FIRST GREEN

GCSAA

Getting Started Guide





Getting Started Guide

GCSAA's STEM Outreach Group

Call 1.800.472.7878



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Introduction to First Green

Thank you for your interest in the First Green program. Founded in 1997, First Green is the only STEM education and environmental outreach program in the United States and Canada that uses golf courses as learning labs. First Green is a program of the Golf Course Superintendents Association of America (GCSAA) and is administered by the Environmental Institute for Golf (EIFG), the philanthropic organization of GCSAA.

First Green pairs golf courses with local schools for unique Science, Technology, Engineering, and Mathematics (STEM) learning opportunities. Golf Course Superintendents coordinate a 90 minute to two (2) hour field trip. Students rotate through learning stations covering topics such as soil and plant science, golf course ecology, testing water quality, various math calculations using actual problems golf course superintendents need to solve on a daily basis, or going on nature hikes.

There are 11 complete lesson plans in this guide and available on **www.thefirstgreen.org**. However, the potential of First Green learning stations is limited only by what the host superintendent and teacher decide to offer based on the nature of the golf course and interests of the students. First Green field trips benefits young people by helping them apply their classroom knowledge in an outdoor setting. By understanding how STEM concepts can have real-world applications students find new inspiration in their schoolwork and in the possibility of a career in a STEM field or golf. An added benefit to this program is that many of the kids attending these field trips have never been on a golf course. We are introducing a whole new audience to this great game and the valuable green space golf courses offer in their communities.

If hosting students for two hours makes you nervous – don't worry! This guide has prepared the lessons, broken down what you'll need and included step-by-step checklists to help you along the way.

Let's get started!

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Getting Started with First Green

Register Your Interest

The first step in getting started is to register your interest in the program with GCSAA. Please visit www.thefirstgreen.org and click on the “get involved” tab for superintendents. You will find an online registration form. Or, you can fill out the form included in this book and send it in. First Green helps connect interested schools with golf course superintendents.

Connect with a school/local youth group

Making a connection with a local school or youth group can be a challenge. We’ve outlined a few tips from experienced field trip hosts. While the tips center on schools – the actions can easily translate to youth groups such as Boys & Girls Clubs, 4-H, FFA Chapters, First Tee, Girls and Boys Scouts, etc.,

- Start within your network - do you have any friends, neighbors, family members who work in your school district? Reach out to them. Even if they aren’t able to participate in the field trip they can usually introduce you to the individual(s) who can help.
- Identify the public and private schools containing grades 5 and up closest to your golf course. Look on their websites for the names and contact information of the school principal, science program coordinator or teachers.
- Email the principal and teacher introducing yourself and your golf course. A sample message is provided below.
- Be prepared to follow up your email with a phone call. Very often you will need to leave a message.
- Persist and be patient. Teachers and principals are busy!
- Be sure to invite them to look at the First Green website (www.thefirstgreen.org), especially the videos. It is a good way to start a conversation with them.
- BEGIN EARLY – remember that schools schedule their field trips well in advance of the date in order to get all arrangements made.
- Once you get connected to the school and host a field trip, you won’t have any problems with future trips! Getting the conversation started is the hardest part.

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Sample Email Message

Dear _____,

My name is _____ and I am the golf course superintendent at _____. Which is located near your school. I am sending you this email to introduce myself and tell you about First Green, a program that enables you to bring your students to the golf course for science learning labs. The website is www.thefirstgreen.org. Please take a few moments to view the videos on the home page of the website and see the lesson plans and other resources that are available to you without any costs. I would very much like to talk more with you about hosting you and your students at _____. I will call you in a few days to answer any questions you may have and learn about what you would like your students to experience on a field trip.

Thank you in advance for looking at the First Green website. I look forward to talking

Register Your Field Trip

Once you've connected with a school or youth group and settled on a date for the field trip, please register the field trip on the First Green website. You are now ready to plan your field trip.

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Plan Your Field Trip

You've connected with a local school and you have a date confirmed for your First Green field trip. Now it's time to start planning what to do with the students once they arrive at your golf course. We've provided a checklist to help you stay on track and sample agendas from previous field trips. The sample agendas are a good way to see how each superintendent puts their own stamp on the field trip. We encourage you to do the same! Here's a few things to consider before you begin.

Lesson Plans/Learning Stations

We've included all 11 formal lesson plans in this guide. If possible, consult the teacher as you decide which learning stations to include in the field trip. Feel free to use your imagination and go outside the prepared plans in this guide. What does your golf course offer that would be of interest to young minds? Do you have native plants? Do you have beehives? Any bluebird, owl, eagle nesting boxes? Here's your chance to highlight the great work you and your crew do on your course!

While there is no "required" content to First Green the following stations are great for beginners due to the ease of implementing them, and the content is applicable to students of all ages.

- Soils
- Math – Area calculations
- Water Quality
- Putting Contest/Fun Golf activity

Logistics

A typical field trip has 40-50 students and four (4) stations. A key to STEM learning and First Green is the opportunity to let the kids actively participate with the learning stations. This means the students need to be broken down into groups of 10 – 12. Each group will rotate between stations every 20 minutes. Think through where to place each station on your golf course – can the students walk easily between stations in 5 minutes? Is there a bathroom nearby? Here's a few more tips:

- **Learning Stations –** Share the lesson plans with the teacher. Work with him/her to determine what topics to cover. Offer to take the teacher on a tour of your golf course – this can help both of you brainstorm ideas for the field trip.

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- **Supplies –** Each lesson plan has a complete list of needed supplies included in it. Most superintendents have the required items readily available at their golf course. If you need help in sourcing an item – reach out to GCSAA for assistance.
- **Volunteers –** who will lead each of your stations? A best practice is to have two volunteers for each station. This makes the time enjoyable for your volunteer and takes the pressure off one individual having to lead each station. Recruit volunteers from your staff, your fellow superintendents, or your local sales reps. For instance, are you having a station that highlights water conservation? Invite your local irrigation sales representative to lead the station on the irrigation system.
- **Host Superintendent –** The host superintendent should act as a facilitator and timekeeper. He/she will be able to ensure the field trip is running in a timely, smooth manner.
- **Transportation –** if you are working with a public school, they will utilize their bus company to transport to/from your golf course. Please be advised that First Green has a limited number of transportation grants available if the school raises the issue of funding. Contact GCSAA for additional information.
- **Lunch/Snacks –** Most field trips occur in the morning and take anywhere from 90 minutes to 2 hours. If your facility would like to host a lunch for the kids, parents and teachers feel free to do so. Some schools have the kids bring their own lunches and picnic at the golf course. This is a great opportunity to continue to network with the teachers, parents and students.
- **Photo Permission –** if you are planning to take pictures of the participants make sure to ask the teacher(s) if any of the children are not allowed to have their picture taken. With the increased scrutiny regarding protecting privacy it is important that you follow appropriate protocol when interacting with minor children. Most public and private schools will have photo/video permission waivers on file for their students. If they do not, there is a photo permission form available on the First Green website.

This isn't an exhaustive list items to consider. The following checklist and sample agendas will hopefully help you feel confident as you plan your field trip. You are encouraged to reach out to GCSAA for additional tips.

How GCSAA can help

GCSAA encourages you to reach out to your local field staff after you've confirmed your field trip. The field staff have all participated in First Green field trips and would be happy to help with advice, best practices and if their schedule allows attend your field trip. As was mentioned earlier, GCSAA has a limited number of grants to help support your field trip – with transportation costs, or to help offset any cost to your golf facility. GCSAA will also provide First Green feather banners and signage to display your participation in the field trip.

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Planning Checklist

Step 1 | Register your interest to host on *www.thefirstgreen.org*

Step 2 | Connect with a school/youth group (3 – 6 months in advance.)

Reach out to school/youth club at least 3 - 6 months in advance if you do not already have a connection. Remember, the school will need to work this into their schedules. Need help? Check out the Connecting with Local Schools page found on the website.

Step 3 | Plan your field trip! 8 weeks prior to the field trip:

1. Gain the appropriate approval to host a field trip at your golf course. The First Green website has resources to help.

2. Assemble your team – who will help you with the field trip? Remember each station will need someone to lead the learning. We recommend at least 2- 3 stations per field trip, plus a fun activity – like putting. Helpers could include:

- **a.** Your assistants, golf pro, other individuals at your course.
- **b.** Your Chapter – reach out to your fellow chapter members to volunteer. This not only helps you but spreads the First Green message to your colleagues.
- **c.** Allied groups – Do you have a local Audubon chapter that could lead a bird watching station?

3. Brainstorm ideas for your field trip stations. You can use the lesson plans found on the First Green website, in this booklet, or create your own. Be ready to share these ideas with the teacher and your golf course team.

4. Gather any needed equipment/supplies for each station. See the website for needed items. Give GCSAA a call if you need help.

5. Paperwork/Budgeting

- **a.** Make sure the teacher has parents fill out and return the Photo Permission Slip.
- **b.** Budget appropriately for your field trip. Snacks, water, etc.,
- **c.** Transportation – some school districts are tight on funds and a hurdle could be getting the students to and from the golf course. Please know that GCSAA, or your chapter might be able to assist you with a “bus scholarship.”

Step 4 | Register Your Field Trip on the First Green website, at least one month in advance.

Step 5 | Fill out the Post Field Trip Report on the website.

GCSAA collects your valuable feedback to make the program better and will grant service points to any GCSAA members who assisted you. The host will also receive service points.

Sample Agendas

MORAINE
COUNTRY CLUB



Moraine Country Club is happy to host Centerville's Stingley Elementary School's fifth-grade class for the First Green STEM education field trip on May 13. Volunteers from the Miami Valley Golf Course Superintendents Association (MVGCSA), Golf Course Superintendent Association of America (GCSAA) and the Miami Valley Golf Association (MVGA) are assisting with the event.

A few facts about Moraine Country Club:

- The club was established in 1930 and was designed by Alex 'Nipper' Campbell
- Private Country Club located in Kettering, Ohio
- The property sits on 160 acres
- 65 Acres of rough
- 30 Acres of fairways/approaches
- 40 Acres of native areas
- 20 Acres of woods/out of play areas
- 3 Acres of greens
- 2 Acres of tees
- 1.7 Acres of bunkers (62)
- A "Moraine" is a terminal glacier where sand and gravel was deposited
- Under the topsoil you can find pure gravel and sand veins
- The property drains extremely well
- The course sits on part of the Miami Valley Aquifer and this is where we pull our water from to irrigate the golf course
- In 2014 the practice facility and platform tennis courts were rebuilt
- In 2015 the club did a complete renovation rebuilding greens, tees, and bunkers. Fairways, rough, and native ares were also re-grassed
- Host of 1945 PGA Championship won by Byron Nelson. It was Nelson's ninth win in a row. He would go on to win eleven in a row which is still a record on the PGA tour today.
- Host of 1979, 1989, 1999, 2009, 2019 Ohio Amateur Championships. The 2019 Ohio Amateur Championship will be hosted July 8-12.
- Ranked 75th in Golfweek Top 100 Classic rankings and 87th in Golf Magazine Top 100

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This event will be outside so make sure everyone is prepared for the elements. The event will go on rain or shine. Students will be divided into equal groups and rotate stations every 25-30 minutes.

8:45 – 9:00 Arrival

9:00 – 9:20 Introductions and background of course

9:30 – 10:00 Station #1

10:00 – 10:30 Station #2

10:30 – 11:00 Station #3

11:00 – 11:30 Station #4

11:30 – 12:00 Station #5

12:00 – 12:30 Station #6

12:30 – 1:15 Lunch on Terrace (pack a lunch)

Station #1 - Cool Tools on the Green

- Explain how a greens mower operates and cuts the greens to the thickness of a quarter
- Show the difference of a reel mower vs. a rotary mower
- Demonstrate a greens mower in action
- Have a putting station where students can practice putting

Station #2 - Practice Tee

- Students will be able to hit range balls from the practice tee
- Golf professionals will assist the students and clubs will be available to use

Station #3 - Soils

- Learn about the three major components of soil - sand, silt, and clay
- Why different types of soils are used for different areas of the golf course
- They will use a soil sieve to separate the different types of soils
- Plant nutrients and how we correct deficiencies in the soil
- Drainage demonstration based on types of soils
- Demonstrate the use of TDR moisture meters that measure the percent moisture in the soil and temperature

Station #4 - Math

- Area measurement
- Area of a rectangle using a measuring wheel
- Area of an irregular space
- Discuss how many square feet are in an acre
- Compare and discuss the size of different regions of the golf course and how these relate to the size of a football field

Station #5 - Technology Station

- Demonstrate a drone and how it can be used on a golf course
- Show how we are using GPS technology on our sprayers for accurate applications
- Irrigation technology - show we can turn on irrigation using an iPhone
- Over 1,600 irrigation heads that can be individually controlled providing precise irrigation

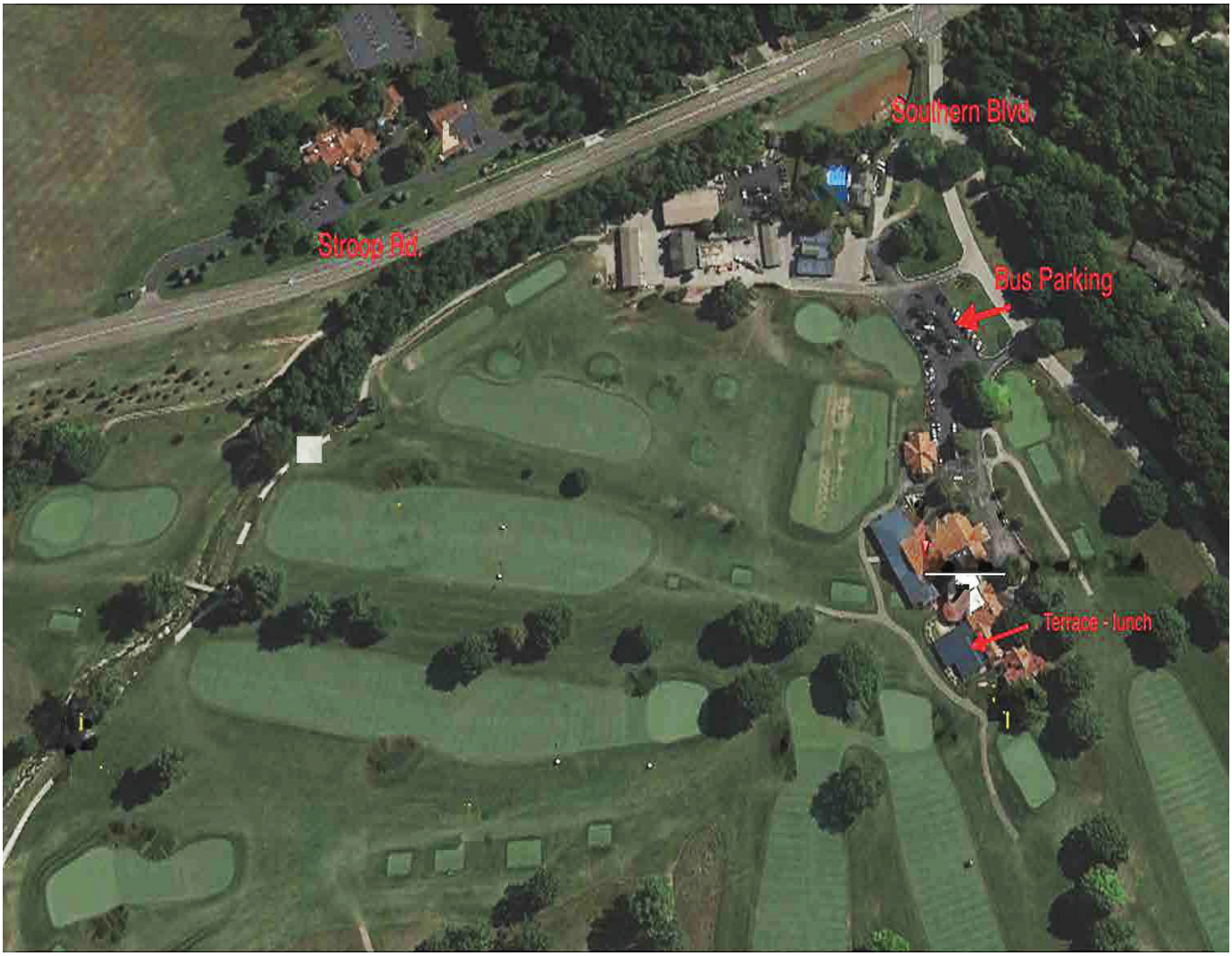
Station #6 - Audubon / Bluebird

- Discuss the Bluebird and Audubon program at Moraine and the benefits it provides
- There are 42 Bluebird boxes throughout the property
- Discuss the bluebirds, tree swallows, chickadees, and wrens that nest in the boxes
- Talk about the different types of nests they make
- Moraine is a Certified Audubon Cooperative Sanctuary
- In 2011 Moraine was the 11th golf course in Ohio and 831st in the world to become

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Moraine Country Club



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A GCSAA PROGRAM

Sample Agendas
Powerpoint Slides



First Green Field Day at Ford Plantation

- First Green is an innovative environmental and STEM (Science, Technology, Engineering and Math) education outreach program using golf courses as environmental learning labs. Golf Course Superintendents and/or local golf course representatives host students on field trips where they collect soil samples, identify plants and learn about the ecology and environmental aspects of the golf course. The students are also introduced to many other aspects of golf.
- Golf Courses offer economic benefits, recreational opportunities and green spaces to the communities they serve. Golf Courses are large parcels of land with healthy turf, trees and other vegetation. They provide wildlife habitat, produce oxygen and filter surface water.
- First Green is a program of the Environmental Institute of Golf (EIFG), the philanthropic organization of the Golf Course Superintendents Association of America (GCSAA).
- Read more: http://www.thefirstgreen.org/#ixzz5nGAFN7yT

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Agenda

- Arrive, park, and assemble: 15 minutes- Begin field trip
  - Introduction to golf course, e.g., history of the club, terrain, stats., Nelson
  - Divide 40 students in to groups of 10
  - 9-9:15am
- 4 Activities: Learning Labs: 1 hour 20 minutes (20 minutes at each station): Plants and the Environment, Soils, Cool Tools, Water Conservation
  - 9:15-10:35
- Wildlife and Habitat Management- Walking Tour: 45 minutes
  - 10:35-11:20am
- Conclusion: Lunch and Golf Activities 45 min
  - 11:20-Noon
  - Lunch
  - Practice putting on golf green
  - Hit golf balls at the range tee
  - Fill out surveys
  - Leave club
- TOTAL TIME 3 hours



Station Assignments

- Soils
  - Ron Wright, GCSAA Field Representative
    - The three components of Soil
    - Water infiltration of Soils
    - Soil sieve demonstration
- Cool Tools
  - Alan Bussey, Ford Plantation Head Equipment & Lakes Manager
    - Reel verse Rotary cutting units and technology
  - Chris Skronski and Justin Heath, Ford Plantation Assistant Superintendents
    - Moisture Meters and how they work
    - Cup cutting technology- Hole locations and Putting Green soil compositions
  - Dane Alexander, Ford Plantation Head Superintendent
    - The Stimpmeter- Introduction to green speed and associated math
- Plants and the environment
  - Nelson Caron, Ford Plantation Director of Golf and Grounds
    - Turfgrass anatomy
    - Turfgrass Macro-Scope- getting a closer look at an Ultra-dwarf turfgrass plant through the field macro-scope
- Water Conservation
  - Jacob Bennett, Ford Plantation Assistant Superintendent
    - State of the art irrigation application technology and associated practices on golf courses
    - Evapotranspiration and its role on golf courses
- Wildlife and Habitat Management Walking Tour
  - Brittney Dodge, Ford Plantation Naturalist
    - A nature walk through a Ford Plantation Wetland with animal and plant identification



Professional Representatives Attending Field Trip

- Tenia Workman, Executive Director; Georgia Golf Course Superintendents Association
- Ron Wright, Field Representative; Golf Course Superintendents Association of America
- Nelson Caron, Director of Golf and Grounds Maintenance, Ford Plantation
- Brittney Dodge, Naturalist; Ford Plantation
- Dan Alexander, Head Superintended; Ford Planation
- Jacob Bennett, Justin Heath, Chris Skronski, Assistant Superintendents; Ford Plantation
- Various TFP member volunteers

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Community Outreach

First Green field trips are an excellent way for golf facilities to reach out to their communities and highlight golf's positive environmental message. Students are accompanied by their teachers, chaperones (often the parents of the students), and other adults who might not have much experience with golf. These field trips garner media attention as well. Local television or newspaper coverage of students practicing their math and science skills while having fun on a golf course is a positive story that boosts the entire golf industry.

Social Media

Please share your field trip via social media. Be sure to use to tag @thefirstgreen and @gcsaa when you share your field trip on Twitter. Using the #STEMEducation helps to ensure you are promoting your good work to the largest audiences. You can share your field trip on First Green's Facebook page and Instagram account. Take pictures or videos and promote these on social media to your followers, and allied golf organizations.

First Green Media Step by Step

Who to Contact and When

One month in advance of the First Green event, you will need to contact your local media via e-mail or a phone call. You can search contact information by visiting each outlet's website and finding a Contact Us, Staff Directory or Meet the Team link. Focus on finding a couple of people who might be good contacts at each outlet to reach out to such as:

- Newspapers: Editor, Assignment Editor, Education Writer, Sports Editor
- Television: News Director, Sports Director, Education Reporter, News Tip e-mail address
- Radio: News Director

Another way to find media is via twitter. Tweet at them about your event and for them to reach out to you to get information about this media opportunity.

If you work at a golf course that has a communications/marketing director or you are at a municipal course and your city has a communications/marketing director, utilize their expertise and contacts with the local media to reach out to the media and gain coverage of your event.

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If you haven't heard back from any media, reach out with the press release again two weeks before your event. Or you can make a phone call to media you think would come to the event.

What Information to Send to Media

Press Release

Send a press release one month before the event and send again two weeks before the event if you have not received a response from the media.

- E-mail Subject Line: <Golf Course> Hosting Hands-On Learning Experience For Students
- A First Green press release template has been included in this guide. Simply fill in the blanks about your event or tailor it to your liking. You may also create your own information.
- When you reach out to the media make sure you include your contact information and be responsive to their return calls or e-mails.

Talking Points

If you are having conversations with media prior to the event, you will need to explain why covering the First Green event is a good thing for them and their audience.

The event does a number of things including:

- Provide hands-on learning for students.
- Expose kids to golf courses, which shows them recreation opportunities, importance of green space, potential career path, how superintendents are stewards of the land.
- Shows the industry giving back to the community.
- Great visuals for television and newspaper photographers.

What to Expect

Be prepared to be interviewed by a reporter and to be able to highlight the key messages of the program and how this benefits the students (hands-on learning which supplements their in-class work, some kids may have never been on a golf course and are being introduced to both the game of golf and the potential career of turf management), the golf industry and the benefits of golf courses (importance of green space, wildlife habitat, pollution control, physical activity, stewards of the land, recreational opportunities, etc.…).

One thing to do when you are discussing the event with the teachers before they come out to the course is to tell the teachers there will be television or newspapers there and ask them to make sure the parents are aware of this.

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Day of the Field Trip

The day of the field trip has arrived! By now, you've selected your learning stations, assigned volunteers to lead each station, and have communicated the First Green field trip to your local media and community members. It's time for the fun and learning to begin.

A Day of the Field Trip checklist is on the following page for reference. Here are a few items to keep in mind:

- Make sure the teacher/youth leader points out any minors who should not have their picture taken, or to be interviewed if you have media present. Place these children in the same group. It makes it easier to ensure compliance if they are all together.
- Consider inviting the lead teacher to your golf course prior to the field trip. You can go over the agenda and work through any questions or concerns each of you may have.
- Communicate with your station leaders/volunteers as often as necessary. It can be beneficial to try and get together with everyone prior to the field trip to go over roles and the lesson plans.
- Remember that GCSAA has some First Green grants available to help with unexpected costs.
- Your Regional Representative will either deliver or ship the national First Green banners to display during your field trip. Thank you for appropriately displaying them for us!
- Finally, what will you do if it is raining? Keep an eye on the weather and communicate well in advance with the teacher. Previous field trips have either been postponed due to weather or moved indoors.

Thank you for your support of First Green! We are here to answer any questions you may have!

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First Green Checklist

Day of Field Trip

Set-up

- [ ] First Green Branded Feather Banner(s) and approved signage displayed near the welcome area.
- [ ] Welcome area near where the buses drop the students off. This will be where the superintendent can make his/her opening remarks.
- [ ] Place a table at each station. Leave supplies for that station on the table. Supply list can be found in each lesson plan.
- [ ] Have Station Leaders arrive about an hour before the students. Take the time to go over the plan for the day and to answer any questions.

Field Trip

- [ ] Divide kids into groups. Keep the groups around 10 students if possible.
- [ ] Have volunteers escort their groups to their station.
- [ ] Assign a timekeeper to help rotate and keep the field trip moving.
- [ ] 90 minutes to 2 hours total time.

Consider offering lunch. Have fun!

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Bugs

There are over 8 million different species of insects in the world! There could be over 2000 in a square foot! Insects aid in the decomposition of organic matter and in the formation of soil. They are responsible for the pollination of almost every fruit, flower, and vegetable crop. They serve as food for birds, reptiles, small mammals, and other insects.

Student Learning Objectives

1. **Learn and understand what an insect's job is, and where they live.**
   (Insects aid in the decomposition of soil, living in leaf litter, a combination of decomposing leaves, sticks, small animals, wet soil, organisms and lots of bugs. Bugs travel in and around soil leaving tunnels which helps with aeration of soil. Bugs can also help in pollination of fruit, flowers and vegetable crops.)

2. **Observe and document five different types of insects seen in containers.**
   Some examples: (slugs, millipedes, centipedes, ants, earwigs, squash bug, bee-tles, earthworms)

3. **Identify different anatomy parts of each type of insect found.**
   (Head, thorax, abdomen, legs, and wings)

4. **Identify what the study of insects is called (entomology).**
   (Entomologists have divided insects into 32 different orders; some might be millipedes, centipedes, crustaceans.)

5. **Identify how bugs eat.**
   (They use three different types of mouthparts for chewing, piercing and sucking, and biting.)

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Student Worksheet Questions

Review the worksheet questions with students at the beginning of lab and at the end. The worksheet may also be printed out for students to complete as part of the field trip.

1. Why are bugs important in our soil?
2. How do they aerate the soil?
3. How is leaf litter created?
4. What are the five anatomy parts of bugs?
5. What is the name of someone who studies bugs?
6. Describe how bugs eat.

   Note: The teacher may want to have additional material covered and will add to these questions. Take time to talk with the teacher in advance of the field trip.

Field Trip Requirements

- Several laminated pictures of all insects found in the leaf litter (maybe a few that will not be in the containers, can also include pictures of ants, ladybugs, beetles, spiders, etc.) These are at the end of this lab.
- 4 - 5 clear plastic tubs (best size: 18” x 24”)
- Collect enough leaf litter to fill 1/3 of each container.
- The day before, collect 7 or 8 different kinds of leaf litter insects for each container. Store in a large bin or trash can to keep in moisture and cover to keep bugs in. Be sure the lid has air holes.
- Plastic spoons and clear low cups for each student.
- Have wet wipes and a garbage bag for trash.

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Field Trip Outline

1. The golf course superintendent or golf course representative should begin the bug lesson by asking students if they have looked in the soil at their homes, and whether they know why bugs are important to soil. Let students share some of their knowledge. Show and explain to students, what leaf litter is and why it is important in a bug's life. Let them feel and touch it. Ask them how insects help with pollination; let them have a moment to think of what they do.

   Bees pollinate flowers; small animals, birds, and insects eat bits of fruit then poop seeds out in various areas. Refer to the questions at the beginning of the lesson plan.

2. If the learning lab is located where the students can see areas of the golf course, or a place where there might be leaf litter, point out some of the natural features such as: natural areas, wetlands, or wildlife corridors. Help students understand that these areas promote leaf litter, aerated soil, and pol-lination of small animals and insects. Ask students if there are other areas that they can think of that would have leaf litter and lots of bugs. Some of their answers might be: forests, gardens, or native areas. Ask students if they think all soil or leaf litter is the same? If the soil is dry and hard, what would that mean to the bugs?

3. Let the students look at the laminated pictures of your "found" bugs, before they get into the tubs to look for insects. Review the pictures with them so they know the names of the bugs. Some might be: slugs, worms, millipedes, centipedes, stinkbugs, sow bugs, earwigs, or beetles.

4. Once the students are comfortable with the names, let them carefully start dipping their spoons into the plastic tubs. Remind students that bugs are living creatures, and that they need to be careful in lifting and placing them back in the leaf litter. Students will use the spoons to lift their bugs into their cups to see them more clearly. As the students are looking through the containers, talk about how the bugs are moving and hiding in the leaf litter, and aerating the soil. Go over the mouthparts that they see, and the body parts that they are seeing. What body parts do kids have that are the same as the bugs? Students will want to tell you what they are seeing and identifying. Ask students to share with their friends at the table, and tell them which bugs they are finding.

   Let the Hunt Begin!

5. Ask students if they are enjoying finding and looking at bugs; which ones have they seen so far? Do they know what an "Entomologist" is? Explain that they are doing what an entomologist does sometimes, and that they study bugs every day in their laboratories.

   Expect adult chaperones to have as much fun as the students.

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Wrap Up and Review

Tell students that you will be reviewing with them. If there is time, you can hand out the worksheets for them to write down their answers, or have the teacher take the worksheets to extend the learning in the classroom. Discuss the following:

- What do you know about leaf litter? What is it made up of?
- What do bugs do in the leaf litter?
- What kind of bugs did you see?
- What are the 5 body parts?
- What are the different ways bugs eat?
- What does an Entomologist do?
- How do insects communicate? (Their sounds, or antennae, or chemical scents)

Lesson Extensions for Older Students

Have a quick discussion on what students think is a good bug (soldier bug, dragon fly, centipede, ladybug, black beetle) vs a bad bug (grasshopper, spotted asparagus beetle, leaf roller, grub, cutworm, squash bug, and crane fly) and what they could possibly do to the golf course turf.

Students can look through plastic tubs; identify the insect, check out the anatomy of each one. They can also figure out what "class" the insect is from.

- Millipedes (most have 30 or more pairs of legs)
- Centipedes (single pair of legs on each flat body segment)
- Crustaceans (Pill bugs / sow bugs have a tough exoskeleton that provides protection)
- Symphylum (tiny centipedes, with 12 pairs of legs) or insecta (insects, ants).

REMEMBER TO TAKE PICTURES. Permission forms are on the field trip page of our website.

Additional Resources

If you'd like to purchase any of the resources listed below, see http://www.thefirstgreen.org/resources-cited for more information.

Reiley, H. Edward., and Carroll L. Shry. Introductory Horticulture, 7th Edition. Clifton Park, NY: Thomson Delmar Learning, 2007. Print.

Ingels, Jack E. Ornamental Horticulture, Thomson Delmar Learning, 2000. Print. ISBN-13: 9780766814172
Encyclopedia of Bugs, by Miles Kelly Publishing. ISBN: 9781782094456

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Worksheet for Bug Lab

Date_____ Golf Course_____

Student Name_____

Please answer the questions below while participating in the learning lab.

1. Why are bugs important in our soil?

2. Why are bugs important to small mammals and birds?

3. What is leaf litter and how is it made?

4. What are the five bug parts?

5. What is the study of bugs called?

6. Describe how bugs eat.

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Print, cut and laminate to make bug identification cards.



Pill Millipede (Rolybug)



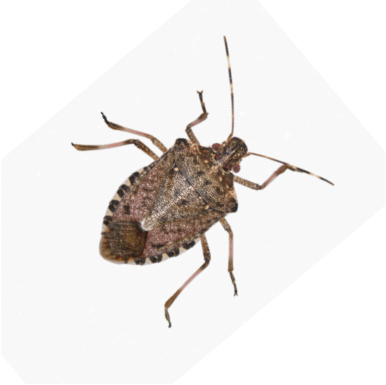
Ant



Earwig



Centipede



Squash Bug



Millipede



Earthworm



Spittle Bug



Crane Fly

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Cool Tools on the Green

This lesson plan is designed to go with our YouTube video,"Tech on the Golf Course."
The video https://youtu.be/yeh8uKTjqa4 should be viewed as part of the preparation for this lab.

Technology is increasingly used on golf courses, just as it is in everyday life. Golf course superintendents rely heavily on the new tools in maintaining the greens to create optimum putting surfaces. The most important part of the golf course is the green, where golfers spend 40% their time. Superintendents and their crews use cool technology to make sure the green is in perfect condition daily. They need to meet the demands and high expectations of the golfers to deliver very smooth surfaces for players.

Student Learning Objectives

1. **Describe what a prism gauge is and how it is used.**
   (A prism gauge is used to measure the height of the cut and to show superintendents how well the mowers are cutting.)

2. **Explain the differences between shoot heights in relation to root length on different areas of a golf course such as fairways vs the putting green.**
   (Golf greens are mowed very short and turf grows mostly on a sand base with a small amount of soil. Fairways grow on a soil base and are let grow longer.)

3. **Demonstrate how a soil probe is used and explain why it is important to superintendents.**
   (A soil probe is inserted into the turf and pulls a sample of the turf and underlying soil. It is the fastest way to be able to see the root health, length, and thatch content as well as moisture amount of the soil.)

4. **Describe how a moisture meter works and why it is important tool on a green.**
   (Moisture meters are inserted into the turf with sensors that measure and display the percentage of moisture in the root zones of different areas of the green. They are helpful in knowing how much water the green needs on a daily basis.)

5. **Explain why Stimpmeters are important to superintendents for greens maintenance.**
   (A Stimpmeter is used to check for the consistency and speed on a green and throughout the golf course. This is important so that all greens on the course are the same speed for golfers.)

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6. **Explain why superintendents use a macroscope.**
   (Macroscopes allow superintendents to take a closer look at the blade of grass to be able to identify possible diseases and see if the mowers are cutting sharply and evenly.)

7. **Describe the differences between a reel and a rotary mower.**
   (Reel mowers have 7-14 blades that spin on a shaft like a wheel. Reel mowers are very precise and can be set down to very low heights of cut. Rotary mowers have 1 blade that spins around horizontally. These are the same mowers that homeowners use.)

Student Worksheet Questions

Review the worksheet questions with students at the beginning of the lab and at the end. The work-sheet may also be printed out for students to complete as part of the field trip.

1. Name four tools that are used on the green and explain how they are used on the green.
2. Explain the relationship between shoot heights and root length as it relates to height of cut.
3. What is a soil probe used for and what results can be obtained from its use?
4. Why and how is a moisture meter used?
5. Explain the differences between a reel and a rotary type mower.

Field Trip Requirements

- Choose a putting green for this lab
- 2 quarters (2 x $.25)
- Rotary mower
- Reel mower
- Prism, 2 soil probes, Stimpmeter and a macroscope
- Moisture meter
- Printed copies of student worksheets

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Field Trip Activity Outline

1. The instructor should start the lab by asking students if they have ever been on a golf green. Or, have they ever mowed a lawn? Students will have several answers to share. Ask students if they think their lawn is different than the grass they are standing on.

2. Ask students to feel the turf on the green. What does it feel like? Is it truly real? Talk to them about the time it takes to maintain a green and what goes into it.

3. Stack two quarters (which shows the approximate green cutting height) and show to the students. Ask kids what they think their home lawn length might be.

4. Show and tell students about how a prism works and why it is used. A prism is used to measure the height of the cut. Let students get down and look through the prism so they can see the height of cut; discuss how it is used.

5. Show students the differences between a reel mower (7 - 14 blades) and a rotary mower (1 blade and spins horizontally) and how they cut. Speak about the mower maintenance, and how sharp the blades must be to make a clean cut. Golfers, who spend 40% of their time on a putting green, are very partic-ular. They expect a perfect surface which requires considerable maintenance activity at the golf course.

6. Show students the moisture meter and explain why it is an important tool for superintendents to measure the percentage of moisture in the soil. Take several readings on the green and discuss your findings. Talk about how it is used to measure water in the soil and how much irrigation might be necessary that day. Superintendents are environmentally conscious about not over watering and only watering when needed. Let students take some readings at different locations and discuss why these may be different percentages of moisture.

7. Discuss how and why a soil probe is used. Take two samples, one on the green and the other off the green. Show the differences between the grass height and the root length. Show students the root zone material and how it affects growth. Students can also look at the moisture content of the sam-ples and check to see if there any thatch present. Explain how excessive thatch affects putting green surfaces.

8. Show a macroscope and explain how it is used on the green. Macroscopes allow the superintendents to look at the health of the plant. They also can identify any diseases in the turf and check to see if the mowers are cutting properly. Let students look at a soil sample through the macroscope. What are they seeing?

9. Show and explain a Stimpmeter and how it is used to check for consistency and speed throughout the golf course. Show students how you use it and why it is an important tool for managing greens speed on the course. Let students take turns and measure the distances and compare measurements.

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Wrap and Review Together

Ask students if they have any questions about what they learned.

1. What are four cool tools that are used on a green and how and why are they used?
2. What is the relationship between grass height and root length?
3. What is a soil probe used for and what does it tell a superintendent?
4. Why is a moisture meter used?
5. What are the differences between a rotary mower and a reel mower?

Other good questions at closing of the lab:

1. How many would like to learn how to play golf?
2. What was the coolest take-away from this lab?

Lesson Extensions for Older Students

In groups of 4 or 5

- Have students measure and write down their findings from moisture gauge readings on different areas of the green. Ask the students to explain these differences.
- Test the Stimpmeter on different areas of the green for consistency and compare.
- Use the prism gauge on different parts of the green and compare findings.

Remember to get some pictures of kids. Check thefirstgreen.org for necessary release forms.

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Worksheet for Cool Tools on the Golf Course

Date_____ Golf Course_____

Student Name_____

Please answer the questions below while participating in the learning lab:

1. Name four tools that are used on the green and explain how they are used on the green.

2. Explain the relationship between shoot heights and root length as it relates to height of cut.

3. What is a soil probe used for and what results can be obtained from its use?

4. Why and how is a moisture meter used?

5. Explain the differences between a reel and a rotary type mower.

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Golf and the Environment

Golf courses are community green spaces that provide recreational and environmental benefits to local areas. Golf courses are large parcels of land with healthy turf, trees and other vegetation. Collectively, they provide wildlife habitat, improve air quality, reduce noise and dust, filter surface water, recharge ground water supplies, and in many cases are used to reclaim and restore environmentally damaged sites.

Student Learning Objectives

1. **Identify and record the natural environmental features which were incorporated into the design of the golf course.**
   Lakes, ponds, wetlands, trees, rivers, streams, topography, geological features and native areas.

2. **Identify and record golf course features which were designed or planted to protect the environment. Explain how the features protect the environment.**
   Drainage and storm water retention systems, use of native and pest resistant plants, and buffer zones.

3. **Identify golf course maintenance practices designed to conserve resources and protect the environment.**
   IPM strategies, low maintenance areas, mowing heights, irrigation schedules, recycle clippings.

4. **Identify positive environmental factors that a golf course provides to the surrounding community. Explain the benefits of each.**
   Wildlife habitat, clean air, water filtration and recharge, noise reduction, and land reclamation.

5. **Observe and record how water moves through soil and the factors which affect drainage.**
   Gravity, soil texture, layering and perched water table.

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Field Trip Requirements

- Safe location on the golf course where running water is available and students can see examples of environmentally friendly architectural design, and maintenance practices.
- Aerial photo of the golf course.
- Samples of sand, silt, clay, gravel or other soil components.
- Six empty two-liter clear plastic bottles with the bottoms cut off. The upper (neck) portion will be used.

Field Trip Outline

The golf course superintendent or golf course representative will host a walking tour of the golf course with an emphasis on introducing students to the positive environmental impact of a golf course within the community.

The host will begin by showing an aerial photo of the golf course (or sample golf course) and point out how the golf course fits into the surrounding natural environment. The host will then lead the group on a walking tour of the golf course; pointing out natural features such as lakes, ponds, wetlands, trees, rivers, streams, topography, geological features, wildlife corridors and native areas. Tell how these features impact the surrounding area. The host will also point out golf course design elements (drainage swales, native plants and buffer zones) along with maintenance practices (use of IPM, low maintenance areas, mowing heights and clipping recycling) and discuss the environmental impact of each element or practice.

For the class activity, the students use empty two-liter, clear plastic bottles to view water movement through soil. After cutting three inches off the bottoms of the bottles and plugging the neck opening with cotton or paper towels, the students will fill the bottles 2/3 full of the different soils. Representative samples of straight sand, silt, clay along with layered combinations should be used for demonstration. The students will then pour water over the soil and watch the water move through the soil. The host will then discuss the factors which influence water movement through soil. Factors such as gravity, soil type, compaction, layering, and perched water table should be discussed.

Additional Resources

- Textbook titled: Turfgrass Management for Golf Courses by James B. Beard
- Booklet titled: Environmental Principles for Golf Courses in the United States by The Center for Resource Management

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Golf Course Operations

Golf is a game which was first played in Scotland more than 500 years ago. The game made its way to the United States in the early 1800's and today is enjoyed by more than 30 million Americans. Golf courses are classified into two major categories based on accessibility for golfers. They are either open to the public or accessible through a private membership. The game of golf is growing in popularity, and as a business, contributes substantially to the local economy through employment, taxes, property value improvement and the support of local charities through fund raisers.

In 2016, golf's economic impact in the United States was $191.9 billion dollars. Within a golf course operation there are usually at least three departments; turfgrass maintenance, food and beverage, and the pro shop operation. Each department is managed by professional trained staff that work together to produce the best possible playing experience for their guests. In fact over 1.9 million jobs in the United States are impacted by the golf industry.

Student Learning Objectives

1. **Become familiar with and understand the specific uses of the different equipment used to maintain a golf course.**
   Walking and riding mowers, reel and rotary mowers, bunker rakes, carts and special equipment.

2. **Identify and investigate the career opportunities available in the golf industry.**
   Golf course design, landscape and maintenance; golf professional, club house management.

3. **Experience golf through participation in a golfing activity.**
   Become a golfer by hitting golf balls on the driving range or putting green.

4. **Identify and explain the different playing surfaces that comprise a golf course.**
   Green, tee, fairway, rough, bunker, water hazards and out-of-bounds.

5. **Gain knowledge of the history and development of the game of golf. Understand the history and development of the local golf course**
   Golf began in Scotland, and came to the U.S. in the early 1800's, local golf course history.

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Field Trip Requirements

- Safe location on the golf course such as the putting green or driving range to facilitate a golfing experience.
- Group will tour clubhouse, pro shop, and golf course maintenance facilities.
- Printed job descriptions and job applications.
- Golf clubs and/or putters, golf balls.
- Rules of golf booklet.

Field Trip Outline

The golf course superintendent or golf course representative will host a walking tour of the golf course. Stops will be made at the clubhouse, pro shop and maintenance facility. The emphasis of the tour will be to introduce students to the game of golf, introduce available career opportunities, and discuss the financial impact of a golf course within the community. The host will begin with a brief discussion about the history of the golf course and the game of golf. The host will then lead the group on a walking tour of the golf course; pointing out the different playing surfaces such as greens, tees, fairways, roughs, bunkers, water hazards and out-of-bounds. Tell the purpose of each surface, and include some maintenance practices required for each area. Upon arriving at the maintenance facility, show the students the equipment used to maintain the golf course. Allow the students the opportunity to sit on the equipment. Discuss with the students the available careers in the golf course industry and pass out seasonal job applications to all who are interested. Travel to the location where the golfing experience will take place. Before the students are allowed to hit golf balls, discuss safety and etiquette rules. Demonstrate hitting a golf ball for the students, and then allow them to have fun in a safe environment. If possible, design a competition between the students and award prizes (golf balls) to the students.

Additional Resources

- Textbook titled: Turfgrass Management for Golf Courses by James B. Beard
- Textbook titled: The Rules of Golf printed by the United States Golf Association

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Macro Invertebrates

Water is essential to all life. Water is a place to explore and understand the aquatic habitats that water supports. The aquatic environment may be in lakes, ponds, streams and wetlands. Aquatic wildlife, macroinvertebrates, depend on aquatic habitats for survival. Why do these bugs matter?

Aquatic species and ecosystems give humans early warnings about the quality of the environment in which they live. The absence or presence of certain species tells us about the quality of the water. This is called the biotic index.

Explanation of biotic index: In many streams and ponds, several organisms called indicator species tell us about the quality of the water in that area. The macroinvertebrates comprise a biotic index. Their absence or presence tells us something about the water quality. Water with a varied number of creatures is healthy. Water with only a few species indicates the water is less healthy.

Student Learning Objectives

1. **Describe macroinvertebrates, aquatic wildlife and habitats.**
   (Organisms that lack internal skeletons, and are can be seen with the naked eye. They live in ponds, streams and other places where there is enough water, and they are an integral part of stream ecosystems)

2. **Identify several macro invertebrates with help from pictures.**
   (Examples of macroinvertebrates might be; sow bug, scud, backswimmer, mayfly, caddisfly, damselfly, crayfish, beetle and stoneflies.)

3. **Understand the relative environmental quality of the stream or pond.**

4. **Be able to explain the biotic index.**

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Student Worksheet Questions

Review the worksheet questions with students at the beginning of lab and at the end. It may also be printed out for students to complete as part of the field trip.

1. Describe a macroinvertebrate. Name 3 different ones.
2. Why is water important to aquatic species and habitats?
3. Where does the aquatic environment happen?
4. What is the Biotic Index?

Note: The teacher may want to have additional material covered which can be added to these questions. Take time to talk with the teacher in advance of the field trip.

Field Trip Requirements

The day before, make sure you find in your stream or pond, enough macroinvertebrates to have in all your tubs. Each tub should have approximately the same amount, but can all be different types.

1. Ask the teacher to have the students in groups of four.
2. 2 or 3 waist-high tables, for groups to be able to work on both sides.
3. Four to five 12” square white plastic tubs (Bugs show up better in white tubs.)
4. Low, clear plastic cups, 2 per group.
5. White plastic soup spoons to retrieve bugs (4 per group).
6. Wet wipes and garbage bags.
7. Laminated pictures of all possible macro invertebrates – 1 set per 2 groups (included with this lab).
8. Clip board and pencils for each group.

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Field Trip Outline

1. Ask students, “What kind of bugs do you think you’ll see?”

2. Show students the laminated pictures of the macroinvertebrates. Identify each one, and let them look at them close up. (Body type, legs, hairy, exoskeleton, tails etc.)

   (Examples of some invertebrates that they might see in your pond or stream could be: mayflies, stoneflies, dragonflies, caddisflies and worms, beetles, crayfish, scud, backswimmers, aquatic sow bugs.)

3. Explain how fragile the aquatic bugs are, and that students need to be gentle when handling them with the spoons and cups. When they are done with one type, gently place them back into tubs and look for more.

4. Ask students to observe the water first, to see what invertebrates might be on the surface. What are they doing? They might see backswimmers, worms, water boatman, water spiders or crane flies.

5. Students will be excited to start collecting invertebrates with their spoons and placing them in their clear cups for observation.

6. If time allows, have students record on the attached worksheet which macro invertebrates they found and how many of each kind.

7. After the observation time, and if time allows, ask students to finish up their worksheets with their group members.

Wrap Up

1. Tell students you are going to review the lab. While reviewing, ask kids to tell you the answers.

2. Ask students what macro invertebrates they saw and learned about today. Ask students how many macroinvertebrates they saw. Ask them which they liked the best and why.

3. Ask students if they think the water from where you retrieved the bugs is healthy.

4. Ask students, “What could make the pond or stream polluted or hard for macroinvertebrates to live in?” (Some answers might be: soap in the water, oil, fertilizers, sewage, construction, etc.)

5. These pollutants go down a storm drain, and how it ends up in streams and ponds. Briefly explain the difference between storm water and sewer drains. Ask the students how they could help keep the water clean for these organisms and have healthy streams. See our learning lab on water that has this information. (Wash the car on the grass, or go to the car wash, be careful about fertilizers and keep them away from driveways and walkways, scooping the poop, etc.)

6. Ask students what they learned, and how many new words they learned in today’s lab. (macroinvertebrates, biotic index, aquatic species)

Remember to take pictures – the permission forms are on our field trip page.

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Additional Resources

If you'd like to purchase any of the resources listed below, *see http://www.thefirstgreen.org/resources-cited for more information.*

Project Wild, Western Association of Fish and Wildlife Agency, and Western Regional Environmental Education.

Project Wet, Curriculum and Activity Guide, by Montana State University, 1995.

Murdoch, Thomas, Martha Cheo, and Kate O'Laughlin. Streamkeeper's Field Guide: Watershed Inventory and Stream Monitoring Methods. Adopt-A-Stream Foundation, 1996. Print.

Freshwater Habitats Trust Identifying Creatures in Your Pond. Web. 8 Nov. 2015.
LaMotte Aquatic Insect Identification Flash Cards, Pkg. of 18, Mfr. Model #:5882-SA1.

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Worksheet for Macro Invertebrates Learning Lab

Lab Extension for older students

Date_____ Golf Course_____

Student Name_____

Weather Conditions: ☐ Clear ☐ Cloudy ☐ Rainy ☐ Other _____

MACROINVERTEBRATE	HOW MANY DID YOU SEE?
Mayflies	
Stoneflies	
Caddisflies	
Other:	

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Worksheet for Macro Invertebrates Learning Lab

Date_____ Golf Course_____

Student Name_____

1. Why is the water important to the aquatic species and habitat?

2. Where does the aquatic environment happen?

3. Explain the biotic index?

4. Describe a macroinvertebrate.

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Print, laminate to make bug identification sheets.



Mayfly



Stonefly



Aquatic Earthworm



Aquatic Sowbug



Freeliving Caddisfly



Case Makers



Scud



Crayfish



Water Boatman



Backswimmer



Crane Fly

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Math #1

Football Field (Square Footage)

Superintendents use math on the golf course in many ways and area measurements are the most important. A golf course superintendent should be able to accurately calculate the size of an area. Once the size is calculated and an application rate is chosen, the total amount of seed, fertilizer, or topdressing sand to be used can be determined.

Student Learning Objectives

1. **What is a square foot?**

2. **What is a rectangle and how do you calculate the area of a rectangle?**

3. **What is an acre and how many square feet are in an acre?**

4. **A football field is a rectangle.**
   How many square feet are in a football field?
   [120 yards long-end zones included, and 53.33 yards wide]
   How many acres is one football field?

Note: The teacher may want to have additional material covered. Take time to talk with the teacher in advance of the field trip.

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Field Trip Requirements

- 100 foot measuring tape
- Calculator
- Clipboards and pencils
- Irrigation flags or spray paint to determine the corners of the area being measured

Field Trip Activity Outline

Take the students out to an area on the golf course to calculate the size of an area. Start out with a smaller rectangle -- about 20 X 30 feet and have the students measure that area. Mark the corners with irrigation flags or spray paint so the students can see the total area being measured.

Ask The Students

- How do you determine the area of a rectangle?
- What is a square foot and how big is it?
- How many square feet are in the sample area?

Steps

1. Ask students to pair up.

2. Give each pair of students a worksheet, and a pencil. These calculations can easily be done without a calculator.
3. Instruct the students to fill in the numbers on the worksheet.

4. Have the students ask any questions they may have completing the worksheet.

5. Go over their results and compare to the worksheet answers.

6. End with a discussion of what they learned and why it is important to be able calculate area measurements.

Additional Recommended Reference

Christians, Nick, and Michael L. Agnew. The Mathematics of Turfgrass Maintenance. 3rd ed. N.p.: Wiley, 2000. Print.

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Worksheet #1 for Math on the Golf Course

Date_____ Golf Course_____

Student Name_____

Calculating Area Measurements

1. The area of a rectangle is determined by length (l) X width (w).
   One square foot is 12 inches by 12 inches. How many square inches are in one square foot?

2. A yard is three feet long. One square yard is 3 feet by 3 feet, or 9 square feet.
   What are the dimensions of the sample area (in feet or meters)?
   length_____ width_____

3. What is the area in square feet (or square meters) of the sample area? _____

4. An American football field is 53.33 yards wide by 120 yards long (end zones included).
   How many square feet is one football field? _____
   How many square yards? _____

Extra Credit/Extension

1. One acre is 43,560 square feet. How many acres is one football field?

2. If a golf course is 145 acres in size, how many football fields would fit on the golf course?

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Math #2

Square Footage of an Irregular Space

Superintendents use math on the golf course in many ways and understanding area measurements is essential in managing the golf course. A golf course superintendent should be able to accurately calculate the size of an area. Once the size is calculated and an application rate is chosen, the total amount of seed, fertilizer, or topdressing sand to be used can be determined.

Student Learning Objectives

1. **What is a square foot?**

2. **How do you calculate the area of an irregularly-shaped space?**

3. **What is an acre and how many square feet are in an acre?**

4. **Why is it important to be able to calculate area measurements?**

Note: The teacher may want to have additional material covered. Take time to talk with the teacher in advance of the field trip.

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Field Trip Requirements

- 100 foot measuring tape
- Calculator
- Clipboards and pencils
- An irregularly-shaped area to measure such as a green or a sand bunker

Field Trip Activity Outline

Take the students out to an area on the golf course to calculate the size of an irregularly-shaped area. A putting green or a sand bunker works well. Explain what a square foot is and how big it is. Explain the offset method for determining the area. Help them determine what distance between the offset lines to use. How many square feet are in the sample area?

Ask The Students

- How do you determine the area of a rectangle?
- How could you figure out the square footage of an irregular shape?
- How many square feet are in the sample area?

Steps

1. Ask students to pair up.

2. Give each pair of students a worksheet, and a pencil. These calculations can easily be done without a calculator.

3. Instruct the students to fill in the numbers on the worksheet.

4. Have the students ask any questions they may have completing the worksheet.

5. Go over their results and compare to the worksheet answers.

6. End with a discussion of what they learned and why it is important to be able calculate area measurements.

Additional Recommended Reference

Christians, Nick, and Michael L. Agnew. The Mathematics of Turfgrass Maintenance. 3rd ed. N.p.: Wiley, 2000. Print.

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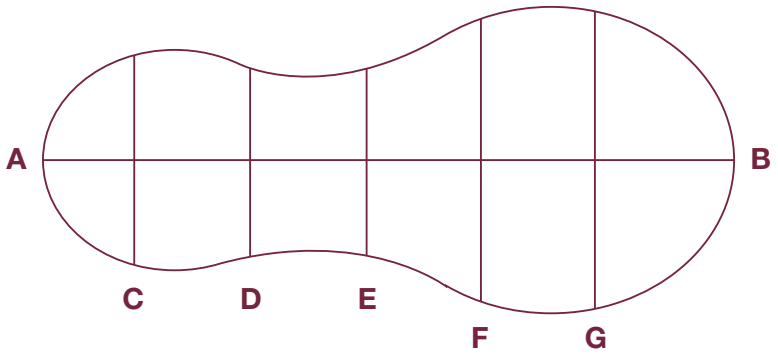
Worksheet #2 for Math on the Golf Course

Date_____ Golf Course_____

Student Name_____

Calculating Area Measurements

1. The area of an irregular shaped area is calculated by using the offset method.



Step 1. Determine the length line, the distance between points A & B _____.

Step 2. Determine the distance between the offset lines _____.

Step 3. Add the lengths of the offset lines, C + D + E + F + G

(your area may use more) _____.

Step 4. The length of the combined offset lines is _____ feet (X).

Step 5. The distance between the offset lines is _____feet (Y).

Step 6. Area = X times Y _____ square feet.

Extra Credit/Extension

One acre is 43,560 square feet. How many acres is the irregular shaped area?

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Math #3

Measuring and Calculating Stream Flow

Superintendents use math on the golf course in many ways and understanding volume measurements is essential in managing the golf course. A golf course superintendent should be able to accurately calculate volume to properly apply sand topdressing, apply pesticides, or determine the volume of water in a pond. This lesson will determine the volume of water in a stream and calculate its velocity.

Student Learning Objectives

1. **What is a square foot?**

2. **What is a cubic foot, and how many gallons are there in a cubic foot of water?**

3. **What is an acre and how many gallons are there in one acre foot of water?**

Note: The teacher may want to have additional material covered. Take time to talk with the teacher in advance of the field trip.

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Field Trip Requirements

- Slow moving stream with depth below 18 inches and banks low enough for easy access (the flow needs to be slow enough for kids to safely move around in it).
- 100 foot measuring tape
- 2 pairs of rubber boots (appropriately sized for the age of kids attending the field trip) to wade in the stream
- Yardstick or other measuring device for depth measurements
- Calculator
- Pen and paper
- Stream flow worksheets with clipboards
- Stopwatch
- Orange or tennis ball to float down the stream

Field Trip Activity Outline

1. Take the students out to an area on the stream that is out of play on the golf course where the banks are low enough for easy access.
2. Explain what is a cubic foot (a square that is one foot high, one foot long, and one foot wide.) One cubic foot of water contains 7.48 gallons.
3. Explain an acre foot of water contains 325,000 gallons. (You can relate that to the size of your irrigation pond or other pond on the course).
4. Talk about stream flow and how it is expressed as in cubic feet per second (CFS).

Ask The Students

- What is a square foot?
- What is a cubic foot?
- Why would a superintendent need to know the square footage of areas of the course?
- Why would a superintendent need to know the cubic footage of an irrigation pond?

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Steps

1. Ask students to pair up. Get two volunteers to put on the rubber boots for in stream measurements. Another student is needed to record the time measurements.

2. Give each pair of students a worksheet, clipboard, and a pencil. These calculations need to be done with a calculator.

3. Instruct the students to mark out a 50 foot section of the stream. Drop a tennis ball, orange, or marshmallow in the stream and record the amount of time it takes to travel 50 feet. Do this 4 times and record the findings on the worksheet. Add the four numbers together and divide by 4 to get the average surface velocity of the stream. Record the number on the worksheet.

4. Pick an area within the 50 foot section to measure the width of the stream. Stretch the tape measure across the stream and record the width on the worksheet. Have one of the students use a yardstick or other measuring device to take the depth readings at one foot intervals along the tape measure. Record the findings on the worksheet then add the depth interval numbers together. Divide by the number of readings to get the average depth of stream.

5. Work through the rest of the worksheet to determine stream velocity in cubic feet per second (CFS). Ask students why they think a correction factor is used in calculating velocity.

6. Extra Credit
   If a stream is flowing at 8.5CFS, what is the flow rate in gallons per second? What is the flow rate in gallons per hour? What is the flow rate in gallons per day? What is the flow rate in acre feet per day?

7. End with a discussion of what they learned and why it is important to be able calculate volume measurements.

Additional Recommended Reference

Christians, Nick, and Michael L. Agnew. The Mathematics of Turfgrass Maintenance. 3rd ed. N.p.: Wiley, 2000. Print.

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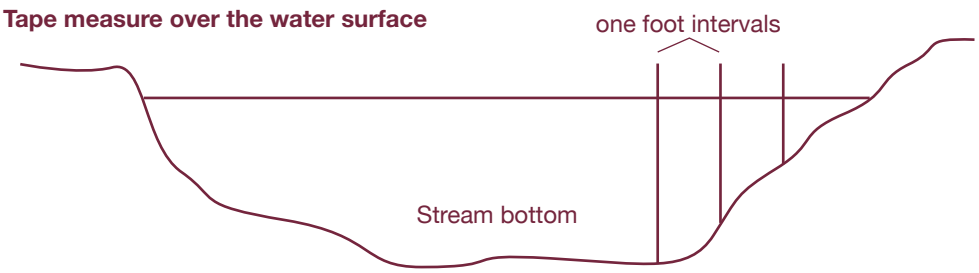
Worksheet #2 for Math on the Golf Course

Date_____ Golf Course_____

Student Name_____

Measuring and Calculating Stream Flow

AREA X CORRECTED VELOCITY = FLOW



First, let's calculate the area of a "slice" of the stream.

AREA = WIDTH X AVERAGE DEPTH

Width of Stream_____ (in tenths of feet)

Depth of stream at 1-foot intervals

1.

2.

3.

4.

5.

6.

7.

8.

9.

10.

11.

12.

13.

14.

15.

Average depth of stream:

_____

AREA = Width x Avg. depth =

_____

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Calculate Corrected Velocity

Surface velocity of stream (20 feet in seconds). Take 4 measurements.

1.

2.

3.

4.

Calculate the average surface velocity of stream for 20 feet _____ (seconds)

1-foot stream velocity_____ (ft/second)

Select **Correction Factor** based on river bed characteristics.

a) Rough, loose rocks, coarse gravel or weeds - .0.8

b) Smooth, mud, sand or bedrock – 0.9

CORRECTED VELOCITY of stream for 1 foot _____ (ft/second)
(Multiply 1-foot stream velocity by correction factor above.)

AREA X CORRECTED VELOCITY = FLOW

STREAM AREA: Multiply stream width by average stream depth _____ ft2
(You calculated this on p. 1 of the worksheet.)

CORRECTED VELOCITY: _____
(You calculated this above.)

FLOW: _____ ft3/sec or cfs
(Multiply STREAM AREA by CORRECTED STREAM VELOCITY.)

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Soils

Golf courses are community green spaces that provide recreational and environmental benefits to local areas. Golf courses are large parcels of land with healthy turf, trees and other vegetation. Collectively, they provide wildlife habitat, improve air quality, reduce noise and dust, filter surface water, recharge ground water supplies, and in many cases, are used to reclaim and restore environmentally damaged sites. Healthy soil is a study topic in environmental science classes and offers teachers and students learning activities on every golf course.

Student Learning Objectives

1. **Identify the three components of soil and the ideal mixture of the components for soil that supports growth of grass and plants.**

   (Sand, silt and clay are the three components. The goal is to minimize the amount of clay for better water drainage. On the golf course, the best soil for fairways and borders is sandy loam which is a mixture of 70% sand, 20% silt and 10% clay. Soil on the greens is more like 90% sand, 7% silt and 3% clay.)

2. **Explain the importance of soil nutrients in supporting healthy turf and water filtration.**

   (Soil nutrients are essential for plant growth (like vitamins and minerals to humans). These nutrients need to be in balance for plants. Water filtration allows the plants to absorb water for life; excess water in the soil robs the plants of nutrients and eventually kills the plants.)

3. **Describe the best range of pH numbers for healthy plants and what can be done to keep soil at this level.**

   (The ideal pH range for healthy plants is 6 to 7. Golf course superintendents test the soil to determine the kinds of nutrients necessary to correct imbalances. Depending on the age of the students, you can discuss ways that you correct imbalances on the golf course through targeted fertilizers and adequate organic mixture in the soil.)

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Student Worksheet Questions

Review the worksheet questions with students at beginning of lab and at the end. It may also be printed out for students to complete as part of the field trip.

1. List three environmental benefits of golf courses.

2. What are the three components of soil?

3. Why do soil nutrients matter?

4. What is the ideal pH number for healthy soil?

Note: The teacher may want to have additional material covered and will add to these questions. Take time to talk with the teacher in advance of the field trip.

Field Trip Requirements

- Samples of sand, silt and clay.
- Soil sieve.
- Collect enough leaf litter to fill 1/3 of each container.
- Three or four empty water bottles with the bottoms cut off to use for water filtration lesson.
- Soil probe to pull soil samples.
- Soil testing kits for testing pH. See the First Green website for ordering information. (http://thefirstgreen.org/-superintendent-resource-kit)

Field Trip Activity Outline

1. The golf course superintendent or golf course representative should begin the soils lesson by asking the students if they take care of lawns at home and whether they know what kind of soil it takes to grow healthy grass and plants. Use the questions at the beginning of the lesson plan. If the learning lab is located where the students can see the golf course, point out some of the natural features such as lakes, ponds, wetlands, trees, rivers, streams, topography, geological features, wildlife corridors and native areas. For older students, also point out golf course design elements (drainage swales, native plants and buffer zones) along with maintenance practices (use of low maintenance areas, mowing heights and clipping recycling), and discuss the environmental impact of each element or practice and how a healthy soil is the underlying requirement.

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2. A soil sieve is useful in demonstrating the components of soil. Put some soil in the top of the sieve and allow students to take turns shaking the sieve. Stop and open the layers of the sieve one or more times to show students how the soil moves through the sieve. Students like to feel the sand, silt and clay as one way to understand the differences in texture. If your golf course has significant amounts of clay, younger students like to take the clay to shape it into objects and also feel a ball made of dried clay. You can shape a ball of clay and let it dry out completely to use as a learning sample.

3. To view water movement through soil, use empty, clear plastic bottles. Individual size water bottles work well. In preparation for the class, the superintendent should cut off two inches off the bottoms of the bottles and plug the neck opening with cotton or paper towels. Fill the bottles 2/3 full of the different soils. Put one sample in each bottle and the fourth can be a combination of different layers. Have a bottle of water at the learning lab and ask the students to pour water over the soil and watch the water move through the soil. The learning lab host should then discuss the factors which influence water movement through soil. Factors such as gravity, soil type, compaction, layering, and perched water table can be discussed appropriate to the age level of the students.

4. Additional learning labs on soil: students learn by seeing soil samples using the soil probe. Grass roots, layers of sand and other soil features are readily identified. Middle school students enjoy using the soil probe to pull their own individual soil samples if there is time to allow them to do so. Soil testing kits usually include the materials necessary for explaining soil nutrients. Students are easily involved in testing the soil for pH as part of the discussion on soil nutrients. Use the soil testing kit as directed. Take a soil sample and conduct the test, allowing students to be involved in each step of the testing such as inserting the drops and shaking the test tubes. Talk with the students about the ideal pH for soil and what you have to do on your golf course to maintain this level. Ask students why homeowners and golf courses aerate turfgrass. What are the benefits? Explain what this is if the students do not know.

Wrap Up

Tell the students that you are going to review what they have learned. Ask them the questions that you posed at the beginning of the lesson plan and make sure they know the answers. If you are using the worksheet, have the students complete the worksheet and read out the answers.

The teacher may want to have additional material covered and will add to these questions. Take time to talk with the teacher in advance of the field trip. Depending on the age level of the students, the teacher may request more detail on one of these topics such as soil nutrients.

1. List three environmental benefits of golf courses.
2. What are the three components of soil?
3. Why do soil nutrients matter?
4. What is the ideal pH number for healthy soil?

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Worksheet for Soils Learning Lab

Date_____ Golf Course_____

Student Name_____

Please answer the questions below while participating in the learning lab:

a. List three environmental benefits of golf courses.

   1.

   2.

   3.

b. What are the three components of soil?

   1.

   2.

   3.

c. Why do soil nutrients matter?

d. What is the ideal pH number for healthy soil?

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Water

About 71% of the earth is covered by water. The world's total water supply of about 332.5 million mi^3 of water, over 96 percent is saline. And, of the total freshwater, over 68 percent is locked up in ice and glaciers. Another 30 percent of freshwater is in the ground. Rivers are the source of most of the fresh surface water people use, but they only constitute about 300 mi3 (1,250 km3), about 1/10,000th of one percent of total water. With the small percentage of drinkable fresh water, it's important to preserve water quality.

Student Learning Objectives

1. **Understand the difference between storm drains and sanitary sewers.**
   (Storm drains carry rainfall runoff and other drainage untreated to local streams, rivers and lakes. Sanitary sewers carry everything from the inside of houses and buildings to a wastewater treatment plant before it is discharged into local waterways.)

2. **Learn what can be done at home to protect water quality.**
   (Scoop the poop (pet waste), "hit the target" (keep product off of hard surfaces to prevent runoff into storm drains) when using fertilizer and pesticides at home, use commercial car wash or wash car on grass, allow nothing but rain down the drain.)

3. **Identify and describe measures taken by golf courses to protect the quality of water on the course.**
   (Buffer strips around water, covering drains and removing product from cart paths when applying dry fertilizer, growing healthy turfgrass (avoids having to use extra products), no spray zones, bioswales for drainage, high tech spray equipment, timing and application methods, including use of weather data to determine ideal timing of products; equipment wash off stations and water-oil separators and water quality testing.)

4. **Take samples from a golf course water body and analyze the results. You may choose to do one or more of the following tests, depending on available time.**
   (Nutrient content in the water (nitrates, ammonia, and phosphorus), dissolved oxygen, and pH.)

Note: If your course uses reclaimed water for irrigation, share with the group that the quality of the reclaimed water often differs depending on the treatment plant that it comes from. Individual states normally set the standards for reclaimed water, so it may differ from state to state, in terms of quality, particularly sodium content.

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In many cases, sulfur and sulfur-containing fertilizers are applied to soils to bring down the pH. In other instances, superintendents will acidify the actual water using an acid injection or a sulfur burner which brings down the pH levels before the water is used for the irrigation. It's more expensive and requires equipment, but nevertheless, a lot of courses using reclaimed water do just that.

Student Worksheet Questions

Review the worksheet questions with students at beginning of lab and at the end. It may also be printed out for students to complete as part of the field trip.

1. Water quality

    a. What is the difference between a storm drain and a sanitary sewer?

    b. How can we protect water quality at home?

    c. How do golf courses protect water quality?

    d. What did you learn from the water test process?

Note: The teacher may want to have additional material covered and will add to these questions. Take time to talk with the teacher in advance of the field trip.

Field Trip Requirements

- Safe location on the golf course to take class of students, adjacent to a lake or pond.
- LaMotte Pondwater Tour testing kit or similar water testing kit.
  See First Green website (http://thefirstgreen.org/-superintendent-resource-kit) for more information.
- Bucket of water collected from nearby pond or stream.

Field Trip Activity Outline

Water Quality

Either host a walking tour of the golf course or just stand and point and discuss lake and pond management. You might discuss the use of buffer strips around water, covering drains and removing product from cart paths when applying dry fertilizer, growing healthy turfgrass (avoids having to use extra products), no spray zones, bioswales for drainage, high tech spray equipment, timing and application methods, including use of weather data to determine ideal timing of products; equipment wash off stations and water-oil separators and water quality testing.

If possible, locate your learning lab near a lake or pond. Beforehand, fill a bucket from the water source so students won't risk falling into the water to collect their samples.

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Ask The Students

1. What is the difference between storm drains and sanitary sewers?
   Storm drains carry rainfall runoff and other drainage untreated to local streams, rivers and lakes. Sanitary sewers carry everything from the inside of houses and buildings to a wastewater treatment plant before it is discharged into local waterways.

2. How can we protect water quality at home?
   Scoop the poop (pet waste), use commercial car wash or wash car on grass, allow nothing but rain down the drain.

3. What are some ways to test water quality?
   Nutrient content in the water (nitrates, ammonia, and phosphorus), dissolved oxygen, temperature and pH.

Testing Water Quality of Retention Pond

Steps

1. Ask students to pair up.

2. Give each pair of students an empty water sample baggie.

3. Instruct students to fill their bag with the pond/stream water to the fill line. (They should use the bucket of water that you've filled ahead of time.)

4. Have the students add the reagent according to your kit's instructions.

Note: If you do not have enough baggies or reagent, then select a student to help you with the experiment.

1. Allow the students to get their hands wet to create a lasting experience.

2. Analyze the results and discuss the outcomes and implications. Ask the students how your golf course might protect surface water from products used on the golf course.

3. The tour can end with a discussion of the use and value of lakes and ponds to the golf course and the surrounding community.

Wrap Up

Tell the students that you are going to review what they have learned. Ask them the questions that you posed at the beginning of the lesson plan and make sure they know the answers. If you are using the worksheet, have the students complete the worksheet and read out the answers.

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Worksheet for Water Quality Learning Lab

Date_____ Golf Course_____

Student Name_____

Please answer the questions below while participating in the learning lab:

a. What is the difference between storm drain water and sanitary sewer water?

b. How can we protect water quality at home?

c. What are some ways to test water quality?

d. How can golf courses preserve water quality?

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Water Conservation

Water comprises 80 to 85% of the weight of a grass plant. In most locations, supplemental water in the form of irrigation is needed to maintain healthy turfgrass plants throughout the season. Efficient water use is a very important component of a golf course maintenance operation.

Student Learning Objectives

1. **How and when is water used on a golf course?**

2. **How do you decide when to irrigate?**

3. **Where does the water come from?**
   (Reclaimed water, municipal, wells, streams, lakes)

4. **Observe and document the application of differing water conservation efforts of golf courses.**
   (Visual appearance of brown areas, existence of native plants, use of drip irrigation systems, types of sprinklers, weather stations, use of weather data, moisture sensors and use of drought tolerant grasses.)

5. **What are the delivery systems used for water on the golf course?**
   (Pump systems, sprinkler heads, drip irrigation systems, energy conservation efforts.)

6. **Why is it important to conserve water?**
   (cost, playability, disease management, resource management)

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Student Worksheet Questions

Review the worksheet questions with students at beginning of lab and at the end. It may also be printed out for students to complete as part of the field trip.

1. Water conservation

    a. How do superintendents decide when to water?

    b. How can a golf course conserve water?

    c. Why is it important to conserve water?

Note: The teacher may want to have additional material covered and will add to these questions. Take time to talk with the teacher in advance of the field trip.

Field Trip Requirements

Review of your irrigation system and water conservation efforts.

Field Trip Activity Outline

Either host a walking tour of the golf course or just stand and point and discuss your central irrigation control program. Show the central computer, weather station, pump station, radio control and watering program.

Ask the students and see what they say

1. What do plants need to live?
2. What happens when plants don't get enough water?
3. What happens when grass gets too much water?
4. For those who water grass at home, how do you know when to water your lawn?
5. How do we know when to water the golf course?

Talk about the role of irrigation in management of healthy turfgrass, and the importance of conserving the quantity of water use. Show different types of sprinklers to the class. If you are able, show the sprinklers in action. Students love seeing the controllers activate the sprinklers at your command. If you are near the maintenance facility, students love to see the computer operating system.

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Ask The Students

Discuss the management factors such as soil type, grass type, temperature, wind and evapotranspiration (ET) rate which must be considered when determining how and when to irrigate turf. Relate the differences between golf course and home lawn irrigation practices – individual head control vs. zone control, sensors vs timers.

As the golf course tour progresses, point out several measures (weather station, non-irrigated turf areas, sensors, examples of drip irrigation, low flow sprinklers, use of native plants, and drainage swales, etc.) that the golf course uses to conserve water.

If you have a weather station, share how using it helps you manage water use.

Has anyone heard of reclaimed water? It's waste water that has not been treated to drinking water standards that can be used to meet daily irrigation needs.

What can be done at home to conserve water?

Wrap Up

Tell the students that you are going to review what they have learned. Ask them the questions that you posed at the beginning of the lesson plan and make sure they know the answers. If you are using the worksheet, have the students complete the worksheet and read out the answers.

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Worksheet for Water Conservation Learning Lab

Date_____ Golf Course_____

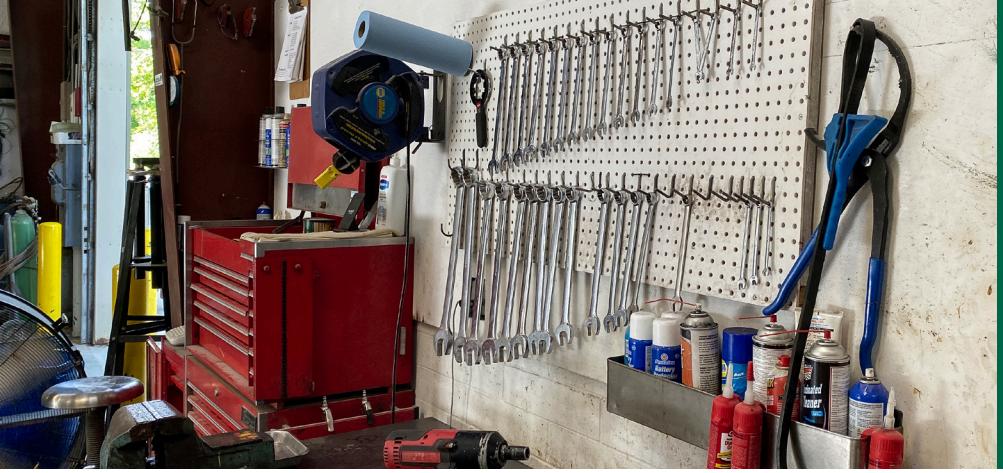
Student Name_____

Please answer the questions below while participating in the learning lab:

a. What are the different ways golf courses water the turf grass?

b. How can a golf course conserve water?

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Equipment Manager – Simple Circuit

A golf course Equipment Manager must be able to diagnose and troubleshoot a variety of problems as he/she cares for the equipment on a golf course. Understanding basic electrical operation is an essential skill and helps to diagnose root causes and repair electrical issues.

Student Learning Objectives

1. Students should learn the basics of a DC (direct current) electric circuit.

A circuit is a complete path along which electricity flows. It helps make electricity practical by connecting the negative and positively charged ends of a power source to a conductor and allows it to charge the load.

2. Students should be able to name the essential elements of a basic electrical circuit.

Power source (the battery), Load (the light bulb) and Conductor (the wire(s)).

3. Students should understand how to troubleshoot their circuits and what are common causes of failure to work.

The circuit must be closed to operate. Other common problems? Short to ground before load (dead short lots of smoke), short to ground after load (nothing noticeable), short to power (load is always operating) and an open circuit (nothing happens).

Field Trip Requirements

This field trip requires:

- Start with a disabled piece of equipment, such as head light. A head light does not turn on due to an open circuit.
- 3-volt battery
- Light Emitting Diode (colored LED)
- Tape

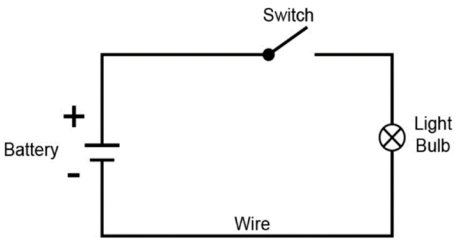
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Field Trip Outline

The equipment manager or golf course representative should begin the lesson by asking the students what they understand about electricity. A good way to start this lab is to attempt to turn on a piece of equipment whose headlight has been disabled. If possible, have one of the students try to turn it on. Ask the students to make a guess as to what the problem might be. Now explain to the students we are going to move from their observations regarding switches and electricity to how electricity is used in the various equipment at the golf course. Explain how equipment managers must have a basic understanding of circuits to perform their jobs and reference the malfunctioning piece of equipment as an example.

Have the students build their own circuits with the battery, LED and tape.

Now that the circuit has been built, it can be used as a model to explain the terms “short to power”, “short to ground” and “dead short.” Other electrical principles can be discussed as time and the age of the students allows.



Ask the students share a hypothesis on why the piece of the equipment did not work based on what they have recently learned with their own circuits.

Move to the equipment with the disabled headlight. If possible, show the students how to fix the equipment and have one of them turn it on.

Student Worksheet

1. What is a circuit? How does electricity work? Expect a wide range of answers here and be prepared to share a simple definition.
2. What is the purpose of a switch? It can open or close a conductive path.
3. What are some common problems that can cause the light bulb not to work?
4. Can you think of an example where you could have used this knowledge to fix something at home?”

Additional Resources

You can create hands-on kits for the circuitry lesson plan by visiting a local hardware/auto parts store, or there are kits approved for students available here: https://www.enasco.com/p/NE30039



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THE HOME DEPOT


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Planning Checklist

Step 1 | Register your interest to host on *www.thefirstgreen.org*

Step 2 | Connect with a school/youth group (3 – 6 months in advance.)

Reach out to school/youth club at least 3 - 6 months in advance if you do not already have a connection. Remember, the school will need to work this into their schedules. Need help? Check out the Connecting with Local Schools page found on the website.

Step 3 | Plan your field trip! 8 weeks prior to the field trip:

1. Gain the appropriate approval to host a field trip at your golf course. The First Green website has resources to help.

2. Assemble your team – who will help you with the field trip? Remember each station will need someone to lead the learning. We recommend at least 2- 3 stations per field trip, plus a fun activity – like putting. Helpers could include:

- **a.** Your assistants, golf pro, other individuals at your course.
- **b.** Your Chapter – reach out to your fellow chapter members to volunteer. This not only helps you but spreads the First Green message to your colleagues.
- **c.** Allied groups – Do you have a local Audubon chapter that could lead a bird watching station?

3. Brainstorm ideas for your field trip stations. You can use the lesson plans found on the First Green website, in this booklet, or create your own. Be ready to share these ideas with the teacher and your golf course team.

4. Gather any needed equipment/supplies for each station. See the website for needed items. Give GCSAA a call if you need help.

5. Paperwork/Budgeting

- **a.** Make sure the teacher has parents fill out and return the Photo Permission Slip.
- **b.** Budget appropriately for your field trip. Snacks, water, etc.,
- **c.** Transportation – some school districts are tight on funds and a hurdle could be getting the students to and from the golf course. Please know that GCSAA, or your chapter might be able to assist you with a “bus scholarship.”

Step 4 | Register Your Field Trip on the First Green website, at least one month in advance.

Step 5 | Fill out the Post Field Trip Report on the website.

GCSAA collects your valuable feedback to make the program better and will grant service points to any GCSAA members who assisted you. The host will also receive service points.

First Green Checklist

Day of Field Trip

Set-up

- [ ] First Green Branded Feather Banner(s) and approved signage displayed near the welcome area.
- [ ] Welcome area near where the buses drop the students off. This will be where the superintendent can make his/her opening remarks.
- [ ] Place a table at each station. Leave supplies for that station on the table. Supply list can be found in each lesson plan.
- [ ] Have Station Leaders arrive about an hour before the students. Take the time to go over the plan for the day and to answer any questions.

Field Trip

- [ ] Divide kids into groups. Keep the groups around 10 students if possible.
- [ ] Have volunteers escort their groups to their station.
- [ ] Assign a timekeeper to help rotate and keep the field trip moving.
- [ ] 90 minutes to 2 hours total time.

Consider offering lunch. Have fun!



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