven agronomic regions and by course feature (tees, putting greens, fairways, roughs, practice areas, and nurseries) on US golf courses and to identify changes in species selection that have occurred since 2005.

Methodology

A survey instrument was created that contained identical questions to those used in the prior evaluations of land and energy use on US golf facilities in 2005 and 2015. The survey was distributed in English via online software. The electronic mailing lists of the National Golf Foundation and the Golf Course Superintendents Association of America were used to distribute a link to the survey to 13,938 unique golf facilities. The survey was opened on 1 Sept. 2022 and closed on 17 Oct. 2022. The 2021 land-use data were merged with raw data from 2005 and 2015, whereas the 2021 energy-use

data were merged with raw data from 2008 and 2015 which allowed for analysis and reporting across multiple years. Responses were received from 1861 golf facilities, which was 13.3% of the known US total.

Responses were stratified according to their agronomic region (Figure 10). To provide a valid representation of US golf facilities, data were weighted based upon one of 35 categories depending on facility type (public or private), number of golf holes (9, 18, or ≥ 27), and public green fee ($< \$55$ or $\geq \$55$ per round) (Table 30). The weights were calculated based upon the proportion each group held within the total survey response.

Graphic and numeric analysis of the data residuals indicated the data were not normally distributed. As a result, data were fit to a log-logistic model. Median and Percentage values were determined using only 18-hole facilities except where facility types were compared by holes. Median separations were performed using the Tukey-Kramer test ($\alpha = 0.1$). Golf facility Percentages were analyzed using PROC SURVEYFREQ in SAS and years were separated by using the chi-square test at the 10% significance level on all pairwise comparisons. Projected values were based on 18-hole equivalents, which were calculated by assigning 9-, 18-, and 27-hole facilities an 18-hole-equivalent value of 0.5, 1.0, and 1.5, respectively. Projected values were calculated by multiplying the 18-hole facility average acres by the respective 18-hole-equivalent value.

Results National Summary Facility Acreage

- The projected total acreage of U.S. golf facilities was 2,131,838 acres, which was a 12% reduction from 2005 (Table 1).
- The median acreage of an 18-hole golf facility was 146 acres, which was equivalent to the golf facility acres in 2005 and 2015 (Figure 1).
- Because the projected total facility acreage decreased and the median acreage did not change, the decrease in the projected total was likely a result of course closures between 2005 and 2021 (Table 2).
- The length of 9-hole golf facilities decreased to 2,814 yards, which was a 12% reduction from the 3,208 yards in 2005 (Figure 11).
- The length of 18-hole facilities increased to 6,705 yards and 27+-hole facilities increased to 6,988 yards in 2021 (Figure 11).



Maintained Turfgrass Acreage

- Maintained turfgrass acreage accounted for 62% of 18-hole facility acres (Table 1 and Table 3), which was consistent with 2005 and 2015.
- Projected acreage of maintained turfgrass declined to 1,316,443 acres, which was a 14% reduction from 2005 to 2021 (Table 3).
- The median acreage of maintained turfgrass on 18-hole facilities declined

- to 95 acres, which was a 3% reduction from 2005 to 2021 (Table 3).
- Because the reduction in projected turfgrass acres was greater than the reduction in median acres, the projected reduction was primarily a result of an increase in facility closures (Table 2).
- Median maintained turfgrass acres was greater on 27+-hole facilities than on 9- and 18-hole facilities in 2005, 2015, and 2021 for each course feature except nurseries (Table 4).
- The median total maintained turfgrass acres declined on 9- and 18-hole facilities by 14% and 3%, respectively, between 2005 and 2021 (Table 4).
- The median maintained turfgrass acres increased on 27+-hole facilities

- from 142.7 to 167.5 between 2005 and 2021, respectively (Table 4).
- Private golf facilities reported maintaining 5.5 acres more turfgrass than public golf facilities (Table 5).
- Private golf facilities reported maintaining greater acres of greens, fairways, and grounds than public facilities (Table 5).
- Public golf facilities maintained 6.6% greater acres of tees than private facilities (Table 5).
- The median acres of greens on 18-hole golf facilities increased from 3.1 to 3.3 acres from 2005 to 2021 (Table 6).
- The median acres of tees and roughs on 18-hole golf facilities remained unchanged from 2005 to 2021 (Table 6).

Table 1. Total projected and median acreage of US golf facilities in 2005, 2015, and 2021.

Year	US	NC ⁱ	NE	Pac	SE	SW	Trans	UWM
	Area (acres)							
Projected								
2005	2,421,605	629,957	394,247	90,282	508,134	198,205	447,796	152,985
2015	2,301,808	585,532	368,877	83,144	501,079	184,562	425,963	152,650
2021	2,131,838	543,227	364,231	72,999	419,552	185,937	367,032	178,861
Median								
2005	149 a ⁱⁱ	158 a	146 a	140 a	140 a	148 a	151 a	151 a
2015	147 a	155 a	141 a	127 a	145 a	140 ab	153 a	149 a
2021	146 a	158 a	153 a	122 a	136 a	130 b	148 a	145 a

ⁱ NC = North Central; NE = Northeast; Pac = Pacific; SE = Southeast; SW = Southwest; Trans = Transition; US = United States; UWM = Upper West/Mountain.

ⁱⁱ Within columns, values followed by a common letter are not significantly different according to the Tukey-Kramer test at the 10% significance level.

- The median acres of fairways were 27.1, which was a decline of 5.9% from 2005 to 2021 (Table 6).

Turfgrass Types

- The projected acres of bermudagrass, Kentucky bluegrass, and annual bluegrass declined from 2005 to 2021 (Figure 9).
- The projected acres of tall fescue, zoysiagrass, and seashore paspalum increased by 15%, 54%, and 107%, respectively (Figure 9).
- Bermudagrass accounted for the greatest percentage of total turfgrass acres at 32% in 2021, which was a reduction from the 34% and 35% reported in 2005 and 2015, respectively (Figure 12).

- Kentucky bluegrass accounted for the second greatest percentage of total turfgrass acres at 24% in 2021, which was equivalent to 2005 and 2015 (Figure 12).
- When pooled nationally, the proportion of acres with cool- or warm-season turfgrass was 65% to 35%, respectively, and was approximately equivalent to 2005 and 2015 (Figure 8).

Bermudagrass

- Bermudagrass was the most common turfgrass type on US golf facilities covering 393,610 acres (Table 19).
- Bermudagrass was the most common turfgrass type on fairways, tees, roughs, and practice areas (Table 19).

- Bermudagrass was primarily grown in the Southeast with some acres grown in the Transition and Southwest (Figure 41). The northern regions accounted for <1% of US bermudagrass acres.

Kentucky bluegrass

- Kentucky bluegrass was the second most common turfgrass on US golf facilities covering 292,926 acres (Table 19).
- 75% of the Kentucky bluegrass on US golf facilities was used in roughs (Table 19).
- The majority of Kentucky bluegrass was grown in the North central region with the Northeast and Upper West/Mountain accounting for -16% of the national acres (Figure 44).

Table 2. Number of US golf facilities in 2005, 2015, and 2021 by region and the projected change in facility and turfgrass acreage between 2005 and 2021.

Region	Golf facilities			Change (2005-21)		
	2005	2015	2021	Facility		Turfgrass
	(no.)			Projected area (acres)		
US	14,969	14,289	13,167	-1,802	-291,758	-178,994
North Central	3,690	3,476	3,188	-502	-85,540	-49,901
Northeast	2,507	2,445	2,248	-259	-41,883	-27,858
Southeast	3,303	3,078	2,758	-545	-82,906	-52,015
Southwest	1,236	1,207	1,134	-102	-16,724	-8,912
Pacific	594	579	542	-52	-7,004	-5,064
Transition	2,722	2,565	2,303	-419	-66,697	-37,316
Upper West/Mountain	918	940	994	76	13,675	7,676

Table 3. Projected and median acreage of maintained turfgrass on US golf facilities in 2005, 2015, and 2021.

Year	US	NC ⁱ	NE	Pac	SE	SW	Trans	UWM
	Area (acres)							
	Projected							
2005	1,535,767	411,804	241,376	58,509	315,767	128,173	284,941	95,197
2015	1,408,412	368,977	216,187	51,826	298,702	113,168	264,887	94,664
2021	1,316,443	345,840	224,803	47,420	267,277	99,964	234,809	96,329
Median								
2005	98 a ⁱⁱ	107 a	90 ab	94 a	92 a	100 a	100 a	99 a
2015	94 b	102 a	84 b	85 a	92 a	90 b	99 a	95 a
2021	95 b	103 a	94 a	84 a	94 a	84 b	97 a	93 a

ⁱ NC = North Central; NE = Northeast; Pac = Pacific; SE = Southeast; SW = Southwest; Trans = Transition; US = United States; UWM = Upper West/Mountain.

ⁱⁱ Within columns, values followed by a common letter are not significantly different according to the Tukey-Kramer test at the 10% significance level.

Annual Bluegrass

- Annual bluegrass acres declined to 139,026 acres from 2005 to 2021 and are now approximately equal to the acres of creeping bentgrass and perennial ryegrass (Table 19).
- The North central region has historically been the most common region for annual bluegrass, but in 2021 annual bluegrass acres in the north

central declined to 43,752 acres, which was slightly less than the acres in the northeast (45,422) (Figure 43).

Perennial ryegrass

- Perennial ryegrass acres declined by 20% from 2005 to 2021 (Table 19).
- The majority of perennial ryegrass was used in roughs (Table 19).
- Perennial ryegrass was grown primar-

ily in the north central and northeast regions but the upper west/mountain and pacific regions accounted for 14% and 12%, respectively (Figure 45).

Creeping Bentgrass

- Creeping bentgrass acreage increased by 2,939 acres from 2005 to 2021 (Table 19).
- The majority of creeping bentgrass was grown on fairways (Table 19).
- Creeping bentgrass was by far the most common turfgrass on putting greens accounting for more putting green acres than all other turfgrasses combined (Table 19).
- Creeping bentgrass was grown primarily in the north central and northeast regions (Figure 42).

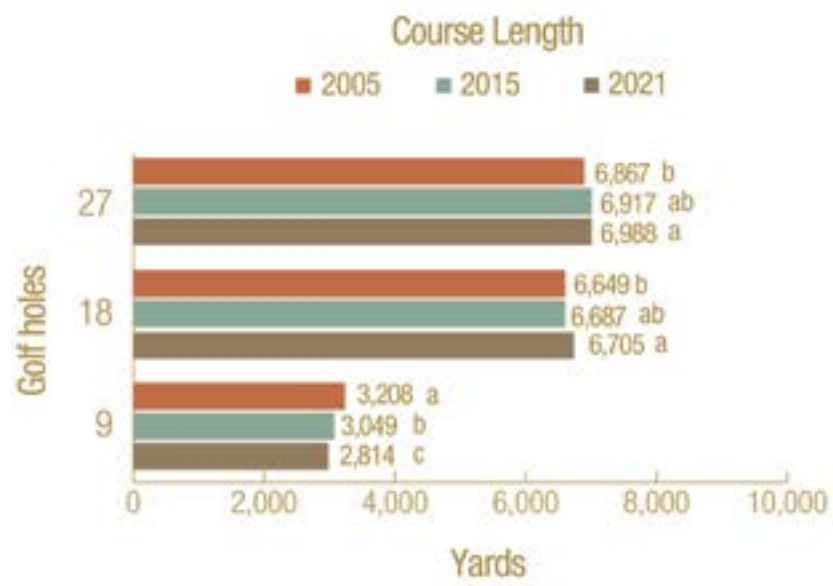


Figure 11. Median length of US golf courses from the furthest tee to the putting green in 2005, 2015, and 2021.

Tall fescue

- Tall fescue acreage increased to 81,583 acres from 2005 to 2021 (Table 19).
- 93% of tall fescue was grown in roughs (Table 19).
- Tall fescue was grown mostly in the transition region (Figure 48).

Fine fescue

- Fine fescue was the least common cool-season turfgrass grown in 2005, 2015, and 2021 (Table 19).
- Fine fescue was primarily a rough turfgrass grown in the north central and northeast regions (Table 19 and Figure 49).

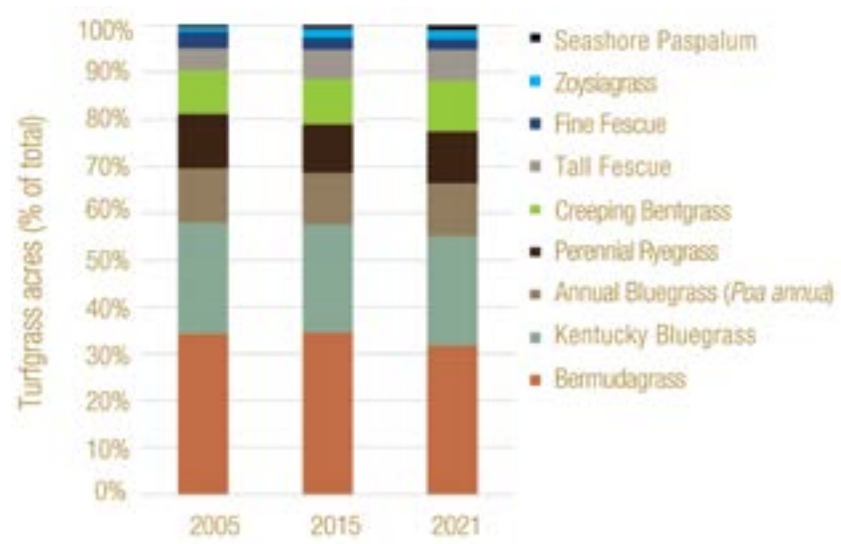


Figure 12. Turfgrass types as a percentage of total turfgrass acres on US golf facilities in 2005, 2015, and 2021.

Zoysiagrass and seashore paspalum

- Zoysiagrass and seashore paspalum were the least common turfgrasses used in 2005, 2015, and 2021 (Table 19).
- Zoysiagrass and seashore paspalum acreage increased by 54% and 108% from 2005 to 2021 (Table 19).
- Zoysiagrass was most commonly grown in the transition and southeast regions with <1% being grown elsewhere (Figure 46).
- Seashore paspalum was grown in the southeast and southwest regions with <1% being grown elsewhere (Figure 47).

Putting green construction

- Nationally, the percentage of US golf facilities that had USGA-specified,

pushup, or California-style putting greens was 44%, 46%, and 11%, respectively (Figure 13).

- A greater percentage of private golf facilities had USGA-specified putting greens (53%) than public facilities (40%) (Figure 14).
- Inversely, a greater percentage of public golf facilities had pushup putting greens (47%) than private facilities (42%) (Figure 14).
- Equivalent percentages of private and public golf facilities had California-style putting greens (Figure 14).
- A greater percentage of 27+-hole facilities had USGA-specified and California-style putting greens and a lower percentage had pushup putting greens than either 9- or 18-hole golf facilities (Figure 15).

Note: The sum of individual components may not equal overall totals due the use of median values.

Overseeding Practices

- The projected acres of overseeded turf decreased by 60% to 58,884 acres from 2005 to 2021 (Table 20).
- 81% of overseeded acres were in the Southeast and Southwest regions (Table 20).
- The percentage of facilities that overseeded at least one course feature declined from 30% to 21% from 2005 to 2021 (Figure 6).
- The percentage of facilities that overseeded at least one course feature declined within each region except the Pacific region the percentage nearly doubled since 2005 to 27% of facilities (Figure 6).
- Perennial ryegrass was used as overseed on >85% of overseeded acres (Figure 7).

Water Acreage

- An 18-hole golf facility had a median 5.7 acres of water features or 4% of the facility acreage (Table 7 and Figure 2).
- In 2021, the projected acres of water features for US golf facilities were 141,746 accounting for 6.6% of the total golf facility acreage (Table 7).
- Each region reported a reduction in water feature acreage except the Upper West/Mountain region, which reported a 19% increase since 2005

Table 4. Median maintained turfgrass acreage for 9-, 18-, and 27+-hole US golf facilities in 2005, and 2015, and 2021.

Year	9-Holes	18-Holes	27+-Hole
	Area (acres)		
	Total		
2005	42.3 aC ⁱ	97.9 aB	142.7 bA
2015	37.8 bC	93.9 bB	177.3 aA
2021	36.3 bC	95.0 bB	167.5 aA
	Greens		
2005	1.3 bC	3.1 bB	4.5 bA
2015	1.4 abC	3.2 aB	5.9 aA
2021	1.5 aC	3.3 aB	5.9 aA
	Tees		
2005	1.2 bC	3.0 aB	4.7 bA
2015	1.2 abC	3.1 aB	5.8 aA
2021	1.3 aC	3.1 aB	5.9 aA
	Fairways		
2005	14.4 aC	28.8 aB	41.2 bA
2015	13.0 bC	27.7 bB	48.4 aA
2021	11.5 cC	27.1 bB	48.0 aA
	Roughs		
2005	17.2 aC	48.6 aB	71.6 bA
2015	15.0 bC	47.2 aB	95.5 aA
2021	16.6 abC	49.0 aB	88.7 aA
	Practice		
2005	4.1 aC	6.5 aB	8.2 aA
2015	3.4 bC	5.9 bB	9.1 aA
2021	3.2 bC	5.9 bB	8.1 aA
	Nursery		
2005	0.8 abB	0.9 aA	1.0 aA
2015	0.9 aAB	0.9 abB	1.1 aA
2021	0.6 bB	0.8 bA	0.9 aA
	Grounds		
2005	1.3 aC	2.0 aB	2.5 abA
2015	1.2 bC	1.7 bB	2.7 aA
2021	1.1 bC	1.7 bB	2.1 bA

ⁱ Within columns, values followed by a common lowercase letter are not significantly different according to the Tukey-Kramer test at the 10% significance level. Within rows, values followed by a common uppercase letter are not significantly different according to the Tukey-Kramer test at the 10% significance level.

Table 5. Median maintained turfgrass acreage of public and private US golf facilities in 2021.

Facility Type	Total	Greens	Tees	Fairways	Roughs	Practice	Nursery	Grounds
	Area (acres)							
Public	93.3 b ⁱ	3.2 b	3.2 a	26.8 b	48.2 a	5.9 a	0.9 a	1.5 b
Private	98.8 a	3.4 a	3.0 b	27.9 a	50.7 a	5.8 a	0.8 a	2.1 a

ⁱ Within columns, values followed by a common letter are not significantly different according to the Tukey-Kramer test at the 10% significance level.

Table 6. Median maintained turfgrass acreage of US golf facilities in 2005, 2015, and 2021.

Year	US	NC ⁱ	NE	Pac	SE	SW	Trans	UWM
	Area (acres)							
	Greens							
2005	3.1 b	3.2 b ⁱⁱ	3.2 b	2.9 b	2.9 b	3.0 a	3.1 a	3.0 a
2015	3.2 a	3.4 a	3.4 a	3.1 ab	3.0 a	3.1 a	3.2 a	3.1 a
2021	3.3 a	3.5 a	3.6 a	3.3 a	3.0 ab	3.0 a	3.2 a	3.2 a
	Tees							
2005	3.0 a	2.9 b	2.6 a	3.0 a	3.4 a	3.3 a	3.2 a	3.2 a
2015	3.1 a	3.1 a	2.6 a	3.0 a	3.3 a	3.1 a	3.4 a	3.2 a
2021	3.1 a	3.1 ab	2.8a	3.2 a	3.4 a	3.1 a	3.3 a	3.0 a
	Fairways							
2005	28.8 a	27.4 a	25.5 a	31.4 a	30.8 a	33.0 a	29.0 a	33.4 a
2015	27.7 b	26.6 ab	24.5 a	31.1 a	29.6 ab	30.2 a	27.9 ab	31.0 ab
2021	27.1 b	26.1 b	24.8 a	29.3 a	28.5 b	30.2 a	26.7 b	30.0 b
	Roughs							
2005	48.6 a	59.5 a	46.6 ab	43.1 a	41.2 b	45.5 a	50.8 a	44.3 a
2015	47.2 a	55.6 a	42.8 b	36.3 a	43.7 ab	41.9 ab	52.4 a	44.3 a
2021	49.0 a	58.1 a	51.8 a	36.7 a	45.3 a	37.0 b	52.2 a	42.8 a
	Practice areas							
2005	6.5 a	7.3 a	5.4 a	5.5 a	6.2 a	7.0 a	6.4 a	7.6 a
2015	5.9 b	6.2 b	4.9 ab	5.3 a	6.0 a	6.1 ab	6.2 a	6.3 a
2021	5.9 b	6.4 b	4.4 b	5.7 a	6.4 a	5.2 b	6.1a	6.8 a
	Nursery							
2005	0.9 a	1.0 a	0.9 a	0.9 a	0.9 a	0.7 a	1.1 a	0.9 a
2015	0.9 ab	0.9 a	0.8 ab	0.8 a	0.8 a	0.9 a	1.0 a	0.8 a
2021	0.8 b	0.9 a	0.7 b	0.9 a	0.9 a	0.8 a	0.9 a	0.9 a
	Grounds							
2005	2.0 a	2.1 a	2.1 a	1.5 a	2.2 a	1.7 a	1.8 a	1.6 a
2015	1.7 b	1.8 b	1.7 a	1.4 a	1.8 b	1.4 a	1.9 a	1.2 b
2021	1.7 b	1.6 b	1.8 a	1.5 a	1.8 b	1.4 a	1.9 a	1.2 b

ⁱ NC = North Central; NE = Northeast; Pac = Pacific; SE = Southeast; SW = Southwest; Trans = Transition; US = United States; UWM = Upper West/Mountain.

ⁱⁱ Within columns, values followed by a common letter are not significantly different according to the Tukey-Kramer test at the 10% significance level.

to 11,202 (Table 7). This increase occurred primarily as open water features.

- The greatest median acreage of water features for an 18-hole golf facility was in the Southeast region (10.2 acres), which was nearly double the national median (Table 7).
- Open water was the largest component of water features at 69% (Table 36).
- The second most common component of water features was wetlands at 19% (Table 36).

Natural/native/unmowed acreage

- In 2021, an 18-hole golf facility had a median 23.3 acres of natural areas, which accounted for 18% of the total facility acreage (Figure 2 and Table 7).
- Nationally, the projected acreage of natural areas on US golf facilities was 549,518 acres of which 25% was reported in the North Central region (Table 7).
- The largest component of natural areas was forests which accounted for 41% (Table 37).
- The acreage of native/undisturbed grasslands has nearly doubled since 2005 and was the second largest component of natural areas (27%) in 2021 (Table 37).

Non-landscaped Acreage Buildings

- In 2021, an 18-hole golf facility had a median 2.1 acres of buildings, which accounted for 1% of the total facility acreage (Figure 2 and Table 7).
- In 2021, the projected acres of building on US golf facilities were 46,682 acres, which accounted for 2.1% of the total golf facility acreage (Table 7).

Parking Lots

- In 2021, an 18-hole golf facility had a median 2.2 acres of parking lots, which accounted for 1% of the total facility acreage (Figure 2 and Table 7).
- In 2021, the projected acres of parking lot on US golf facilities were 42,189 acres, which accounted for 1.9% of the total golf facility acreage (Table 7).

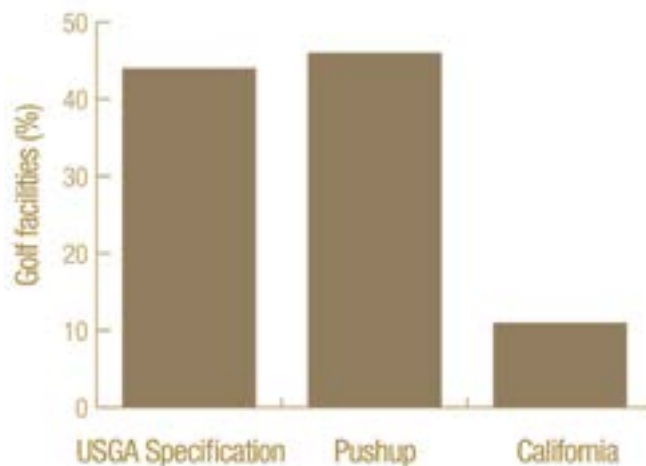


Figure 13. Frequency of putting green construction styles on US golf facilities in 2021.

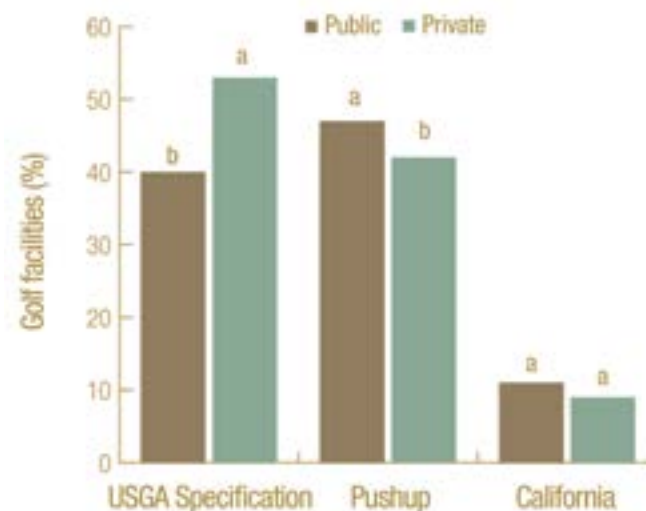


Figure 14. Frequency of putting green construction styles on public and private US golf facilities in 2021. Bars with a common letter are not significantly different according to chi-square test at the 10% significance level.

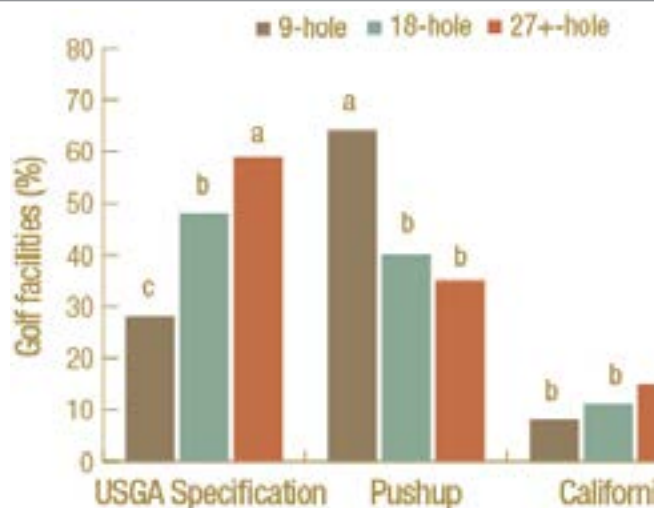


Figure 15. Frequency of putting green construction styles on 9, 18, and 27+-hole US golf facilities in 2021. Bars with a common letter are not significantly different according to chi-square test at the 10% significance level.

Table 7. Projected and median acreage of US golf facility sub-features in 2021.

Region	Bunkers	Buildings	Parking Lots	Water features	Natural areas
	Area (acres)				
Projected					
US	44,631	46,682	42,189	141,746	549,518
North Central	9,884	10,216	9,701	34,279	135,579
Northeast	9,528	8,240	8,470	19,688	94,841
Pacific	1,759	1,316	1,607	2,951	17,038
Southeast	9,363	10,776	8,067	45,642	82,479
Southwest	4,197	6,270	4,582	8,064	63,742
Transition	6,668	6,669	6,563	19,920	94,606
Upper West/Mountain	3,231	3,195	3,199	11,202	61,233
Median					
US	2.2	2.1	2.2	5.7	23.3
North Central	2.1 a ⁱ	2.0 a	2.4 a	5.4 bc	23.9 a
Northeast	2.5 a	2.2 a	2.4 a	4.1 c	31.0 a
Pacific	1.9 a	1.9 a	2.6 a	3.6 c	19.2 ab
Southeast	2.4 a	2.4 a	1.9 b	10.2 a	15.2 b
Southwest	2.3 a	1.9 a	2.2 ab	4.1 bc	24.3 a
Transition	2.1 a	2.0 a	2.2 ab	5.9 b	25.4 a
Upper West/Mountain	2.1 a	2.1 a	2.2 ab	5.4 bc	26.1 a

ⁱ Within columns, values followed by a common letter are not significantly different according to the Tukey-Kramer test at the 10% significance level.

Table 8. Median acreage of impervious surfaces on US golf facilities in 2005, 2015, and 2021.

Year	US	NC ⁱ	NE	Pac	SE	SW	Trans	UWM
	Area (acres)							
Cart paths								
2005	1.7 b ⁱ	1.0 b	0.9 b	2.6 a	2.4 a	2.2 a	2.9 b	1.2 a
2015	2.0 a	1.2 ab	1.0 ab	2.9 a	2.7 a	2.6 a	3.3 a	1.5 a
2021	2.1 a	1.4 a	1.2 a	2.8 a	2.8 a	2.3 a	3.5 a	1.8 a
Parking lots								
2005	3.1 a	3.1 a	3.2 a	3.2 a	3.2 a	3.1 a	3.1 a	3.0 a
2015	2.1 b	2.2 b	2.2 b	2.5 a	2.0 b	2.0 b	2.2 b	2.0 b
2021	2.0 b	2.1 b	2.1 b	2.5 a	1.8 b	2.1 b	2.0 b	1.9 b
Buildings								
2005	3.6 a	3.4 a	3.6 a	3.1 a	3.9 a	3.6 a	3.9 a	3.1 a
2015	2.2 b	2.0 b	2.2 b	2.1 b	2.4 b	1.9 b	2.2 b	2.0 b
2021	2.1 b	2.0 b	2.2 b	1.9 b	2.4 b	1.9 b	2.0 b	2.1 b
Total								
2005	9.6 a	8.8 a	8.5 a	10.0 a	10.4 a	9.4 a	10.9 a	8.5 a
2015	7.3 b	6.3 b	6.6 b	8.1 a	7.9 b	7.0 b	8.5 b	6.6 b
2021	7.1 b	6.5 b	6.4 b	7.9 a	7.3 b	7.2 b	8.2 b	6.1 b

ⁱ NC = North Central; NE = Northeast; Pac = Pacific; SE = Southeast; SW = Southwest; Trans = Transition; US = United States; UWM = Upper West/Mountain.

ⁱⁱ Within columns, values followed by a common letter are not significantly different according to the Tukey-Kramer test at the 10% significance level.

Table 9. Projected acres, median length, and median width of cart paths on US golf facilities in 2005, 2015, and 2021.

Year	US	NC ⁱ	NE	Pac	SE	SW	Trans	UWM
	Projected area (acres)							
2005	44,190	8,988	4,840	2,044	11,189	4,621	9,923	2,585
2015	36,617	6,854	4,330	1,871	9,929	3,084	8,356	2,191
2021	34,565	6,800	4,407	1,657	8,671	2,688	7,329	3,015
	Length (ft.)							
2005	12,967 b ⁱⁱ	8,461 b	8,545 a	17,771 a	17,067 b	14,955 a	19,814 b	10,669 a
2015	15,270 a	10,260 a	10,154 ab	19,272 a	19,652 a	17,942 a	22,307 a	12,499 a
2021	16,446 a	12,303 a	11,566 a	19,736 a	20,616 a	17,132 a	23,357 a	13,814 a
	Width (ft.)							
2005	6.9 a	6.9 a	6.9 a	7.1 a	6.9 a	7.0 a	6.9 a	7.1 a
2015	6.9 a	7.0 a	6.8 a	7.0 a	6.8 a	6.8 a	6.9 a	7.1 a
2021	6.8 a	6.7 b	7.0 a	7.1 a	6.7 a	6.7 a	6.8 a	7.2 a

ⁱ NC = North Central; NE = Northeast; Pac = Pacific; SE = Southeast; SW = Southwest; Trans = Transition; US = United States; UWM = Upper West/Mountain.

ⁱⁱ Within columns, values followed by a common letter are not significantly different according to the Tukey-Kramer test at the 10% significance level.

Table 10. Frequency of US golf facilities that made an addition or improvement to the listed feature during the five years preceding 2005, 2015, and 2021.

Added or improved feature	2005	2015	2021
	Golf facilities (%)		
Irrigation system	66 a ⁱ	62 b	56 c
Recycling	39 b	55 a	42 b
Native plantings	51 a	42 b	38 c
Wildlife habitat	48 a	42 b	32 c
Chemical storage	51 a	38 b	30 c
Erosion control	43 a	36 b	29 c
Buffer strips	33 a	33 a	24 b
Waste reduction	26 b	30 a	22 c
Wild pollinator habitat (not including beehives/apiaries)	- ⁱⁱ	10 b	20 a
Equipment washing stations	32 a	19 b	18 b
Chemical mix and load pads	27 a	20 b	17 c
Stream bank restoration	20 a	19 ab	17 b
Composting	24 a	18 b	17 b
Stormwater retention	23 a	17 b	13 c
Petroleum storage tank	39 a	16 b	12 c
Wetland construction/restorations	17 a	13 b	10 c
Alternate water source	13 a	12 a	9 b
Beehives/apiaries	-	5 b	8 a
Capped/closed water wells	14 a	9 b	4 c
Rain garden	-	2 a	2 a

ⁱ Within rows, values followed by a common letter are not significantly different according to the chi-square test at the 10% significance level.

ⁱⁱ Question not asked in 2005.

Table 11. Frequency of fuel source on US golf facilities in 2008, 2015, and 2021.

Energy source	2008	2015	2021
	Golf facilities (%)		
Gasoline	98.3 a ⁱ	98.4 a	94.7 b
Diesel	94.7 a	95.5 a	89.0 b
Natural Gas	21.1 b	22.7 b	44.0 a
Propane	35.7 ab	32.8 b	39.0 a
Heating Oil	7.4 a	8.3 a	8.1 a
Solar-electric	1.3 b	4.4 a	5.2 a
Biodiesel	3.7 a	4.2 a	3.3 a
Geothermal	0.1 b	0.1 b	1.4 a
Hydro-electric	0.2 b	0.0 ⁱⁱ	1.1 a
Solar-heat	0.3 a	0.0	0.7 a
Wind	0.5 a	0.0	0.6 a
Waste Bio-mass	0.0	0.0	0.6
Methane	0.1 b	0.0	0.3 a
Hydrogen	0.0	0.0	0.0

ⁱ Within rows, values followed by a common letter are not significantly different according to the chi-square test at the 10% significance level.

ⁱⁱ Values without variability were not analyzed.

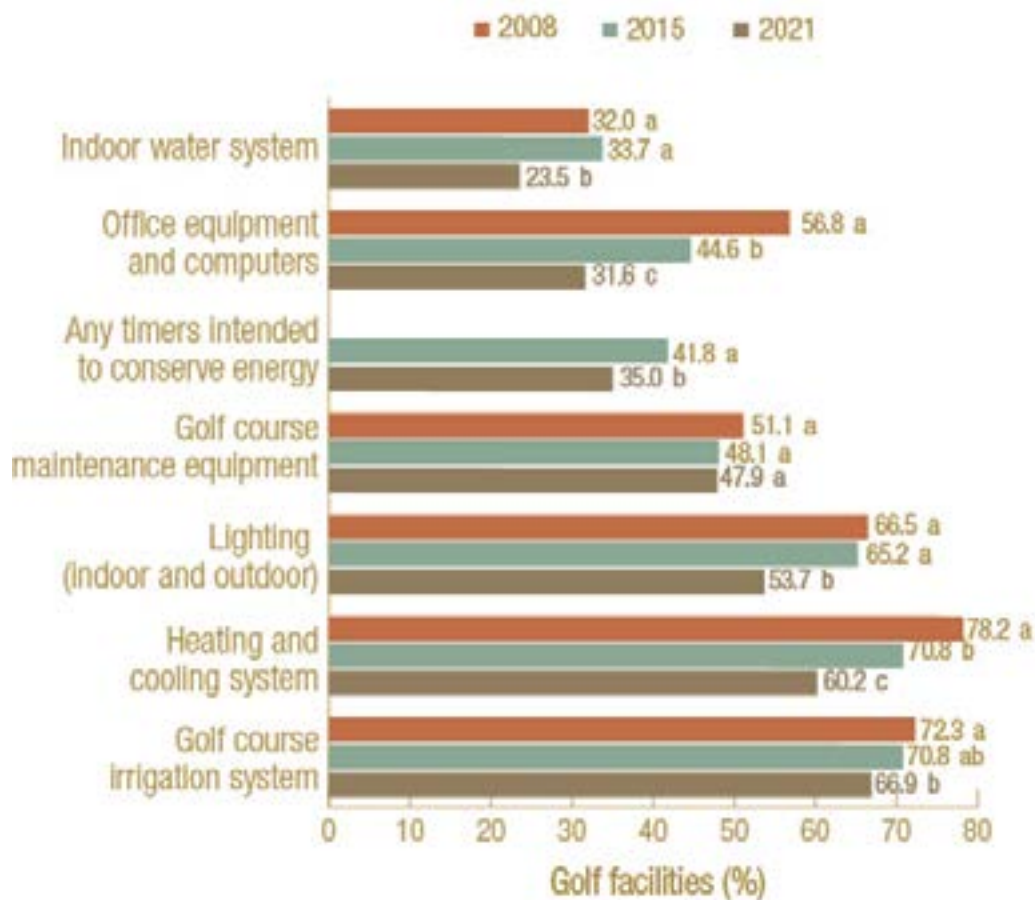


Figure 16. Percentage of US golf facilities that implemented behavioral changes in 2008, 2015, and 2021.

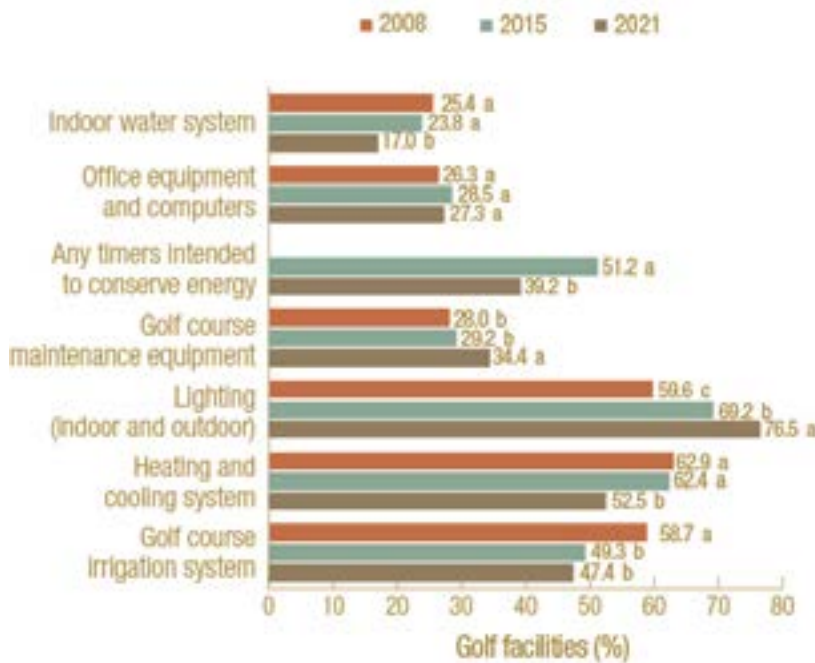


Figure 17. Percentage of US golf facilities that implemented design changes in 2008, 2015, and 2021.

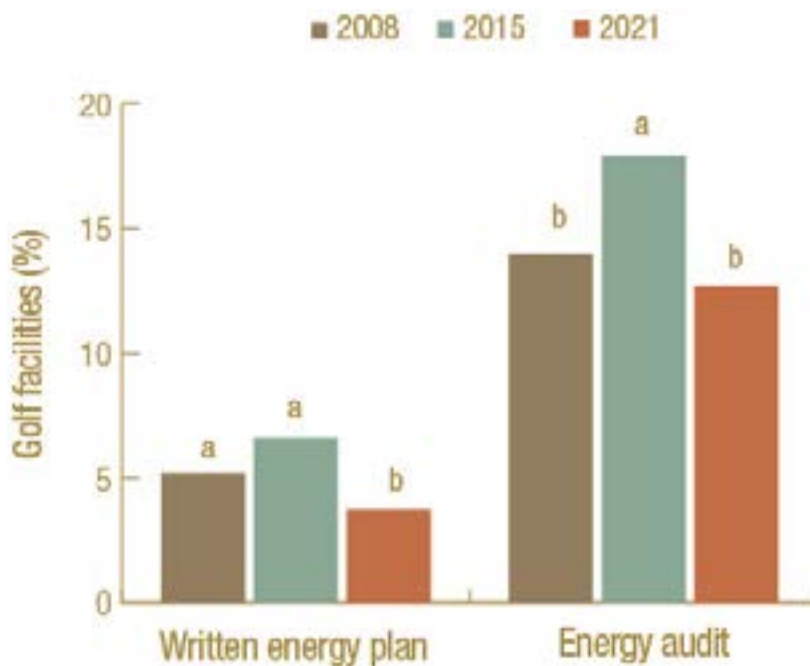


Figure 18. Percentage of US golf facilities that had a written energy plan or conducted an energy audit in 2008, 2015, and 2021.

Bunkers

- In 2021, an 18-hole golf facility had a median 2.2 acres of bunkers, which accounted for 1% of the total facility acreage (Figure 2 and Table 7).
- In 2021, the projected acres of bunkers on US golf facilities were 44,631 acres, which accounted for 2.0% of the total golf facility acreage (Table 7).

Cart Paths

- In 2021, an 18-hole golf facility had a median 2.1 acres of cart paths (Table 8 and Table 9). This represented a 24% increase from 2005 to 2021.
- In 2021, the projected acres of cart paths on US golf facilities were 34,565 acres, which accounted for 1.6% of the total golf facility acreage (Table 7). This represented a 22% reduction from 2005 to 2021.
- Because the median cart path acreage increased and the projected cart path acreage decreased, the cause of the projected cart path acreage reduction was course closures from 2005 to 2021 (Table 2).
- Nationally, the median length of cart paths on 18-hole facilities increased to 16,446 ft., which was a 27% increase from 2005 to 2021 (Table 9).
- The median length of cart paths varied greatly depending on region with the longest cart paths reported in the Transition at 23,357 ft. and the shortest reported in Northeast at 11,566 ft. (Table 9).
- Nationally, the median width of cart paths did not change at 6.8 ft. (Table 9).

Environmental Practices

- The percentage of US golf facilities that participate in their state's best management practices increased from 5.3% to 32.1% from 2015 to 2021 (Table 38).
- The percentage of US golf facilities that participate in the GCSAA's IPM Planning Guide and pollinator programs increased to 13.9% and 7.0% in 2021 (Table 38).
- Participation in the Audubon Cooperative Sanctuary decreased from 22.1% to 16.5% between 2005 and 2021 (Table 38).

LAND USE

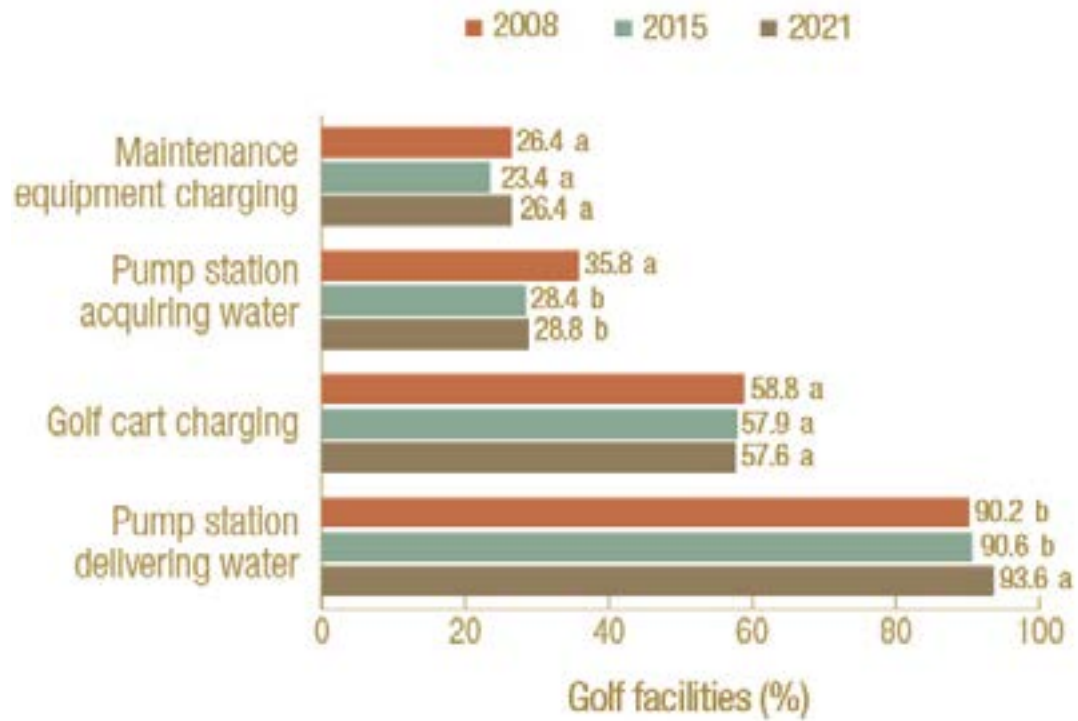


Figure 19. Percentage of US golf facilities that conducted the listed operation during non-peak hours in 2008, 2015, and 2021.

- Total projected acres of overseeded turfgrass declined 60% from 2005 to 2021 (Figure 5).
- The frequency US golf facilities adding or improving features associated with environmental practices generally declined from 2005 to 2021 except recycling (which remained equivalent to 2005), wild pollinator habitat increased to 20%, and apiaries increased to 8% from 2015 to 2021 (Table 10).
- In 2021, the median acreage of impervious surfaces for an 18-hole golf facility decreased from 9.6 to 7.1 acres from 2005 to 2021 (Table 8).

Energy Practices

- The percentage of golf facilities that reported using gasoline and diesel fuel declined from 98% to 95% and from 95% to 89%, respectively, from 2005 to 2021 (Table 11). Whereas the percentage of golf facilities that reported using natural gas and solar-electric increased from 21% to 44% and from

1.3% to 5.2%, respectively. Geothermal, hydro-electric, and methane power sources also resulted in a minor but significant increase between 2005 and 2021.

- Between 2005 and 2021, the percentage of golf facilities that implemented behavioral changes associated with energy conservation declined for each category, except maintenance equipment, which was equivalent to 2005 (Figure 16).
- Between 2005 and 2021, the percentage of golf facilities that implemented design changes associated with energy conservation increased in the categories of lighting and maintenance equipment, was unchanged for office equipment, and declined in all remaining categories (Figure 17).
- The percentage of golf facilities that reported having a written energy plan declined to 4% in 2021 13% of golf facilities reported having an energy audit conducted in the 5 years prior to 2021. (Figure 18)

- The percentage of US golf facilities that used their pump station to deliver water during non-peak energy hours increased from 90.2% to 93.6% from 2005 to 2021 (Figure 19). The percentage of US golf facilities that conducted equipment and golf-cart charging during non-peak energy hours did not change from 2005 to 2021 and facilities used their pump station to acquire water decrease from 35.8% to 28.8% from 2005 to 2021.

Regional Summary Facility Size

- The North Central region reported the greatest facility acres (158) and the Pacific region reported the least facility acres (122) in 2005, 2015, and 2021 (Figure 1).
- The Southwest region was the only region that reported a reduction in facility acres (18 acres) between 2005 and 2021 (Figure 1).

Maintained Turfgrass Acreage

- The US golf facility median maintained turfgrass acreage was 95 acres with the greatest acreage reported in the North Central (103 acres) and the least reported in the Pacific and Southwest (84 acres) (Figure 4).
- Each region reported similar maintained turfgrass acreage in 2021 as in 2005 except the Southwest region that reported a decrease from 100 to 84 acres between 2005 and 2021 (Figure 4).

Overseeded Turfgrass Acreage

- Nationally, the projected overseeded acreage decreased by 60%, which occurred in the Northeast, Southeast, Southwest, Transition, and Upper West/Mountain regions (Table 20). However, the North Central and Pacific regions reported an increase in projected overseeded acres of 290% and 48%, respectively, between 2005 and 2021.

Region Results

North Central

Facility size

- The median size of facilities in the North Central was 157.9 acres and has not changed since 2005 (Figure 20).
- The projected total acres of golf facilities in the North Central has decreased by 13.7% from 2005 to 2021 (Table 1). This is likely a result of a reduction in golf facilities which also decreased by 13.6% from 2005 to 2021 (Table 2).

Maintained turfgrass acreage

- The median acreage of maintained turfgrass on 18-hole golf facilities in the North Central was 102.5 acres and has not changed since 2005 (Figure 20).
- 18-hole facilities in the North Central region maintain more turfgrass than

any other region (Figure 4). This result was also reported in 2005 and 2015.

- Total projected maintained turfgrass acreage of golf facilities in the North Central region declined by 16.0% since 2005 (Table 3). Most of this reduction is likely a result of the reduction in golf facilities.

Non-turf acreage

- The median acreage of natural areas in the North Central increased to 23.8 acres, which was a 41.6% increase from 2005 to 2021 (Figure 20).
- The median acreage of water features, parking lots, bunkers, and buildings decreased from 2005 to 2021 (Figure 20).
- The median length of cart paths on 18-hole facilities in the North Central increased by 45.4% to 12,303 ft. from 2005 to 2021 (Table 9).

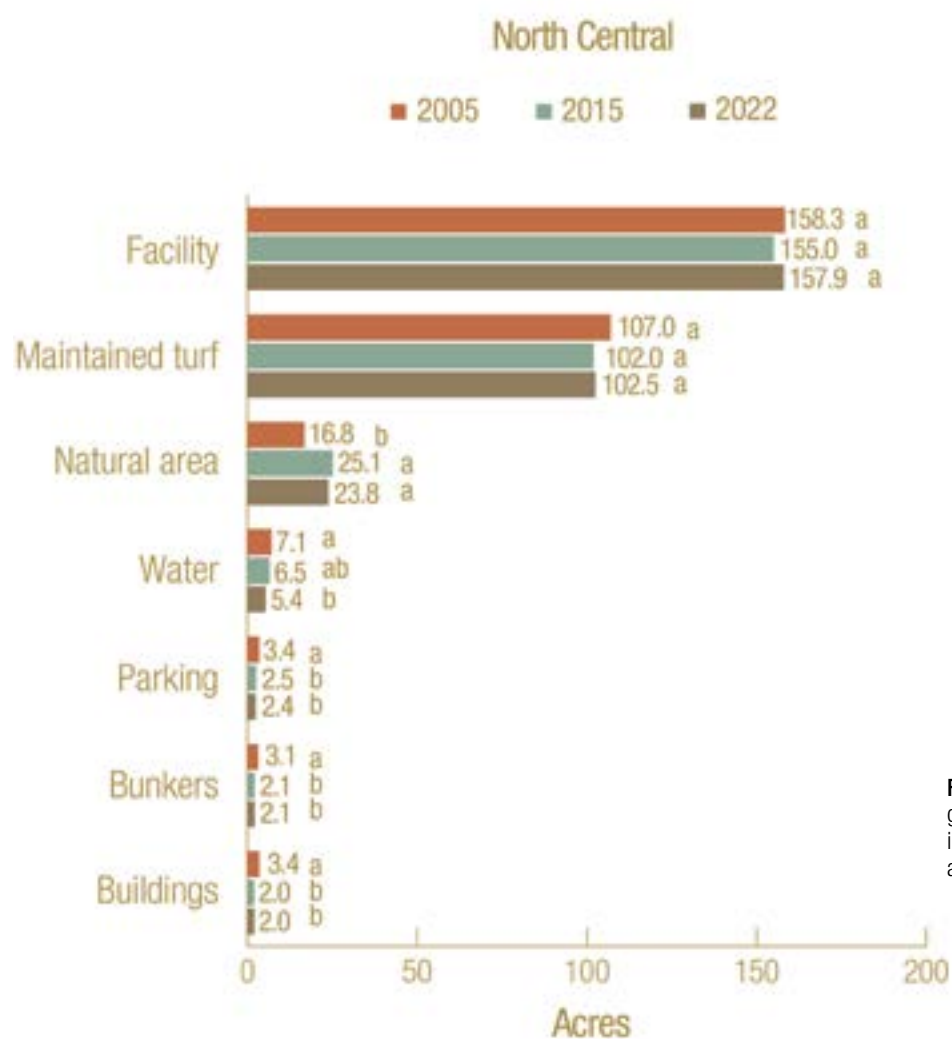


Figure 20. Median land use of 18-hole golf facilities in the North Central region in 2005, 2015, and 2022.

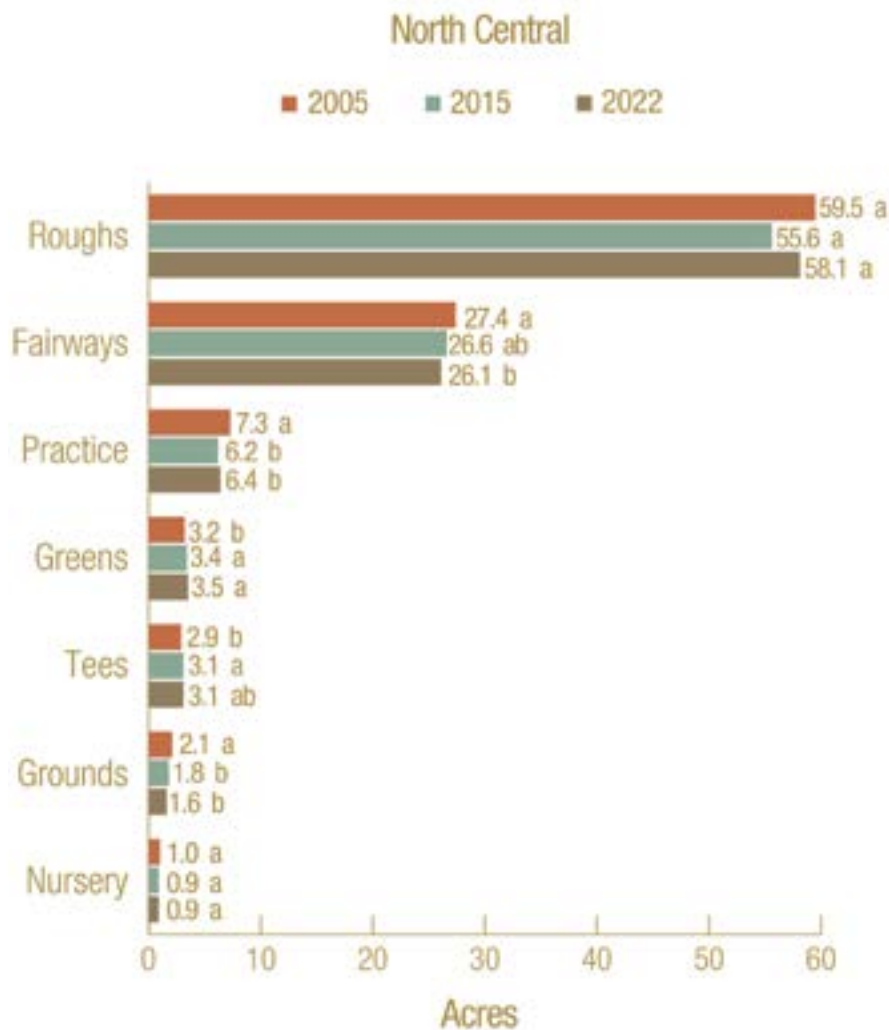


Figure 21. Median acres of turfgrass features on 18-hole golf facilities in the North Central region in 2005, 2015, and 2022

- The median of total impervious surfaces on 18-hole facilities in the North Central decreased by 26.1% to 6.5 acres from 2005 to 2021 (Table 8).

Turf features

- The median acres of putting greens on 18-hole facilities in the North Central increase by 9.3% to 3.5 acres from 2005 to 2021 (Figure 21).
- The median acres of fairways, practice areas, and grounds on 18-hole facilities in the North Central decreased by 4.7%, 12.3%, and 23.8%, respectively (Figure 21).
- The median acres of tees, roughs, and nurseries on 18-hole facilities in the North Central did not change from 2005 to 2021 (Figure 21).

Turf types

- The most common turfgrass was Kentucky bluegrass, which accounted for 46% of all projected turfgrass acres (Figure 22).
- The percentage of 18-hole golf facilities in the North Central that had bentgrass on greens declined from 99% to 86%, whereas the percentage of fairways increased from 46% to 56% between 2005 and 2021 (Table 12).
- As a percentage of golf facilities, annual bluegrass was the most common turfgrass in fairways (61%), bentgrass was the most common turfgrass on tees (63%), and Kentucky bluegrass was the most common turfgrass in roughs (79%) (Table 12).

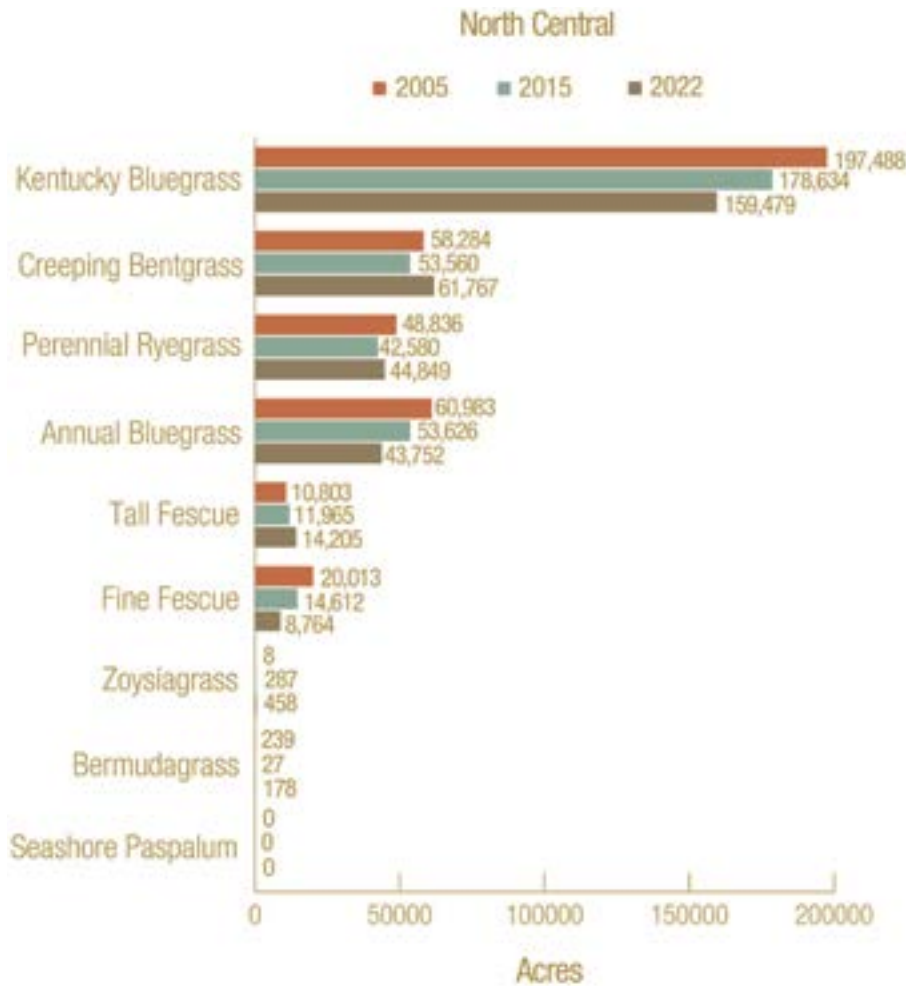


Figure 22. Projected acres of turf-grasses in the North Central region in 2005, 2015, and 2022.

Table 12. Frequency of golf facilities in the US North Central region that have the listed turfgrass species or cultivar on greens, fairways, tees, roughs, or practice areas in 2005, 2015, and 2021.

Year	Bentgrass	Kentucky Bluegrass	Annual Bluegrass	Perennial Rye	Tall Fescue	Fine Fescue	Bermuda	Zoysia	Seashore Paspalum	Buffalo
	Golf facilities (%)									
Greens										
2005	99 a ⁱ	1 a	70 b	1 a	0 ⁱⁱ	0	0	0	0	- ⁱⁱⁱ
2015	99 a	1 a	77 a	1 a	0	0	1	0	0	-
2021	86 b	3 a	66 b	1 a	0	0	0	0	0	0
Fairways										
2005	46 b	63 a	71 a	39 a	3 a	6 b	1 a	0	0	-
2015	53 a	67 a	73 a	43 a	3 a	10 a	1 a	1	0	-
2021	56 a	56 b	61 b	34 a	3 a	6 b	0	0	0	0
Tees										
2005	59 a	56 a	67 a	35 a	1 a	4 a	0	1 a	0	-
2015	64 a	58 a	68 a	33 a	1 a	6 a	1	1 a	0	-
2021	63 a	46 b	55 b	30 a	3 a	4 a	0	1 a	0	0
Roughs										
2005	11 b	89 a	45 a	60 a	23 b	30 a	1 a	1 a	0	-
2015	16 a	93 a	46 a	53 b	23 b	28 a	1 a	1 a	0	-
2021	19 a	79 b	39 a	50 b	29 a	21 b	1 a	1 a	0	0
Practice areas										
2005	26 a	59 b	37 a	41 a	8 a	12 a	1 a	0	0	-
2015	31 a	66 a	38 a	39 a	11 a	10 a	1 a	1 a	0	-
2021	28 a	48 c	27 b	34 b	7 a	6 b	1 a	1 a	0	1

ⁱ Within columns, values followed by a common letter are not significantly different according to the chi-square test at the 10% significance level.

ⁱⁱ Values without variability were not analyzed.

ⁱⁱⁱ Question not asked in that year.

Northeast Facility size

- The median size of facilities in the Northeast was 152.5 acres and has not changed since 2005 (Figure 23).
- The projected total acres of golf facilities in the Northeast was 364,231, which was a 7.6% decrease from 2005 to 2021 (Table 1). This is likely a result of a reduction in golf facilities which also decreased by 10.3% from 2005 to 2021 (Table 2).

Maintained turfgrass acreage

- The median acreage of maintained turfgrass on 18-hole golf facilities in the Northeast was 93.7 acres and has not changed since 2005 (Figure 23).
- 18-hole facilities in the Northeast region maintain turfgrass equivalent to the national median (Figure 4).

- Total projected maintained turfgrass acreage of golf facilities in the Northeast region declined by 6.8% since 2005 (Table 3). This reduction is likely a result of the reduction in golf facilities.

Non-turf acreage

- The median acreage of natural areas in the Northeast increased to 31.1 acres, which was a 50.4% increase from 2005 to 2021 (Figure 23).
- The median acreage of water features, parking lots, bunkers, and buildings decreased from 2005 to 2021 (Figure 23).
- The median length of cart paths on 18-hole facilities in the Northeast increased by 35.4% to 11,566 ft. from 2005 to 2021 (Table 9).

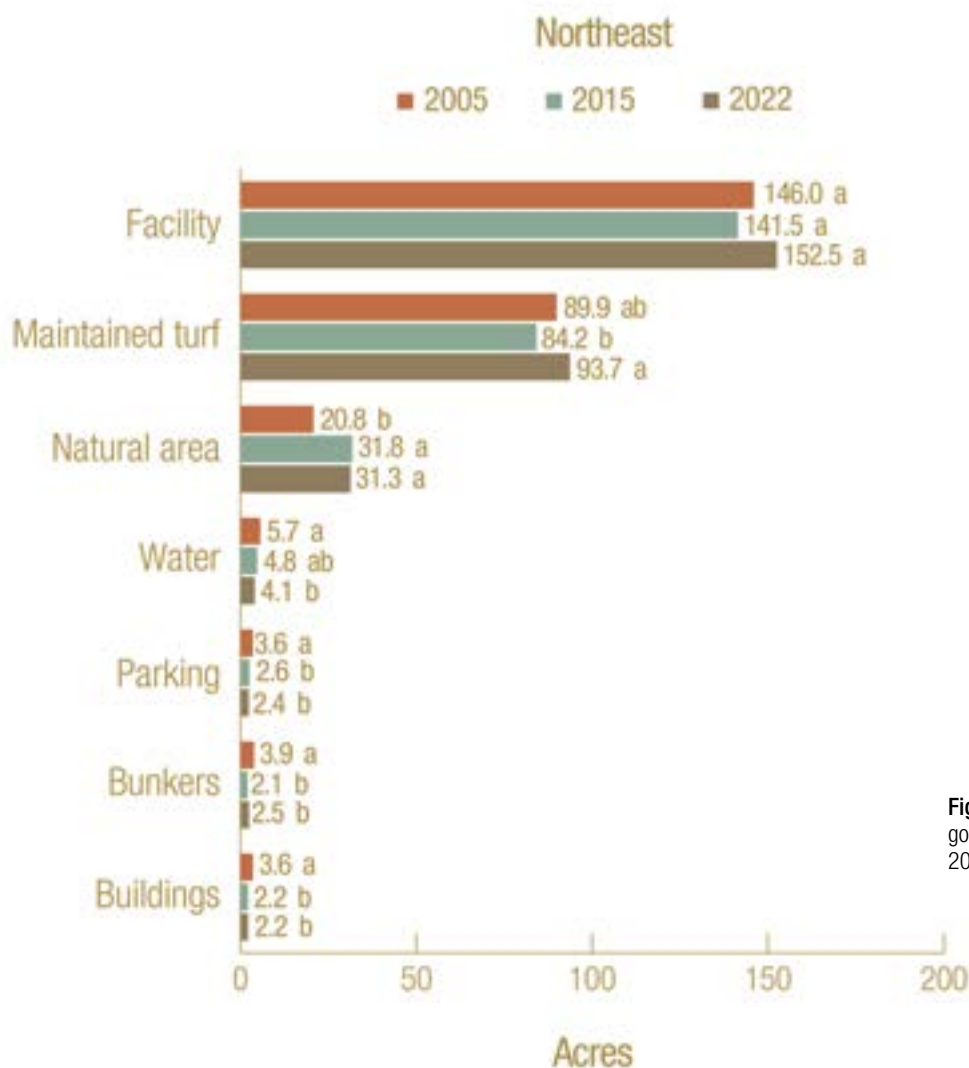


Figure 23. Median land use of 18-hole golf facilities in the Northeast region in 2005, 2015, and 2022.

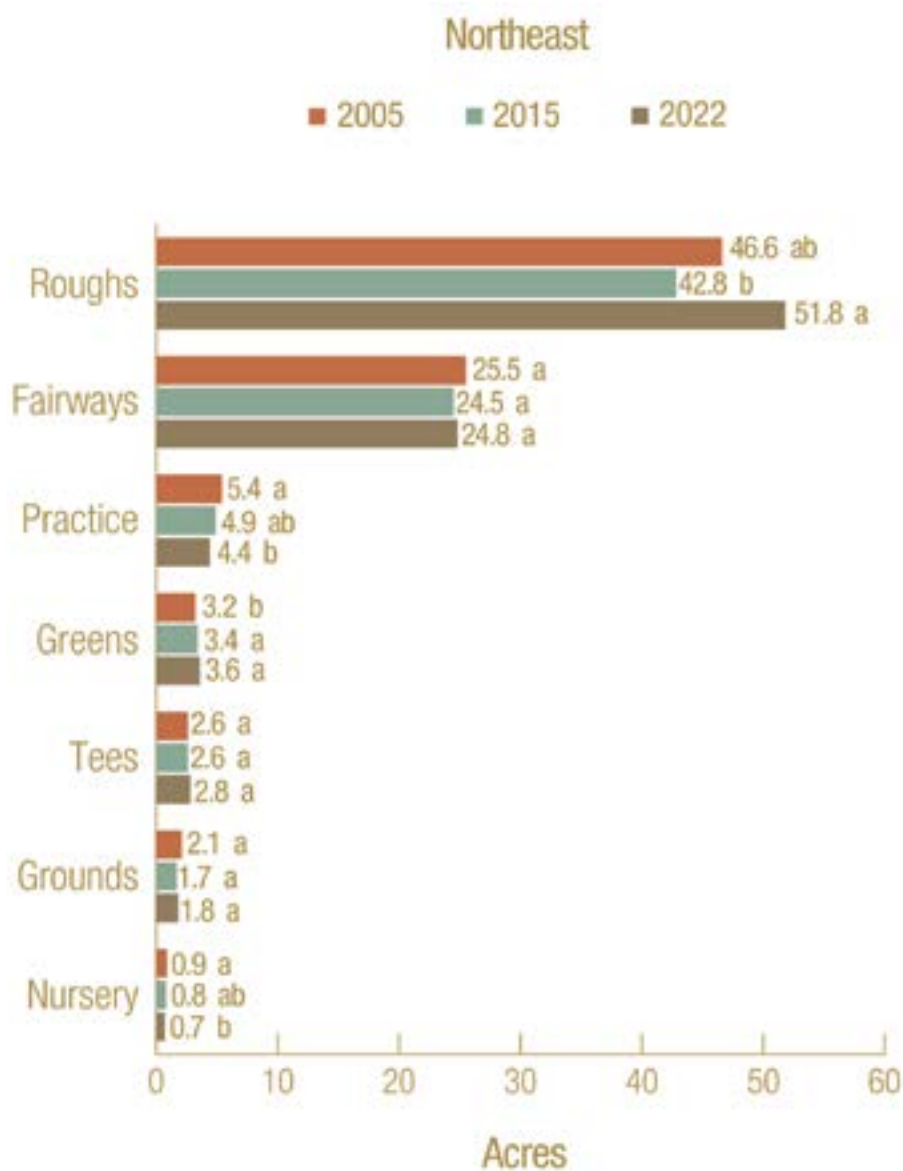


Figure 24. Median acres of turfgrass features on 18-hole golf facilities in the Northeast region in 2005, 2015, and 2022.

- The median of total impervious surfaces on 18-hole facilities in the Northeast decreased by 24.7% to 6.4 acres from 2005 to 2021 (Table 8).

Turf features

- The median acres of putting greens on 18-hole facilities in the Northeast increase by 12.5% to 3.6 acres from 2005 to 2021 (Figure 24).
- The median acres of practice areas and nurseries on 18-hole facilities in the Northeast decreased by 18.5% and 22.2%, respectively (Figure 24).
- The median acres of roughs, fairways, tees, and grounds on 18-hole facilities

in the Northeast did not change from 2005 to 2021 (Figure 24).

Turf types

- The most common turfgrass was Kentucky bluegrass at 58,896 projected acres, but annual bluegrass, creeping bentgrass, and perennial ryegrass were also commonly used (Figure 25).
- The percentage of 18-hole golf facilities in the Northeast that had bentgrass on greens declined from 97% to 80% (Table 13).
- The percentage of 18-hole golf facilities in the Northeast that had bent-

grass or annual bluegrass fairways were approximately equal at ~69% (Table 13).

- 73% of 18-hole golf facilities in the Northeast reported having Kentucky bluegrass roughs and >50% of golf facilities reported having either annual bluegrass or perennial ryegrass roughs (Table 13).

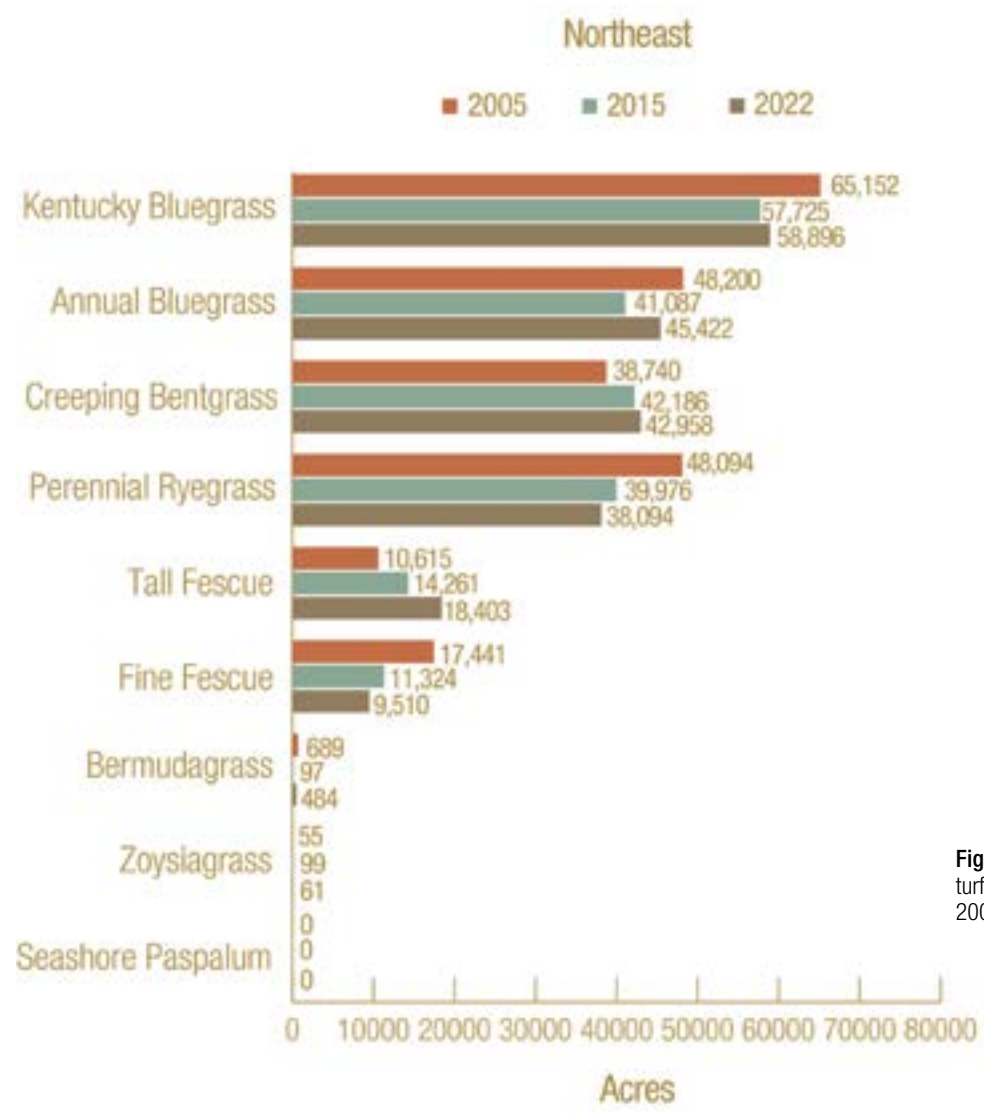


Figure 25. Projected acres of turfgrasses in the Northeast region in 2005, 2015, and 2022.

Table 13. Frequency of golf facilities in the US Northeast region (Fig. 1) that have the listed turfgrass species or cultivar on greens, fairways, tees, roughs, or practice areas in 2005, 2015, and 2021.

Year	Bentgrass	Kentucky Bluegrass	Annual Bluegrass	Perennial Rye	Tall Fescue	Fine Fescue	Bermuda	Zoysia	Seashore Paspalum	Buffalo
	Golf facilities (%)									
Greens										
2005	97 a ⁱ	1 a	83 a	1 a	0 ⁱⁱ	1 a	1	0	0	- ⁱⁱⁱ
2015	98 a	0	84 a	1 a	0	0	0	0	0	-
2021	80 b	1 a	72 b	1 a	0	1 a	0	0	0	0
Fairways										
2005	70 ab	44 a	81 a	60 a	6 a	20 a	1 a	0	0	-
2015	76 a	39 a	75 b	52 b	4 b	16 ab	0	0	0	-
2021	66 b	30 b	69 b	47 b	4 b	11 b	1 a	0	0	0
Tees										
2005	73 a	41 a	76 a	60 a	2 b	14 a	1	0	0	-
2015	74 a	39 a	72 a	46 b	3 ab	11 ab	0	0	0	-
2021	68 a	29 b	61 b	43 b	5 a	7 b	0	0	0	0
Roughs										
2005	19 b	86 a	66 a	77 a	36 a	51 a	1 a	1 a	0	-
2015	20 b	80 b	59 ab	71 a	39 a	41 b	1 a	1 a	0	-
2021	27 a	73 c	54 b	58 b	42 a	27 c	1 a	1 a	0	1
Practice areas										
2005	27 a	50 a	44 a	50 a	14 a	21 a	1 b	0	0	-
2015	30 a	45 a	40 ab	48 a	14 a	17 ab	1 b	1 a	0	-
2021	30 a	36 b	36 b	35 b	12 a	13 b	2 a	1 a	0	0

ⁱ Within columns, values followed by a common letter are not significantly different according to the chi-square test at the 10% significance level.

ⁱⁱ Values without variability were not analyzed.

ⁱⁱⁱ Question not asked in that year.

Pacific Facility size

- The median size of facilities in the Pacific was 122.4 acres and has not changed since 2005 (Figure 26).
- The projected total acres of golf facilities in the Pacific were 72,999, which was a 19.1% decrease from 2005 to 2021 (Table 1). This is at least partially a result of a reduction in golf facilities which decreased by 8.7% from 2005 to 2021 (Table 2).

Maintained turfgrass acreage

- The median acreage of maintained turfgrass on 18-hole golf facilities in the Pacific was 84 acres and has not changed since 2005 (Figure 26).
- 18-hole facilities in the Pacific region maintain 11 acres of turfgrass less than the national median (Figure 4).

- Total projected maintained turfgrass acreage of golf facilities in the Pacific region declined to 47,420 or 18.9% since 2005 (Table 3). This reduction is at least partially a result of the reduction in golf facilities.

Non-turf acreage

- The median acreage of natural areas in the Pacific was 19.1 acres, which was equivalent to 2005 (Figure 26).
- The median acreage of water features, parking lots, bunkers, and buildings decreased from 2005 to 2021 (Figure 26).
- The median length of cart paths on 18-hole facilities in the Pacific was 19,736 ft., which was equivalent to 2005 (Table 9).

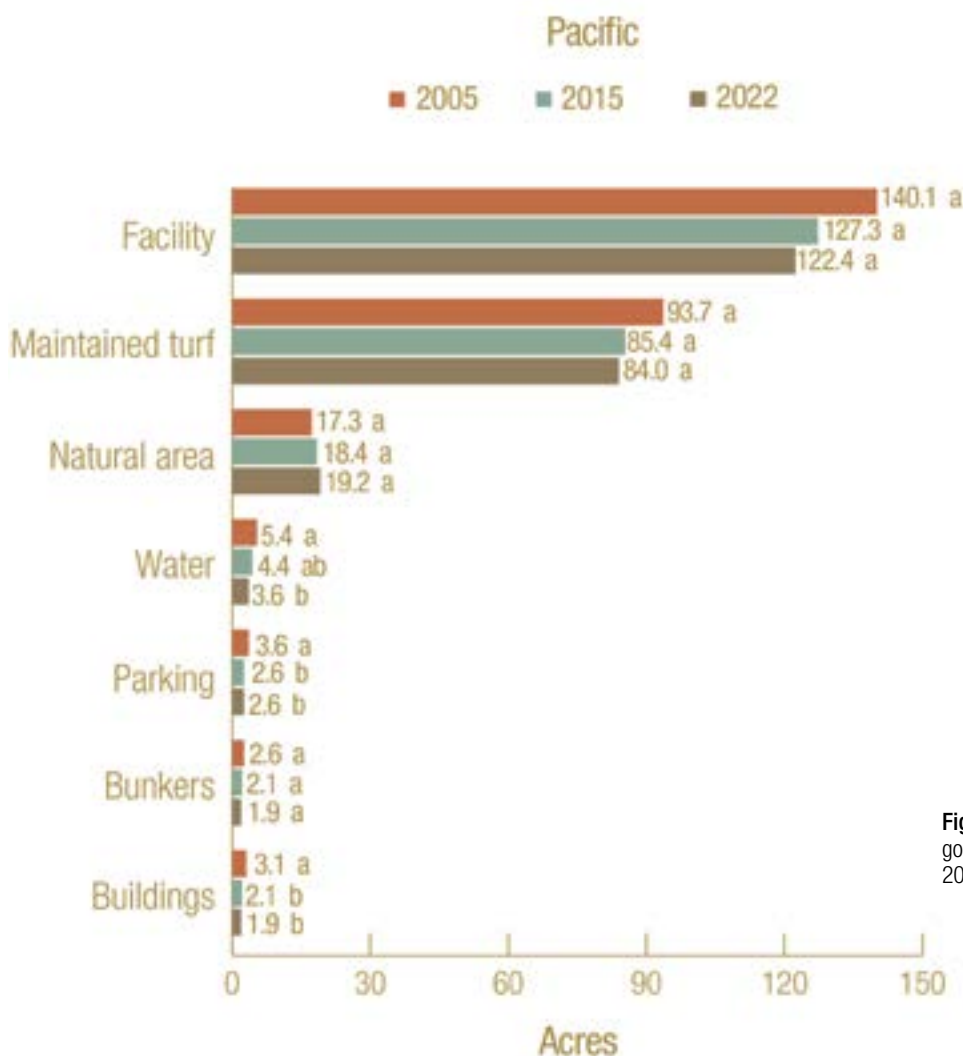


Figure 26. Median land use of 18-hole golf facilities in the Pacific region in 2005, 2015, and 2022.

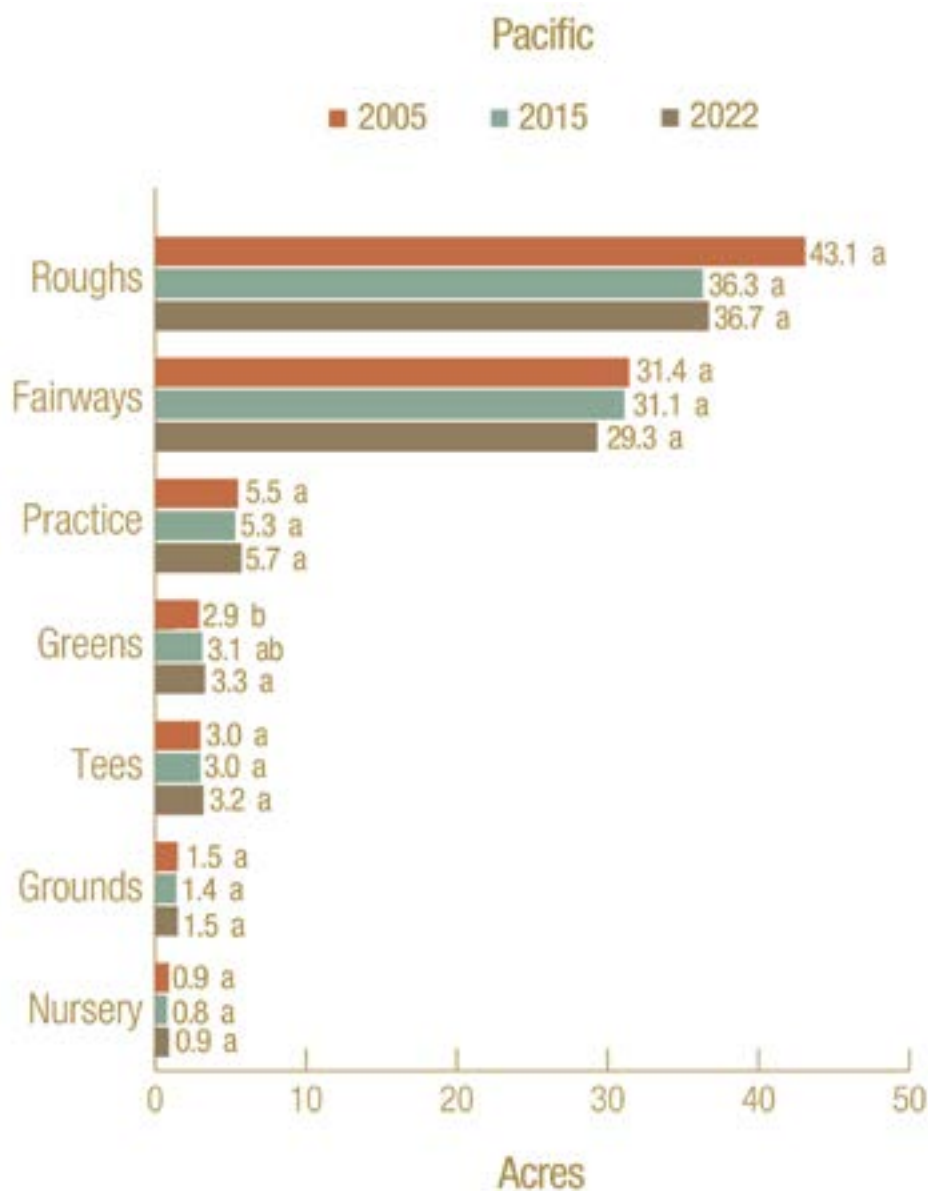


Figure 27. Median acres of turfgrass features on 18-hole golf facilities in the Pacific region in 2005, 2015, and 2022.

- The median of total impervious surfaces on 18-hole facilities in the Pacific was 7.9 acres, which was equivalent to 2005 (Table 8).

Turf features

- The median acres of putting greens on 18-hole facilities in the Pacific increase by 13.7% to 3.3 acres from 2005 to 2021 (Figure 27).
- The median acres of roughs, fairways, practices areas, tees, grounds, and nurseries on 18-hole facilities in the Pacific did not change from 2005 to 2021 (Figure 27).

Turf types

- The most common turfgrass was annual bluegrass accounting for 19,417 projected acres with perennial ryegrass accounting for 15,532 projected acres (Figure 28).
- The percentage of 18-hole golf facilities in the Pacific that had bentgrass or annual bluegrass on putting greens was approximately equal at 63% and 68%, respectively (Table 14).
- Annual bluegrass and perennial ryegrass were most commonly reported on fairways, tees, and roughs at

approximately 60% of 18-hole facilities (Table 14).

- The percentage of 18-hole golf facilities in the Pacific that reported using bermudagrass on fairways, tees, and roughs was 21%, 15%, and 21%, respectively and has not changed since 2005 (Table 14).

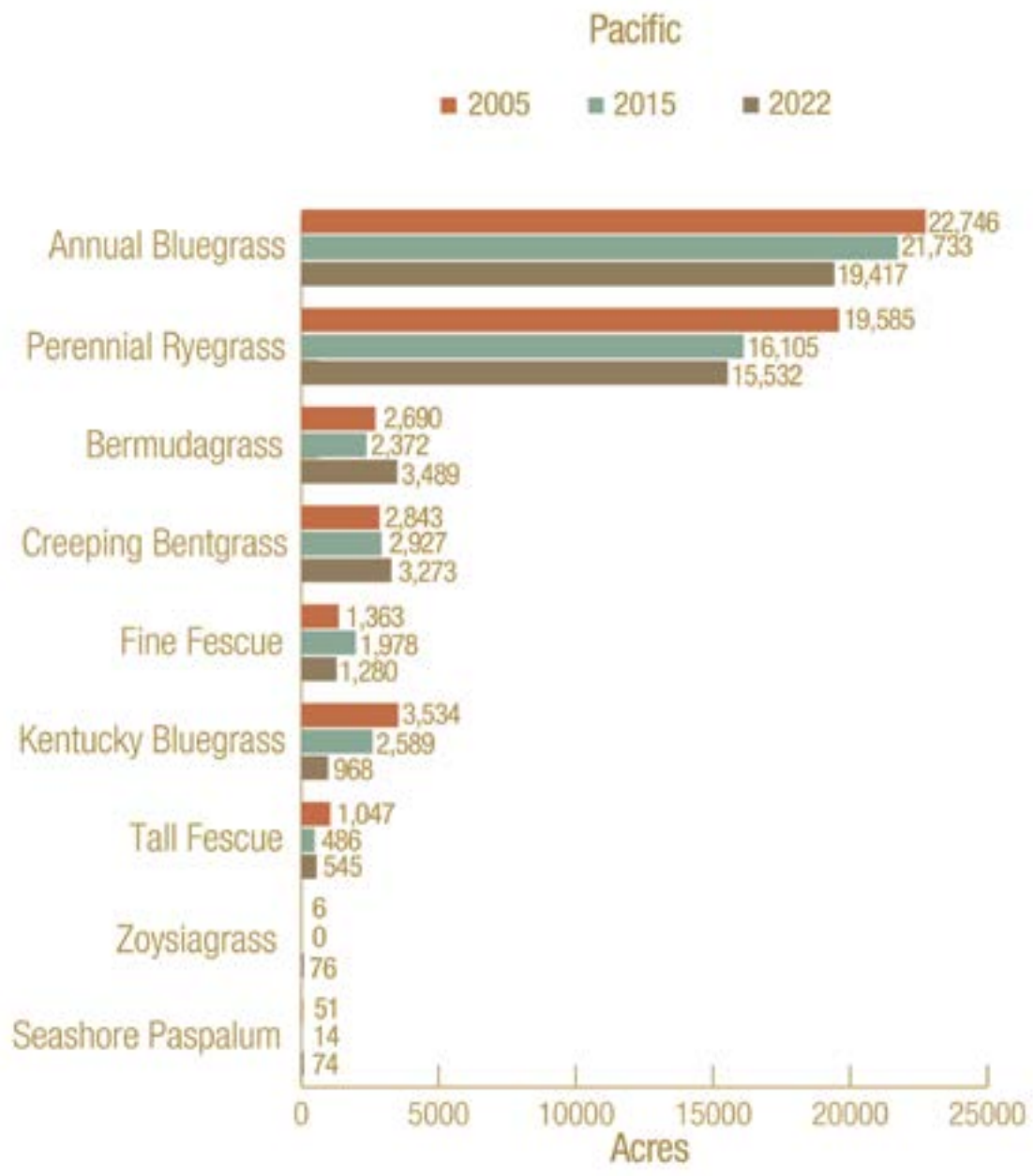


Figure 28. Projected acres of turfgrasses in the Pacific region in 2005, 2015, and 2022.

Table 14. Frequency of golf facilities in the US Pacific region (Fig. 1) that have the listed turfgrass species or cultivar on greens, fairways, tees, roughs, or practice areas in 2005, 2015, and 2021.

Year	Bentgrass	Kentucky Bluegrass	Annual Bluegrass	Perennial Rye	Tall Fescue	Fine Fescue	Bermuda	Zoysia	Seashore Paspalum	Buffalo
	Golf facilities (%)									
Greens										
2005	73 a ⁱ	1 a	78 ab	4 a	0 ⁱⁱ	3 a	1 a	0	0	- ⁱⁱⁱ
2015	72 a	1 a	89 a	1 a	0	6 a	1 a	0	0	-
2021	63 a	0	68 b	0	0	0	3 a	0	0	0
Fairways										
2005	22 a	20 a	79 a	84 a	3 a	11 a	18 a	0	1 a	-
2015	30 a	10 b	87 a	72 ab	1 a	7 a	25 a	0	1 a	-
2021	32 a	4 c	59 b	61 b	1 a	6 a	21 a	1	2 a	0
Tees										
2005	23 b	12 a	71 ab	78 a	2 a	6 a	13 ab	0	0	-
2015	35 a	8 ab	83 a	65 ab	2 a	7 a	7 b	0	0	-
2021	26 ab	5 b	62 b	57 b	1 a	2 b	15 a	0	0	0
Roughs										
2005	14 a	19 a	72 b	72 a	10 a	21 a	13 b	0	1 a	-
2015	19 a	12 ab	89 a	73 a	8 a	12 b	25 a	0	0	-
2021	19 a	9 b	58 c	59 a	5 a	11 b	21 ab	1	1 a	0
Practice areas										
2005	14 a	13 a	55 a	64 a	7 a	7 a	13 a	1 a	0	-
2015	16 a	7 ab	62 a	42 b	7 a	5 ab	13 a	0	0	-
2021	11 a	3 b	40 b	48 b	4 a	2 b	19 a	1 a	1	0

ⁱ Within columns, values followed by a common letter are not significantly different according to the chi-square test at the 10% significance level.

ⁱⁱ Values without variability were not analyzed.

ⁱⁱⁱ Question not asked in that year.

Southeast Facility size

- The median size of facilities in the Southeast was 136.1 acres and has not changed since 2005 (Figure 29).
- The projected total acres of golf facilities in the Southeast was 419,552, which was a 17.4% decrease from 2005 to 2021 (Table 1). This reduction was a result of a reduction in golf facilities which decreased by 16.5% from 2005 to 2021 (Table 2).

Maintained turfgrass acreage

- The median acreage of maintained turfgrass on 18-hole golf facilities in the Southeast was 93.8 acres and has not changed since 2005 (Figure 29).
- 18-hole facilities in the Southeast region maintain turfgrass equivalent

to the national median (Figure 4).

- Total projected maintained turfgrass acreage of golf facilities in the Southeast region declined to 267,277 or by 15.3% since 2005 (Table 3). This reduction is at least partially a result of the reduction in golf facilities.

Non-turf acreage

- The median acreage of natural areas in the Southeast was 15.1 acres, which was equivalent to 2005 (Figure 29).
- The median acreage of water features was 10.2 and did not change from 2005 to 2021 (Figure 29).
- The median acreage of parking lots, bunkers, and buildings decreased from 2005 to 2021 (Figure 29).
- The median length of cart paths on 18-hole facilities in the Southeast

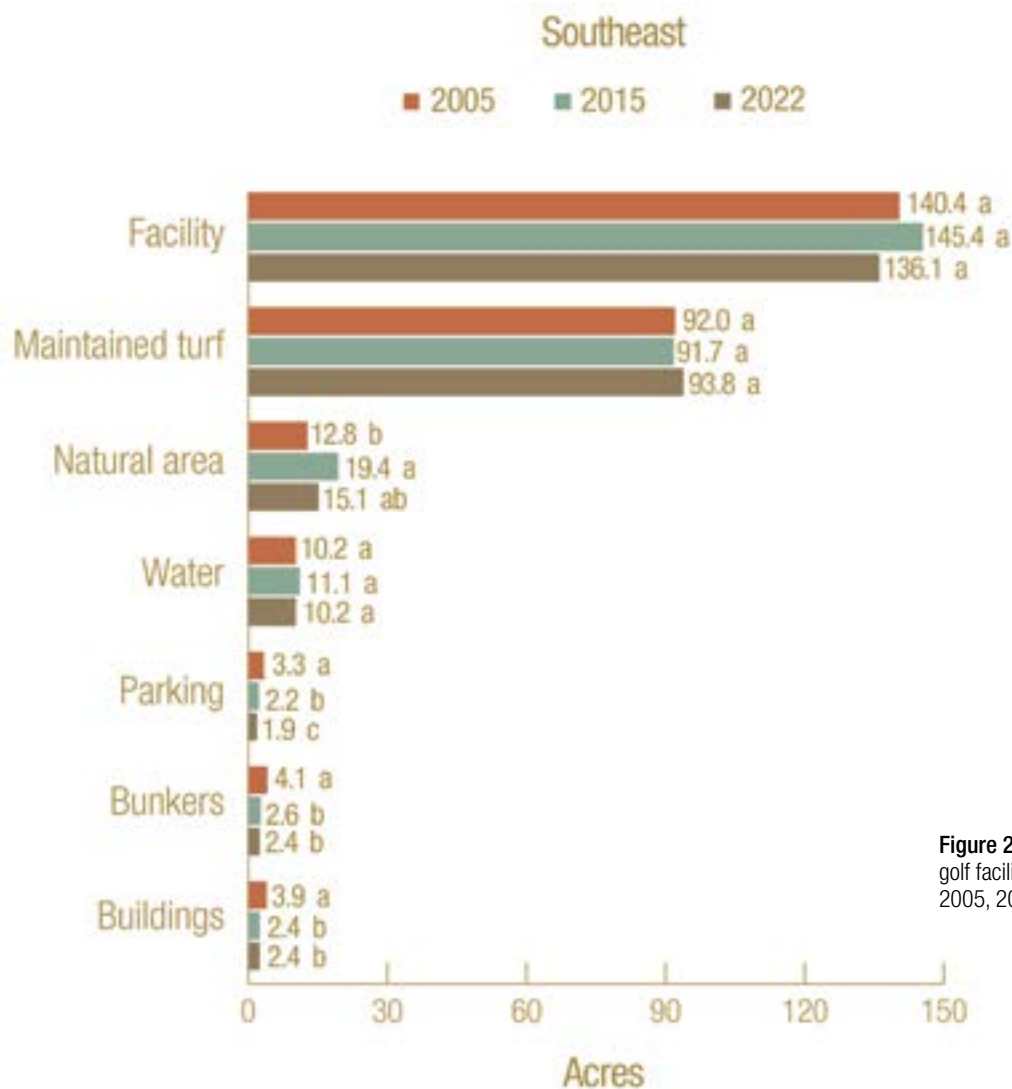


Figure 29. Median land use of 18-hole golf facilities in the Southeast region in 2005, 2015, and 2022.

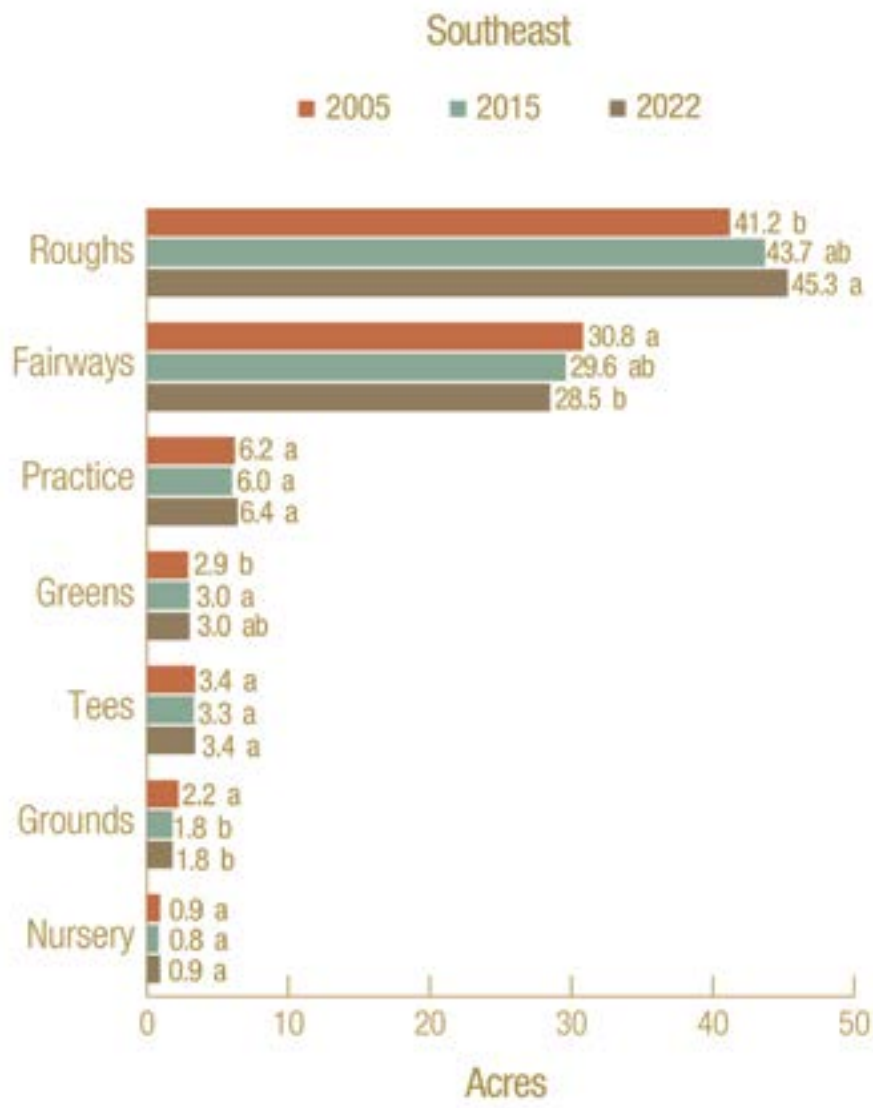


Figure 30. Median acres of turfgrass features on 18-hole golf facilities in the Southeast region in 2005, 2015, and 2022.

increased to 20,616 ft., which was a 20.7% increase from 2005 to 2021 (Table 9).

- The median of total impervious surfaces on 18-hole facilities in the Southeast was 7.3 acres, which was a 29.8% reduction from 2005 to 2021 (Table 8).

Turf features

- The median acres of putting greens on 18-hole facilities in the Southeast was 3.0 acres, which did not change from 2005 to 2021 (Figure 30).
- The median acres of roughs on 18-hole facilities in the Southeast increased by 9.9% to 45.3 acres from 2005 to 2021 (Figure 30).
- The median acres of practice areas

and tees on 18-hole facilities in the Southeast was 6.4 and 3.4 acres, respectively, and did not change from 2005 to 2021 (Figure 30).

Turf types

- The most common turfgrass was bermudagrass accounting for 227,324 or 85% of the total projected turfgrass acres (Figure 31).
- The percentage of 18-hole golf facilities in the Southeast that had bermudagrass decreased on each course feature, whereas the percentage that had seashore paspalum or zoysiagrass increased on each course feature (except zoysiagrass on tees) (Table 15).
- The percentage of 18-hole golf facilities in the Southeast that had bent-

grass on putting greens decreased by 50% to 8% of facilities (Table 15).

- The percentage of 18-hole golf facilities in the Southeast that had tall fescue in roughs decreased by 70% to 3% of golf facilities (Table 15).

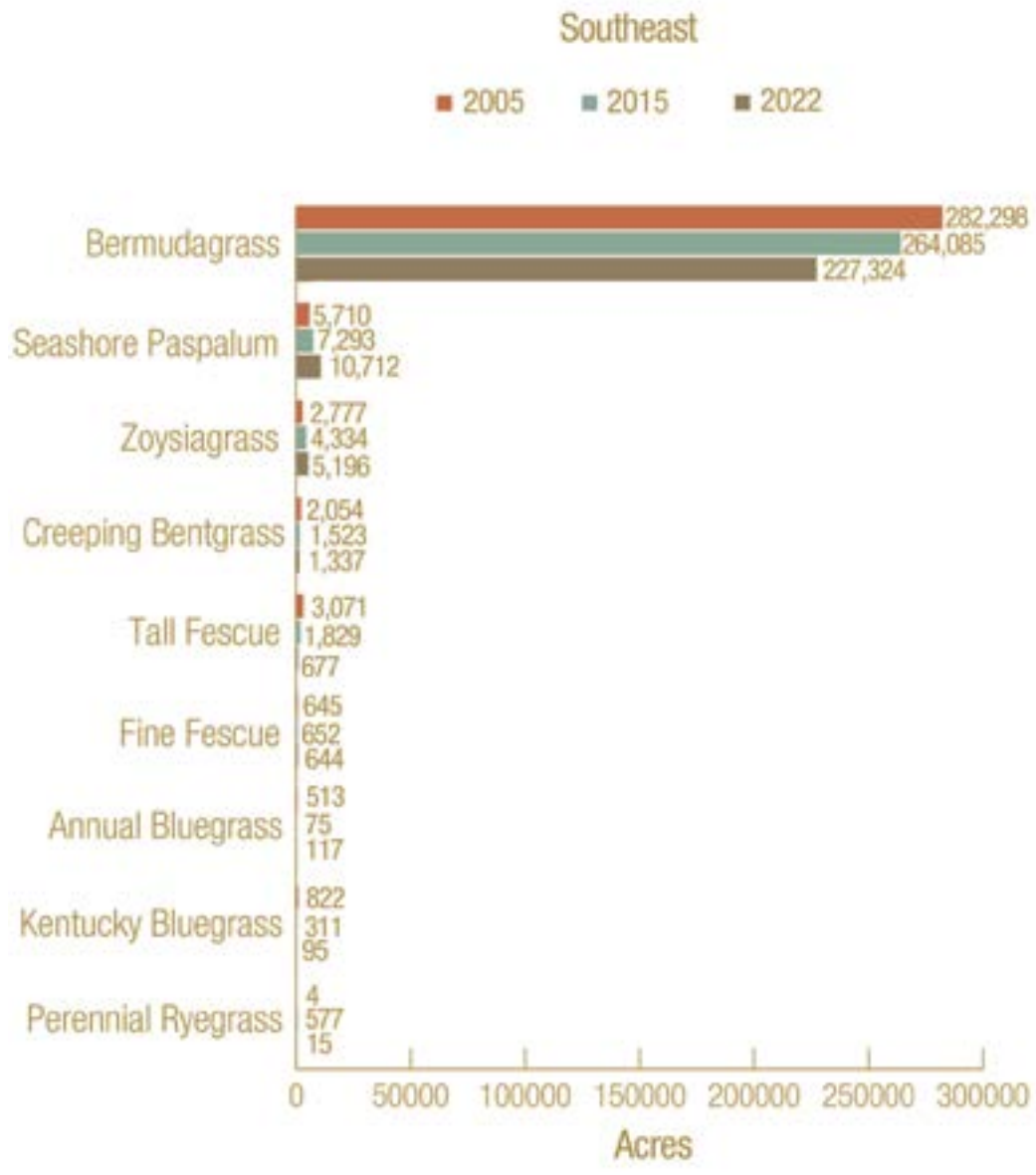


Figure 31. Projected acres of turfgrasses in the Southeast region in 2005, 2015, and 2022.

Table 15. Frequency of golf facilities in the US Southeast region (Fig. 1) that have the listed turfgrass species or cultivar on greens, fairways, tees, roughs, or practice areas in 2005, 2015, and 2021.

Year	Bentgrass	Kentucky Bluegrass	Annual Bluegrass	Perennial Rye	Tall Fescue	Fine Fescue	Bermuda	Zoysia	Seashore Paspalum	Buffalo
	Golf facilities (%)									
Greens										
2005	16 a ⁱ	0	2 a	0 ⁱⁱ	0	0	79 a	1 c	2 b	- ⁱⁱⁱ
2015	12 ab	0	2 a	0	1	1 a	80 a	2 b	9 a	-
2021	8 b	0	1 b	0	0	1 a	72 b	7 a	8 a	0
Fairways										
2005	1 a	1	1 a	0	1	0	96 a	2 b	2 b	-
2015	1 a	0	1 a	1 b	0	1 a	94 a	3 ab	6 a	-
2021	1 a	0	0	2 a	0	1 a	86 b	4 a	8 a	0
Tees										
2005	1 a	1	1 a	1 a	0	0	94 a	19 a	4 b	-
2015	1 a	0	1 a	1 a	0	1 a	93 a	18 a	8 a	-
2021	1 a	0	0	0	0	1 a	85 b	22 a	8 a	0
Roughs										
2005	0	1 a	1 a	1 b	10 a	2 a	93 a	6 b	2 b	-
2015	0	1 a	1 a	1 b	6 b	1 a	91 a	7 ab	5 a	-
2021	0	1 a	1 a	2 a	3 c	1 a	80 b	9 a	6 a	2
Practice areas										
2005	1 a	1 a	1	1 a	1 a	1 a	87 a	2 b	2 b	-
2015	1 a	1 a	0	1 a	1 a	1 a	82 a	4 ab	5 a	-
2021	1 a	1 a	0	1 a	0	1 a	74 b	4 a	8 a	0

ⁱ Within columns, values followed by a common letter are not significantly different according to the chi-square test at the 10% significance level.

ⁱⁱ Values without variability were not analyzed.

ⁱⁱⁱ Question not asked in that year.

Southwest Facility size

- The median size of facilities in the Southwest was 129.7 acres, which was a 12.1% reduction from 2005 to 2021 (Figure 32).
- The projected total acres of golf facilities in the Southwest were 185,937, which was a 6.1% decrease from 2005 to 2021 (Table 1). This reduction was a result of a reduction in golf facilities which decreased by 8.2% from 2005 to 2021 (Table 2).

Maintained turfgrass acreage

- The median acreage of maintained turfgrass on 18-hole golf facilities in the Southwest was 84.3 acres and decreased since 2005 (Figure 32).
- 18-hole facilities in the Southwest region maintain approximately 10

fewer acres of turfgrass than the national median (Figure 4).

- Total projected maintained turfgrass acreage of golf facilities in the Southwest region declined to 99,964 or by 22.0% since 2005 (Table 3). This reduction was likely a result of the reduction in golf facilities.

Non-turf acreage

- The median acreage of natural areas in the Southwest was 24.0 acres, which was equivalent to 2005 (Figure 32).
- The median acreage of water features was 4.1 acres and did not change from 2005 to 2021 (Figure 32).
- The median acreage of parking lots, bunkers, and buildings decreased from 2005 to 2021 (Figure 32).
- The median length of cart paths on 18-hole facilities in the Southwest

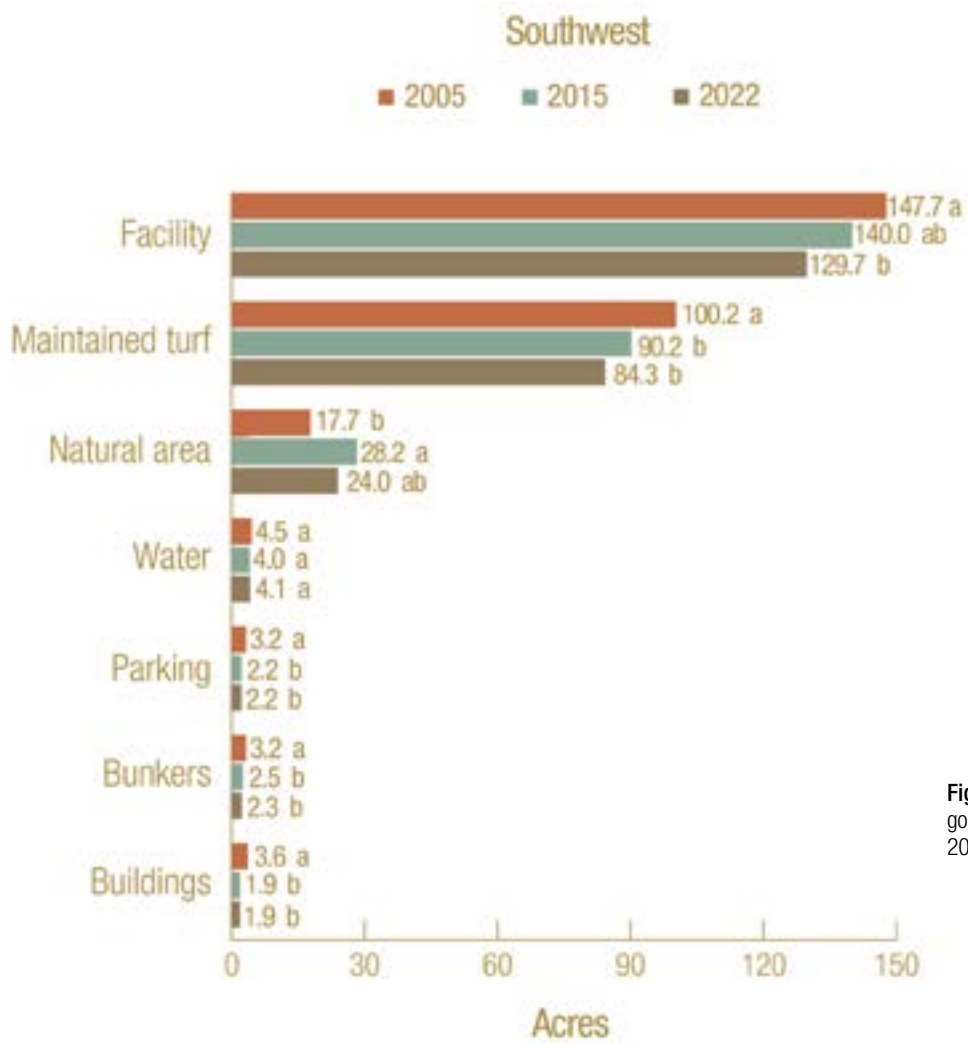


Figure 32. Median land use of 18-hole golf facilities in the Southwest region in 2005, 2015, and 2022.

Southwest

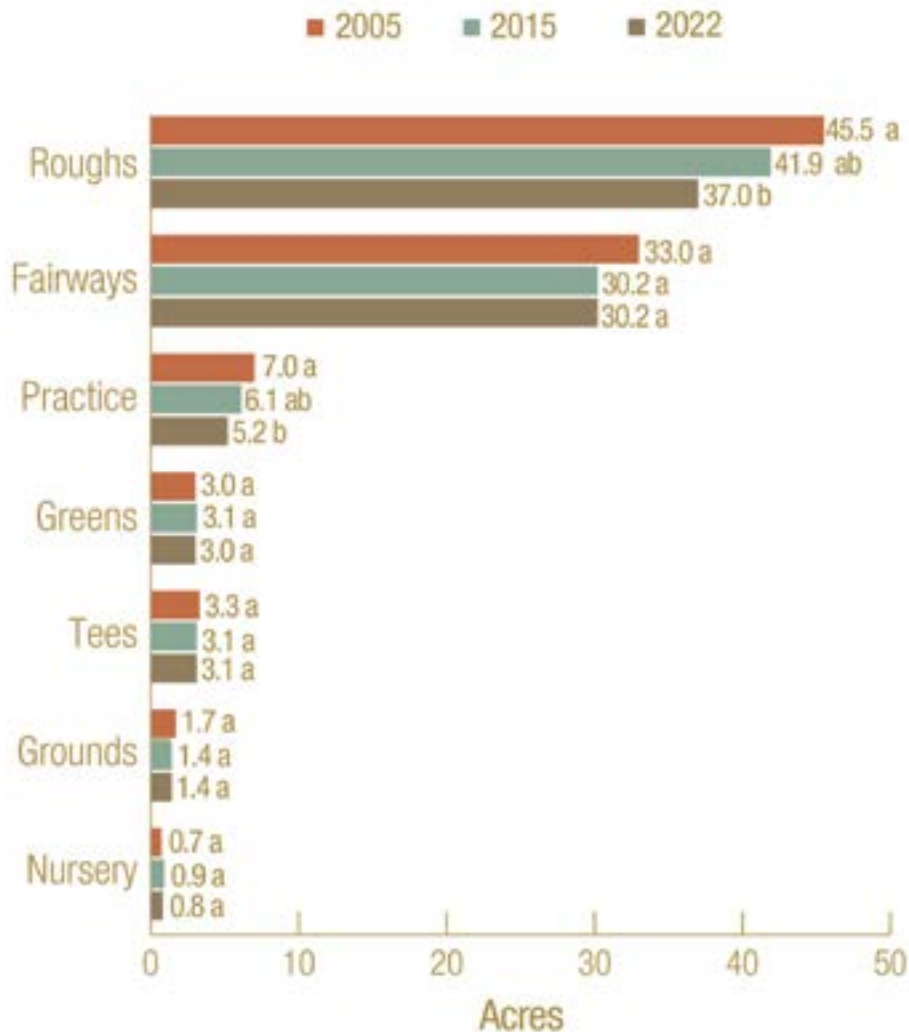


Figure 33. Median acres of turfgrass features on 18-hole golf facilities in the Southwest region in 2005, 2015, and 2022.

increased to 17,132 ft., which was equivalent to 2005 (Table 9).

- The median of total impervious surfaces on 18-hole facilities in the Southwest was 7.2 acres, which was a 23.4% reduction from 2005 to 2021 (Table 8).

Turf features

- The median acres of putting greens on 18-hole facilities in the Southwest was 3.0 acres, which did not change from 2005 to 2021 (Figure 33).
- The median acres of roughs on 18-hole facilities in the Southwest decreased by 18.6% to 37.0 acres from 2005 to 2021 (Figure 33).
- The median acres of practice areas decreased by 25.7% to 5.2 acres from 2005 to 2021 (Figure 33).

- The median acres of tees, grounds, and nurseries did not change from 2005 to 2021 (Figure 33).

Turf types

- The most common turfgrass was bermudagrass accounting for 60,398 acres or 60.4% of the total projected turfgrass acres (Figure 34).
- Putting greens in the Southwest were split between bentgrass, annual bluegrass, and bermudagrass at 48%, 35%, and 30% of 18-hole golf facilities (Table 16).
- The percentage of 18-hole golf facilities in the Southwest that had bentgrass putting greens declined to 48%, whereas the percent that had seashore paspalum increased to 6% in 2021 (Table 16).

- Greater than 50% of 18-hole golf facilities had bermudagrass on all areas of the golf facility (except putting greens) making bermudagrass the most common turfgrass in the Southwest (Table 16).

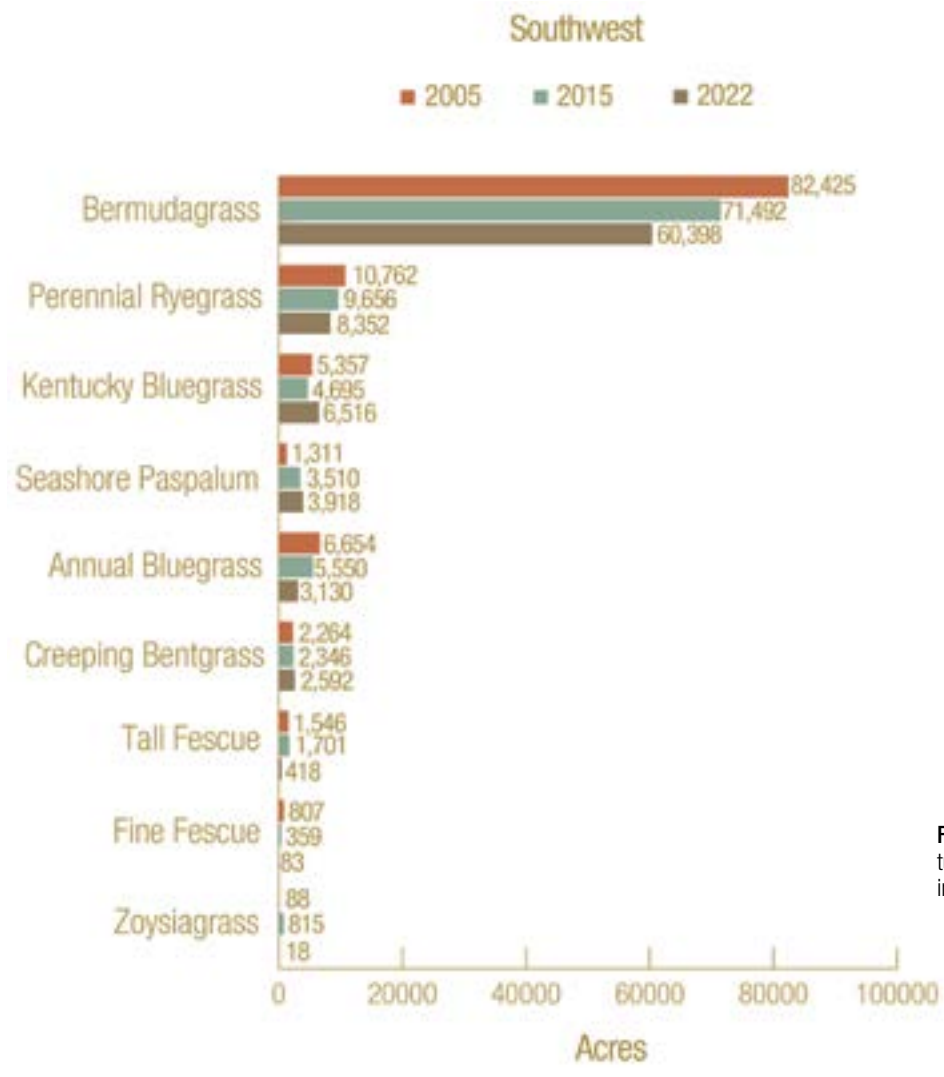


Figure 34. Projected acres of turfgrasses in the Southwest region in 2005, 2015, and 2022

Table 16. Frequency of golf facilities in the US Southwest region (Fig. 1) that have the listed turfgrass species or cultivar on greens, fairways, tees, roughs, or practice areas in 2005, 2015, and 2021.

Year	Bentgrass	Kentucky Bluegrass	Annual Bluegrass	Perennial Rye	Tall Fescue	Fine Fescue	Bermuda	Zoysia	Seashore Paspalum	Buffalo
	Golf facilities (%)									
Greens										
2005	60 a ⁱ	2	43 a	2 a	0 ⁱⁱ	0	36 a	1 a	2 b	- ⁱⁱⁱ
2015	53 ab	0	40 a	7 a	0	3	41 a	1 a	4 ab	-
2021	48 b	0	35 a	0	0	0	30 a	1 a	6 a	0
Fairways										
2005	5 ab	10 a	23 a	20 a	1 a	1	78 a	1 a	3 a	-
2015	2 b	6 a	16 ab	21 a	2 a	0	75 ab	1 a	7 a	-
2021	6 a	9 a	11 b	16 a	1 a	0	65 b	1 a	6 a	0
Tees										
2005	8 a	10 a	22 a	23 a	0	1	78 a	1 a	3 a	-
2015	8 a	4 b	16 ab	23 a	2 a	0	74 ab	1 a	6 a	-
2021	6 a	9 ab	11 b	23 a	1 a	0	66 b	2 a	6 a	0
Roughs										
2005	3 a	9 ab	23 a	30 a	6 a	5 a	73 a	1 a	2 b	-
2015	1 b	6 b	18 a	29 a	3 a	1 b	76 a	1 a	4 ab	-
2021	2 ab	13 a	9 b	22 a	3 a	1 b	65 a	1 a	6 a	2
Practice areas										
2005	2 a	6 a	12 a	22 a	4 a	2	64 a	0	2 a	-
2015	2 a	6 a	11 a	21 a	3 ab	0	71 a	1	2 a	-
2021	1 a	8 a	5 b	13 b	1 b	0	50 b	0	3 a	0

ⁱ Within columns, values followed by a common letter are not significantly different according to the chi-square test at the 10% significance level.

ⁱⁱ Values without variability were not analyzed.

ⁱⁱⁱ Question not asked in that year.

Transition Facility size

- The median size of facilities in the Transition was 147.9 acres and did not change from 2005 to 2021 (Figure 35).
- The projected total acres of golf facilities in the Transition were 367,032, which was a 18.0% decrease from 2005 to 2021 (Table 1). This reduction was a result of a reduction in golf facilities which decreased by 15.4% from 2005 to 2021 (Table 2).

Maintained turfgrass acreage

- The median acreage of maintained turfgrass on 18-hole golf facilities in the Transition was 96.9 acres and has not changed since 2005 (Figure 35).
- 18-hole facilities in the Transition region maintain turfgrass approxi-

mately equivalent to the national median (Figure 4).

- Total projected maintained turfgrass acreage of golf facilities in the Transition region declined to 234,809 or by 17.6% since 2005 (Table 3). This reduction was likely a result of the reduction in golf facilities.

Non-turf acreage

- The median acreage of natural areas in the Transition was 25.4 acres, which was a 62.9% increase from 2005 to 2021 (Figure 35).
- The median acreage of water features was 5.9 acres and did not change from 2005 to 2021 (Figure 35).
- The median acreage of parking lots, bunkers, and buildings decreased from 2005 to 2021 (Figure 35).

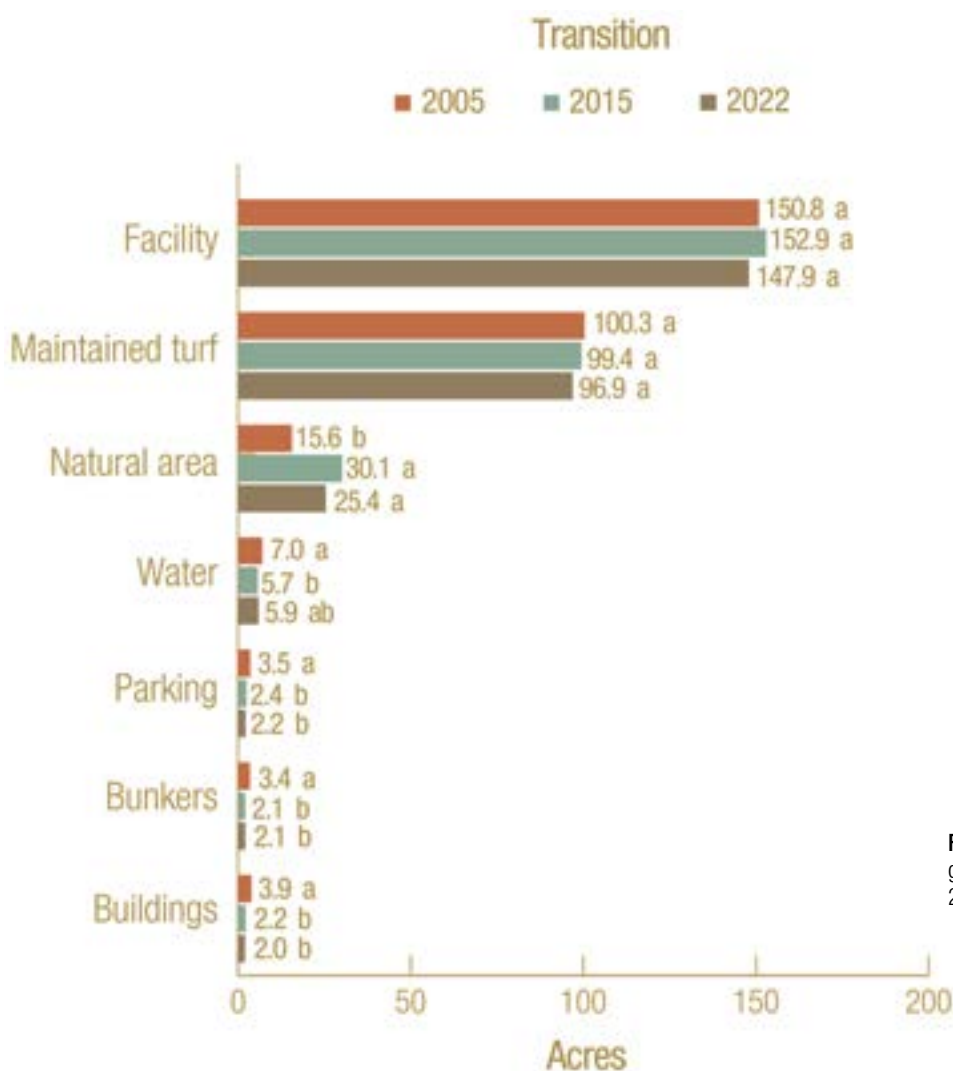


Figure 35. Median land use of 18-hole golf facilities in the Transition region in 2005, 2015, and 2022.

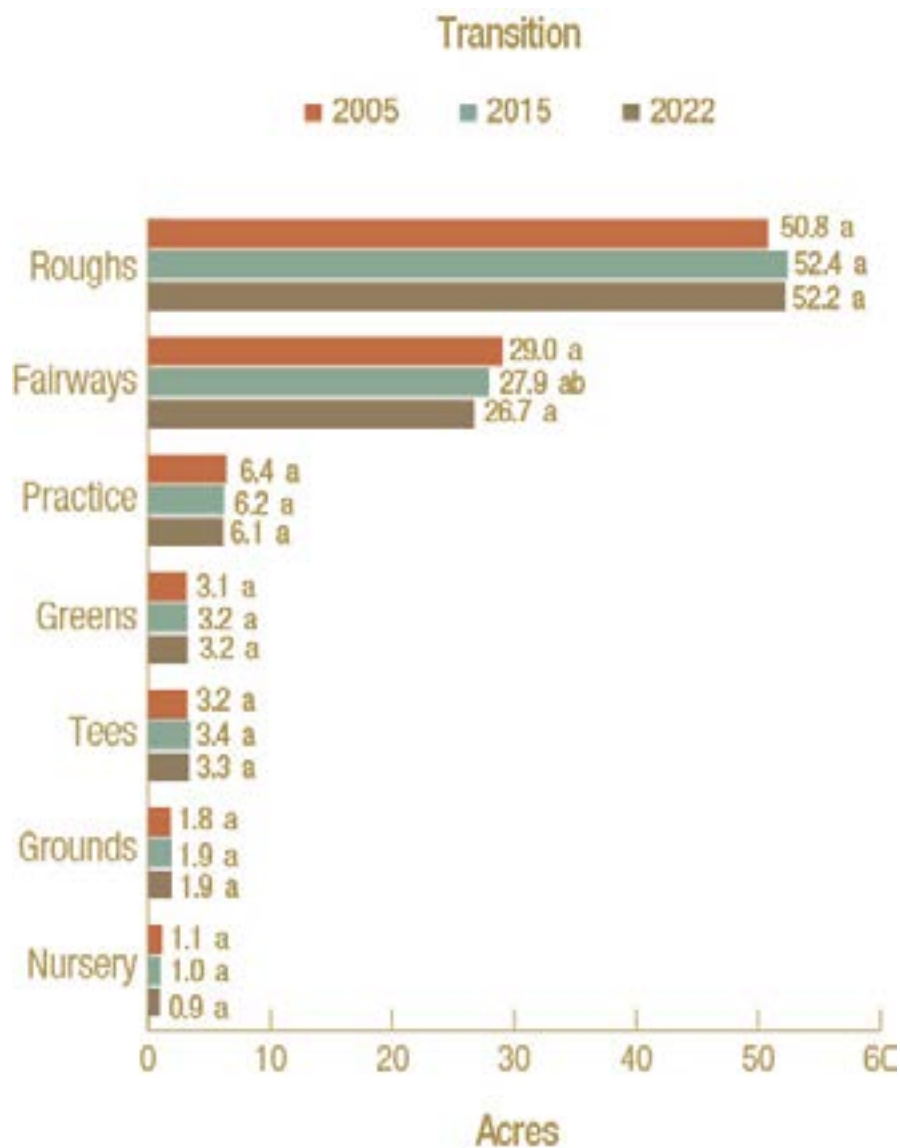


Figure 36. Median acres of turfgrass features on 18-hole golf facilities in the Transition region in 2005, 2015, and 2022.

- The median length of cart paths on 18-hole facilities in the Transition increased to 23,357 ft., which was a 17.9% increase from 2005 to 2021 (Table 9).
- The median of total impervious surfaces on 18-hole facilities in the Transition was 8.2 acres, which was a 12.2% reduction from 2005 to 2021 (Table 8).

Turf features

- The median acres of putting greens on 18-hole facilities in the Transition was 3.2 acres, which did not change from 2005 to 2021 (Figure 36).
- The median acres of fairways on 18-hole facilities in the Transition

decreased by 4.8% from 2005 to 2021 to 26.7 acres (Figure 36).

- The median acres of practice areas, tees, grounds, and nurseries did not change from 2005 to 2021 (Figure 36).

Turf types

- The most common turfgrass was bermudagrass accounting for 99,675 acres or 38.6% of the total projected turfgrass acres (Figure 37).
- 72% of 18-hole golf facilities reported having bentgrass on putting greens making bentgrass the most common turfgrass on putting greens (Table 17).
- The second most common turfgrass on putting greens in the Transition was annual bluegrass, which was reported

on 36% of 18-hole golf facilities (Table 17).

- Although bentgrass and annual bluegrasses on putting greens, their use among 18-hole facilities declined from 2005 to 2021. Concomitantly, the percentage of facilities that reported having Bermudagrass on putting greens more than tripled to 17% of 18-hole facilities.
- Bermudagrass dominated fairways, tees, roughs, and practice areas with its use being reported by >45% of 18-hole facilities (Table 17).
- The use of zoysiagrass increased on all course features except putting greens (Table 17).

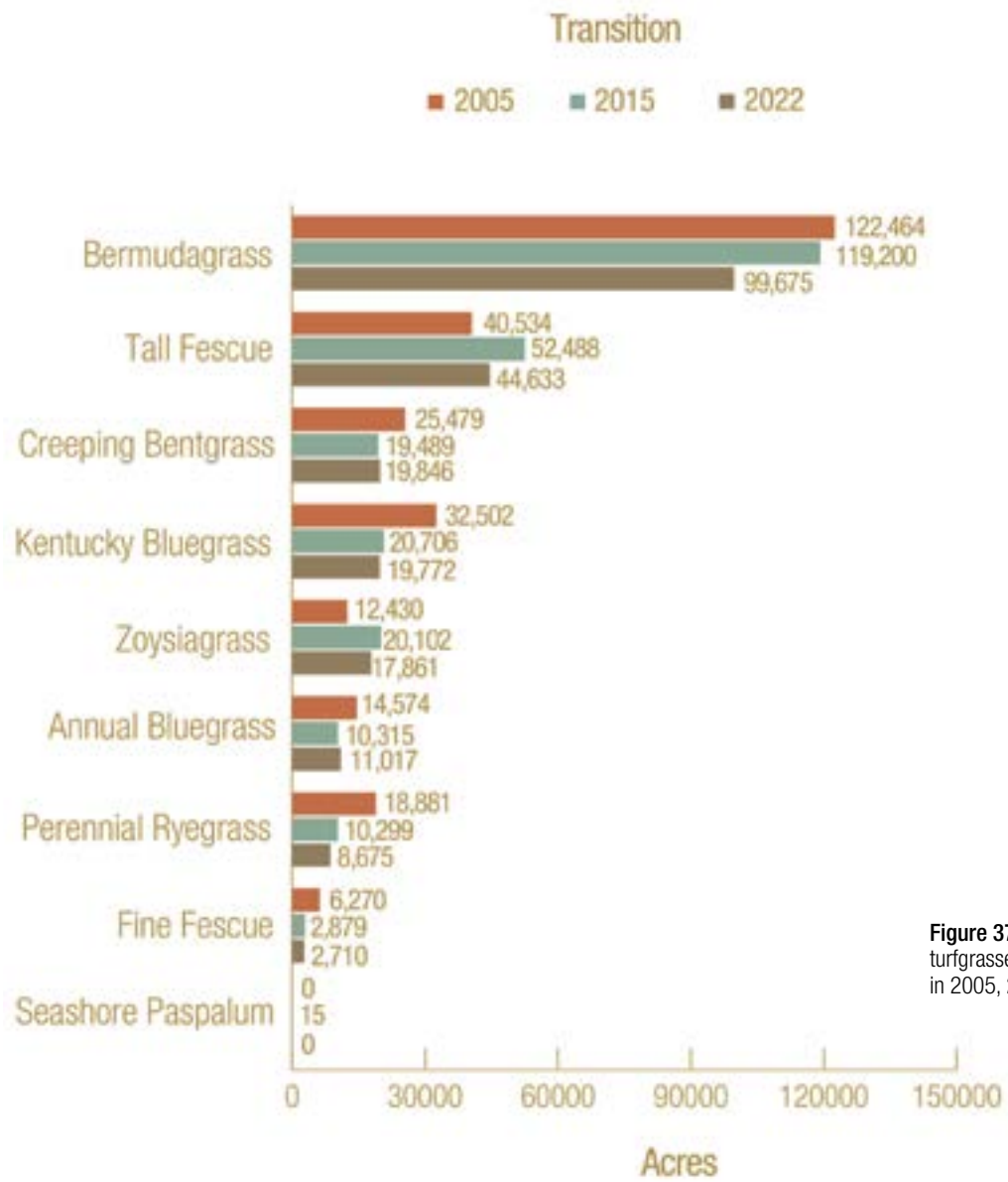


Figure 37. Projected acres of turfgrasses in the Transition region in 2005, 2015, and 2022.

Table 17. Frequency of golf facilities in the US Transition region (Fig. 1) that have the listed turfgrass species or cultivar on greens, fairways, tees, roughs, or practice areas in 2005, 2015, and 2021.

Year	Bentgrass	Kentucky Bluegrass	Annual Bluegrass	Perennial Rye	Tall Fescue	Fine Fescue	Bermuda	Zoysia	Seashore Paspalum	Buffalo
	Golf facilities (%)									
Greens										
2005	95 a ⁱ	1 a	45 a	0 ⁱⁱ	0	0	5 b	0	0	- ⁱⁱⁱ
2015	84 b	1 a	38 ab	0	0	0	15 a	1 a	0	-
2021	72 c	1 a	36 b	1	1	1	17 a	2 a	1	1
Fairways										
2005	16 a	16 a	27 a	21 a	5 a	1 a	61 a	16 b	0	-
2015	16 a	5 b	18 b	12 b	4 a	3 a	63 a	31 a	0	-
2021	20 a	12 ab	18 b	11 b	4 a	1 a	52 b	25 a	0	0
Tees										
2005	23 a	16 a	22 a	22 a	3 a	2 a	56 a	28 b	0	-
2015	27 a	6 b	19 a	15 b	1 a	1 b	56 a	36 a	0	-
2021	27 a	12 ab	18 a	15 b	4 a	3 a	52 a	35 a	1	0
Roughs										
2005	5 b	45 a	26 a	28 a	64 a	16 a	54 a	5 b	0	-
2015	3 b	34 b	25 a	24 ab	64 a	13 ab	57 a	5 b	1	-
2021	8 a	33 b	22 a	19 b	52 b	8 b	52 a	9 a	0	1
Practice areas										
2005	10 a	21 a	16 a	19 a	25 b	5 a	46 a	5 b	0	-
2015	9 a	15 a	17 a	16 ab	37 a	6 a	49 a	8 a	0	-
2021	10 a	16 a	12 a	11 b	26 b	2 a	45 a	8 a	0	2

ⁱ Within columns, values followed by a common letter are not significantly different according to the chi-square test at the 10% significance level.

ⁱⁱ Values without variability were not analyzed.

ⁱⁱⁱ Question not asked in that year.

Upper West/Mountain Facility size

- The median size of facilities in the Upper West/Mountain was 145.1 acres and did not change from 2005 to 2021 (Figure 38).
- The projected total acres of golf facilities in the Upper West/Mountain were 178,861, which was a 16.9% increase from 2005 to 2021 (Table 1). This increase was partially a result of an increase in golf facilities from 2005 to 2021 (Table 2).

Maintained turfgrass acreage

- The median acreage of maintained turfgrass on 18-hole golf facilities in the Upper West/Mountain was 93.3

acres and has not changed since 2005 (Figure 38).

- 18-hole facilities in the Upper West/Mountain region maintain turfgrass approximately equivalent to the national median (Figure 4).
- Total projected maintained turfgrass acreage of golf facilities in the Upper West/Mountain region increased to 96,329 or by 1.2% since 2005 (Table 3). This increase was likely a result of the increase in golf facilities.

Non-turf acreage

- The median acreage of natural areas in the Upper West/Mountain was 26.2 acres, which was equivalent to 2005 (Figure 38).

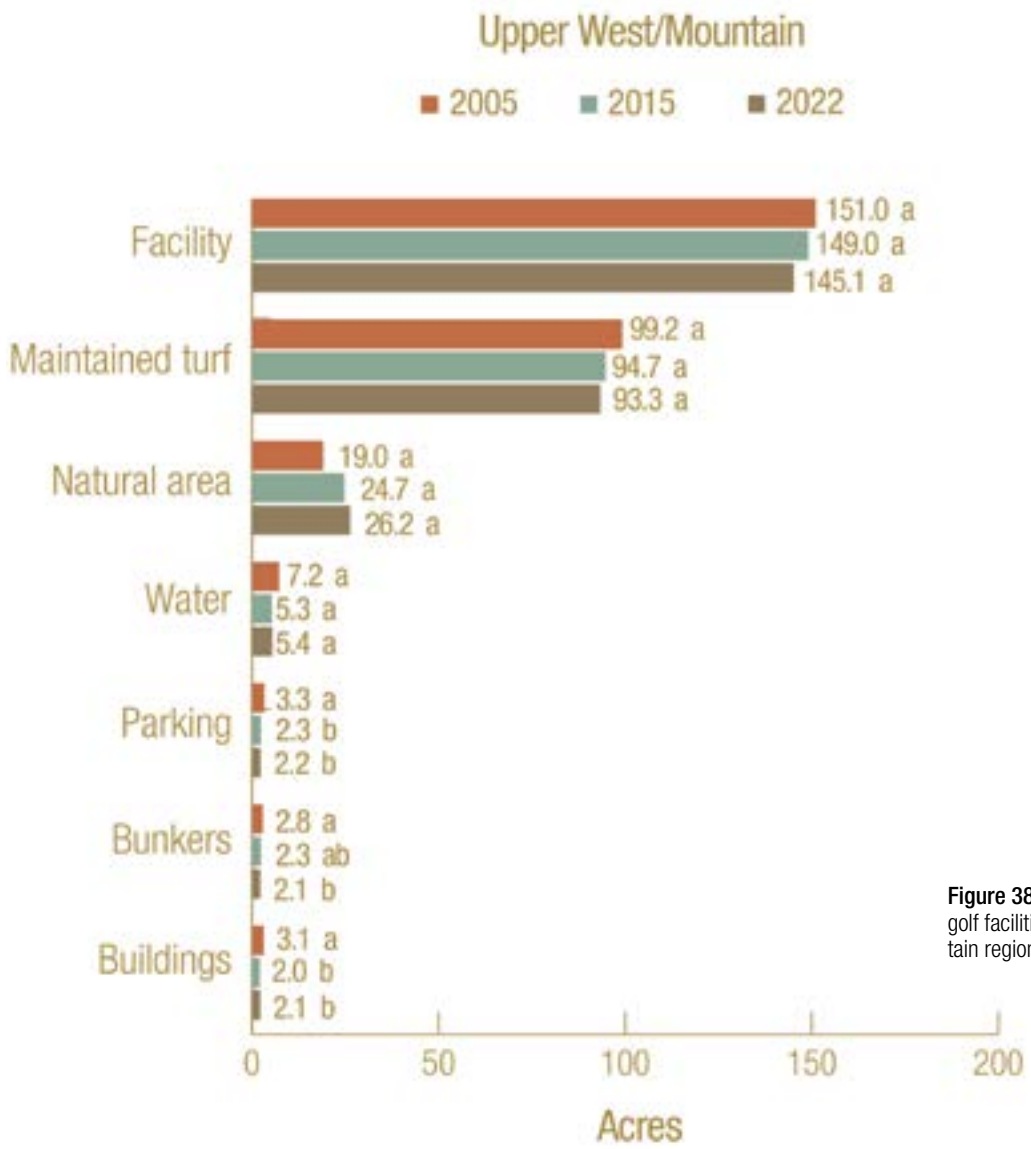


Figure 38. Median land use of 18-hole golf facilities in the Upper West/Mountain region in 2005, 2015, and 2022.

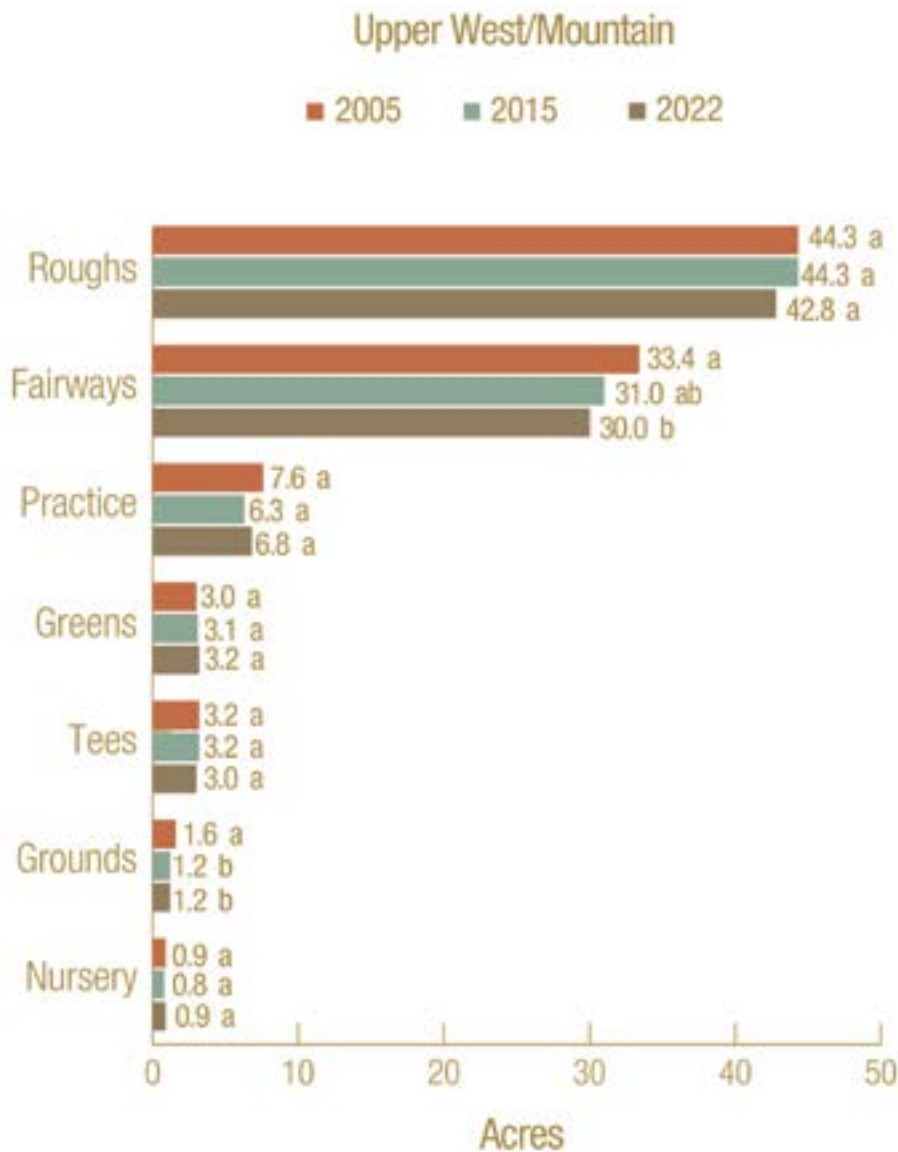


Figure 39. Median acres of turfgrass features on 18-hole golf facilities in the Upper West/Mountain region in 2005, 2015, and 2022.

- The median acreage of water features was 5.4 acres and did not change from 2005 to 2021 (Figure 38).
- The median acreage of parking lots, bunkers, and buildings decreased from 2005 to 2021 (Figure 38).
- The median length of cart paths on 18-hole facilities in the Upper West/Mountain increased to 13,814 ft., which was equivalent to 2005 (Table 9).
- The median of total impervious surfaces on 18-hole facilities in the Upper West/Mountain was 6.1 acres, which was a 28.2% reduction from 2005 to 2021 (Table 8).

Turf features

- The median acres of putting greens on 18-hole facilities in the Upper West/Mountain was 3.2 acres, which did not change from 2005 to 2021 (Figure 39).
- The median acres of fairways on 18-hole facilities in the Upper West/Mountain decreased by 10.2% from 2005 to 2021 to 30 acres (Figure 39).
- The median acres of practice areas, tees, grounds, and nurseries did not change from 2005 to 2021 (Figure 39).

Turf types

- The most common turfgrass was Kentucky bluegrass, which accounted for

47,199 acres or 49.0% of the total projected turfgrass acres (Figure 40).

- 78% and 63% of 18-hole golf facilities reported having bentgrass and annual bluegrass on putting greens, respectively (Table 18).
- Kentucky bluegrass, annual bluegrass, and perennial ryegrass were used somewhat uniformly across all remaining course features with approximately 50% of 18-hole facilities reporting their use on fairways, tees, roughs, and practice areas (Table 18).

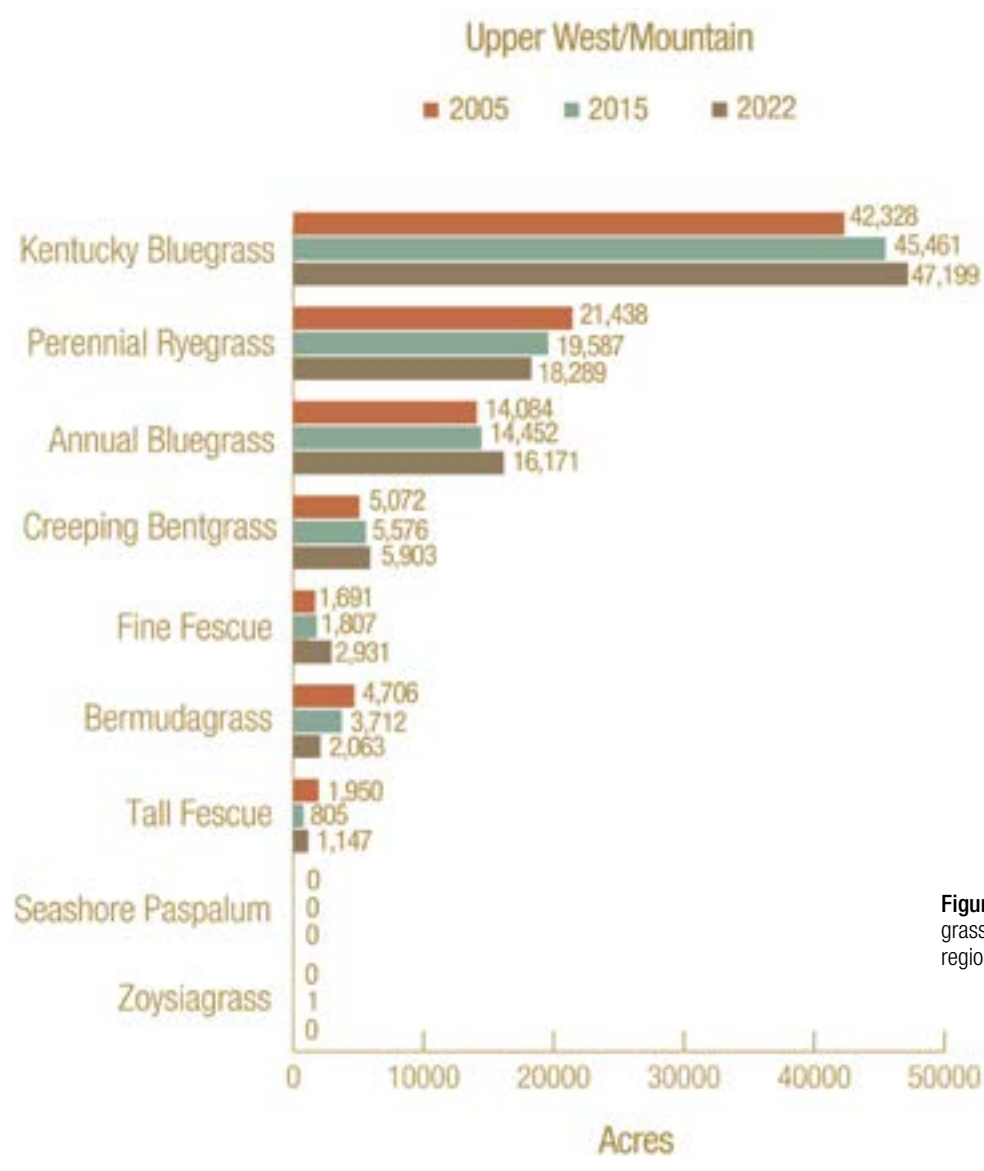


Figure 40. Projected acres of turf-grasses in the Upper West/Mountain region in 2005, 2015, and 2022.

Table 18. Frequency of golf facilities in the US Upper West/Mountain region (Fig. 10) that have the listed turfgrass species or cultivar on greens, fairways, tees, roughs, or practice areas in 2005, 2015, and 2021.

Year	Bentgrass	Kentucky Bluegrass	Annual Bluegrass	Perennial Rye	Tall Fescue	Fine Fescue	Bermuda	Zoysia	Seashore Paspalum	Buffalo
	Golf facilities (%)									
Greens										
2005	97 a ⁱ	1 b	74 a	0 ⁱⁱ	0	0	0	0	0	- ⁱⁱⁱ
2015	98 a	0	73 ab	0	0	1 a	0	0	0	-
2021	78 b	3 a	63 b	0	0	2 a	2	0	0	0
Fairways										
2005	20 a	87 a	56 a	66 a	1 a	4 ab	6 a	0	0	-
2015	22 a	78 b	57 a	53 b	3 a	2 b	6 a	0	0	-
2021	21 a	67 c	50 a	51 b	5 a	6 a	6 a	0	0	0
Tees										
2005	27 a	81 a	54 a	61 a	1 b	3 a	5 a	0	0	-
2015	30 a	74 a	54 a	59 ab	3 ab	2 a	6 a	2	0	-
2021	29 a	62 b	51 a	50 b	4 a	5 a	5 a	0	0	0
Roughs										
2005	9 a	85 a	45 a	58 a	13 a	11 ab	5 a	0	0	-
2015	9 a	79 a	43 a	53 ab	9 a	7 b	5 a	0	0	-
2021	8 a	69 b	42 a	45 b	9 a	14 a	6 a	0	0	1
Practice areas										
2005	12 a	69 a	37 a	51 a	4 a	4 b	4 a	0	0	-
2015	9 a	72 a	38 a	55 a	4 a	5 ab	4 a	0	0	-
2021	11 a	58 b	37 a	37 b	3 a	8 a	4 a	0	0	1

ⁱ Within columns, values followed by a common letter are not significantly different according to the chi-square test at the 10% significance level.

ⁱⁱ Values without variability were not analyzed.

ⁱⁱⁱ Question not asked in that year.



Conclusions

US golf facilities have made the following improvements to reduce their environmental impact:

- The projected acres of maintained turfgrass on US golf facilities declined by 14.2% since 2005 whereas the median acres of maintained turfgrass declined 3%. These results imply the source of the acreage reduction was primarily course closures between 2005 and 2021.
- US golf facilities reduced the use of overseed by 60% since 2005.
- In 2005, only 1 in 20 golf facilities reported that they participated in best management practices. In 2021, nearly 1/3 of US golf facilities now

participate in best management practices. This substantial increase may be a result of the establishment of a best management practice manual for each state, which was completed in 2020.

- With few exceptions, participation in programs associated with environmental stewardship declined between 2005 and 2021.
- The percentage of US golf facilities that use gasoline or diesel fuel remains high at 89%, but results indicate this percentage is declining. Concomitantly, the use of cleaner energy sources, such as natural gas and solar, have increased.

Appendix

Table 19. Projected acres of turfgrass types on US golf facilities by course feature in 2005, 2015, and 2021.

Year	Creeping bentgrass	Kentucky bluegrass	Annual bluegrass	Perennial ryegrass	Tall fescue	Fine fescue	Bermudagrass	Zoysiagrass	Seashore paspalum
Total									
2005	134,736	347,183	167,755	167,600	70,489	51,454	495,511	15,364	7,072
2015	127,608	310,122	146,839	138,781	85,510	38,634	460,984	25,637	10,832
2021	137,675	292,926	139,026	133,807	81,583	29,933	393,610	23,670	14,704
Greens									
2005	28,025	75	10,514	78	0	0	9,469	3	213
2015	25,327	35	10,877	66	0	0	10,055	180	731
2021	24,361	150	10,057	32	0	0	9,379	236	708
Fairways									
2005	71,674	62,830	68,017	48,097	924	3,226	182,805	11,043	2,750
2015	72,435	56,624	57,943	40,869	1,976	5,023	160,235	18,775	4,505
2021	74,916	48,133	50,639	36,411	1,555	4,011	133,503	15,926	5,535
Tees									
2005	10,416	5,776	6,507	5,374	0	0	20,592	1,603	476
2015	10,718	5,647	5,952	4,286	0	0	17,368	2,146	740
2021	11,397	4,867	5,514	4,568	0	0	15,648	2,378	717
Rough									
2005	9,244	250,605	71,150	99,636	64,991	44,846	240,219	1,910	2,905
2015	8,961	225,831	63,628	82,566	77,802	31,564	238,109	3,153	3,976
2021	13,114	220,076	64,738	82,016	75,667	24,156	204,460	3,899	6,722
Practice areas									
2005	7,278	26,774	10,029	14,057	4,446	3,323	39,119	469	627
2015	6,434	21,498	7,586	10,824	5,582	1,991	33,197	1,049	739
2021	7,635	19,109	6,789	10,488	4,245	1,694	28,366	897	817
Nursery									
2005	8,099	1,123	1,538	357	128	60	3,306	337	101
2015	3,732	486	852	171	149	57	2,020	334	141
2021	6,252	592	1,289	292	115	72	2,255	334	204

LAND USE

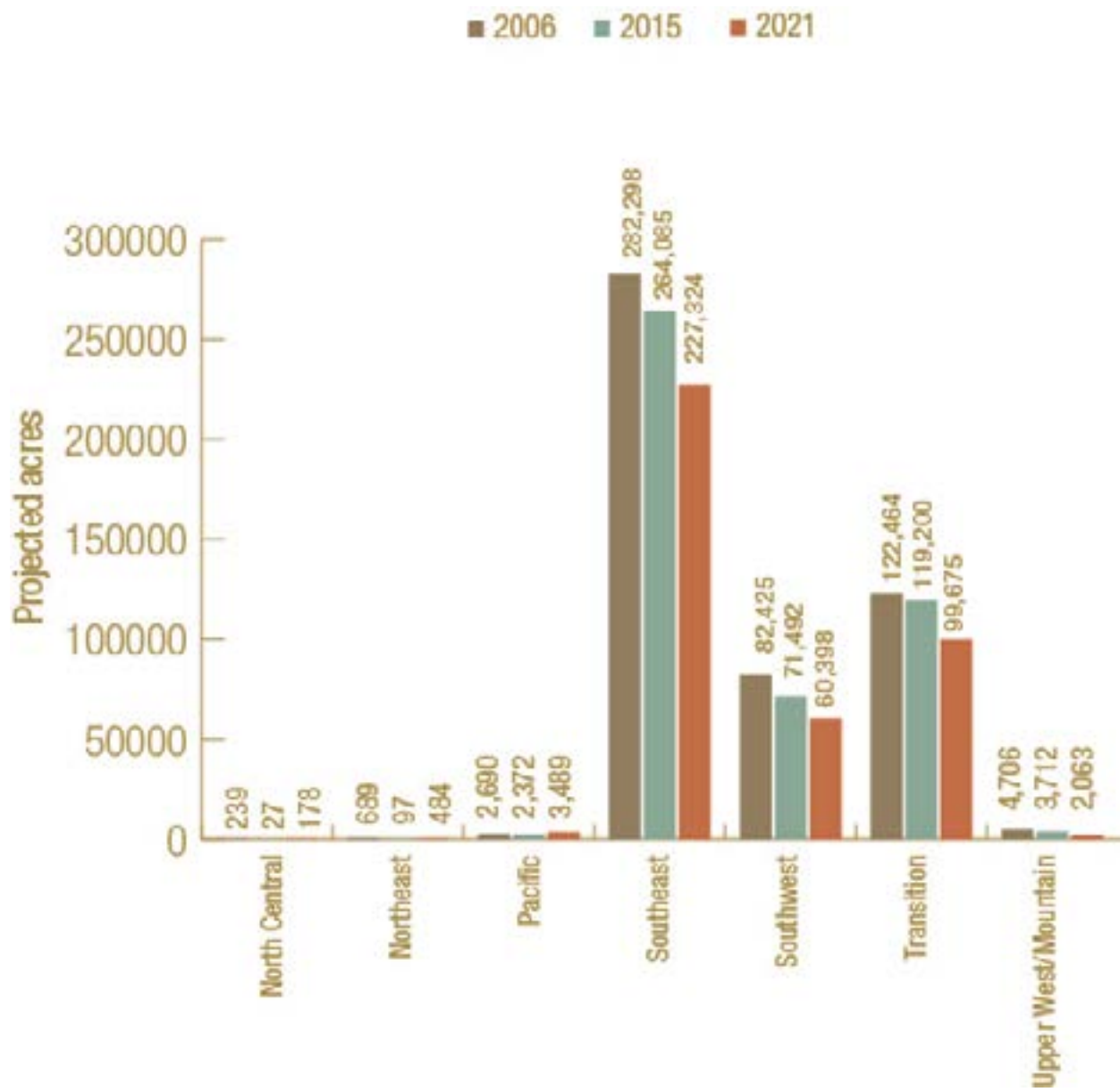


Figure 41. Projected acres of bermudagrass on US golf facilities in 2005, 2015, and 2021.

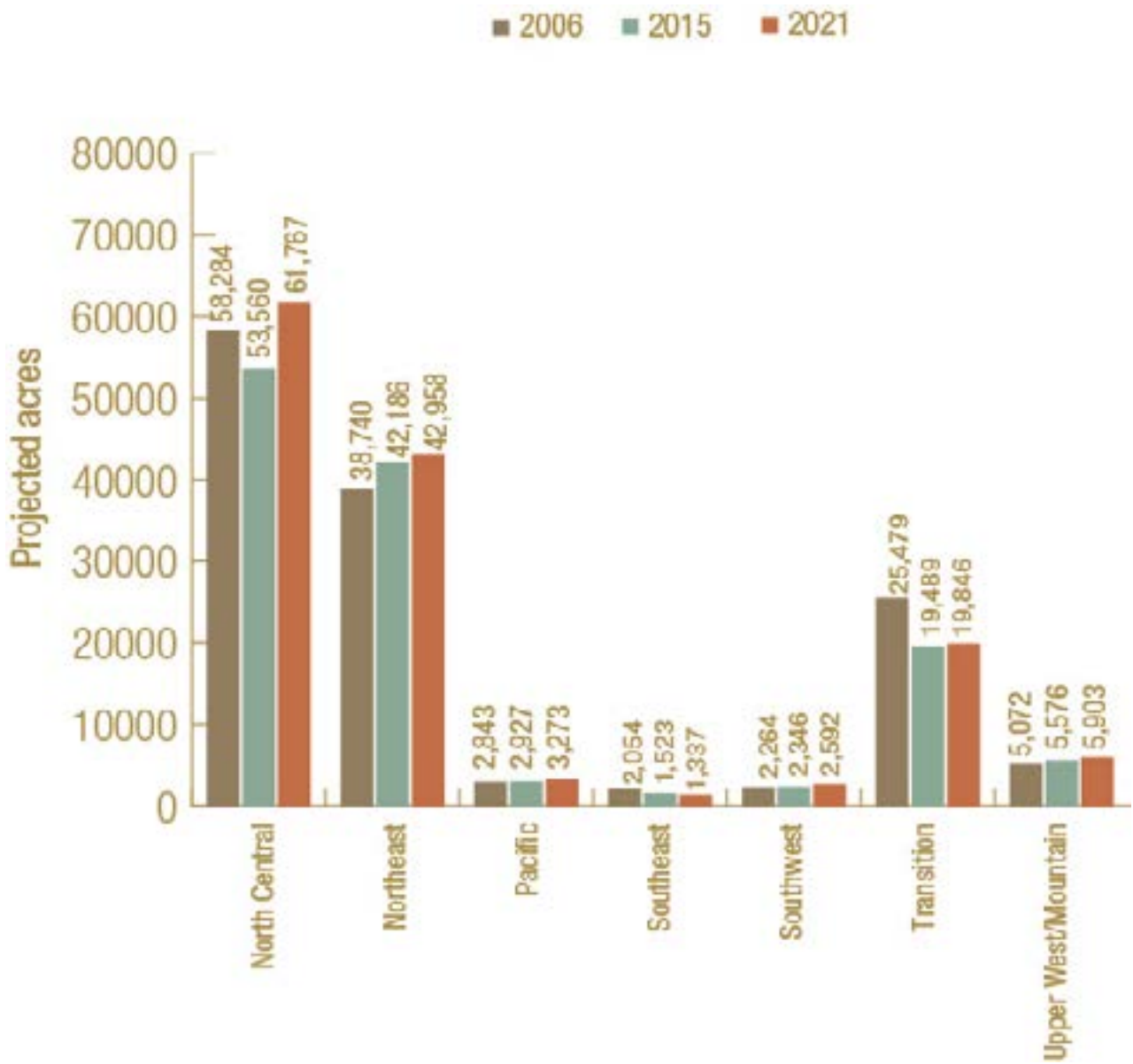


Figure 42. Projected acres of creeping bentgrass on US golf facilities in 2005, 2015, and 2021

LAND USE

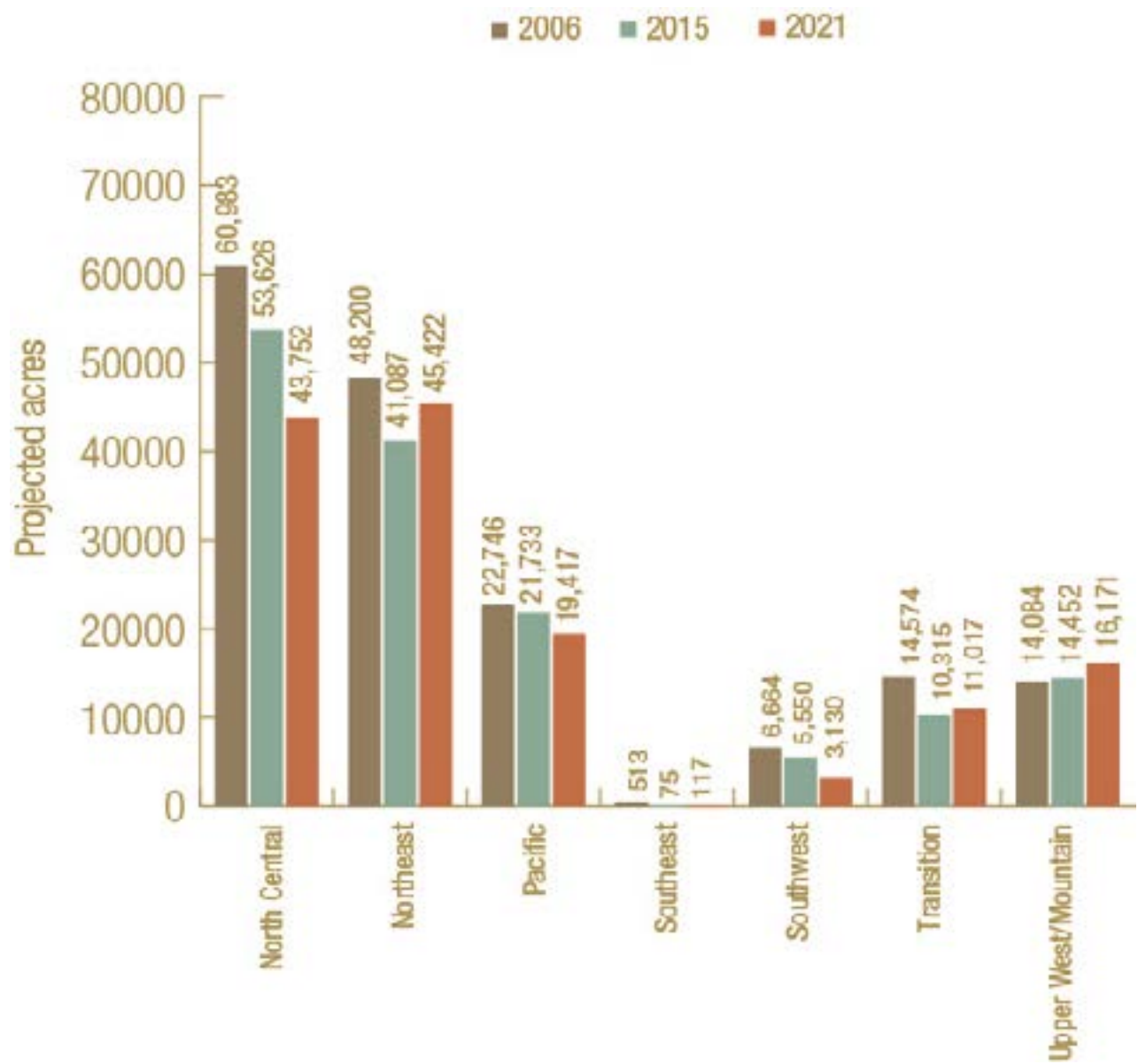


Figure 43. Projected acres of annual bluegrass on US golf facilities in 2005, 2015, and 2021.

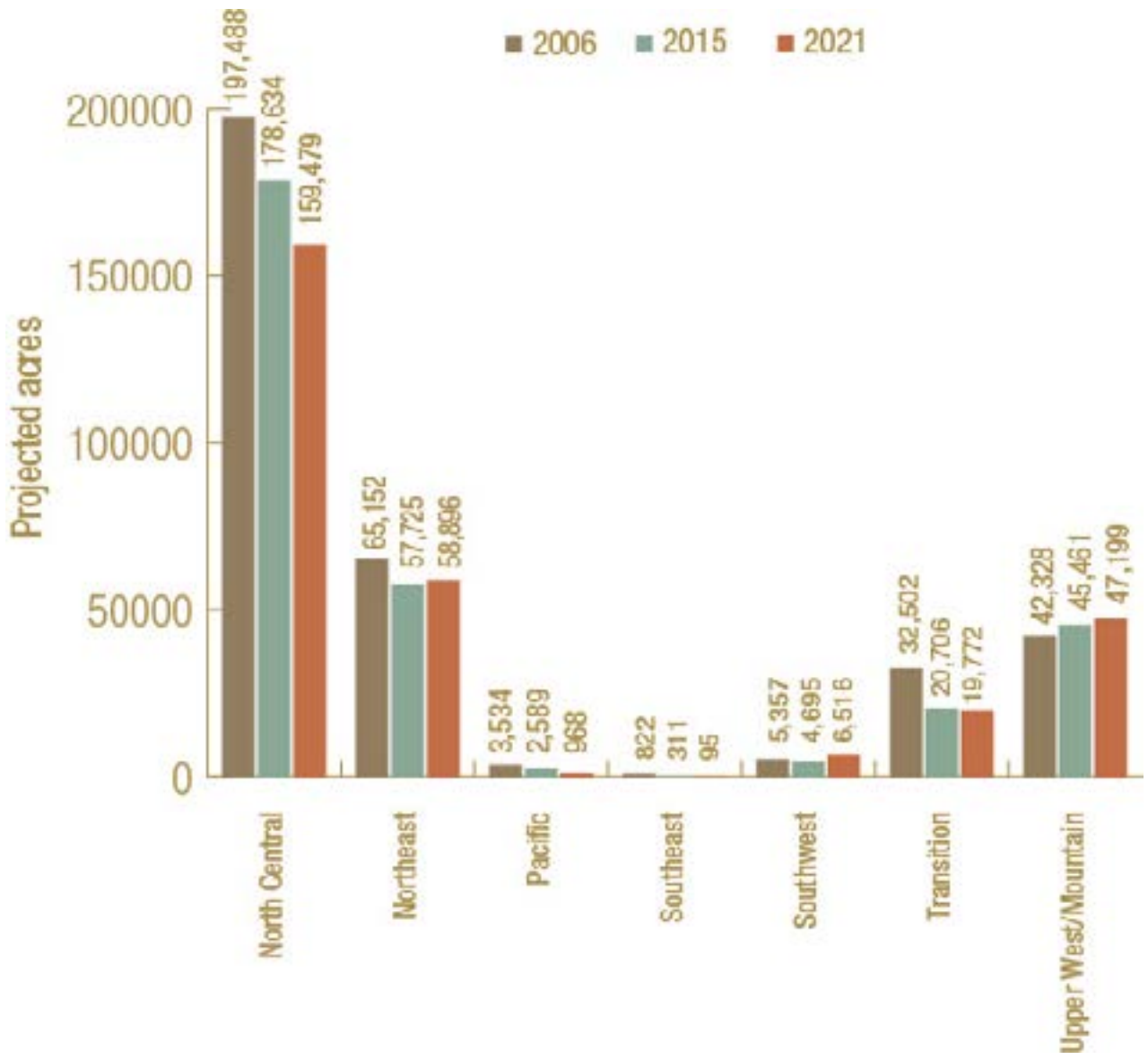


Figure 44. Projected acres of Kentucky bluegrass on US golf facilities in 2005, 2015, and 2021.

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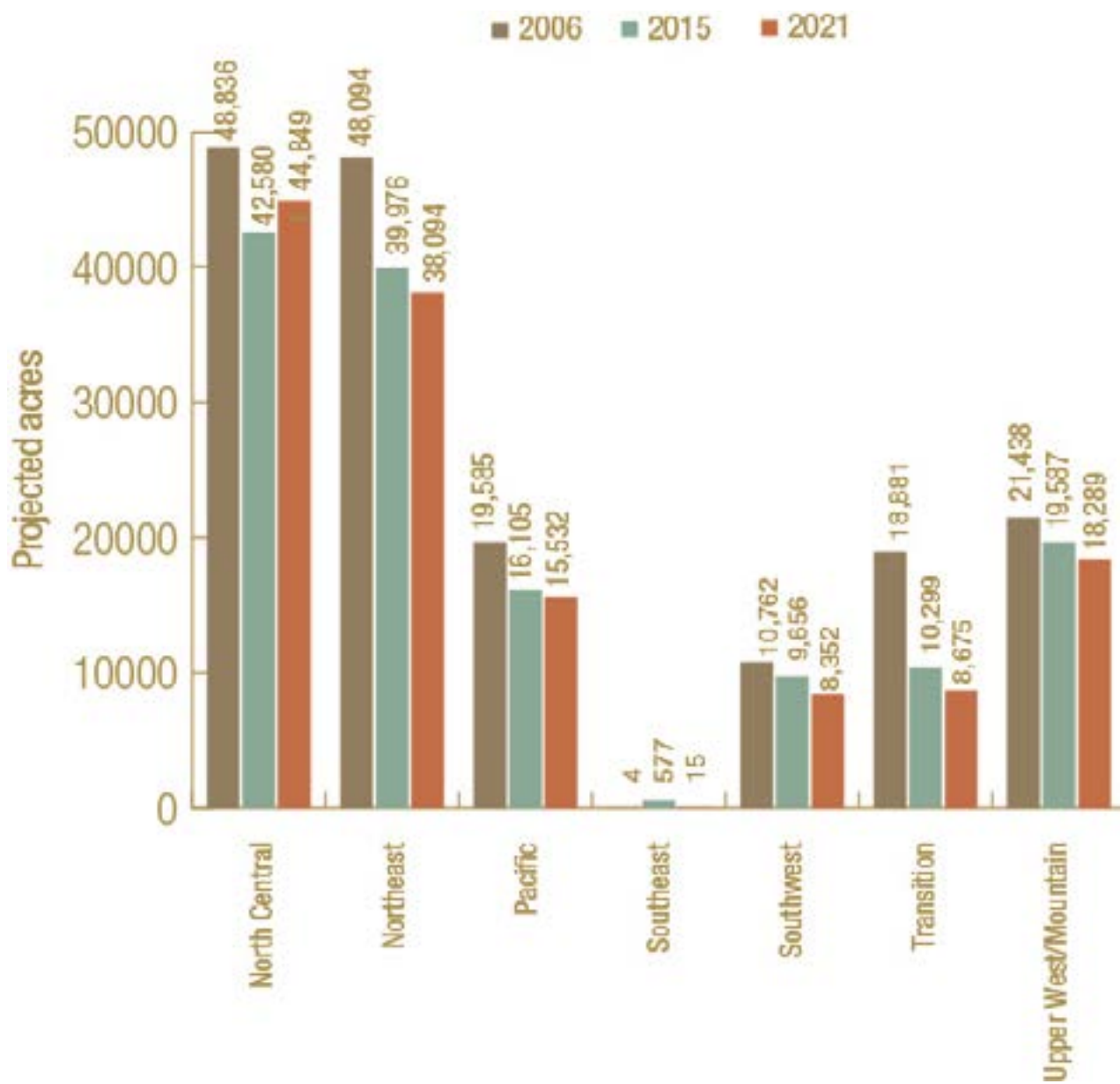


Figure 45. Projected acres of perennial ryegrass on US golf facilities in 2005, 2015, and 2021.

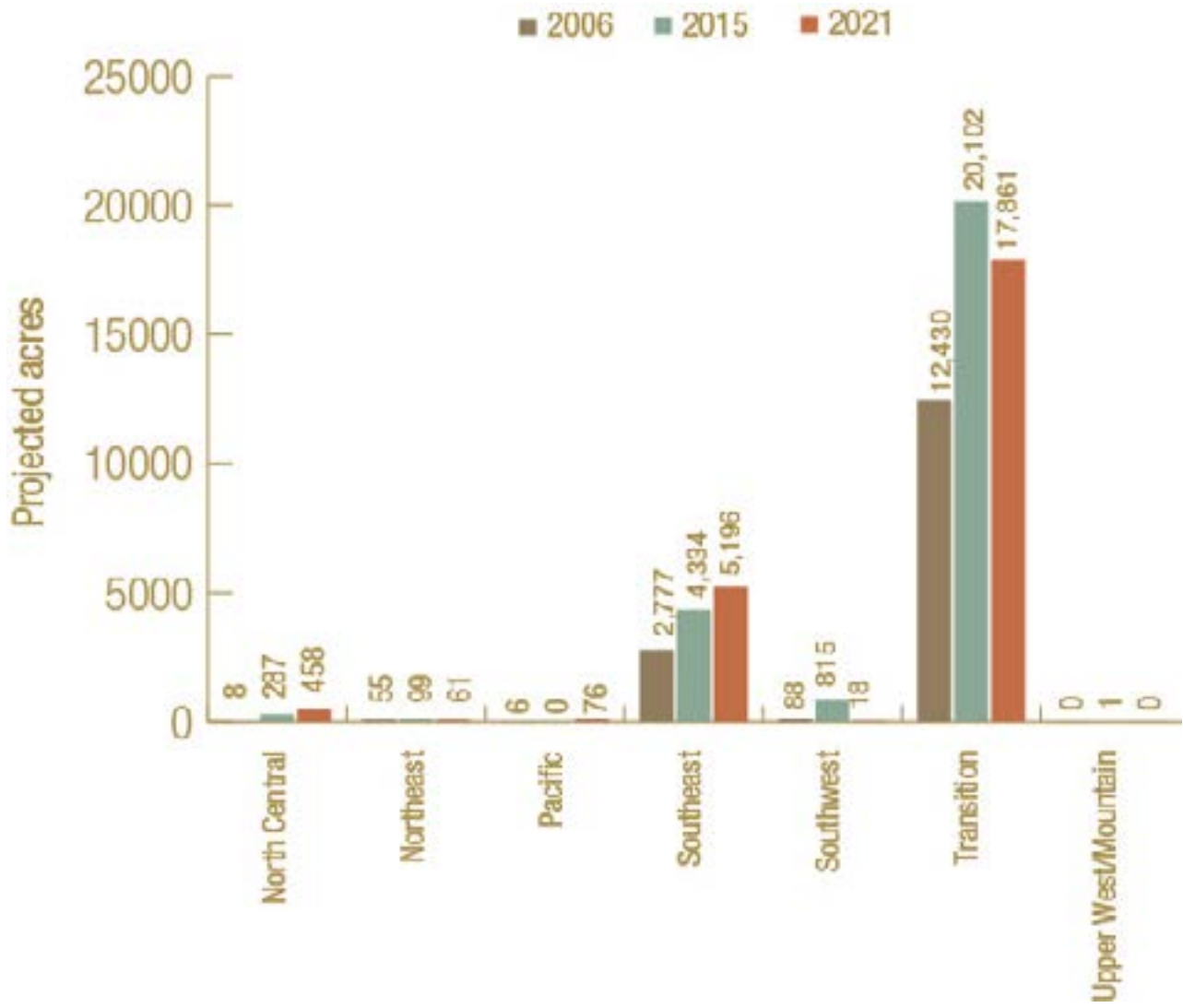


Figure 46. Projected acres of zoysiagrass on US golf facilities in 2005, 2015, and 2021

LAND USE

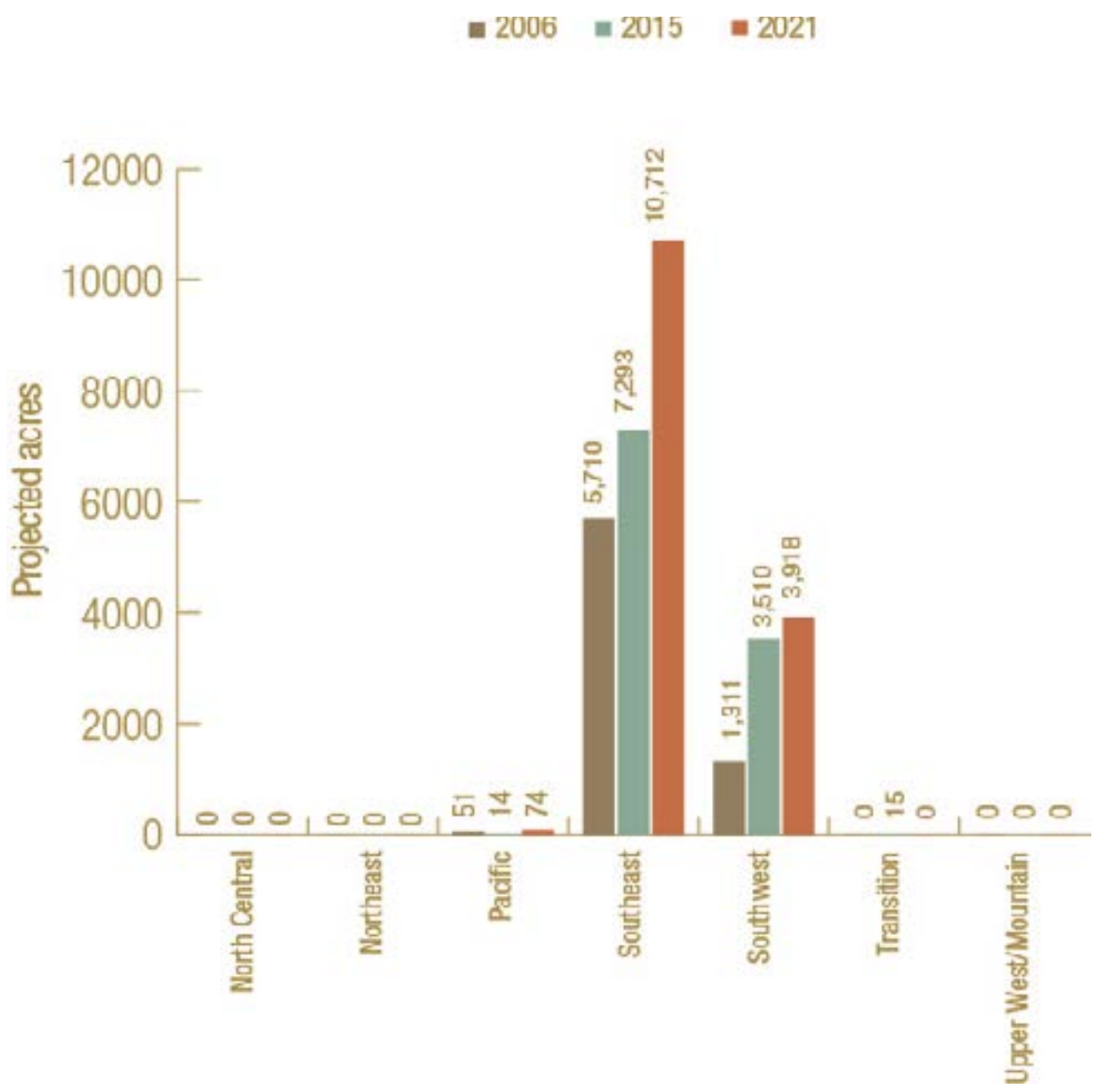


Figure 47. Projected acres of seashore paspalum on US golf facilities in 2005, 2015, and 2021.

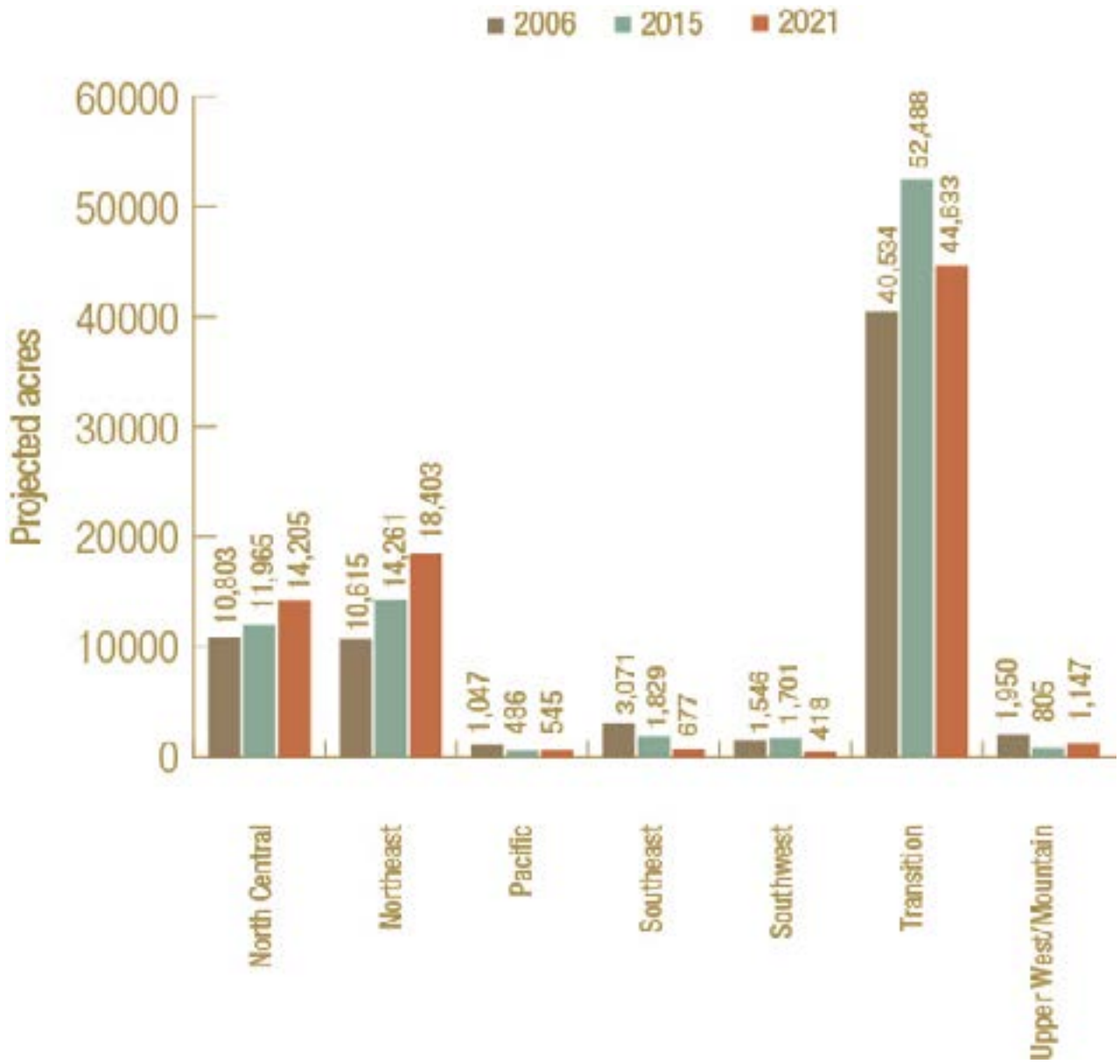


Figure 48. Projected acres of tall fescue on US golf facilities in 2005, 2015, and 2021.

LAND USE

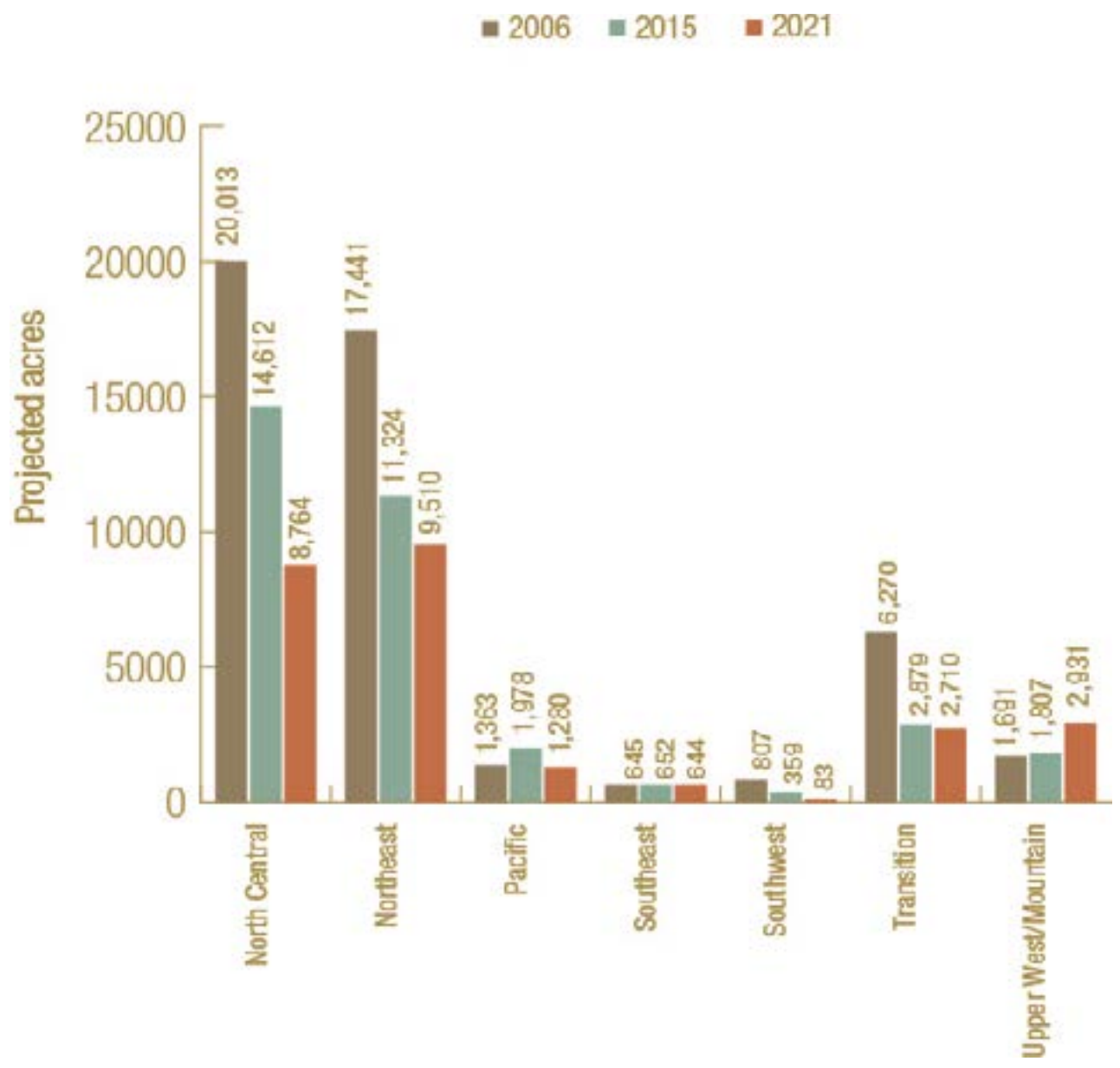


Figure 49. Projected acres of fine fescue on US golf facilities in 2005, 2015, and 2021.

Table 20. Projected acres of overseeded turfgrass by course feature for US golf facilities in 2005, 2015, and 2021.

Year	US	NC ⁱ	NE	Pac	SE	SW	Trans	UWM
	Area (acres)							
Total								
2005	147,681	310	1,830	2,505	67,529	54,095	19,353	2,060
2015	76,464	410	33	1,308	32,028	34,928	6,762	996
2021	58,884	1,211	1,631	3,698	21,587	26,104	4,357	296
Greens								
2005	6,216	16	107	36	4,433	1,371	233	20
2015	2,906	19	0	17	1,601	1,270	0	0
2021	1,944	39	30	79	708	981	108	0
Tees								
2005	14,721	44	104	165	8,065	3,420	2,692	232
2015	7,570	19	0	149	3,808	2,537	917	141
2021	6,849	107	77	724	3,040	2,210	624	67
Fairways								
2005	74,934	133	886	1,653	37,444	23,269	10,453	1,097
2015	37,868	99	0	864	17,780	14,747	3,784	593
2021	31,799	727	411	1,964	11,696	14,862	1,976	163
Roughs								
2005	39,463	117	725	492	11,616	21,874	4,127	510
2015	21,005	273	0	185	5,344	13,718	1,296	188
2021	12,768	339	953	680	3,483	6,648	616	49
Practice Areas								
2005	11,983	0	9	150	5,739	4,072	1,813	201
2015	6,955	0	33	90	3,430	2,564	764	74
2021	5,413	0	156	234	2,661	1,314	1,032	17
Nursery								
2005	364	0	0	8	232	89	35	0
2015	160	0	0	3	65	93	0	0
2021	111	0	5	17	0	89	0	0

ⁱ NC = North Central; NE = Northeast; Pac = Pacific; SE = Southeast; SW = Southwest; Trans = Transition; US = United States; UWM = Upper West/Mountain.

Table 21. Projected acres of overseeded turfgrass on US golf facilities in the Northeast in 2005, 2015, and 2021.

Year	Creeping bentgrass	Intermediate ryegrass	Perennial Ryegrass	Rough bluegrass	Other
	Overseeded area (acres)				
	Tees				
2005	6	12	63	11	11
2015	0	0	0	0	0
2021	49	0	29	0	0
	Greens				
2005	91	0	0	16	0
2015	0	0	0	0	0
2021	30	0	0	0	0
	Fairway				
2005	265	121	235	235	30
2015	0	0	0	0	0
2021	103	0	205	0	103
	Rough				
2005	239	0	243	243	0
2015	0	0	0	0	0
2021	457	0	286	0	219
	Driving Range				
2005	0	0	4	4	0
2015	0	0	33	0	0
2021	0	0	156	0	0
	Turf Nursery				
2005	0	0	0	0	0
2015	0	0	0	0	0
2021	5	0	0	0	0

Table 22. Projected acres of overseeded turfgrass on US golf facilities in the North Central in 2005, 2015, and 2021.

Year	Creeping bentgrass	Intermediate ryegrass	Perennial Ryegrass	Rough bluegrass	Other
	Overseeded area (acres)				
	Tees				
2005	22	0	0	22	0
2015	19	0	0	0	0
2021	35	0	0	71	0
	Greens				
2005	16	0	0	0	0
2015	19	0	0	0	0
2021	39	0	0	0	0
	Fairway				
2005	133	0	0	0	0
2015	99	0	0	0	0
2021	240	0	0	487	0
	Rough				
2005	0	0	0	117	0
2015	0	0	0	0	273
2021	0	0	0	339	0
	Driving Range				
2005	0	0	0	0	0
2015	0	0	0	0	0
2021	0	0	0	0	0
	Turf Nursery				
2005	0	0	0	0	0
2015	0	0	0	0	0
2021	0	0	0	0	0

Table 23. Projected acres of overseeded turfgrass on US golf facilities in the Transition in 2005, 2015, and 2021.

Year	Creeping bentgrass	Intermediate ryegrass	Perennial Ryegrass	Rough bluegrass	Other
	Overseeded area (acres)				
Tees					
2005	13	133	2,509	16	21
2015	0	37	880	0	0
2021	0	0	593	31	0
Greens					
2005	122	0	35	63	12
2015	0	0	0	0	0
2021	79	0	0	29	0
Fairway					
2005	0	465	9,616	60	313
2015	0	151	3,633	0	0
2021	0	119	1,640	217	0
Rough					
2005	763	0	2,321	116	928
2015	0	0	181	0	1,115
2021	0	0	86	277	253
Driving Range					
2005	14	74	1,688	9	28
2015	0	46	711	0	8
2021	0	31	1,001	0	0
Turf Nursery					
2005	19	0	14	3	0
2015	0	0	0	0	0
2021	0	0	0	0	0

Table 24. Projected acres of overseeded turfgrass on US golf facilities in the Southeast in 2005, 2015, and 2021.

Year	Creeping bentgrass	Intermediate ryegrass	Perennial Ryegrass	Rough bluegrass	Other
Tees					
2005	2	182	7,502	289	90
2015	0	38	3,694	38	38
2021	30	91	2,858	61	0
Greens					
2005	197	44	886	3,127	179
2015	0	0	80	1,521	0
2021	0	35	0	672	0
Fairway					
2005	0	779	36,493	0	172
2015	0	178	17,602	0	0
2021	0	234	10,526	936	0
Rough					
2005	0	1,005	10,123	0	489
2015	0	267	5,077	0	0
2021	0	0	3,169	313	0
Driving Range					
2005	0	90	5,401	120	129
2015	0	34	3,396	0	0
2021	0	106	2,448	80	0
Turf Nursery					
2005	9	0	114	99	10
2015	0	0	8	57	0
2021	0	0	0	0	0

Table 25. Projected acres of overseeded turfgrass on US golf facilities in the Southwest in 2005, 2015, and 2021.

Year	Creeping bentgrass	Intermediate ryegrass	Perennial Ryegrass	Rough bluegrass	Other
	Overseeded area (acres)				
	Tees				
2005	14	0	3,205	74	127
2015	0	51	2,435	51	0
2021	22	88	1,989	22	66
	Greens				
2005	214	0	498	597	63
2015	152	0	406	686	25
2021	59	29	167	706	20
	Fairway				
2005	151	0	22,748	0	370
2015	0	442	14,305	0	0
2021	297	594	13,376	149	446
	Rough				
2005	339	0	21,516	20	0
2015	0	412	13,306	0	0
2021	66	0	6,449	0	199
	Driving Range				
2005	0	0	3,914	24	133
2015	0	154	2,359	0	51
2021	0	0	1,274	26	13
	Turf Nursery				
2005	13	0	55	20	1
2015	0	0	78	15	0
2021	0	0	48	33	9

Table 26. Projected acres of overseeded turfgrass on US golf facilities in the Upper West/Mountain in 2005, 2015, and 2021.

Year	Creeping bentgrass	Intermediate ryegrass	Perennial Ryegrass	Rough bluegrass	Other
Tees					
2005	0	0	229	3	0
2015	0	0	128	0	13
2021	0	0	67	0	0
Greens					
2005	20	0	0	0	0
2015	0	0	0	0	0
2021	0	0	0	0	0
Fairway					
2005	0	0	1,079	18	0
2015	0	0	593	0	0
2021	0	0	163	0	0
Rough					
2005	0	0	422	88	0
2015	0	0	188	0	0
2021	0	0	49	0	0
Driving Range					
2005	0	0	197	3	1
2015	0	0	74	0	0
2021	0	0	17	0	0
Turf Nursery					
2005	0	0	0	0	0
2015	0	0	0	0	0
2021	0	0	0	0	0

Table 27. Projected acres of overseeded turfgrass on US golf facilities in the Upper West/Mountain in 2005, 2015, and 2021.

Year	Creeping bentgrass	Intermediate ryegrass	Perennial Ryegrass	Rough bluegrass	Other
	Overseeded area (acres)				
	Tees				
2005	0	0	161	3	2
2015	13	0	135	0	0
2021	145	51	528	0	0
	Greens				
2005	34	0	0	2	0
2015	17	0	0	0	0
2021	79	0	0	0	0
	Fairway				
2005	132	0	1,494	0	27
2015	0	0	864	0	0
2021	20	0	1,944	0	0
	Rough				
2005	31	0	461	0	0
2015	0	0	185	0	0
2021	61	0	619	0	0
	Driving Range				
2005	24	0	124	2	0
2015	0	0	90	0	0
2021	0	0	234	0	0
	Turf Nursery				
2005	7	0	0	1	0
2015	3	0	0	0	0
2021	17	0	0	0	0

Table 28. Projected acres of turfgrasses on US golf facilities in the North Central in 2005, 2015, and 2021.

Year	Annual Bluegrass	Bermudagrass	Creeping Bentgrass	Fine Fescue	Kentucky Bluegrass	Perennial Ryegrass	Seashore Paspalum	Tall Fescue	Zoysiagrass	Other
	Maintained turfgrass (acres)									
	Tees									
2005	2,672	0	5,136	0	2,725	1,037	0	0	0	112
2015	2,428	0	4,985	0	3,050	1,029	0	0	30	185
2021	1,794	0	5,533	0	2,237	900	0	0	47	142
	Greens									
2005	3,440	0	9,242	0	28	68	0	0	0	0
2015	3,316	0	8,643	0	34	0	0	0	0	70
2021	2,748	0	8,806	0	88	28	0	0	0	0
	Fairways									
2005	28,039	0	33,162	1,065	33,172	9,914	0	213	0	671
2015	23,853	0	31,929	1,188	31,167	9,907	0	69	178	693
2021	17,740	0	34,663	1,096	23,700	8,555	0	331	334	83
	Roughs									
2005	22,517	234	2,973	18,444	145,374	33,190	0	10,041	0	1,241
2015	20,821	0	3,040	13,902	131,070	28,265	0	11,071	21	1,489
2021	18,591	110	4,106	8,274	122,676	31,556	0	13,485	37	658
	Driving Range									
2005	3,763	3	4,133	1,542	15,501	4,490	0	724	0	145
2015	2,963	27	3,549	703	12,953	3,333	0	874	50	385
2021	2,262	67	4,308	440	10,311	3,638	0	663	14	101
	Nursery									
2005	552	2	3,639	27	688	137	0	37	8	20
2015	245	0	1,414	8	360	46	0	20	8	29
2021	617	0	4,350	50	466	172	0	57	26	42

Table 29. Projected acres of turfgrasses on US golf facilities in the Northeast in 2005, 2015, and 2021.

Year	Annual Bluegrass	Bermudagrass	Creeping Bentgrass	Fine Fescue	Kentucky Bluegrass	Perennial Ryegrass	Seashore Paspalum	Tall Fescue	Zoysiagrass	Other
	Maintained turfgrass (acres)									
Tees										
2005	1,685	19	2,814	0	952	1,328	0	0	0	148
2015	1,550	0	3,265	0	931	1,054	0	0	0	95
2021	1,341	0	3,332	0	662	1,108	0	0	0	121
Greens										
2005	2,886	20	5,650	0	9	3	0	0	0	114
2015	3,195	0	5,384	0	0	39	0	0	0	0
2021	2,996	0	5,250	0	59	4	0	0	0	2
Fairways										
2005	18,212	197	24,004	1,249	8,199	12,531	0	276	0	1,072
2015	14,318	0	27,362	1,256	7,356	10,699	0	185	0	382
2021	15,412	11	25,988	953	4,936	9,574	0	285	0	393
Roughs										
2005	22,347	375	2,800	16,385	51,111	30,171	0	9,847	54	871
2015	19,950	71	3,584	10,456	45,847	25,042	0	13,435	59	237
2021	23,799	271	5,739	8,864	50,207	24,764	0	17,784	49	1,960
Driving Range										
2005	2,684	77	1,875	1,040	4,761	4,020	0	737	0	188
2015	1,885	26	1,895	854	3,550	3,105	0	821	39	137
2021	1,717	202	2,105	636	3,013	2,637	0	610	12	131
Nursery										
2005	387	0	1,597	16	120	40	0	31	1	41
2015	189	0	697	13	42	39	0	5	0	0
2021	156	0	544	10	19	6	0	8	0	0

Table 30. Projected acres of turfgrasses on US golf facilities in the Pacific in 2005, 2015, and 2021.

Year	Annual Bluegrass	Bermudagrass	Creeping Bentgrass	Fine Fescue	Kentucky Bluegrass	Perennial Ryegrass	Seashore Paspalum	Tall Fescue	Zoysiagrass	Other
	Maintained turfgrass (acres)									
Tees										
2005	857	122	173	0	77	895	0	0	0	61
2015	864	76	175	0	89	532	0	0	0	107
2021	1,339	217	311	0	53	1,049	0	0	0	188
Greens										
2005	1,165	0	625	0	10	6	0	0	0	24
2015	1,161	3	608	0	1	27	0	0	0	42
2021	1,441	0	711	0	0	0	0	0	0	0
Fairways										
2005	8,534	1,202	1,145	325	1,101	7,094	8	71	0	829
2015	8,669	1,029	1,433	1,035	1,035	5,696	14	83	0	798
2021	6,767	1,616	1,247	612	221	5,170	33	119	15	722
Roughs										
2005	10,514	1,130	629	1,289	2,131	10,138	43	973	0	1,611
2015	9,497	1,015	549	1,826	1,289	8,759	0	454	0	265
2021	8,582	1,192	793	1,200	675	7,906	41	499	61	907
Driving Range										
2005	1,403	234	85	67	212	1,352	0	68	6	235
2015	1,401	249	55	138	170	1,064	0	29	0	103
2021	1,022	459	75	80	18	1,361	0	46	0	119
Nursery										
2005	274	2	187	6	2	100	0	6	0	14
2015	141	0	108	14	5	27	0	3	0	0
2021	266	5	136	0	1	46	0	0	0	0

Table 31. Projected acres of turfgrasses on US golf facilities in the Southeast in 2005, 2015, and 2021.

Year	Annual Bluegrass	Bermudagrass	Creeping Bentgrass	Fine Fescue	Kentucky Bluegrass	Perennial Ryegrass	Seashore Paspalum	Tall Fescue	Zoysiagrass	Other
	Maintained turfgrass (acres)									
Tees										
2005	19	11,661	11	0	14	1	375	0	320	20
2015	3	9,948	67	0	0	42	546	0	259	94
2021	0	9,045	41	0	0	0	523	0	523	85
Greens										
2005	39	7,621	1,644	0	0	0	165	0	2	336
2015	47	7,930	982	0	0	0	564	0	90	93
2021	2	6,875	832	0	0	0	500	0	189	78
Fairways										
2005	171	103,085	86	0	86	0	1,988	32	1,251	192
2015	10	91,571	341	341	0	127	2,931	0	1,802	253
2021	0	76,010	335	335	0	0	3,868	0	1,925	510
Roughs										
2005	253	135,850	0	626	656	0	2,609	2,967	1,103	4,994
2015	15	135,095	0	575	272	393	2,661	1,769	1,951	8,498
2021	114	118,205	0	564	55	0	4,947	677	2,198	6,671
Driving Range										
2005	28	21,911	14	19	67	2	487	104	77	499
2015	0	18,219	47	78	39	16	497	60	181	278
2021	0	15,626	40	80	40	15	671	0	247	860
Nursery										
2005	4	2,170	300	0	0	0	85	0	25	31
2015	0	1,321	87	0	0	0	93	0	52	12
2021	1	1,562	88	0	0	0	204	0	114	19

Table 32. Projected acres of turfgrasses on US golf facilities in the Southwest in 2005, 2015, and 2021.

Year	Annual Bluegrass	Bermudagrass	Creeping Bentgrass	Fine Fescue	Kentucky Bluegrass	Perennial Ryegrass	Seashore Paspalum	Tall Fescue	Zoysiagrass	Other
	Maintained turfgrass (acres)									
Tees										
2005	183	3,455	32	0	249	410	101	0	5	244
2015	164	2,756	123	0	140	381	195	0	33	219
2021	133	2,522	140	0	170	406	194	0	1	250
Greens										
2005	927	1,428	1,423	0	12	1	48	0	1	100
2015	1,144	1,224	1,273	0	0	0	167	0	32	50
2021	930	1,122	1,246	0	0	0	208	0	0	0
Fairways										
2005	1,999	31,155	114	381	2,016	2,757	754	267	9	4,379
2015	1,301	25,805	441	0	1,560	2,446	1,560	761	460	3,713
2021	1,129	22,983	760	0	2,018	2,944	1,635	209	11	4,305
Roughs										
2005	3,171	39,786	340	705	2,707	6,706	253	1,428	74	6,638
2015	2,471	36,166	140	359	2,600	6,097	1,300	1,507	196	5,200
2021	717	29,605	176	83	3,851	4,455	1,734	377	7	6,527
Driving Range										
2005	278	6,299	63	100	363	884	139	113	0	1,118
2015	283	5,310	77	0	388	721	242	193	71	737
2021	117	3,915	6	0	477	522	146	41	0	754
Nursery										
2005	96	301	292	2	10	3	16	5	0	14
2015	186	231	292	0	8	12	47	0	22	53
2021	104	252	265	0	0	26	0	0	0	23

Table 33. Projected acres of turfgrasses on US golf facilities in the Transition in 2005, 2015, and 2021.

Year	Annual Bluegrass	Bermudagrass	Creeping Bentgrass	Fine Fescue	Kentucky Bluegrass	Perennial Ryegrass	Seashore Paspalum	Tall Fescue	Zoysiagrass	Other
	Maintained turfgrass (acres)									
Tees										
2005	612	5,169	1,874	0	519	808	0	0	1,278	12
2015	411	4,458	1,711	0	193	481	0	0	1,823	94
2021	302	3,789	1,533	0	410	330	0	0	1,807	88
Greens										
2005	1,170	400	7,345	0	6	0	0	0	0	0
2015	967	899	6,462	0	0	0	0	0	57	0
2021	815	1,356	5,386	0	0	0	0	0	47	34
Fairways										
2005	5,121	45,321	11,732	8	4,388	6,819	0	42	9,784	50
2015	3,263	40,271	8,849	515	1,431	4,125	0	825	16,335	106
2021	2,855	31,946	9,634	8	2,499	2,986	0	460	13,641	386
Roughs										
2005	6,773	60,567	2,021	5,883	25,449	9,790	0	37,894	679	1,795
2015	5,306	64,020	897	2,837	18,136	4,879	15	48,838	926	1,132
2021	6,572	54,284	1,890	2,522	15,759	4,679	0	41,836	1,546	1,406
Driving Range										
2005	791	10,182	967	380	2,010	1,446	0	2,593	386	168
2015	325	9,093	645	29	939	806	0	3,528	708	172
2021	450	7,868	801	186	1,084	677	0	2,746	624	146
Nursery										
2005	106	824	1,539	6	130	17	0	47	303	0
2015	45	460	926	13	8	8	0	122	252	0
2021	22	431	601	1	21	3	0	51	195	2

Table 34. Projected acres of turfgrasses on US golf facilities in the Upper West/Mountain in 2005, 2015, and 2021.

Year	Annual Bluegrass	Bermudagrass	Creeping Bentgrass	Fine Fescue	Kentucky Bluegrass	Perennial Ryegrass	Seashore Paspalum	Tall Fescue	Zoysiagrass	Other
	Maintained turfgrass (acres)									
Tees										
2005	480	165	376	0	1,240	894	0	0	0	22
2015	531	130	392	0	1,245	769	0	0	1	95
2021	605	75	507	0	1,336	775	0	0	0	108
Greens										
2005	886	0	2,097	0	10	0	0	0	0	1
2015	1,047	0	1,976	0	0	0	0	0	0	43
2021	1,125	26	2,129	0	3	0	0	0	0	25
Fairways										
2005	5,941	1,845	1,431	197	13,868	8,980	0	23	0	23
2015	6,530	1,559	2,080	689	14,075	7,868	0	53	0	105
2021	6,736	937	2,289	1,007	14,759	7,183	0	151	0	0
Roughs										
2005	5,575	2,278	481	1,514	23,177	9,641	0	1,842	0	413
2015	5,568	1,742	751	1,610	26,617	9,131	0	728	0	803
2021	6,362	793	410	2,648	26,852	8,656	0	1,008	0	227
Driving Range										
2005	1,083	413	143	174	3,860	1,862	0	106	0	72
2015	730	273	168	188	3,459	1,781	0	77	0	30
2021	1,221	227	300	271	4,166	1,638	0	139	0	32
Nursery										
2005	119	6	545	2	172	61	0	2	0	0
2015	46	8	209	9	64	38	0	0	0	10
2021	122	4	268	11	84	38	0	0	0	10

Table 35. Projected acres of US golf facility subfeatures in 2005, 2015, and 2021.

Year	US	NC ⁱ	NE	Pac	SE	SW	Trans	UWM
	Area (acres)							
Total								
2005	2,421,605	629,957	394,247	90,282	508,134	198,205	447,796	152,985
2015	2,301,808	585,532	368,877	83,144	501,079	184,562	425,963	152,650
2021	2,141,210	545,500	365,571	72,091	423,604	186,819	369,235	178,390
Maintained Turf								
2005	1,535,767	411,804	241,376	58,509	315,767	128,173	284,941	95,197
2015	1,408,412	368,977	216,187	51,826	298,702	113,168	264,887	94,664
2021	1,307,071	343,567	223,463	48,328	263,225	99,082	232,605	96,801
Native								
2005	458,589	112,730	84,218	19,240	82,509	41,023	83,169	35,701
2015	589,778	143,802	107,238	21,660	111,067	54,110	109,914	41,986
2021	545,303	132,033	93,584	17,201	82,477	64,217	92,992	62,800
Water								
2005	184,773	46,236	25,717	4,740	55,821	9,530	33,311	9,419
2015	159,072	38,514	21,589	3,874	52,964	7,266	27,697	7,168
2021	141,746	34,279	19,688	2,951	45,642	8,064	19,920	11,202
Bunkers								
2005	80,261	18,967	15,164	2,239	19,323	5,871	14,778	3,920
2015	46,136	12,027	7,702	1,974	10,740	3,754	7,129	2,809
2021	44,631	9,884	9,528	1,759	9,363	4,197	6,668	3,231
Buildings								
2005	87,690	21,587	14,337	2,721	19,719	7,614	17,499	4,214
2015	52,632	10,393	7,995	1,714	17,726	3,235	8,694	2,875
2021	46,682	10,216	8,240	1,316	10,776	6,270	6,669	3,195
Parking Lots								
2005	74,525	18,635	13,435	2,833	14,996	5,995	14,097	4,535
2015	45,779	11,818	8,166	2,096	9,879	3,030	7,642	3,147
2021	42,189	9,701	8,470	1,607	8,067	4,582	6,563	3,199

ⁱ NC = North Central; NE = Northeast; Pac = Pacific; SE = Southeast; SW = Southwest; Trans = Transition; US = United States; UWM = Upper West/Mountain.

Table 36. Projected acres of water features on US golf facilities in 2005, 2015, and 2021.

Year	US	NC ⁱ	NE	Pac	SE	SW	Trans	UWM
	Area (acres)							
Total								
2005	184,773	46,236	25,717	4,740	55,821	9,530	33,311	9,419
2015	159,072	38,514	21,589	3,874	52,964	7,266	27,697	7,168
2021	141,746	34,279	19,688	2,951	45,642	8,064	19,920	11,202
Open								
2005	114,316	26,814	13,016	2,729	37,374	7,393	21,041	5,949
2015	105,595	21,681	10,748	2,338	40,196	5,638	20,463	4,531
2021	97,620	21,209	9,641	1,491	36,286	6,577	14,580	7,837
Wetlands								
2005	42,238	13,153	8,467	866	11,441	463	6,466	1,381
2015	32,003	11,009	6,406	599	7,961	262	4,235	1,531
2021	26,859	8,231	6,994	779	5,865	724	2,379	1,888
Streams/Rivers								
2005	16,301	4,457	2,758	647	2,989	396	3,763	1,292
2015	11,814	3,905	2,558	727	1,682	80	2,260	602
2021	10,387	3,606	1,671	271	1,586	253	2,043	956
Drainage waterways								
2005	8,950	1,631	1,234	438	2,442	1,040	1,643	522
2015	6,564	1,481	1,009	189	1,682	1,241	642	319
2021	5,234	1,044	1,284	91	1,195	441	816	363
Irrigation canals								
2005	2,967	181	242	60	1,575	237	398	274
2015	3,095	438	868	20	1,442	46	95	186
2021	1,645	189	98	319	709	69	102	158

ⁱ NC = North Central; NE = Northeast; Pac = Pacific; SE = Southeast; SW = Southwest; Trans = Transition; US = United States; UWM = Upper West/Mountain.www

Table 37. Projected acres of natural/native/unmowed areas on US golf facilities in 2005, 2015, and 2021.

Year	US	NC ⁱ	NE	Pac	SE	SW	Trans	UWM
	Area (acres)							
Native								
2005	458,589	112,730	84,218	19,240	82,509	41,023	83,169	35,701
2015	589,778	143,802	107,238	21,660	111,067	54,110	109,914	41,986
2021	549,518	135,579	94,841	17,038	82,479	63,742	94,606	61,233
Forest/woodland								
2005	199,734	50,041	50,641	5,531	39,553	2,076	44,266	7,627
2015	259,643	56,615	64,557	8,265	62,081	4,510	54,201	9,415
2021	224,896	51,337	51,549	6,045	44,106	10,869	44,084	16,905
Native/undisturbed grassland								
2005	76,653	18,401	8,946	5,863	11,466	7,710	12,060	12,206
2015	122,567	36,141	11,888	5,444	13,952	12,119	26,574	16,448
2021	147,402	36,676	18,003	3,092	16,181	18,887	27,253	27,311
Mixed/improved grassland								
2005	52,571	17,516	7,392	2,326	7,402	2,681	9,637	5,617
2015	79,881	28,394	12,375	2,774	9,913	2,728	15,519	8,178
2021	68,895	20,873	12,635	2,649	9,045	4,196	11,778	7,720
Shrublands								
2005	25,376	4,167	3,984	760	6,972	4,621	3,403	1,468
2015	21,294	2,490	3,143	1,066	5,722	3,517	2,976	2,382
2021	16,790	3,357	2,351	605	2,065	4,798	2,235	1,379
Desert								
2005	18,584	74	251	47	297	14,877	0	3,038
2015	26,406	35	0	52	275	24,608	77	1,358
2021	27,730	469	103	793	145	20,503	0	5,715
Riparian zone								
2005	13,731	2,544	1,629	1,359	2,776	494	3,185	1,744
2015	9,466	2,974	2,095	707	1,530	586	821	754
2021	7,885	2,515	1,176	1,289	665	222	940	1,079
Buffer strips								
2005	12,976	3,651	2,380	754	1,950	519	2,750	973
2015	12,270	3,078	2,460	347	3,304	287	2,206	586
2021	8,923	2,400	1,888	541	1,974	29	1,610	480
Garden/landscape area								
2005	13,933	2,249	1,980	522	3,734	2,928	2,042	477
2015	8,939	1,418	1,608	232	2,325	2,165	846	344
2021	7,228	755	679	270	2,146	2,458	688	231
Other un-mowed vegetation area								
2005	29,893	10,989	4,385	1,424	5,452	2,595	4,002	1,046
2015	26,478	7,090	5,798	1,425	3,243	1,711	5,156	2,056
2021	19,309	6,849	3,010	1,073	3,526	689	2,643	1,520
Other natural area								
2005	15,139	3,098	2,631	653	2,908	2,521	1,824	1,505
2015	22,833	5,568	3,313	1,349	8,720	1,878	1,539	465
2021	16,246	6,802	2,190	843	2,625	1,566	1,762	459

ⁱ NC = North Central; NE = Northeast; Pac = Pacific; SE = Southeast; SW = Southwest; Trans = Transition; US = United States; UWM = Upper West/Mountain.

Table 38. Percent of US golf facilities participating in environmental stewardship programs in 2005, 2015, and 2021.

Program	2005	2015	2021
	Golf facilities (%)		
State Best Management Practices	- ⁱⁱ	5.3 b ⁱ	32.1 a
Audubon Cooperative Sanctuary	22.1 a	21.6 a	16.5 b
GCSAA's IPM Planning Guide	-	5.9 b	13.9 a
Operation Pollinator or similar pollinator programs	-	2.4 b	7.0 a
Other IPM program	-	-	6.3
Energy management program	-	-	4.6
Other wildlife habitat management program	-	-	3.0
Audubon International Signature Program	1.8 b	1.5 b	2.7 a
Any clean stream or river water quality program	-	3.4 a	2.6 a
Pollution prevention program	-	-	2.6
Golf Course Environmental Management Program	1.6 a	2.2 a	1.4 a
Any green building certification program	0.0 b	0.1 b	1.1 a
A golf-centric water management program	-	-	0.9
Michigan Turfgrass Environmental Stewardship Program	2.3 a	1.8 a	0.9 b
Golf Environmental Organization	-	0.3 a	0.6 a
Groundwater Guardian Green Site Program	-	1.5 a	0.5 b
Epar USA	-	1.8 a	0.3 b
Vermont Green Links Program	-	0.3 a	0.1 a
CMAA's Environmental Performance Audit	0.1 a	0.1 a	0.0 a
Clean Corporate Citizens	-	0.0 a	0.0 a

ⁱ Within rows, values followed by a common letter are not significantly different according to the chi-square test at the 10% significance level.

ⁱⁱ Question not asked in that year.

Table 39. 2021 nutrient survey responses and weighting factors categorized by region, facility type, number of holes, and green fee.

Region	Facility type	Holes	Green fee	Golf facilities		Survey responses		Weight
		(no.)	(\$)	(no.)	(%)	(no.)	(%)	
Northeast	All	9	All	629	4.5	47	2.5	1.787
Northeast	Public	18	< 55	458	3.3	26	1.4	2.352
Northeast	Public	18	≥ 55	590	4.2	88	4.7	0.895
Northeast	Private	18	All	576	4.1	124	6.7	0.620
Northeast	All	27+	All	178	1.3	22	1.2	1.080
North Central	All	9	All	1125	8.1	48	2.6	3.129
North Central	Public	18	< 55	1085	7.8	90	4.8	1.610
North Central	Public	18	≥ 55	563	4.0	96	5.2	0.783
North Central	Private	18	All	451	3.2	115	6.2	0.524
North Central	All	27+	All	296	2.1	58	3.1	0.681
Transition	All	9	All	625	4.5	31	1.7	2.692
Transition	Public	18	< 55	761	5.5	85	4.6	1.195
Transition	Public	18	≥ 55	394	2.8	60	3.2	0.877
Transition	Private	18	All	517	3.7	116	6.2	0.595
Transition	All	27+	All	174	1.2	41	2.2	0.567
Southeast	All	9	All	442	3.2	10	0.5	5.902
Southeast	Public	18	< 55	679	4.9	55	3.0	1.648
Southeast	Public	18	≥ 55	529	3.8	76	4.1	0.929
Southeast	Private	18	All	676	4.9	153	8.2	0.590
Southeast	All	27+	All	342	2.5	78	4.2	0.585
Southwest	All	9	All	235	1.7	8	0.4	3.922
Southwest	Public	18	< 55	142	1.0	19	1.0	0.998
Southwest	Public	18	≥ 55	353	2.5	37	2.0	1.274
Southwest	Private	18	All	217	1.6	39	2.1	0.743
Southwest	All	27+	All	169	1.2	34	1.8	0.664
Upper West/Mountain	All	9	All	416	3.0	25	1.3	2.222
Upper West/Mountain	Public	18	< 55	167	1.2	34	1.8	0.656
Upper West/Mountain	Public	18	≥ 55	328	2.4	83	4.5	0.528
Upper West/Mountain	Private	18	All	159	1.1	45	2.4	0.472
Upper West/Mountain	All	27+	All	79	0.6	22	1.2	0.479
Pacific	All	9	All	166	1.2	9	0.5	2.463
Pacific	Public	18	< 55	44	0.3	4	0.2	1.469
Pacific	Public	18	≥ 55	202	1.4	42	2.3	0.642
Pacific	Private	18	All	116	0.8	27	1.5	0.574
Pacific	All	27+	All	55	0.4	14	0.8	0.525

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Funded in part by the USGA
through the GCSAA Foundation

Results are also published in *Golf Course Management* and online (<https://www.gcsaa.org/Environment/golf-course-environmental-profile>) where the information is used by the GCSAA and other golf-centric organizations to communicate to the public the golf industry's commitment to environmental stewardship and to promote the efforts golf course superintendents are making on their golf courses.



1421 Research Park Drive
Lawrence, KS 66049-3859
Toll Free 800.472.7878