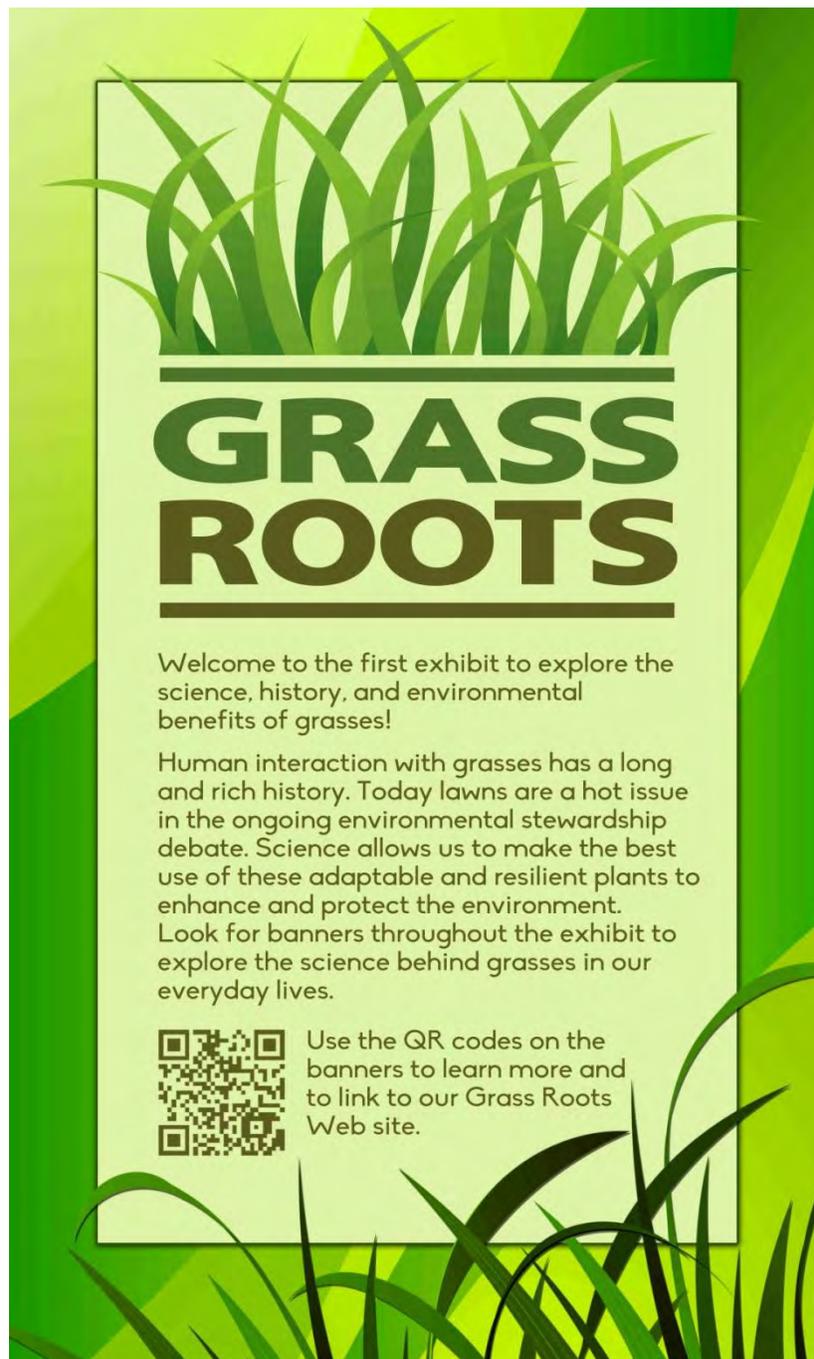


# Grass Roots Exhibit Signage Gallery

If you can't visit our Grass Roots exhibit in person, or if you'd like to read the exhibit signage again after you've seen it at the Arboretum, we've reproduced the banners and interactive signs here. Click on the QR Code questions copied beneath the banners to read the answers.

[Photo credits](#)





## Bottoms Up!

Unlike the leaves of many plants, grass leaves grow from the bottom up. The cells that divide to make the leaves grow are at the crown, located at the base of the plant. When you mow your grass, you're only cutting off the tips of the leaves. The dividing cells at the crown are unharmed and can continue to divide and grow. This growth pattern not only allows us to mow grass repeatedly without damaging it, but also explains how grasses are able to withstand foot traffic, fire, and grazing.

What is the tallest grass species in the world?



Crown



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## Remarkable Roots

Grasses have an extensive system of fibrous roots that allow them to hold soil and to survive drought. Certain types of grasses can have over 300 miles of roots reaching as far as 7 feet below the soil surface. As they decompose, these roots become the organic foundation of our most fertile agricultural soils. Whether living or dead, grass roots help reduce global warming by storing vast quantities of carbon in the soil. An acre of grassland may remove as much as one ton of carbon from the atmosphere per year.



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What effect does mowing have on root development?



QR Code Question: [What effect does mowing have on root development?](#)

## Grasses Grab Pollutants

Lawns and rain gardens work together to keep stormwater on site and to remove pollutants that would otherwise flow into storm drains or streams. The lawn portion of our rain garden slows runoff, intercepts sediment, and holds the soil to prevent erosion. The rest of the rain garden is planted with ornamental grasses and sedges adapted to thrive in soils that are sometimes saturated. In this part of the garden, stormwater slowly percolates into the soil.



How big should a rain garden be to remove pollutants from an acre of parking lot?



# Grasses Grab Pollutants

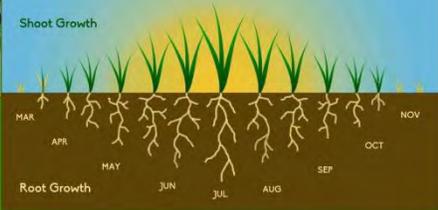
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**Warm Season Grasses**

Shoot Growth



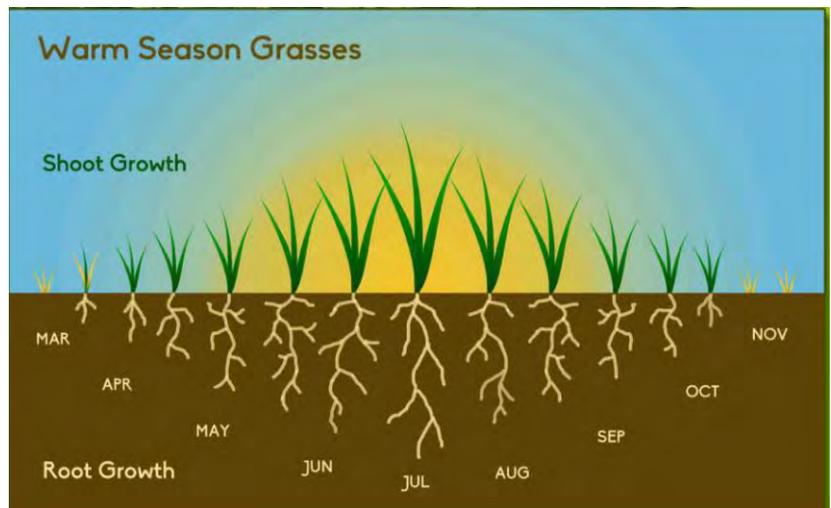
Root Growth

**Happy with Heat**

Some grasses are dormant in cold weather and grow mainly during the warmer months of the year. These warm-season turfgrasses thrive during summer heat and stay green with minimal watering during drought, but most species in this category are poorly adapted to surviving winters in the far north. Common warm-season turfgrasses include zoysia and bermudagrass.

How do you choose the best grass species for your region?





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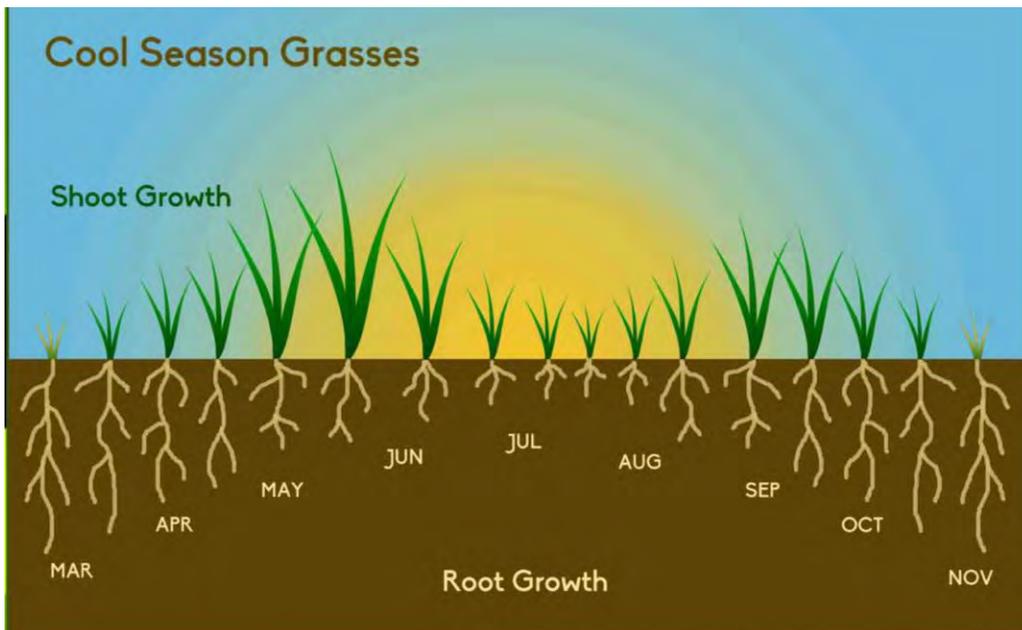
## Content with Cold

Some grasses are dormant in hot, dry weather and grow rapidly in spring and fall when conditions are cool and wet. Cool-season turfgrasses may adapt to summer heat and drought by turning brown and growing less, but many of them also tolerate bitter cold, so they tend to be used in lawns where winters are harsh. Common cool-season turfgrasses include Kentucky bluegrass and fescue species.



# Content with Cold

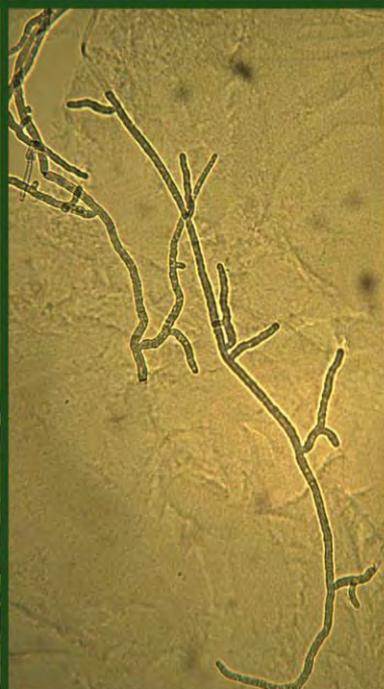
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# What's Troubling My Turf?



In the Mid-Atlantic, fertilizing tall fescue in warm, humid weather can lead to diseases like brown patch fungus that weaken the lawn, leaving it vulnerable to crabgrass invasion.



*Rhizoctonia solani*  
fungus under  
a microscope





Some insects, like Japanese beetles, feed on grass roots while in their larval stage. Check your lawn frequently in mid-summer to detect young larvae before they cause serious damage.





Increasing mowing height, fertilizing properly, and overseeding thin areas of your lawn are the best defenses against weeds, like dandelions.





The urine of dogs can be toxic to turf, causing dead spots.





Too much foot traffic  
compacts the soil,  
preventing oxygen and  
water from reaching the  
grass roots.



Aerate compacted  
areas and reseed  
to reestablish turf.

**Natural Grass Field**

Grass  
Sand + peat  
Coarse sand  
Driveway  
Subsoil

**Synthetic Turf Field**

Synthetic turf  
Fine gravel  
Overall  
Permeable fabric  
Subsoil

**Game-Winning Grass**

We expect sports turf to perform as well as the athletes. Sports fields are highly engineered—they must meet stringent requirements for uniformity, safety, and aesthetic quality. Synthetic turf, while often considered a low-maintenance playing surface, requires maintenance that includes cleaning, topdressing, disinfecting, and irrigation for cooling.

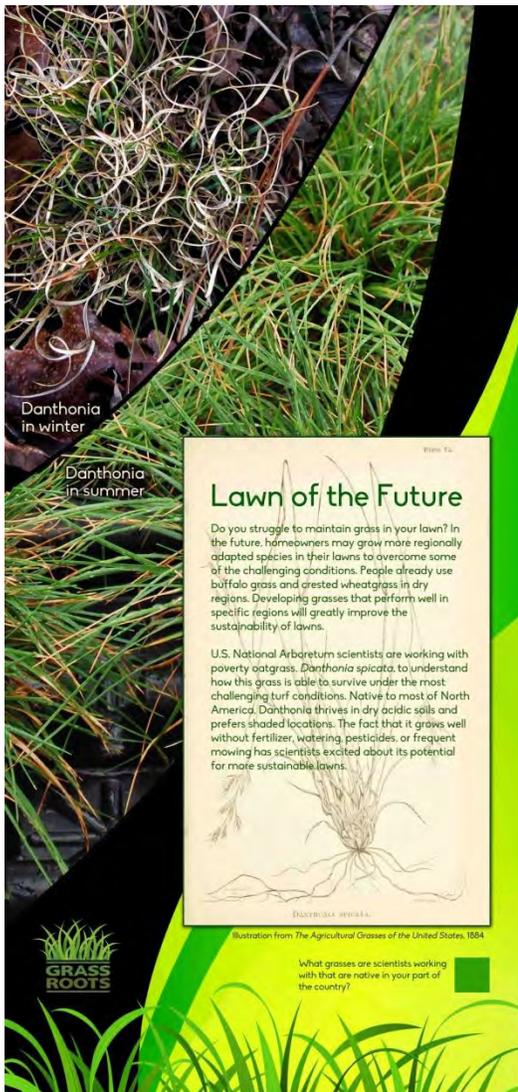
How does the difference in temperature between synthetic and natural grass affect athletes on a hot summer day?

**GRASS ROOTS**

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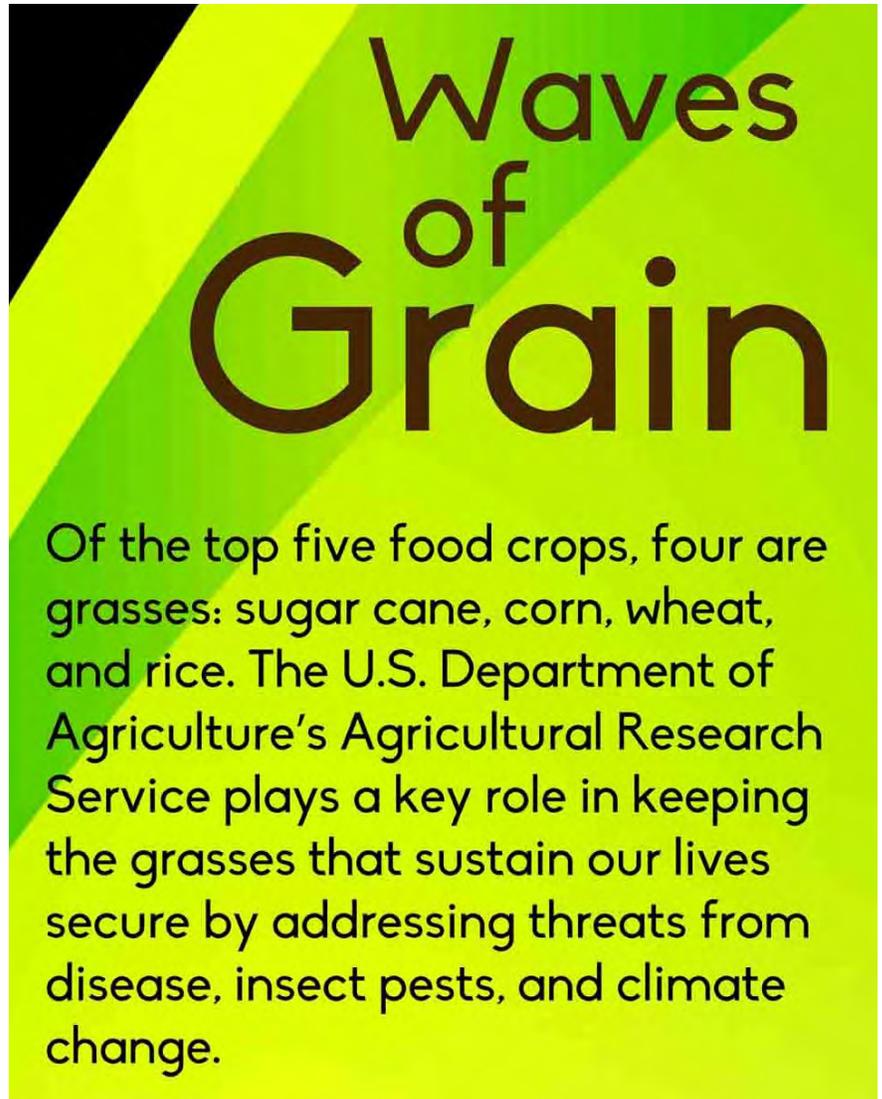
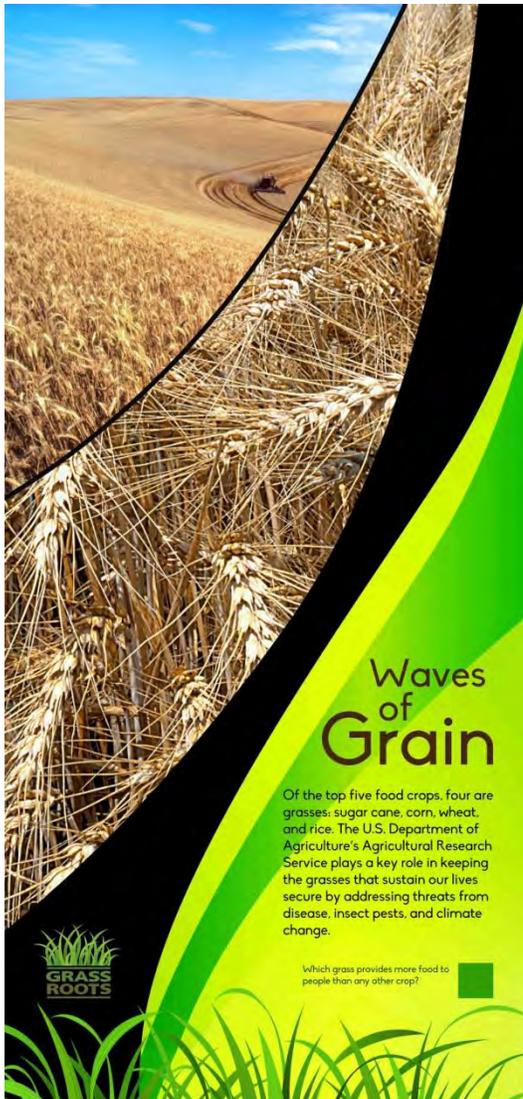


# Lawn of the Future

Do you struggle to maintain grass in your lawn? In the future, homeowners may grow more regionally adapted species in their lawns to overcome some of the challenging conditions. People already use buffalo grass and crested wheatgrass in dry regions. Developing grasses that perform well in specific regions will greatly improve the sustainability of lawns.

U.S. National Arboretum scientists are working with poverty oatgrass, *Danthonia spicata*, to understand how this grass is able to survive under the most challenging turf conditions. Native to most of North America, *Danthonia* thrives in dry acidic soils and prefers shaded locations. The fact that it grows well without fertilizer, watering, pesticides, or frequent mowing has scientists excited about its potential for more sustainable lawns.

QR Code Question: [What grasses are scientists working with that are native in your part of the country?](#)



QR Code Question: [Which grass provides more food to people than any other crop?](#)



## Green Golf

The U.S. Golf Association has been a leader in promoting turfgrass research, beginning in 1920 with its first collaboration with the U.S. Department of Agriculture to develop improved turfgrass. Today, golf courses respond to environmental concerns by using species in roughs that require less mowing, planting buffers for waterways, and incorporating grasses for wildlife habitat. In heavily developed areas, golf courses serve an important function by providing green space for stormwater management and groundwater recharge.

**GRASS ROOTS**

What research funded by the U.S. Golf Association has led to improvements in the grass species used for your home lawn?



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## Liquid Assets

Grass needs water to stay green throughout the growing season in much of the country. With greater pressure on water resources and concern about the energy consumption associated with pumping irrigation water, scientists and engineers have been working hard to develop irrigation technologies that make the most of every drop. A key way to save water is to apply it at the correct pressure so the water droplets are large and less likely to blow away or evaporate.

Test the irrigation heads to your right. Which one saves more water?

Water should penetrate the root zone

Watering at a slow rate over a long period of time allows water to soak in rather than running off.

What is the most drought-resistant grass species?

GRASS ROOTS

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QR Code Question: [What is the most drought-resistant grass species?](#)



Apply fertilizer in the right season—fall for cool-season grasses and early summer for warm-season grasses.

# Feed Me!

Proper fertilization can help your turf grow thick and healthy so it can function more efficiently as an environmental asset, filtering runoff and preventing erosion. The amount of fertilizer your lawn needs depends on the grass species you grow and the fertility of your soil. Allowing clippings to remain in your lawn can provide some of the nutrients it needs. Look at the two examples planted here to see how fertilization can help your turf reach its full environmental potential.

What percentage of nutrient loading in the Chesapeake Bay comes from lawns and turf?

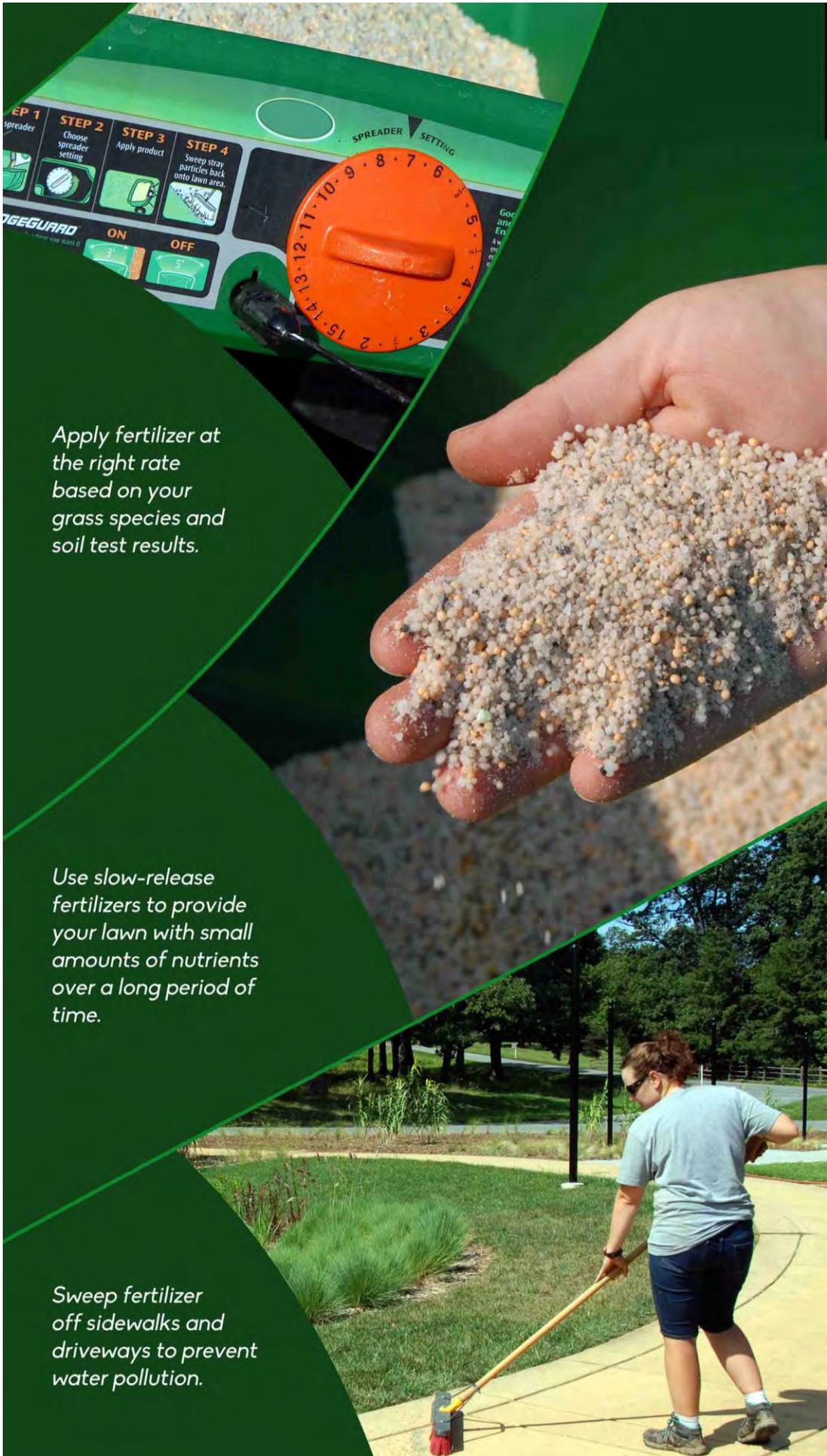



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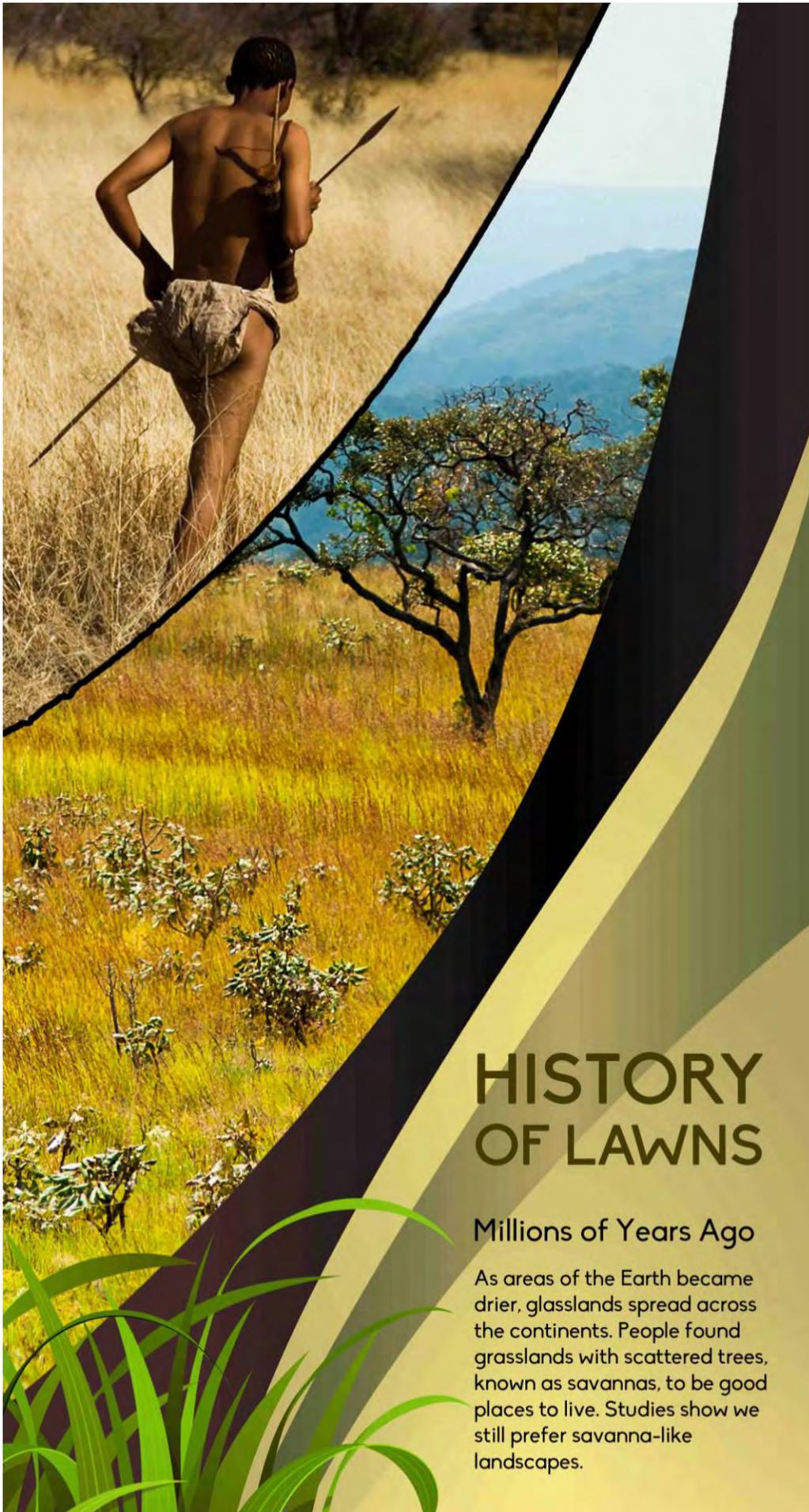
QR Code Question: [What percentage of nutrient loading in the Chesapeake Bay comes from lawns and turf?](#)



Apply fertilizer at the right rate based on your grass species and soil test results.

Use slow-release fertilizers to provide your lawn with small amounts of nutrients over a long period of time.

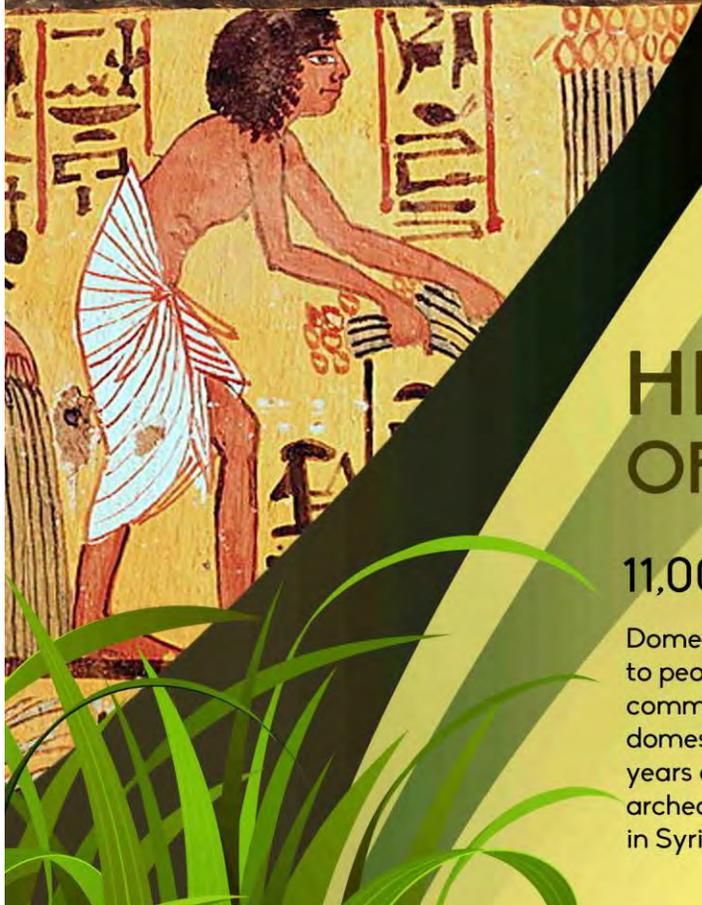
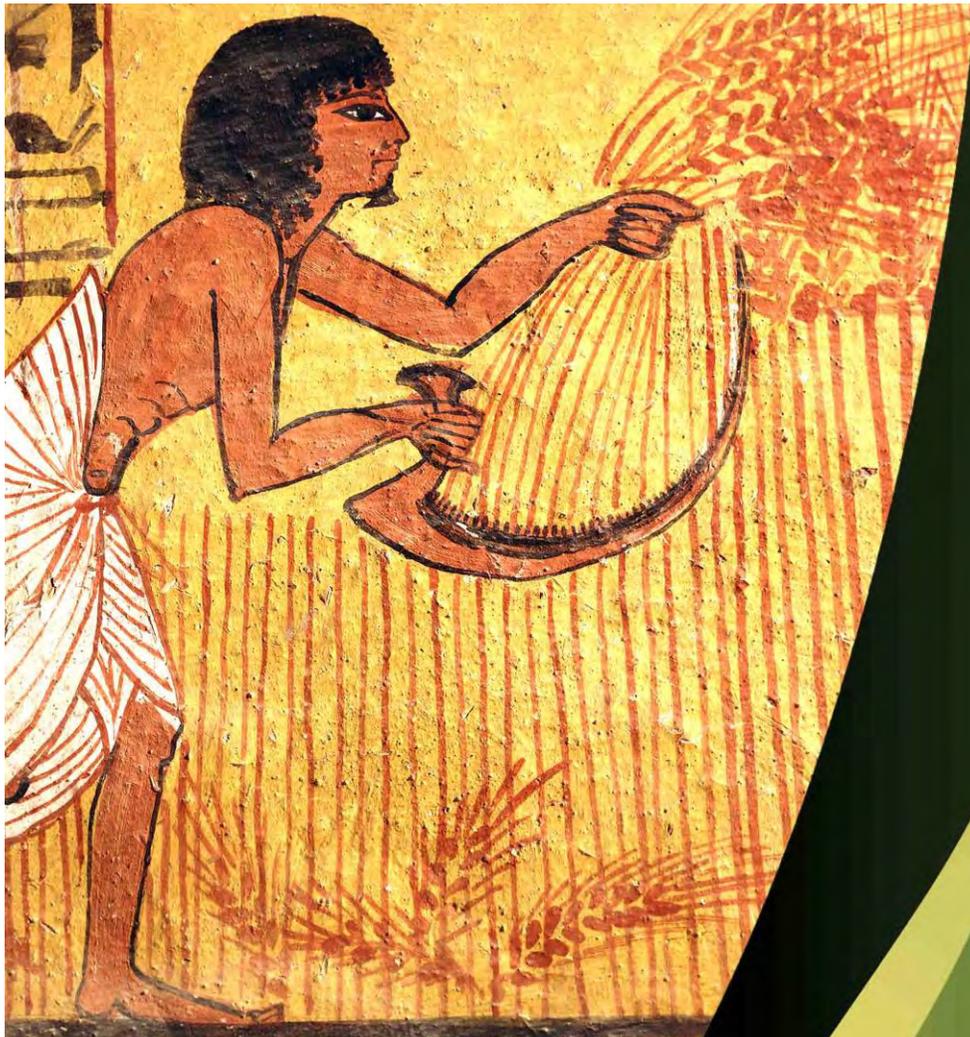
Sweep fertilizer off sidewalks and driveways to prevent water pollution.



# HISTORY OF LAWNS

## Millions of Years Ago

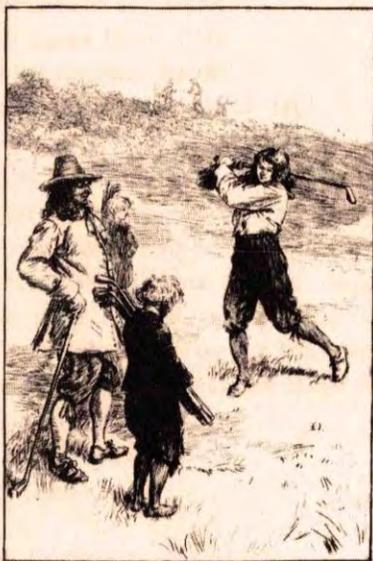
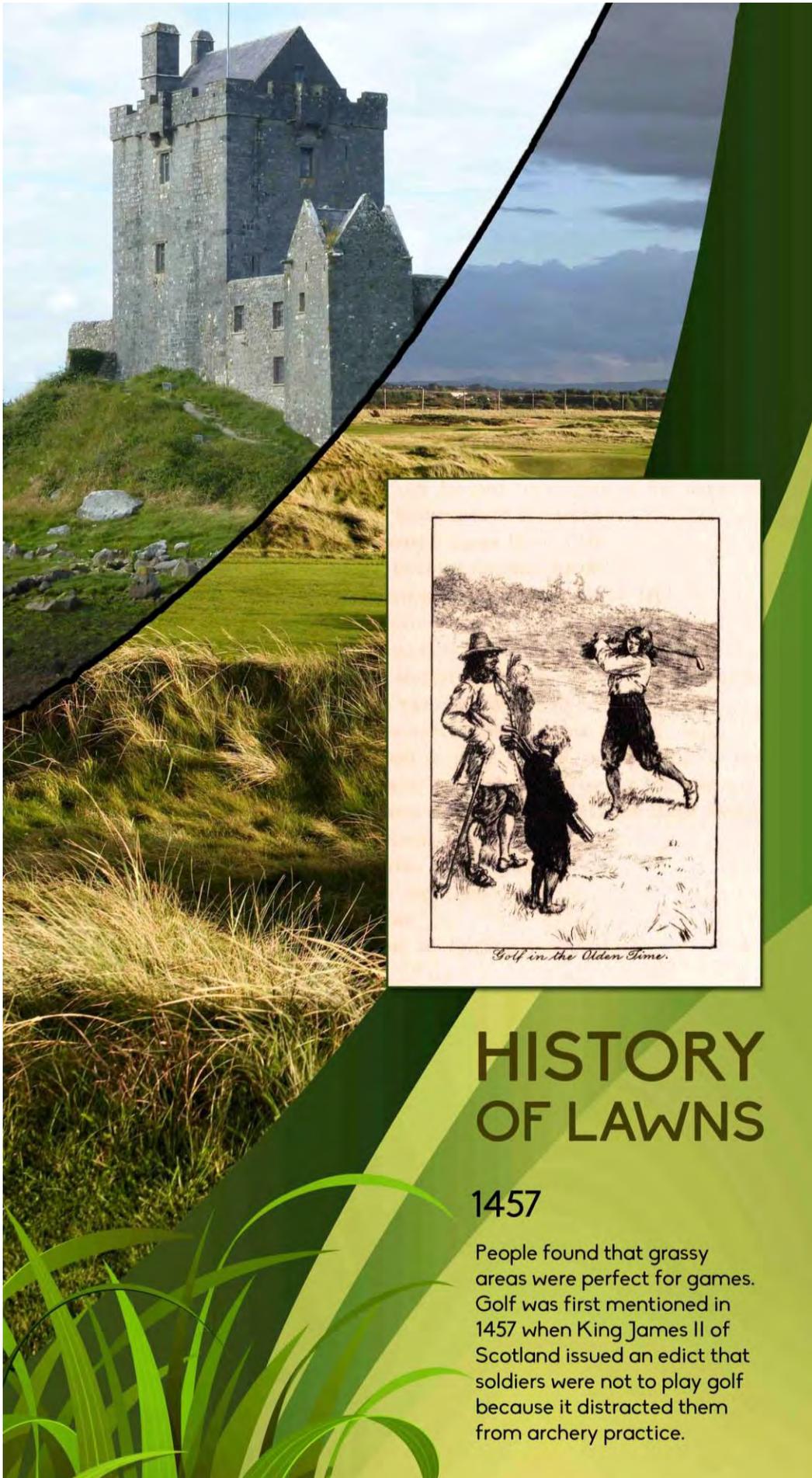
As areas of the Earth became drier, grasslands spread across the continents. People found grasslands with scattered trees, known as savannas, to be good places to live. Studies show we still prefer savanna-like landscapes.



# HISTORY OF LAWNS

## 11,000 Years Ago

Domestication of grasses led to people settling in permanent communities. Rye was first domesticated at least 11,000 years ago, according to archeological evidence found in Syria.

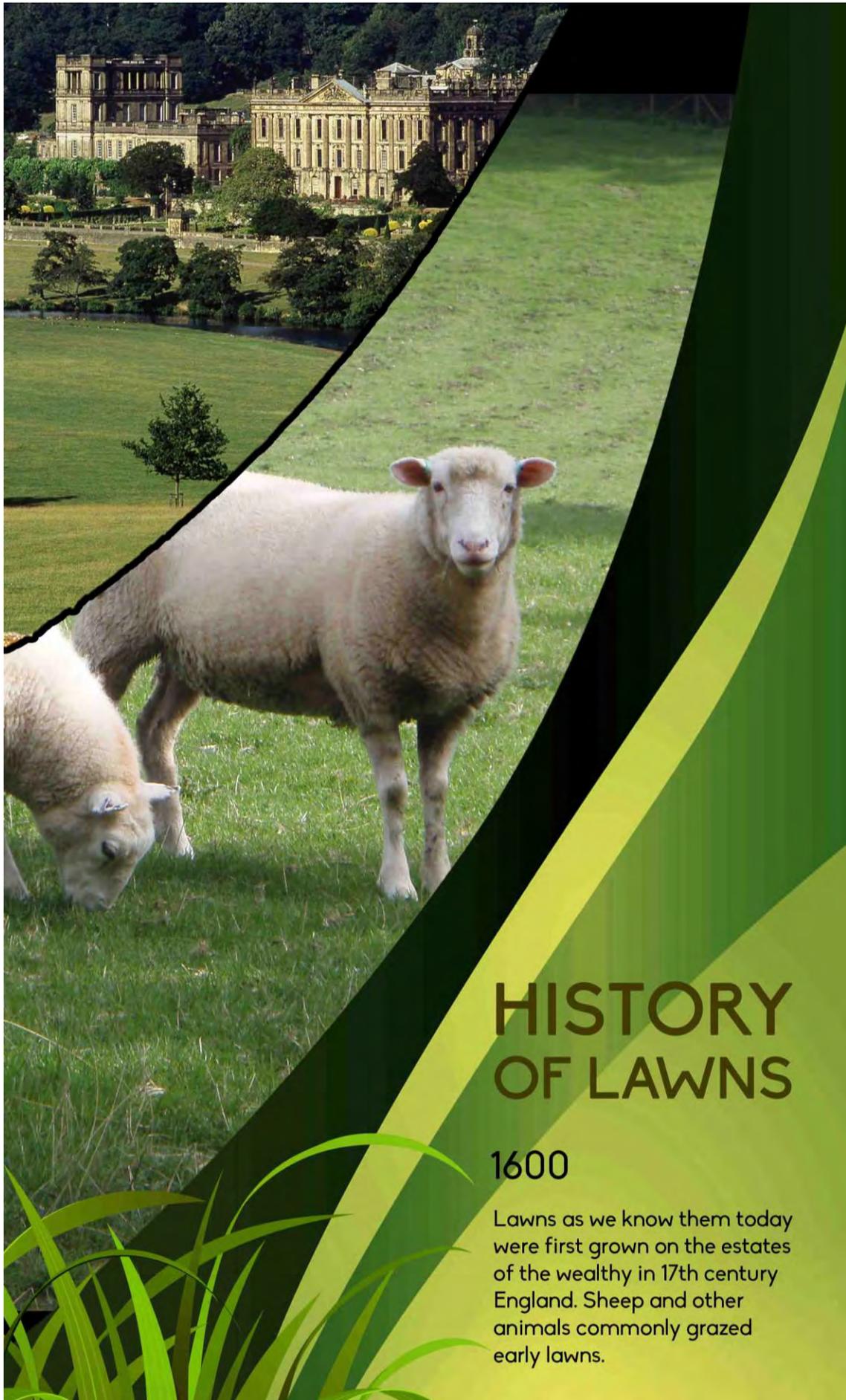


*Golf in the Olden Time.*

# HISTORY OF LAWNS

1457

People found that grassy areas were perfect for games. Golf was first mentioned in 1457 when King James II of Scotland issued an edict that soldiers were not to play golf because it distracted them from archery practice.



# HISTORY OF LAWNS

1600

Lawns as we know them today were first grown on the estates of the wealthy in 17th century England. Sheep and other animals commonly grazed early lawns.

Lawn Mower.  
No. 73,807 Patented Jan. 28, 1868

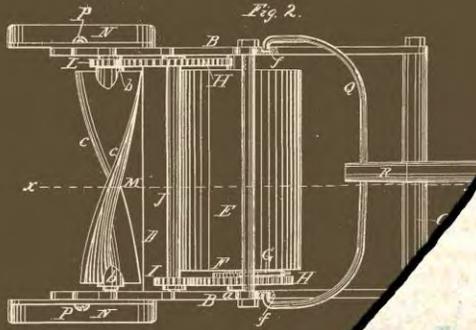
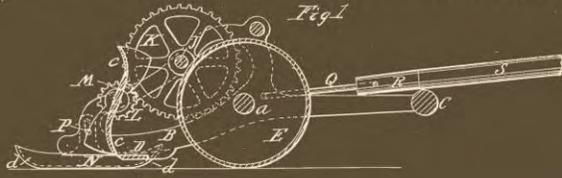
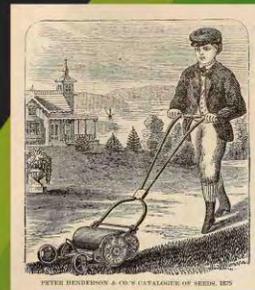


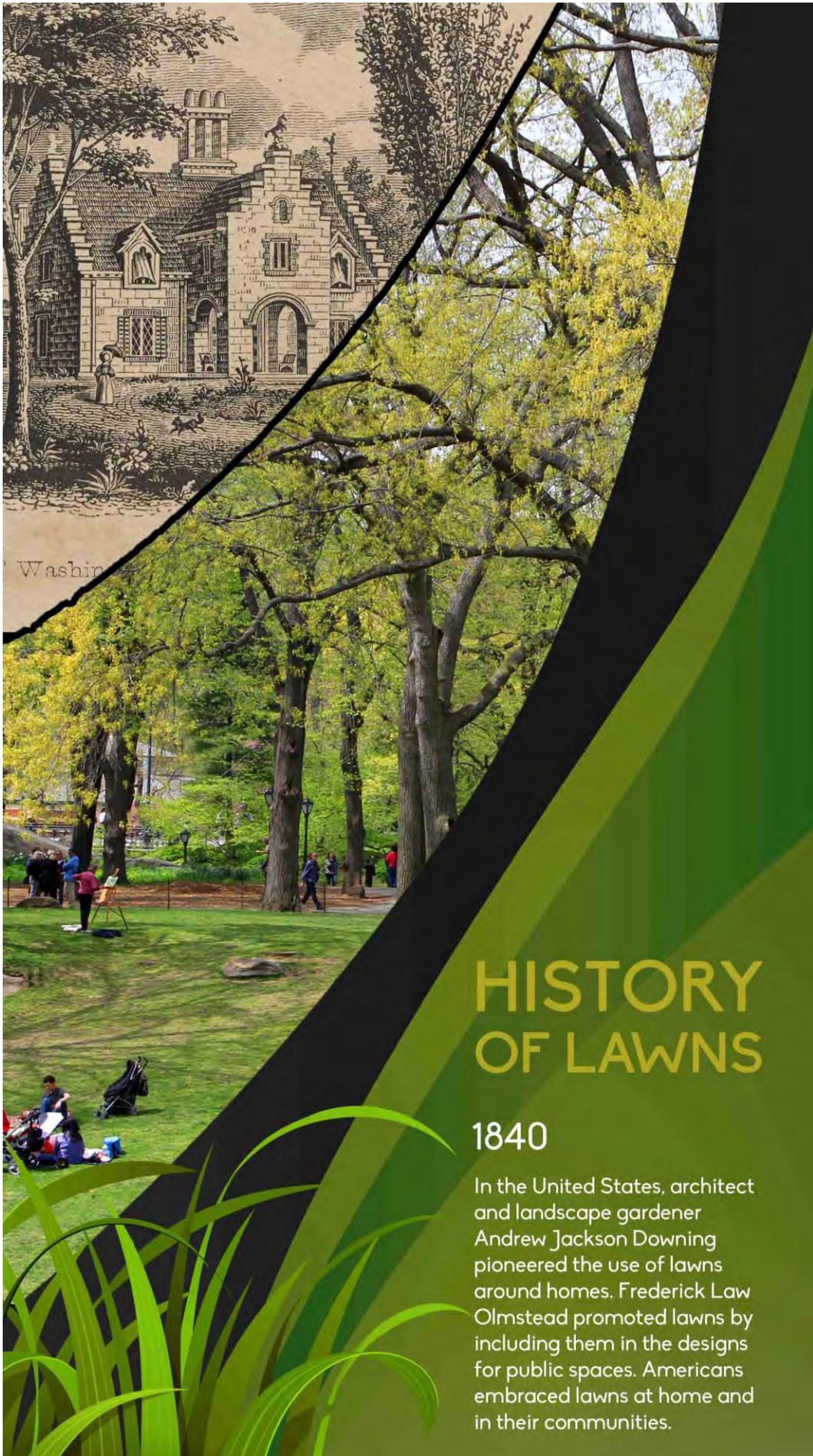
Fig. 3.  
Witnesses  
I. H. S. S. S. S. S.  
Wm. S. S. S.



# HISTORY OF LAWNS

## 1830

The invention of the lawn mower in England in 1830 made it possible for the average homeowner to have a lawn. Hand mowers manufactured under American patents became widely available in this country in the late 1860s.

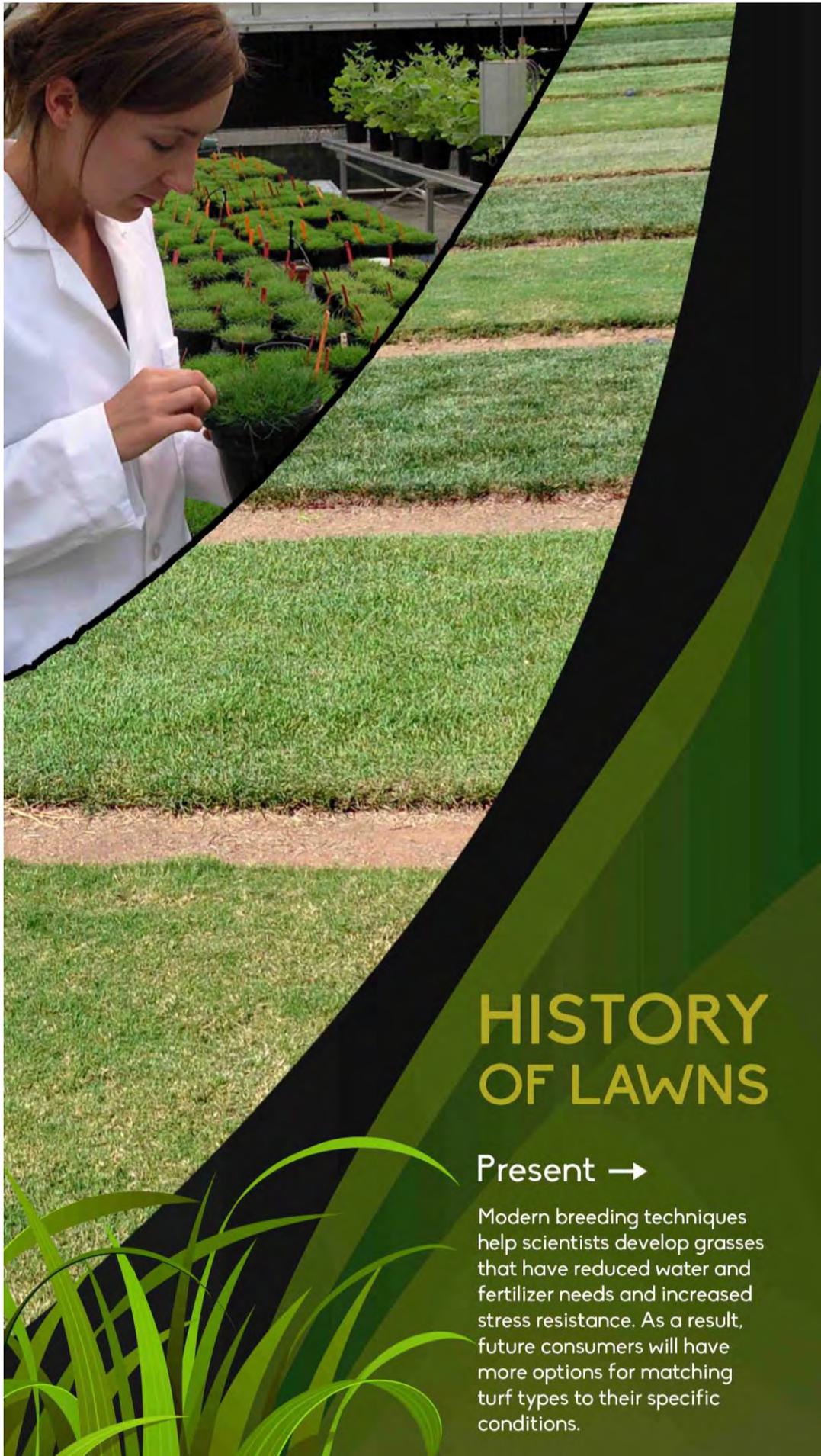


Washin

# HISTORY OF LAWNS

## 1840

In the United States, architect and landscape gardener Andrew Jackson Downing pioneered the use of lawns around homes. Frederick Law Olmstead promoted lawns by including them in the designs for public spaces. Americans embraced lawns at home and in their communities.



# HISTORY OF LAWNS

## Present →

Modern breeding techniques help scientists develop grasses that have reduced water and fertilizer needs and increased stress resistance. As a result, future consumers will have more options for matching turf types to their specific conditions.