



9th Grade Curriculum

Theme: I can be the science leader the world needs!

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9th Grade Curriculum Overview

Guiding Concept: Students can be the Science Leaders the world needs.

Science Discovery Process Focus:

- Make a Difference
- Explore and Wonder
- Investigate & Analyze
- Communicate

Ocean Discovery Unit

Next Generation Science Standards:

Cross Cutting Concept:

Systems and systems models – students understand that a system is a group of related parts that make up a whole and can carry out functions its individual parts cannot. They can also describe a system in terms of its components and their interactions.

NGSS Alignment

Overarching Responsibilities of Lead Team Lead:

- Classroom management & timing of lesson.
- Execution of all lesson material in this curriculum.
- Lead discussions & ask guiding questions to get students thinking about science.
- Use Belief and Science Discovery Process exploration language during lesson.
- Provide rules for activities.
- Encourage participation from all students to create an inclusive environment.
- Determine floor management with team BEFORE the start of the lesson.

Overarching Responsibilities of Assistant Team Leads:

- During lead Team Lead's introduction and closing:
 - Prep supplies quickly, then join the class.
 - Sit with students and model good listening behavior.
 - Sit or stand near any students struggling to pay attention.
- During activities:
 - Mentor students in your floor area by asking questions and providing guidance when necessary.
 - Engage students who are struggling to engage with or complete tasks.

9th Grade Story*Internal – Staff and Teachers*

The theme of the Ocean Discovery High School program is: I can be the Science Leader the world needs! Through hands-on science programming, students learn that their diverse backgrounds, attributes, experiences, ideas, etc., make them the people that science industry leaders will want to hire in the future.

During Community Building Day, students focus on the theme: *Who is needed for science? I am!* Students participate in a scavenger hunt revealing a series of videos highlighting Hoover High School alumni who are science leaders. These science leaders tell the story of their journey from high school student to science leader, share challenges they have faced along the way, and talk about unique traits that make them vital to the scientific community. Students reflect on their similarities with the alumni, discuss the importance of diversity in science, and begin to consider what assets they possess that make them the science leaders of tomorrow.

During Exploration Day at Torrey Pines State Natural Reserve, students focus on the theme: *Who does science – I do!* Students collect data about the Torrey Pine tree, the rarest native pine in the United States, utilizing scientific tools, including GPS, clinometers, and transect tapes, to map the location of the trees and gather data on their growth (height and circumference) and evidence of bark beetles, a natural threat to the trees. Students enter this information into an Arc GIS map, which they will use to analyze the data upon return to their classroom.

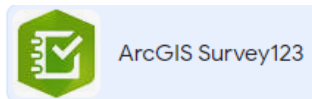
During Make a Difference Day, students focus on the theme: *Who can be a science leader? I can!* They begin by analyzing the data they collected on Explore Day and considering why protecting endangered Torrey Pines is important and what they would do, as future science leaders, to preserve the trees. In the second part of the day, students interview a science leader who is a Hoover High alumni with a focus on equity in science leadership and create a Science Leader Vision board where they highlight ideas, experiences, and personal traits that make them the people industry leaders need to hire and the science leaders of tomorrow.

Setting up iPhones for 9th

Note: Apple ID programs.oceandiscovery@gmail.com ; Password: "Ocean4255!"

ArcGIS Survey link & App

1. Turn on the phone by holding down the button on the right side
2. Press the home button
3. Slide to the right to access the Search bar
4. Type in Safari
 - a. If it does not allow you to open, please follow steps # 5-8
 - b. If it does allow you to open, skip to step #9
5. Go to Settings
6. Click into Content & Privacy, enter code 4255
7. Click into "Allowed Apps"
8. Toggle on Safari
9. Return to Home Screen, click on Safari
10. Type in "tinyurl.com/9thGrade123Survey"
11. Click on the share box in the bottom center
12. Select Save to Home Screen
13. Click Home button
14. Swipe right to access Search bar
15. Type in App Store
16. Search in App Store for "ArcGIS Survey 123"
17. Select ArcGIS Survey123



18. Click Download
19. Once app is downloaded, click into it
20. Click "Sign in with ArcGIS Online"
21. Log in using: Rwhelan4 , Ocean4255
22. Click "Download Surveys"
23. Click on the cloud of "9th Grade Torrey Pines"
24. Click on the back arrow to make sure the survey was downloaded

Turf Hunt App

1. Click Home button
2. Swipe right to access Search bar
3. Type in App Store
4. Search in App Store for "Turf Hunt"
5. Select Turf Hunt app
6. Click download



Community Building Day

In-School Experience

Goal: Students establish the belief that they are a unique individual contributing to a community of science.

Supplies:

- 9th Grade Community Building Day PowerPoint
- 9th Grade Scavenger Hunt Locations (laminated) (6)
- Scavenger Hunt Location Clue Cards (15 sets of 5 cards)
- Clipboards + Pencils (15)
- Scavenger Hunt Questions Sheet (15)
- Self-Reflection Questions (laminated) (10)
- Self-Reflection Questions (Large Format) (laminated) (10 sets)
- Orange Ocean Discovery Lanyards (1/student)
 - Print out a card to place in the pocket from “9th Grade Team Lanyard” document
 - Purpose: to identify our students v. other students walking around Hoover’s campus
- iPhone + charger (1 per 3 students (per class participating at the same time))
 - With Turf Hunt app downloaded and game installed
 - Turf Hunt creator log in: Odinstitute ; Ocean4255?!
- Mini speakers (1/iPhone)
- Power strips (5)
 - For charging iPhones between classes
- Ocean Discovery Stickers for prizes (20-30/class)
- Name tags (w/ sticky backs) (1/student)
 - Sharpies (30)

Timing:

Time	Activity	Learning Cycle
0:00 – 0:20	Introductions & Program Overview	Engagement
0:20 – 1:05	Scavenger Hunt	Exploration
1:05 – 1:20	Self-Reflection	Guided Analysis & Reflection
1:20– 1:30	Introduction to Habitat & Explore Day Research	Engagement

Team Lead Notes:

Prior to entering classroom:

- € Assign areas for Scavenger Hunt.
- € Determine which staff member will deal with technology issues during the scavenger hunt.
- € Set up hotspots in back quad.
- € Connect all iPhones to the hotspots.
 - Turn hotspot off when all phones are connected.
- € Between classes charge iPhones.

Prior to lesson:

- € Introduce yourself and staff to teacher.
- € **Collect waivers from teacher.**
- € Discuss classroom norms with teacher.
 - Attention getting signals, classroom expectations, participation expectations, etc.
- € Invite teacher to participate and explain when you will specifically need their help;
 - Scavenger Hunt: cover an area outside.
 - Self-Reflection: lead a small group – questions and format will be provided.
- € Assign classroom floor management areas with staff.

Assistant Team Lead Set Up:

- € Prep name tags and sharpies for students to make name tags.
- € Cue up 9th Grade Community Building Day PowerPoint from teacher portal.
- € Attach a Scavenger Hunt Questions Sheet to each clipboard.
- € Prep iPhones for Scavenger Hunt.
 - Make sure all are powered on and Turf Hunt app is present.
 - ~~Make sure all iPhone have enough batteries to last for ~40 minutes.~~
 - Attach a set of mini-speakers to each iPhone.

Assistant Team Lead Teaching Notes:

- € During Lead Team Lead's introduction:
 - Hand out name tags and sharpies.
 - Prep supplies quickly, then join the class.
- € During the Scavenger Hunt:
 - Help check out iPhones.
 - Cover an outdoor area during scavenger hunt and help students who are struggling.
 - Remind students of expectations during scavenger hunt.
- € During Scavenger Hunt Debrief:
 - Collect and store iPhones (plug in any that are getting low on batteries).
 - Collect clue cards and team lanyards.
- € During Self-Reflection
 - Lead a small group.
 - Help pass out and collect Self-Reflection Questions

Introductions & Program Overview

Timing

- Introductions (5 min)
- Community Agreements (2 min)
- Ice Breaker (5 min)
- Science Leader (4 min)
- Science Discovery Process (4 min)

Introductions

- Name Tags
 - Have all students create a name tag.
 - Write large
 - Place name tag on front left side.
- All staff members take ~ 1 minute to introduce themselves and share their stories.
- Introduce Ocean Discovery Institute.
 - Ask students:
 - Has anyone done an Ocean Discovery program before?
 - What was it like?
 - What do you remember?
 - Give a brief overview of the In-School Program (3 days, 1 class visit, 1 exploration day, etc.).

Community Agreements

- When working with Ocean Discovery Institute we ask that all of us Be Our Best Self!
 - (Show Community Agreements slide.)
 - To Be Your Best Self, you should:
 - **Be curious!**
 - Ask questions, make observations, and share your thoughts and ideas.
 - **Be respectful!**
 - Respect people, tools, and the environment around you.
 - **Be safe!**
 - Take care of yourself and others.

Ice Breaker

- We are going to start with a quick ice breaker to get us up and moving around.
- We are going to play EXTREME Rock-Paper-Scissors
 - (Show EXTREME Rock-Paper-Scissors slide.)
 - Rules:
 - Each person will pair up with someone.

- When I say “Go” you will play a match of Rock-Paper-Scissors against the person you are paired up with.
 - Best 2 out of 3 wins the match.
- The loser of the match will follow the winner around chanting their name and being their “champion”.
 - (Demonstrate.)
- The winner of the match will walk around until they find another winner to face off against.
 - Best 2 out of 3 wins.
- The loser of the match and their “champion” will become “champions” for the winner until there is a final winner.

Science Leader

- Introduce the theme of the 9th-grade program: I can be the Science Leader the world needs.
 - (Show Program Theme slide.)
- Throughout the program, you will explore:
 - (Show Program Overview slide.)
 - Who is needed in science.
 - Who does science.
 - Who can be a science leader.
- Think-Pair-Share: What do you think a Science Leader is?
 - (Show Think-Pair-Share slide.)
 - Point out sentence starters:
 - I think a science leader...
 - Something a science leader might do is...
 - I remember meeting a science leader who...
- Define Science Leader.
 - (Show Science Leader Definition slide.)
 - At Ocean Discovery we define Science Leaders as:
 - Are people of any age who use science to make a difference in their community and our world.
 - Develop ideas to help solve problems facing our planet, improve human lives, and make our world a better place.
 - Study science or have careers in science and science-related fields.
 - All of you are science leaders already!
 - Point out the underlined areas:
 - People of any age – you!
 - People who study science – you!
 - You are in a Biology class right now studying science.
- As science leaders, we will be using the Science Discovery Process throughout our time together.

- o (Show Science Discovery Process slide.)
 - o The Science Discovery Process is how science is done.
 - o You will notice it's a cycle with no real beginning or end because the process is continuous.
- At the center of science is Making a Difference.
 - o Making a Difference is at the center because science leaders want to make a difference in the world, so their observations and questions come from this.
 - o (Show Make a Difference slide.)
 - o Review an example
 - **Make a Difference:**
 - o A science leader wants to improve human lives – Dr. Adi Utarini.
 - **Explore & Wonder:**
 - o o Observes: Dengue fever can be a life-threatening illness – it kills about 25,000 people each year. Dengue fever is transmitted by mosquitos. There is a bacteria – we will call it “Bacteria A” that prevents mosquitos from transmitting dengue fever.
 - o o Question: Can mosquitos be bred to carry the Bacteria A which prevents the transmission of dengue fever?
 - **Investigate:**
 - o Hypothesis: If we bred and release mosquitos with Bacteria A in an area, then less people in that area should get dengue fever.
 - o Design Investigation:
 - o Bred mosquitos with Bacteria A.
 - o o Release the mosquitos in one town where dengue fever is present.
 - **Analyze:**
 - o After the mosquitos with Bacteria A were released, the town had 77% less cases of dengue fever!
 - **Communicate:**
 - o The results of this study have been shared across the world, though papers, presentations, conferences, etc.
 - o The importance of communicating this information is critical as dengue fever infects millions of people each year in hot and humid climates.
 - **Make a Difference:**
 - o Fewer people will die from dengue fever!
 - o Less people will be hospitalized for dengue fever.
 - o Less people will miss work because they are sick from dengue fever.
 - Today we will focus on Explore and Wonder.
 - o (Show Explore and wonder slide.)
 - o Explore and Wonder means asking questions and making observations.
 - o Today you will explore and wonder about the question - **Who is needed for science?**

Scavenger Hunt

Timing

- Introduction (5 min)
- Prepare for Scavenger Hunt (10 min)
- Scavenger Hunt (15 min)
- Debrief (15 min)

Introduction

- To answer this question, you will be participating in a scavenger hunt.
 - During the scavenger hunt, you will “meet” five people who are science leaders.
 - Each science leader will tell you a bit about their background, work, and pathway to becoming a science leader.
 - Your job is to think about why each of these science leaders is needed in the scientific community.
- Scavenger Hunt overview:
 - To “meet” these science leaders you will have to find them.
 - To find them you will:
 - Utilize a set of written clues.
 - Each written clue will guide you to one of five locations on Hoover’s campus.
 - The clues will help you to find the locations.
 - You can visit the locations in ANY order.
 - You do not need to visit the closest one first.
 - It will be easier if you spread out to find the scavenger hunt locations.
 - When you get your iPhone near the scavenger hunt location it will trigger a video of a science leader to open in your Turf Hunt app.
 - (Show Video Screenshot slide.)
 - Watch the video and answer a question on your Scavenger Hunt Questions sheet.
 - (Show Scavenger Hunt Question sheet slide.)
 - Be sure you are answering the question related to the person in the video.
 - The answer to the question is found in the video. Listen closely. You do not need to write what each person says word for word. You can summarize your answers in less words.
 - You can watch the video more than once to answer the question.
 - Once you have answered the question, choose another written clue to find the next location.
 - Repeat this process until you have watched the videos and answered the questions for all five locations, then return to your classroom.
 - There is no particular order in which you need to visit the locations.

- If you have a technology issue, there will be an Ocean Discovery Institute staff member near the picnic tables, head over there and they will help you.
- Expectations:
 - (Show expectations slide.)
 - Walk everywhere.
 - Use indoor voices only, no shouting.
 - Indoors is off-limits unless you are returning to your classroom.
 - Do not use indoor hallways to go from one location to another.
 - Do not open doors to any buildings (music room, library, etc.)
 - Do not be a distraction to any other students.
 - Stay within the boundaries.
 - (Show Boundaries slide.)
 - Stay within sight of an adult at all times.
 - If you need to use the bathroom – you must ask your teacher for a bathroom pass.
 - Ocean Discovery staff cannot grant access to the bathrooms during the scavenger hunt.
 - Everyone must return to the classroom BEFORE the designated end time.
- Ocean Discovery staff and your teachers will be out walking the campus during the scavenger hunt. If you need help at any time, ask one of them.
- Prizes will be awarded to multiple groups for things including:
 - Any group that completes all five scavenger hunt questions.
 - Teamwork award – groups that are working together to complete the scavenger hunt.
 - (Make up additional awards as appropriate.)

Prepare for Scavenger Hunt

- (TURN HOTSPOT ON.)
- Divide students into groups of three.
- Assign roles in each group.
 - (Show roles slide.)
 - Clue cards – holds and reads clue cards out loud to the group
 - iPhone – holds iPhone and navigates to next location
 - Answer sheet – records answers after discussing with the group
 - (Give students time to assign roles.)
- Give each team a set of lanyards.
 - (All students must wear lanyard to identify them as a student involved in the scavenger hunt.)
- Each team of students will create team name.
 - Team names must be appropriate for school.
 - (Give students time to create team names.)
- Hand out an iPhone to each group.

- o Check out each iPhone.
 - Write the team name next to the number iPhone they are given.
- o Remind students to Be Your Best Self with the iPhone.
 - Treat it gently and respectfully.
 - Please do not drop it or put it on the ground.
- Have students open Turf Hunt App.
 - o (Show Turf Hunt App slide.)
- Have students click “start” (blue lettering).
 - o Type in your team name.
 - (Show Team Name slide.)
 - o You will be in the “Waiting Room” until the Scavenger Hunt starts.
- Determine and communicate the designated end time to all students.
 - o Remind students they can tell what time it is by using their device.

Scavenger Hunt

- Walk all students outside together.
 - o Allow all staff (except the Team Lead) to walk to their assigned area.
- Remind students of expectations and the designated end time.
 - o Remind students they can visit the location in any order.
 - o They need to return to the classroom BEFORE the end time.
- Hand out a set of clue cards to each group.
 - o When everyone has a set of clue cards, say “Ready... Set... Go!” to begin the scavenger hunt.
 - o Encourage students to spread out rather than follow each other.
- Give students a five-minute warning and remind them their whole team must be back in the classroom in five minutes.
 - o When two minutes are remaining all teachers and Ocean Discovery staff should start a “sweep”.
 - o Move slowly back towards classroom while reminding students that time is up and they need to return.

Debrief

(Instructor note: Continue to give sticker prizes to students who: answer questions, give a thoughtful answer, ask a great question, etc.)

- Debrief Individual Videos:
 - o Let’s take a moment to think about what we experienced or learned during the scavenger hunt.
 - o Review each question with students. Answers will vary. Below are some (but not all) of the answers you could expect based on the video:
 - (Show Science Leader slides.)

- **Jair Video:** How is Jair breaking the barrier of “what it is to be a scientist”?
 - Jair’s background many not be “typical” of what many people think of, when they think of a “scientist”. Jair:
 - Is the first person in his family to attend college.
 - Is often the first LGBT person to presenting research at meetings and conferences he attends.
 - Comes from a single-parent household.
- **Merveille Video:** What experiences did Merveille have that made her want to become a science leader?
 - Many times a person’s background or an experience they have can lead them to want to pursue a certain career.
 - Merveille’s experiences growing up led her to her career in health sciences.
 - Her mother was hurt in a war and Merveille saw many nurses and doctors who wanted to help her mom and be there for her.
 - This made Merveille want to give back in a similar way to her own community and become a phlebotomist.
- **Blanka Video:** What is something each of you have in common with Science Leader Blanka? (Each person in the group needs to write an answer – each answer can be different.)
 - Blanka:
 - Attend Hoover High School.
 - Came to America from another country.
 - Didn’t speak English when they started school in America.
 - Loves traveling.
 - Not all science leaders are born in the United States, or grow up speaking English, etc.
 - Science leaders also have many different interests, not just science. Things like traveling, living in a far-away place (Alaska), etc.
- **Alejandro Video:** Alejandro is a Hoover High School student just like you. Alejandro is a Hoover High School student just like you. What advice does he have for 9th graders today?
 - It’s never too late to make a change.
 - Things you can do to improve your grades:
 - Staying after school for tutoring.
 - Getting to know your teachers.
 - Alejandro is currently a student here at Hoover High. Proof that you don’t have to wait to become a science leader!
 - Alejandro has taken advantage of other opportunities that Ocean Discovery offers and done an internship at a local science lab. This is a

great way for anyone to get real life experience and see if they might want to be a science leader.

- **Jorge Video:** How did Jorge's experience with Ocean Discovery help him be successful in college?
 - Because of his experiences with Ocean Discovery Jorge had a strong background in science and experiences doing science. He had experiences with the scientific method, science research, and many topics in science.
 - Because of these experiences when he took science classes in college, he had pre-knowledge of some of the topics being taught which made him feel powerful and confident.
- Debrief Overall:
 - o Pair-share:
 - o What similarities do you share with the science leaders you saw on the videos?
 - (Show Debrief Question slide.)
 - Sentence starters:
 - I am similar to (name of the science leader) because we both...
 - One thing I had in common with one of the science leaders was...
 - o Return to definition of a science Leader.
 - (Show Science Leader Definition slide.)
 - o Look at the last bullet point – people who have careers in science. You might be surprised how many science-related careers there are in the world.
 - (Show Science and Science-related Careers slide.)
 - Biologists, physicists, chemists, environmental scientists, etc.
 - Computer programmers, software engineers, data scientists, etc.
 - Social scientists: Psychologists, Economists, Sociologists, etc.
 - Health care workers: Doctors, nurses, physical therapists, etc.
 - Teachers in science and science-related fields
 - Engineers
 - Pharmacists
 - Architects
 - Veterinarians
 - o People who don't major in a science-related field can still be science leaders by applying science to their careers or staying engaged in science beyond school.
 - Examples:
 - A communications specialist who works for a company that creates drugs to help cancer patients.
 - A politician who focuses their campaign on environmental issues.
 - A lawyer who chooses to specialize in environmental law.
 - An artist whose art focuses on nature to raise awareness.

- A person who volunteers to do a beach clean-up in their community.
 - Any of us can choose to be a science leader and make a difference in the world.
 - (Show Debrief Question slide.)
 - Why do you think it is important for people like the science leaders you met today to be part of the science community?
 - Sentence starters:
 - It's important for people like these science leaders to be part of the science community because...
 - These science leaders are important because...
- Science Leadership Justice
 - STEM workforce overview:
 - (Show STEM Workforce slide.)
 - According to the National Science Foundation, the STEM (Science, Technology, Engineering and Mathematics) workforce is:
 - Race:
 - 65% White
 - 14% Hispanic
 - 9% African American
 - 9% Asian
 - 0.4% American Indian/Alaska Native
 - Unknown – Mixed Race
 - Gender:
 - 66% Male
 - 34% Female
 - Currently, the population of the United States is:
 - Race:
 - 58% White
 - 19% Hispanic
 - 12% African American
 - 6% Asian
 - 3% Mixed Race
 - 1% American Indian/Alaska Native
 - Gender:
 - 50% Male
 - 50% Female
 - Explain to students that current census data only recognizes male and female for gender.
 - Pair-Share: One thing these statistics make me think is....
 - (Show Science Leadership Question slide.)
 - Diversity is critical to science.

- One of the reasons we think it is important for students from City Heights to become science leaders is that currently the science workforce does not represent the population of the United States.
- Our community is uniquely diverse.
 - (Show City Heights Diversity slide.)
- Diversity of people creates diversity of thought. Diversity of thought creates new ideas and innovation. Diversity is what moves science forward.
- To create a diversity of thought, science leaders must come from diverse backgrounds, races, ethnicities, religions, sexual orientations, etc.
- Therefore, we believe it is essential for everyone in this community to have the opportunity to become a science leader if they want to.

Self-Reflection

Timing

- Introduction to Reflection (1 min)
- Prep for Reflection (2 min)
- Reflection in small groups (10 min)
- Debrief & return to regular seats (2 min)

Introduction to Reflection

- Introduce why we do reflection:
 - (Show Self-Reflection slide.)
 - Reflection is a part of every Ocean Discovery Institute experience.
 - Reflection allows you to process and share thoughts and feelings about what you have done, thought about, considered, and learned today.
 - Reflection can open your mind to new possibilities you hadn't considered before and can highlight ways your thoughts, ideas, and feelings change over time as you learn and experience new things.

Prep for Reflection

- Divide students into small groups.
 - Create as many groups as there are adults.
 - Example: 1 Team Lead + 2 fellows + 1 teacher = 4 groups
 - (Mix students up – try to avoid sending students to small groups who have: done the scavenger hunt together, been pair-sharing, etc.)
- Have each group create a small circle with just their chairs.
 - The circle should be small with knees almost touching.
 - (If there isn't enough space to do this with chairs have students stand in a circle - circle should be close together with shoulders almost touching.)
- Each adult in the group will facilitate the Think-Pair-Shares.
 - Adults will read and hold up a question for their group to answer.
 - Use Self-Reflection Questions (Large Format).
 - Review how to do a think-pair-share with everyone.
 - Think time (30 seconds)
 - Pair time (1-2 minutes)
 - Adults in the group should make pairings, so no one gets left out.
 - Create a group of three if necessary.
 - Adults should be a part of the pairings.
 - Ask each person in the pair to share their response to the question.
 - Share in small groups (2 min)
 - Select 1-3 students in the group to share their response to the statement and or respond to another student's response.
- Think-Pair-Share Questions:

- o (Provide each adult with Self-Reflection Questions print out and a set of Individual Self-Reflection Questions (Large Format).)
- o Let adults know once they have questions they can begin with their group.
 - Give 3- and 1- minute time reminders.
- o **A skill or experience I have that would make me a strong science leader is...**
 - REVIEW examples below before releasing students to talk.
 - Examples of skills: I can build things with my hands, ability to sing, ability to see things differently than others, speaking another language, etc.
 - Example of an experience: I grew up in Taiwan for 10 years and I saw how public transportation was inexpensive and easy to use, many people used it daily, this can help me think about how to improve our public transportation system to help keep more cars off the road and combat climate change.
- o **I am needed for science because...**
- o **Diversity is important for science because...**

Debrief & return to regular seats

- Everyone here can be a science leader the world needs, and the world needs more science leaders from communities like City Heights.
- You are a diverse group of people with different interests, ideas, skills, attributes, and experiences.
- That type of diversity is essential in science. When there is a diversity of people in science, there is diversity of thought.

Introduction to Habitat & Explore Day Research

Introduction to Explore Day Research

- Next time we see you will be on our Explore Day field trip.
- We will be visiting Torrey Pines State Natural Reserve in La Jolla.
 - (Show Torrey Pines Reserve slide.)
 - We will visit different parts of the reserve each year of 9th-11th grade.
 - You will study the reserve in a different way each of those years – with a focus on Biology in 9th grade, Physics in 10th grade, and Chemistry in 11th grade.
 - In your senior year, you will visit the Living Lab to look at the data you collected at the reserve over the years and see how it could be applied here in City Heights.
- During this year's trip we will be on the bluffs of Torrey Pines.
 - (Show Torrey Pines Bluffs slide.)
 - We will be walking some of the trails on the upper portion of the reserve.
 - Some of you may have some hesitation about hiking and/or being up on the bluffs.
 - Ocean Discovery always make student safety a top priority!
 - We have walked all the trails you will be walking many times and with other high school students.
 - All the trails are safe!
 - Some of us may have hiked before and for some of us this will be our first time.
 - Ask students: Has anyone ever gone hiking before? What was it like? What did you enjoy about it? What was challenging?
 - Hiking is like taking a walk, except we won't be walking on a road or sidewalk, we will mostly be on trails.
 - Trails can have rough and uneven terrain – tree roots, rocks, steep stairs, etc., so you will want to watch your step while hiking.
 - Hiking can feel physically demanding.
 - You will walk less than 2 miles throughout your 3.5 hours in the park – this is a distance that is doable for everyone.
 - If you feel tired or out of breath, slow down and take your time, but keep going!
 - We will encourage each other – no one gets left behind!
 - If time allows show students the Fleming Trail hike using Fat Map.
 - (Show Fat Map slide.)
 - Log in: info@oceandi.org
 - Password: Ocean4255
- Introduce Torrey Pine Tree
 - San Diego is a very special place.
 - Due to weather and physical features of the land, San Diego has more species of plants than any other county in the United States (~1500 species).

- More rare and endangered plants in San Diego County than in any other area of the United States.
- We will be looking at one of rare plants on our field trip.
- o This is a Torrey Pine Tree.
 - (Show Pictures of Torrey Pine Tree slide.)
 - It is the nation's rarest pine tree.
- o It is found only in two places on Earth – Torrey Pines State Reserve and on Santa Rosa Island off the coast near Santa Barbara.
 - (Show Torrey Pines Map slide.)
 - Potential questions:
 - Why do you think these trees only grow in these areas?
 - They prefer growing in a hot climate with dry summers and mild winters.
 - Coastal fog provides moisture for survival.
 - How could they get from the mainland to an island (175 miles apart) or vice versa?
 - Birds carrying seeds, water carrying seeds, plate tectonics, etc.*
A long time ago, these trees were more widely spread along the Southern California coast.
- Population of Torrey Pine Trees
 - Unfortunately, Torrey Pine trees are now endangered.
 - The Torrey Pine Tree population was approximately 9000 trees in the 1970s, and now the population is about 3000 trees.
 - Do a visual example of this:
 - Have nine students come to the front of the room and explain that they each represent 1000 Torrey Pine trees = 9000 trees.
 - Ask six of the students to step to the side (6000 trees) – these are the trees that have been lost since the 70's.
 - Explain that these are the remaining Torrey Pine trees (~3000 trees).
 - 2/3 are gone.
 - Group Share Out
 - Why do you think the Torrey Pine may have become endangered?
 - (Show Group Share slide.)
 - One thing that could have caused Torrey Pines to become endangered is...
 - Many things have heavily impacted Torrey Pine trees.
 - Habitat loss due to human development.

- As the areas around La Jolla were developed, Torrey Pine trees were cut down to clear space to build homes, etc.
- Impacts from Climate change:
 - Wildfires
 - Increased numbers of wildfires have killed some of the trees.
 - Stress from droughts.
 - Prolonged droughts and warmer temps lead to a lack of water. This stress makes the tree more susceptible to bark beetles.
 - Bark Beetles
 - When trees are stressed due to drought conditions, bark beetles are more easily able to bore into trees and lay eggs which can eventually kill the tree.
- Explore Day Research
 - When we next see you, it will be Torrey Pines State Reserve in La Jolla.
 - While at Torrey Pines we will be exploring: Who does science and what is the current state of the Torrey Pine trees at the reserve.
 - (Show Program Overview slide.)
 - Science leaders are concerned because Torrey Pine tree are dying off again.
 - You will be collecting data about the Torrey Pine trees in the reserve.
 - Later you will analyze that data and consider what you as a science leader would do with that data.

Closing

- Great job today!
- At Ocean Discovery Institute, we **BELIEVE** that science is something you can do, and a science leader is someone you can be, that you can **ACHIEVE** in science and think critically about our world, and you can **LEAD** in science and conservation and make a difference in the world. Because we believe this, we do a “Believe! Achieve! Lead! Go Awesome!” cheer at the end of every program so that you will continue to do awesome things after we leave.
- (Show Go Awesome slide.)
- On the count of three, we will yell, “Believe! Achieve! Lead! Go Awesome!”

Upon Return to Living Lab

- Check in and charge all devices – see Technology Check-In Policy.

Script for Science Leader Videos

- **“Hello! My name is xx. I attended xx elementary and xx middle school and went to Hoover High School.”**
- **Describe your experience with Ocean Discovery In-School Programs.**
 - **“Just like you, when I was in school, I was part of the same Ocean Discovery Institute program you are doing today.”**
 - Talk about an In-School Program that you remember.
 - Example: *“I remember when I was in 4th grade, Ocean Discovery came to my classroom and taught me about the wetlands. The best part was that we visited a natural wetland and explored it all day. I loved being in the wetlands because there were so many plants and animals. I also enjoyed how peaceful it was. With Ocean Discovery, I learned that there are wetlands in City Heights. Since then, I have continued enjoying and exploring wetlands by walking in one of our neighborhood canyons at least once a week.”*
- **College/Degree/Current Job.**
 - **“I graduated from Hoover High and went to xx college, where I got my degree in xx. Now I work for (company name) as (job title).”**
 - Describe your job and how you utilize biology in your work.
 - Example: *I graduated from Hoover High and went to Cal State Sacramento to get my undergraduate degree and my nursing degree. I’ve taken many biology courses throughout my life. Nurses have to have a deep understanding of how the human body works and how things like viruses, bacteria, and diseases can make people sick.*
- **Discuss how you use science in your everyday life/career.**
 - We want students to understand that there are many different types of science-related careers.
 - Example: *As a nurse, I care for people when they are sick or hurt. I use tools throughout the day to collect information about a person – blood samples, heart rate, oxygen levels, etc. to help me determine what is happening in their body and what might be making them sick. Once I figure out what is happening, I can then prescribe various ways to treat an illness so that person can become healthy again. I really love what I do.*
- **Your assets as a Science Leader.**
 - Talk about any unique attributes, skills, experiences, etc., that make you a science leader the world needs.
 - Example: *“One of the most important attributes I have that make me a science leader the world needs is my ability to speak Spanish. The scientific world needs to be able to communicate with the Hispanic population in the United States, and I can help them do that. In college, I minored in Spanish because I knew I wanted to communicate with people from my own culture and those who speak only English.*
- **Why are you a person who is needed in science today?**

- Talk about why the scientific community needs people like you.
 - Example: ***"Science needs people like me because my background and experiences give me a unique perspective. My parents and I were refugees from Somalia. I arrived in the United States at eight years old after spending almost two years in a refugee camp. Part of the reason I want to be a software engineer is to help design software programs for NGOs that could help keep track of refugees and their families, their medical conditions, and communication from family outside the camps. Science needs people like me because my experiences help me understand the importance of software and user-friendly interfaces for people who don't have much computer experience like my parents."***
- **Give advice to the Hoover High School students watching this video.**
 - Example: *"If I could give you one piece of advice, it would be to ask for help when you are struggling. I know that I didn't ask for help from my teachers for many years because I was embarrassed and didn't want to spend more hours in school than I had to. However, my 11th-grade year taught me how important it is to get help from teachers by asking questions in class or after school. I was sure I would fail Physics in 11th grade, but then I started going to extra help after school, which was hard because of sports practice but was worth it. I learned so much! I learned a lot about Physics, but I also learned that teachers want to help you, which made it easier to ask for help in other classes. If I was to give one piece of advice-ask for help!"*
- **You and I are the Science Leaders the World Needs.**
 - ***"Who is needed for science? People like you and me!"***
 - Science Leader #1: The world needs people from City Heights to be science leaders!
 - Science Leader #2: The world needs people from Hoover High to be science leaders! (This should be the student we use for filming if we are able to get one.)
 - Science Leader #3: The world needs people from our community to be science leaders!
 - Science Leader #4: The world needs people from San Diego to be science leaders!
 - Science Leader #5: The world needs young people to be science leaders!
 - ***"You and I are the science leaders the world needs!" (Point at the camera.)***

Exploration Day

Coastal Field Experience

Goal: Students build belief that they can recognize and do science and that science is important and relevant while collecting and analyzing data at Torrey Pines State Reserve.

Logistics for Torrey Pines State Reserve:

- Bus drop-off location AM: Torrey Pines Visitors Center (small buses ONLY).
- Bus pick-up location PM: Torrey Pines Beach Parking Lot (larger buses are okay).
- No food can be eaten in the upper level of the reserve.
- Torrey Pines Docent Society runs field trips on Tuesday, Thursday, and First Friday in the reserve.

Supplies:

- Ocean Discovery Institute Field Trip Volunteer Card printout (1/adult volunteer)
- Attendance Cover sheet (1/class)
- Name tags (w/ sticky backs) (90)
 - Thick sharpies (30)
 - *These are back-up supplies in case a teacher forgets to create and print name-tags for students.*
- Coolers for student lunches
- Explorer Backpacks (1/3 students)
 - Clipboard
 - Pencils (2)
 - Binoculars
 - Hand lens
 - Clinometer
 - Measuring Wheel (1)
 - Transect tape (1)
 - Clipboard and:
 - Torrey Pine Tree Growth Datasheet (laminated) (1)
 - Torrey Pine Tree Growth Protocol (laminated) (1)
 - Torrey Pine Tree Mapping Datasheet (laminated) (1)
 - Torrey Pine Tree Mapping Protocol (laminated) (1)
 - Thin dry erase markers (2)
 - Plants of Torrey Pines ID Card (laminated) (1)
 - Table of Tangents (laminated) (1)
 - Torrey Pines Trail Map (1)
 - Simple calculator (1)
- Team Lead backpacks (1/Team Lead)
 - iPhone + Case + Lanyard (3)
 - With the 123Survey app downloaded & shortcut to Google Form

- o Hot spot (1)
 - o Battery Pack (1)
 - o Magnetic wand (1)
 - o Science Discovery Process poster – small legal paper size (laminated)
 - o Bottle of hand sanitizer (1)
 - o First Aid Kit (1)
 - o White Board + Marker + Eraser (1/1/1)
 - o Torrey Pines Growth Data Sheet (3)
 - o Torrey Pines Mapping Data Sheet (3)
 - o Laminated Emergency Protocol & Phone Numbers (1)
 - o Incident Report Sheets (12)
 - o ODI Flags with numbers #1 – 4
 - o Self-Reflection Questions Directions – Explore Day (laminated) (3)
 - o Self-Reflection Questions (Set of 4 laminated questions) (3 sets)
- Assistant Team Lead Backpack (1/Assistant Team Lead)
 - o iPhone + Case (2)
 - With the 123Survey app downloaded & shortcut to Google Form
 - o Trash bags (4)
 - o Bottle of Hand Sanitizer (1)
 - o Extra Pencils
 - o Self-Reflection Questions Directions – Explore Day (laminated) (1)
 - o Self-Reflection Questions (Set of 4 laminated questions) (1 set)
- General Bin – to be stocked with extra materials for backpacks (1)
 - o Extra binoculars
 - o Extra hand lenses
 - o Extra Pencils
 - o Extra Clipboards
 - o Extra trash bags
 - o Water bottles (10-12)
 - o Additional bottles of hand sanitizer
 - o Torrey Pines Growth Data Sheets
 - o Torrey Pines Mapping Data Sheets

9th Grade Explore Timing:

*Station times include walking time.

On Time:

On Time	Group 1	Group 2	Group 3	Group 4
10:00 – 10:10AM	Arrival			
10:10 – 10:30AM	Introduction Large Pavilion	Introduction Open area next to Pavilion	Introduction Torrey Pine Grove	Introduction Placard at Overlook
10:30 – 12:00PM	Data Collection: Mapping <i>Guy Fleming Trail</i>	Data Collection: Growth <i>Guy Fleming Trail</i>	Data Collection Mapping <i>Parry Grove Trail</i>	Data Collection Growth <i>Parry Grove Trail</i>
12:00 – 12:30PM	Walk Down to Beach			
12:30 – 12:50PM	Lunch @ Picnic Tables			
12:50 – 1:10PM	Self-Reflection Beach			
1:10 – 1:15PM	Closing + Load Buses			

When THREE classes are present add these groupings.

On Time	Group 5	Group 6
10:00 – 10:10AM	Arrival	
10:10 – 10:30AM	Introduction Benches at the Lodge (Left)	Introduction Benches at the Lodge (right)
10:30 – 12:00PM	Data Collection: Mapping <i>Red Butte/Razor Point/Beach Trail</i>	Data Collection: Growth <i>Red Butte/Razor Point/Beach Trail</i>
12:00 – 12:30PM	Walk Down to Beach	
12:30 – 12:50PM	Lunch @ Picnic Tables	
12:50 – 1:10PM	Self-Reflection Beach	
1:10 – 1:15PM	Closing + Load Buses	

Introduction Locations



Data Collection Locations:

Guy Fleming Trail



Parry Grove Trail



Red Butte/Razor Point/Beach Trail



Directions for trail:

- Keep left to Beach trail at the entrance
- Keep left again at fork
- Keep right to Razor Point (at the brown sign)
- (small fork – go left to perform tree mapping and come back up and continue on trail)
- Keep left at fork (do not go into the tree archway)



Program Set Up:

- € Upon entry to the park IS 9th & 10th Grade Coordinator:
- Will oversee safety of field trip.
 - Upon entry to Torrey Pines State Park let booth attendant know our buses from Hoover High will be dropping students off at the top.
 - Determine instructor roles for the day:
 - Arrival roles (see curriculum below)
 - Determine which instructor will walk which trail (2 instructors/trail)
 - On each trail, determine which instructor will collect Growth Data and which will collect Mapping Data (see curriculum).

□ Introduction stations:

Arrival

- **BUS DROP OFF LOCATION:** Upper Torrey Pines Visitors Center parking lot.
- **IS 9th & 10th Grade Coordinator:**
 - **Meet buses at visitor's center parking lot, introduce yourself to teachers and bus driver.**
 - **Review pick-up location with driver: Lower Lot by beach @ 1:15PM**
 - **Welcome students to Torrey Pines State Reserve.**
 - **We will dismiss you to your groups in a moment – stay seated for now.**
- **Begin Arrival Tasks.**
 - **(Note: The below should take place simultaneously.)**
 - **IS 9th & 10th Grade Coordinator (1)**
 - **Dismiss all chaperones on the bus to meet with the Team Lead doing the **Chaperone Introduction.****
 - **Confirm that all students are wearing name tags.**
 - **If not, alert team leads that they will need to have students create name tags.**
 - **Confirm student roster.**
 - **Take teacher off buses and have them note any students absent on the roster and sign a cover sheet stating they've collected all waivers to the best of their ability.**
 - **Confirm students have been divided into six groups.**
 - **Each team lead should be given a roster with the names of their students.**
 - **Students should have been assigned or self-selected into a particular trail:**
 - **Easy – Red Butte/Razor Point/Beach Trail**
 - **Medium – Guy Fleming Trail**
 - **Difficult – Parry Grove Trail**
 - **Teacher to assist in unloading of students by group.**
 - **Remind students that this is an opportunity to be present in nature.**
 - **Please take out earbuds and place cell phones in backpacks.**
 - **Unload one group at a time if possible and direct them to their staff member.**
 - **Repeat until all groups are off the bus.**
 - **Assistant Team Leads (2)**
 - **Help the bus driver unload the lunches.**
 - **Lunches will be placed in an instructor car.**
 - **Team Lead (1)**
 - **Take adult chaperones aside and discuss expectations for the day.**
 - **Provide each one with an "Ocean Discovery Institute Field Trip Volunteer Card" and explain how they can be most helpful today:**

- No cell phones unless snapping a quick picture.
- Interact with the students. Ask them questions. Don't be worried if you don't know the answers to things, that is okay!
 - On your card there is a short list of some questions you can ask students.
- Participate with the group. Sit/stand in the circles with the students. Answer questions, be a partner with a student during pair-shares, etc.
- Please, no side conversations while the Team Lead is talking.
- Have fun!
- Team Leads & Assistant Team Leads (all others)
 - Meet students in your group as they get off the bus.
 - When you have your whole group, head to your Introduction location.
 -

Introduction

Assistant Team Lead Teaching Notes:

- € If necessary – hand out name tags and sharpies for students to make name tags.
 - Ask students to write their names in large letters.
- € Share your story during the Staff and Volunteer Intros.
- € Help distribute Explorer backpacks.
- € Sit with students during introduction.
- € One of the goals of the day is for students to feel that they are **doing science**. Potential questions to ask throughout the day include:
 - Do you feel like you are doing science? Why or why not?
 - Do you think science is important? Why or why not?
 - Who do you think should know about the data you are collecting?

Staff and Volunteer Intros

- *If necessary: Have student create name tags.*
- Staff and volunteer introductions:
 - All staff + volunteers take 30 seconds to introduce themselves and share their story.
- Have students center themselves.
 - Ask all the students to take 2-3 deep breaths.
 - Acknowledge the excitement, nervousness, exhilaration, wonder, etc. they may be feeling.

Review Community Agreements

- To Be Your Best Self, you should:
 - **Be curious!**
 - Ask questions, make observations, and share your thoughts and ideas.
 - **Be respectful!**
 - Practice Leave No Trace.
 - Walk on trails to protect plants and small wildlife, and prevent erosion.
 - Make space for others who aren't part of our group but are also visiting.
 - **Be safe!**
 - Take care of yourself and others.
 - Walk everywhere and stay back from cliff edges.

Welcome student to Torrey Pines State Natural Reserve

- Welcome to Torrey Pines State Reserve!
 - Kumeyaay Acknowledgement.

- Before we being today, it is important to remember that the Kumeyaay People have lived in these lands for thousands of years. Their communities are interwoven with the natural environment.
- We will be exploring the natural gifts these Kumeyaay lands provide.
- We want to be sure to acknowledge this gift and give our respect and gratitude to the Kumeyaay Nation.
- Torrey Pines became part of the California State Parks system in 1959.
 - The reserve is over 1,500 acres and includes the beaches below us, the lagoon area to the east (if visible from your location, point to it), and the bluffs where we are standing now.
- Ask students: How do you think the reserve got its name?
 - (Point out the Torrey Pine trees all around them.)
 - All pine trees they see in the reserve are Torrey Pines.
- Torrey Pines is not a park but a reserve.
 - Reserves are designated to protect threatened plants (like Torrey Pines), animals, habitats, or unique geological formations (like the cliffs).
 - Of the 279 California State Parks, only 14 are reserves, so Torrey Pines is a special place.
- Reserves are protected.
 - Because reserves are so unique, they are protected, and as visitors it is essential that we take special care of this environment.
 - We will practice Leave No Trace - we take nothing and leave nothing but footprints.
 - We take everything we brought here back home with us.
 - We make sure to clean up any trash and dispose of it properly.
 - We don't take anything home with us, including rocks, shells, leaves, etc.
 - Practicing Leave No Trace is part of being our best self.

Preview the Day's Theme

- Today's theme is: Who does science?
- Torrey Pines is a living laboratory.
 - Science leaders from all over the country are currently doing research here on many different topics.
 - Examples (**Choose 1 or 2 depending on time**):
 - Plumes in Nearshore Conditions (PINC) Project

- Scripps Institution of Oceanography and University of Washington are partnering on this project to study how small fresh water outflows interact with the surf zone in the ocean.
- To do this they are dyeing river and stream water pink!
- Science leader then monitoring the pink water from the land, sea, and sky using drones, sensors fixed to poles in the sand, and sensors affixed to jet skis.
 - (Look out for pink water throughout Feb.)
 - The dye is environmentally friendly!
- Bee Monitoring Project:
 - A collaborative project of UC San Diego Natural Reserves System, the Torrey Pines Docent Society, and the Pollinator Lab at the University of Oklahoma.
 - The goal of the project is to use photography to document and monitor the native bee species that occur here in Torrey Pines.
 - Native bees are among the most important pollinators in the world, but they are rapidly losing habitat to development and climate change.
 - In San Diego, much of the native habitat bees use has been converted into urban landscapes, leaving only small pockets of native habitat remaining. Torrey Pines State Natural Reserve is one of the best-preserved patches of native bee habitat along the coast of San Diego, serving as an important sanctuary for native bees.
- Return to today's theme: Who Does Science?
 - People like the science leaders we just described from local and national universities, volunteers from the Torrey Pines Docent Society, and you!
 - Today all of you will also be science leaders doing science!
 - As science leaders, we will continue using the Science Discovery Process.
 - (Show Science Discovery Process poster.)
 - The Science Discovery Process is how science is done.
 - On our first day in your classroom, we wondered: what is the current state of the Torrey Pine trees at the reserve?
 - Today we will investigate Torrey Pine trees and collect evidence here at the reserve.
 - We will analyze that evidence back at school.
 - Then you will have the opportunity to communicate what you as a science leader would do with information to make a difference in the world.
 - The data you collect today will be shared with the Torrey Pines State Park staff so they can continue to monitor the health of these trees. So you are making a difference in the world today.

- To collect data, scientists need tools.
 - In your backpack are various tools that can be used throughout the day.
 - You may use any tool at any point today to collect data and make observations.
 - Treat all tools with respect and return them to your backpack when you finish using them.
- (Review how to use any tools necessary.)
 - Binoculars, etc.
 - Clinometer – describe function but explain you will teach students how to use these to figure out the height of trees later today.
- (Divide students into pre-assigned (from teacher) groups of three.)
 - Each group will get one Explorer Backpack- share the tools within it.
 - You are responsible for your backpack all day.
- (Give students time to look through their backpacks.)
- (Distribute a water bottle to any student who needs one.)

Review Hiking

- One of the best parts of Ocean Discovery Institute field trips is we will be outside in the fresh air all day moving our bodies and exploring.
- Part of the day we will be hiking on some of the trails in the Reserve.
- Remind students: hiking is like taking a walk, except we won't be walking on a road or sidewalk, we will mostly be on trails.
 - Trails can have rough and uneven terrain – tree roots, rocks, steep stairs, etc. It will be important to watch your step while hiking.
 - Hiking can be physically demanding.
 - If you feel tired or out of breath, slow down and take your time, but keep going!
 - Encourage each other – we will leave no one behind!
- Let's head out!
 - (Walk student to Data Collection location.)

Data Collection**Assistant Team Lead Teaching Notes:**

- € Sit with students during introduction.
- € Help students with data collection.
 - Check on data sheets regularly to be sure students haven't missed any data.
 - Try not to simply show them what to do but rather ask questions to get them started.
 - Example: What does the protocol say to do next? Are there any words you don't understand? What do you think that means to do?
- € Help students input data in the 123Survey app.

Timing for this station

- **Mapping Data Collection**
 - Walk to Data Collection location (10 min)
 - Introduction (5 min)
 - Tree Mapping Data Collection/Trail Walk/Sit Spot (55 min)
 - Data Input (15 min)
 - Debrief (5 min)
- **Growth Data Collection**
 - Walk to Data Collection location (10 min)
 - Introduction (5 min)
 - Tree Growth Data Collection/Data Input (40 min)
 - Trail Walk/Sit Spot (30 min)
 - Debrief (5 min)

Walk to Data Collection location

- As you walk to your trail point out things of interest.
 - See "Trail Walk" section of curriculum below.
- When you arrive to your location find a spot off the trail where you can gather the students together to talk.
 - Students should stand with their Explore Backpack group (3 students each).
 - Whenever possible create a circle so everyone can see, hear, and participate.

Introduction

- Review Torrey Pine Tree
 - (Have students stand close to a Torrey Pine – allow students to gently touch the tree.)
 - What do you observe about this tree?
 - (Encourage students to use all their senses.)
 - Things to point out on the tree if present:

- Sap – usually indicates injury to a tree.
- Evidence of bark beetles:
 - Tiny holes – males bore into the tree, release pheromones to attract the females, and females lay eggs in the tree, eggs hatch, and larvae begin to eat the tree
 - Larvae tracks – larvae create these paths as they eat
 - Red frass
 - Beetle scat - Evidence of turpentine beetles
 - Smells like turpentine.
 - Yellow frass
 - Mix of beetle scat and sap.
- This is a Torrey Pine – the tree we will be collecting data on today.
 - Ask students if they see other Torrey Pine trees?
 - Ask students what they recall about Torrey Pine trees.
 - Be sure to cover:
 - Nation’s rarest pine tree (found here and Santa Rosa only).
 - They are endangered. The population has been heavily impacted, and two-thirds of Torrey Pines have been lost since the 1970s.
- Science leaders are concerned because Torrey Pine trees are continuing to die off.
 - Ask students: What do you think could be causing Torrey Pines to die off?
 - Science leaders are worried about the continued impacts from climate change:
 - Climate change has caused more prolonged and increased numbers of droughts.
 - When there is less water available, Torrey Pines are less able to create sap.
 - Sap is the natural barrier to bark beetles.
 - Two types of bark beetles: five-spined engraver and the turpentine beetle.
 - Bark beetles are native to this area – meaning they belong here.
 - When the trees can’t produce sap, bark beetles are more easily able to bore into trees and lay eggs.
 - Over time the beetles eat away at the inside of the Torrey Pine tree and ultimately kill the tree.
- As a science leader, if you were concerned about the remaining Torrey Pine trees, what types of data would you want to collect about these trees?
 - If we want to monitor the health of the existing trees we will need to know:
 - Where are all the trees located.
 - What is the state of each tree?
 - One part of investigating is collecting evidence.

- Define Evidence: is data collected by science leaders.
- Evidence is recorded.
 - Datasheet, science notebook, computer spreadsheet, etc.
- When we collect data, we want to be consistent.
 - Take all measurements in the same way every time.
 - Using the same tools, in the same way, etc.
 - Use the same measurement units every time (inches, centimeters, grams, etc.)

Data Collection

Instructor note: Each group will only collect one type of data: Mapping or Growth. This will be assigned before the program begins by the IS Coordinator or the Trip Lead.

Tree Growth Data Collection/Data Input

Instructor Notes:

- **Collect and input all your data first then do the trail walk/sit spot.**

Overview:

- We will collect data on a small subset of trees that can be used to monitor their growth over the long term:
 - Tree height – how tall the tree is.
 - Tree circumference – how thick the trunk of the tree is.
- Ask students: What could this type of data tell us?

How to Collect Data:

- Hand out iPhones.
 - Show students where to find the GPS.
- Have students take out:
 - Torrey Pine Tree Growth Datasheet
 - Torrey Pine Tree Growth Protocol
 - Table of Tangents
 - Thin dry erase marker
 - Calculator
 - Measuring wheel
 - Transect Tape
 - Clinometer
- Demonstrate how to take growth measurements using the “Torrey Pine Tree Growth Datasheet & Protocol” using an example tree.
 - Have students follow along and record the data under “Practice Tree”.
- Once everyone is ready to collect data – explain to students that they will take measurements off three different trees.
 - Point out where the trees are located.
 - Point out that each tree is numbered.
 - Explain to students that they can go to the trees in any order but that they need to collect data for all three.

Collect Data:

- Have students work with their group to collect Growth Data for the three different trees.

Data Input:

- Overview:

- o (Once all groups have collected their data have them sit together in a circle with their group.)
 - o Explain to students that they will now be taking the data they collected and entering it into an app.
 - o The information they input will be uploaded to a GIS map that we will look at and analyze back in their classroom.
- Tree Growth Averages:
 - o Have students take out:
 - Calculator
 - Torrey Pine Tree Growth Datasheet
 - o Using your whiteboard ask each group to share:
 - The circumference of Tree ____
 - (Write each response on your whiteboard.)
 - Point out that there are differences in the circumference recorded by each group for this tree.
 - o Ask students what we should do if we want the most accurate circumference.
 - Take an average.
 - (Show students how to do this.)
 - Have students record the average on their datasheet.
 - o Repeat for tree height in feet and inches for the same tree.
 - Use the opportunity to talk about outliers.
 - Have any group with an outlier redo their math – try to figure out where the mistake is.
 - o Collect data for the other two trees on the whiteboard.
 - Have students find averages for each set of data.
 - Report averages to be recorded on data sheets.
 - o Input data into 123Survey.
 - Assign each group **one tree's data** to input so we don't reproduce data for the same tree.

Tree Mapping Data Collection/Trail Walk/Sit SpotOverview:

- We will be collecting data about the location and condition of all Torrey Pines along a trail.
 - o The location of the tree. - GPS
 - o The state of the tree. Living? Dead?
 - o If the tree shows evidence of bark beetles.
- Ask students: Why do you think it is important to collect data like this?

How to Collect Data:

- Hand out iPhones.
 - o Show students where to find the GPS.
- Have students take out:
 - o Torrey Pine Tree Mapping Datasheet
 - o Torrey Pine Tree Mapping Protocol
- Demonstrate how to take growth measurements using the “Torrey Pine Tree Mapping Datasheet & Protocol” using an example tree.
 - o Have students follow along and record the data under “Practice Tree”.
- Once everyone is ready to collect data – explain to students that you only want to record each tree once, so we will try to spread out a bit on the trail.

Instructor Data Collection Notes

Goal: For all students to be involved in data collection while limiting the trees we replicate data for.

- ***NEVER*** let your group out of visual proximity.
- *Assign half the groups to the Assistant Team Lead and the other half to the Team Lead.*
- *The Assistant Team Lead and their groups head down the trail first.*
 - o *They should stop at the first Torrey Pine they see that fits the mapping criteria and assign one of their two groups to take data for it.*
 - o *Whenever possible, assign the other groups to take data for another tree within visual distance of the 1st group.*
- *The Team Lead should pass the working groups and stop at the next tree that fits the criteria and have a new group take the data for it.*
 - o *Whenever possible assign other groups to take data for other trees in visual proximity.*
- *The Assistant Team Lead and the Team Lead will leap frog past each other over and over until you come to the end of the trail.*
- *This will not always work perfectly, so if you need to keep both groups together while collecting data on a single tree that is okay.*

Data Collection:

- Walk along the trail, stopping to gather tree map data whenever there is a tree close enough to the edge of the trail (no more than ~6 feet off the trail).
- Data Collection will be done in combination with Trail Walk/Sit Spot.
 - Between collecting data for trees be sure to talk about point of interest (see Trail Walk portion of curriculum below).
 - Stop and do a Sit Spot before you reach the end of the trail (see map above for sit spot locations).

Data Input:

- Overview:
 - (Once your group gets to the end of the trail, find a place to sit together in a circle with their group members.)
 - Explain to students that they will now be taking the data they collected and entering it into an app.
 - The information they input will be uploaded to a GIS map that we will look at and analyze back in their classroom.
- Tree Mapping Data:
 - Introduce 123Survey App.
 - We will upload all our data using 123Survey app.
 - <https://tinyurl.com/9thGrade123Survey>
 - Demonstrate how to enter information using the “Practice tree” and have students follow along on their own iPhone.
 - Have students open 123 survey using the tiny url.
 - <https://tinyurl.com/9thGrade123Survey>
 - Explain that for this portion of data collection, we will be leaving the “Tree Height” and “Tree Circumference” boxes empty.
 - When everyone is comfortable explain that each group will be entering their own data.
 - **Each tree is a separate entry** so you will fill out the survey multiple times – one time for each tree you collected data for.

Sit Spot

Instructor Note: When you reach the location on the trail marked “sit spot” on the map above.

- Prep for sit spot.
 - Spread students out along the trail.
 - Try to create a minimum of 4-6 feet between students but be sure all students are within sight of team leads.
 - Walk students to their location and let them know to stay there.
 - Let students know that they are about to begin.
 - *Instructor note: you may hear whispering or giggling – this is likely a reaction to being uncomfortable. Acknowledge that this may feel uncomfortable or weird because it isn’t something we do every day. Ask students to try and settle in and remain quiet for two minutes. Remind students that this is an opportunity to be their best self.*
- Introduce a sit spot.
 - Sit spots allow you to take a moment and tune into the details of your surroundings using as many senses as possible.
 - We have been busy collecting data all day, chatting with friends, and hiking, so now is an excellent time to take a quiet moment and observe our surroundings.
 - Often, we make lots of observations with our eyes, so now we will try observing using our eyes AND our other senses.
 - In a moment, we will stand silently for two minutes and observe the world.
 - While sitting, try to use all your senses: sight, hearing, taste, feel, and smell.
- Do sit spot.
 - Have students stand quietly for two minutes.
 - Halfway through, quietly ask students try closing their eyes to focus on their other senses.
- Debrief sit spot.
 - (Brings students together.)
 - What are some observations you made?
 - Sounds?
 - Smells?
 - Feelings?
 - Tastes?
 - Were there things that you only just noticed that might have been occurring around you all day?

Trail Walk

Instructor Notes:

- *Use anytime you are walking around the park as a time to explore the reserve further.*
- *The “Trail Walk Points of Interest” are just suggestions about somethings that can be pointed out as you walk. Not all of the below needs to be covered.*
- *Take student interests/teachable moments into account.*

o Pacific Ocean

- Ask students if their neighborhood in City Heights is connected to the Pacific Ocean.
- City Heights is connected to the Pacific Ocean through the Pueblo watershed.
- Water that washed off the streets in our neighborhood when it rains makes its way through the canyons and storm drains, emptying out into San Diego Bay and the ocean.

o Beach

- Students will study the beach with Ocean Discovery Institute in 10th grade.

o Cliffs

- *(Instructor Note: In-depth [Geology resource](#) with rock classifications can be found in the Instructor Background Material section of the curriculum.)*
- The cliffs are almost 300 feet tall in some places.
- This area was formed by a combination of uplift, changing sea levels, sedimentation, and erosion.
- When down on the beach, you can look at the cliffs and see many layers. The study of these layers is called stratigraphy.
- Some of the rocks in the park are over 48 million years old.
- The hard, reddish rock seen at the top of the cliffs is called the Lindavista formation, and it was deposited as the ocean receded less than a million years ago.
- There is magnetite in the sand along the trails.
 - (Use a magnet wand to show students this.)

o History

- Spanish sailors in the 1500s saw the trees growing on a high bluff at Torrey Pines and marked it on their charts as *Punta de los Arboles* or Wooded Point.
- It was a good reference point because most of the southern California coast is dry and trees are only common along streams or in the mountains many miles inland.

o Kumeyaay

- Ate the pine seeds of the Torrey Pines either raw or cooked.
- Ground and cooked pinole for flavoring.
- Use Torrey Pine pitch for glue.
- Modern Kumeyaay tribes use the pine needs for creating coiled baskets.

o Kelp

- Point out kelp beds where you see them.
- Ask students to share what they know about kelp (part of the 9th grade curriculum).

o Bark Beetles

- If students haven't seen these yet:
 - Red frass
 - o Beetle scat - Evidence of turpentine beetles
 - o Smells like turpentine.
 - Yellow frass
 - o Mix of beetle scat and sap.
- Point out Torrey Pine trees decimated by bark beetles.
 - Point out that beetles move from tree to tree by gliding so you can often see a downhill path of dead Torrey Pine trees.
 - Can see the recent bark beetle infestation started at the top of the High Overlook Trail and moved downward through the canyon.
- Pheromone traps
 - Science leaders are attempting to prevent bark beetle infestations with the use of pheromone traps.
 - Define pheromone: a chemical substance (as a scent) that is produced by an animal and is used to signal to other individuals of the same species to engage in some kind of behavior (mating, etc.)
 - Ask students: How do you think these traps work?
 - o They have chemical packets inside that release a scent that mimics the pheromones of male bark beetles. Females glide into the traps (thinking there is a male bark beetle inside) and fall to the bottom where they can't get out.
 - o The traps are designed in such a way as to prevent other animals from being captured (i.e., flies, bees, etc.) because those animals have the ability to maneuver out of the trap unlike the beetles which cannot fly.

o Torrey Pine Trees

- Wind pollinators – require wind to transport seeds from one tree to another.
 - Pine anatomy – male has strobili at the base.
- Point out interesting way some Torrey Pine trees grow. This is most often due to salt pruning.
 - Salt pruning is the process by salty air generated by seawater is driven ashore by winds and thus over time alters the shape of trees or shrubs. The process degrades foliage and branches on the windward side of the plant that faces the body of saline water, more than it does the foliage on the landward side. The resultant growth form is asymmetrical, appearing "swept back" away from the ocean.
- Point out restoration efforts within the park – small saplings surrounded by blue plastic.

- You may notice that many of the restoration efforts occur in areas where there are dead Torrey Pines. Why do you think that might be?
 - Conditions were good for Torrey Pines to grow before.
 - Dead Torrey Pines will decompose and provide nutrients for new Torrey Pines.
- On the other side of the wetlands, CA State Parks has purchased land to eventually plant more Torrey Pine trees.
- Torrey Pines can collect and store water, which is essential in a dry environment.
 - The needles of the Torrey Pines can condense water from the coastal morning fog.
 - They can then absorb some of the water directly through their needles, and any shaken off the tree is absorbed by their roots in the ground.
 - The microscopic texture of the Torrey Pine tree needles, which allows them to effectively harvest water from the fog, was confirmed by a 13-year-old science leader for a Science Fair project. She is now using that information to create moisture-harvesting materials that could help obtain moisture in areas of drought.
- Guy Fleming Trail:
 - Road just before Trailhead:
 - Look across the road and up to see an example of “Witches Broom” (looks like a green pom pom) which is the equivalent of a wart on a Torrey Pine tree. Scientists don’t really understand their purpose.
 - South Overlook:
 - Look out towards Mt. Soledad and you can see geologic marine terraces.
 - North Overlook:
 - On a clear day, look for San Clemente and Catalina islands.

Debrief

- Explain to students that we will analyze the data back in the classroom but you are curious about what they noticed while working today.
- Do some Think-Pair-Shares to debrief.
 - Must ask question:
 - How did it feel to do science?
 - What did you enjoy about it? Find challenging?
 - Potential additional questions include:
 - Why would science leaders and park rangers be interested in the data we collected?
 - What are some flaws in our data collection methods?
 - How could we improve on these?
 - Do you think Torrey Pines should be protected? Why or why not?
 - What would you do to make that happen?
 - If you were a chef? A fireperson? An architect? A professional soccer player?
- Acknowledge and celebrate student's completion of trail hike.
 - Everyone here has completed a hike today – and that's something to be proud of.
 - Whether you found it easy or challenging – you finished it – well done!

Lunch & Bathroom Break

- Walk students down the road to lunch.
- Give hand sanitizer to each student before lunch.
- During lunch, have students take a bathroom break.
- Remind students to refill water bottles from jugs.

Assistant Instructor Teaching Notes:

- € Staff member with lunches will drive their car down to lower parking lot and unload student lunches at picnic table.
- € Make sure student walk OFF the road and on the pathway.
- € Hand out hand sanitizer.
- € Walk around and monitor students while they eat lunch – ask them questions about their experience.
- € Walk around with trash bag when you see students starting to finish up.
- € Supervise and encourage clean- up of surrounding area when clean up begins.
 - Remind students that Torrey Pines is a protected area and to Leave No Trace.
- Give students a five-minute warning before clean-up.
- Remind students that Torrey Pines is a protected area and we practice Leave No Trace.
 - Be sure students throw away all trash into our trash bags.
 - Have students take two minutes to walk around and clean up their area.

Self-Reflection**Assistant Team Lead Teaching Notes:**

- € Manage a small group during the Pair-Shares.
 - o Participate in your small group pair-shares.
 - o Be sure all students have someone to talk with during pair time, if necessary, create a group of three.

Timing

- Reflection & Prep for Reflection (4 min)
- Reflection in Small Groups (14 min)
- Return to full group & Debrief (4 min)

Reflection & Prep for Reflection

- Introduce why we do reflection:
 - o Reflection is a part of every Ocean Discovery Institute experience.
 - o Reflection allows you to process and share thoughts and feelings about what you have done, thought about, considered, and learned today.
 - o Reflection can open your mind to new possibilities you hadn't considered before and can highlight ways your thoughts, ideas, and feelings change over time as you learn and experience new things.
- Prep for Reflection
 - o Divide students into small groups.
 - Create as many groups as there are adults.
 - Example: 2 Team Leads + 2 fellows + 1 teacher = 5 groups
 - o Have each group create a tight circle.
 - Stay within hearing of the Team Lead as they will facilitate.
 - (Mix students up – try to avoid sending students to small groups who have: collected data together, been pair-sharing, etc.)
- Each adult in the group will facilitate the Think-Pair-Shares.
 - o Review how to do a think-pair-share with everyone.
 - Think time (30 seconds)
 - Pair time (1-2 minutes)
 - Adults in the group should make pairings, so no one gets left out.
 - o Create a group of three if necessary.
 - Adults should be a part of the pairings.
 - Ask each person in the pair to share their response to the question.
 - Share in small groups (2 min)
 - Select 1-3 students in the group to share their response to the statement and or respond to another student's response.

Reflection in Small Groups

- Think-Pair-Share Questions:
 - (Provide each adult with Self-Reflection Questions print out.)
 - Think-Pair-Share Sentence Starters:
 - Before today, did you see yourself as a science leader? Why or why not?
 - Has that changed after today? Why or why not?
 - Today, I felt like I was doing science when...
 - I think science is important because...

Return to full group & Debrief

- Today our theme was: Who does science?
 - All of you were doing science today.
 - You were out in the field collecting data using scientific tools.
 - You input that data into the 123 Survey app and we will analyze it back in your classroom.
 - Your work today was significant because it is part of a long-term data set that all 9th grade students at Hoover High School will contribute to.
 - Over the years we will be able to track the health of and potentially protect some of the Torrey Pines here in the reserve – all because of you.
 - WE hope you realize the answer to the question: Who does science? – is – YOU DO!
 - (Point to students.)

Closing + Load Buses

(If using the “A Little Late” or “A Lot Late” schedule, skip the “Clean out Explorer Packs” but do “Go Awesome!” cheer.)

Collect water bottles & clean out explorer packs

- Collect borrowed water bottles.
- Have students empty their backpacks onto the grass.
- Have students make sure they have each of the following:
 - Clipboard
 - (Give students a new Torrey Pine Data Collection sheet.)
 - Pencils (2)
 - Binoculars
 - Hand lens
 - Clinometer
 - Transect tape
 - Plants of Torrey Pines ID Card (laminated)
 - Torrey Pines Trail Map
 - Torrey Pine Tree Growth Datasheet & Protocol
 - Torrey Pine Tree Mapping Datasheet & Protocol
 - Table of Tangents
 - Simple calculator
- If anyone has extras of anything, collect them. If anyone is missing something, replace it.
- Have students throw any garbage from their explorer packs into the trash bags.
- Have students clean binoculars and hand lenses:
 - Give each pair of students a piece of lens paper to clean off the eyepieces of binoculars and hand lenses. Demonstrate.
 - Throw all used lens paper into the garbage bin.
 - Make sure these go in the correct bags.
- Have students replace everything in their bags.

Goodbye

- We are only 30 minutes away from City Heights and Hoover High.
 - You can come back and visit anytime.
 - It is free to visit the reserve. If you want to park in the parking lot, you will need to pay a fee, but you can park along the road for free.

Believe! Achieve! Lead! Go Awesome!

- Great job doing science today!
- Remind students that you will see them one final time back in their classroom, where you will continue to explore the theme: I can be the Science Leader the World needs!
- Thank you for being your best self today, scientists!

- o At Ocean Discovery Institute, we **BELIEVE** that science is something you can do and that a scientist is someone you can be, that you can **ACHIEVE** in science and think critically about our world, and you can **LEAD** in science and conservation and make a difference in the world. Because we believe this, we do a “Believe! Achieve! Lead! Go Awesome!” cheer at the end of every program so that you will continue to do awesome things after we leave.
- o On the count of three, we will yell, “Believe! Achieve! Lead! Go Awesome!”
- (Walk students back to the bus area.)

Clean Up & Return to Lab:

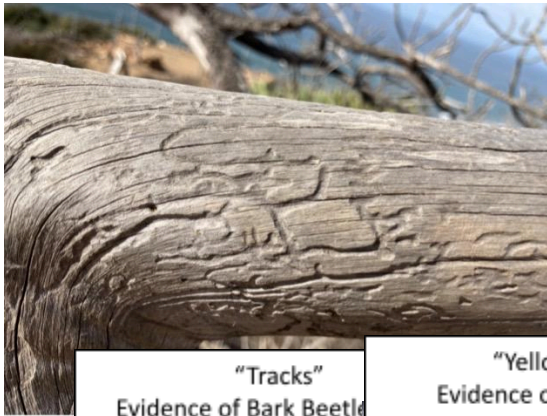
- Report to Alexa any supplies that are running low in the General Bin (pencils, hand lens, etc.)
- Restock backpacks.
- Organize explorer packs (if there wasn't time for students to do this).
- Return to Living Lab and:
 - o ~~Run water bottles through dishwasher at Living Lab.~~
 - o Plug in all devices to charge overnight.
 - o Report any technology issue to Chris.

Tree Mapping Protocol

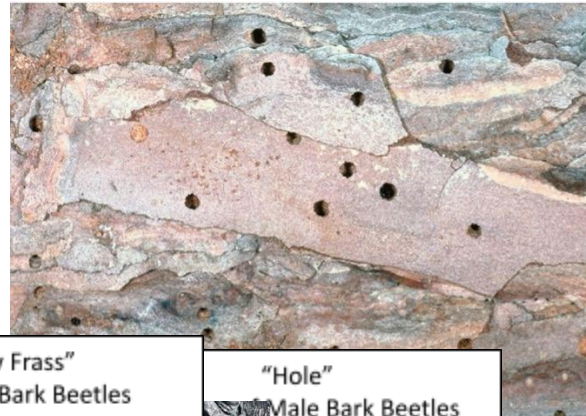
1. Locate a tree that is no more than ~6 feet off the trail.
2. Stand as close to the trunk of the tree as possible.
 - If the tree is off trail (behind a guywire) stand as close as the wire will allow but do NOT go off trail.
3. Record the GPS location.
 - Include ALL numbers.
 - Include any “ - ” signs.
 - Include directional indicators: N, S, E, W
4. Determine the “Condition of the Tree”
 - *Living* – tree has leaves, is standing up, looks healthy, etc.
 - *Dead* – tree has fallen over, no leaves, appears dead, etc.
 - *Unsure* – you cannot tell if the tree is alive or dead.

Bark Beetle Evidence Protocol

- Look for characteristic signs of bark beetles (pictures below).
- Use binoculars to search the entire length of the tree for evidence.



“Tracks”
Evidence of Bark Beetles



“Yellow Frass”
Evidence of Bark Beetles

“Hole”
Male Bark Beetles



Mapping Torrey Pine Trees Datasheet

Tree	GPS Coordinates	Tree Condition	Bark Beetle Evidence
PRACTICE TREE		Living Dead Unsure	☐ Hole ☐ Tracks ☐ Yellow Frass ☐ None
1		Living Dead Unsure	☐ Hole ☐ Tracks ☐ Yellow Frass ☐ None
2		Living Dead Unsure	☐ Hole ☐ Tracks ☐ Yellow Frass ☐ None
3		Living Dead Unsure	☐ Hole ☐ Tracks ☐ Yellow Frass ☐ None
4		Living Dead Unsure	☐ Hole ☐ Tracks ☐ Yellow Frass ☐ None
5		Living Dead Unsure	☐ Hole ☐ Tracks ☐ Yellow Frass ☐ None

Tree Circumference Protocol

- Stand at the base of the tree.
- Measure from the ground up to a height of 150 cm on the tree – this is where you will measure the circumference.
- Wrap the transect tape around the tree at 150 cm in height.
 - Record the circumference (in centimeters - cm) on your datasheet.

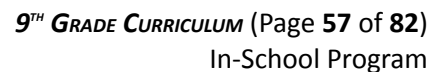
Tree Height Protocol

1. Stand at the base of the tree you want to measure.
2. Walk away from the base in a straight line until you can see the top of the tree.
 - Try to be standing on level ground so that your feet are at the same elevation as the base of the tree.
3. Look through the drinking straw of your clinometer at the top of the tree.
 - For the best results, adjust your distance from the base of the tree so that the clinometer reads as close to 30° as possible.
4. Have your partner read and record the number of degrees (°) of the angle on the clinometer (see diagram below).
 - Record the number of degrees on your data sheet.
5. Using the Table of Tangents, record the TAN of the angle on your data sheet.
6. Using a transect tape, measure the distance between you and the tree in centimeters.
 - Record the number of centimeters (cm) on your data sheet.
7. Using a transect tape, measure the distance from the ground to the level of your eyes in centimeters (cm).
 - Record the number of centimeters (cm) on your data sheet.

How to Use a Clinometer



Read number of
degrees: ~42



TREE CIRCUMFERENCE Tree # _____

GPS Coordinates: _____

Tree Condition (circle one): Living Dead Unsure

Bark Beetle Evidence (check all at apply): ☐ Holes ☐ Tracks ☐ Frass ☐ None

Tree Circumference: _____ centimeters (cm)

TREE HEIGHT

_____ degrees of clinometer = TAN of angle _____

Distance from tree to person w/ clinometer (in cm) _____ Distance from ground to eyelevel of person w/ clinometer (in cm) _____

Height of Tree = _____ x _____ + _____
TAN (angle of clinometer) x distance to tree + eye height

Height of Tree = _____ cm

Make a Difference Day

Living Lab Experience

Goal: Students build belief that they can make a difference and that a career in science is a possibility for them through creating a vision board and interviewing science leaders who are Hoover High alumni.

Supplies:

- General:
 - 9th Grade Make a Difference Day PowerPoint
 - Papi:\\Master Files\\Curriculum\\SI New\\High School (9-12)\\9th Grade\\Make a Difference Day Visuals
 - Science Discovery Process poster
 - \\vmfile01.aquatic.com\\Master Files\\Curriculum\\SI New
 - Chart paper (1)
 - Sharpies (2)
 - Pencils
- Vision Board
 - Vision Board Worksheet (laminated) (20)
- Data Analysis:
 - Torrey Pine Tree Data Analysis Sheet (1/2 students)
 - Simple calculator (1/2 students)
- Science Leaders Interview
 - Science Leaders Interview Questions (laminated) (2)
 - Science Leader Questions poster (2)
- HP Laptops (2/class)
 - To be used by any students who do not have a working Chromebook.
- Name tags (w/ sticky backs) (1/student)
 - Sharpies (30)

Timing:

Time	Group 1	Group 2
0:00 – 0:10	Introduction	
0:10 – 0:35	Data Analysis	
0:35 – 1:00	Science Leader – Student Connection Picnic Tables in Back Quad	Make a Difference/Self Reflection In Classroom
1:00 – 1:25	Make a Difference/Self Reflection In Classroom	Science Leader – Student Connection Picnic Tables in Back Quad
1:25 – 1:30	Closing	

Team Lead Notes:Prior to entering classroom:

- € Confirm that Google Classroom Assignment is ready.
 - Login: OceanDiscovery4255@gmail.com
 - Password: Ocean4255
- € Greet Science Leaders and review the plan for the day.
 - Provide a brief overview:
 - Program theme – I can be the science leader the world needs!
 - Program goals – Believe goals
 - Prior programming – What students did during Community and Explore days.
 - Today's programming – What they will be doing today.
 - Overview of Science Leader – Student Connection
 - Timing
 - Review Science Leader – Student Connections questions.
 - Cues for wrapping up, etc.
- € Assign floor management areas with staff.
- € Determine who Assistant Team Lead A and B are.
 - Review roles of Assistant Team Lead A and B.
- € Bookmark a link to the teacher survey on Chrome on all laptops.

Prior to lesson:

- € Introduce yourself and staff to teacher.
- € Confirm location of additional space for Science Leader-Student Connection
- € Discuss classroom norms with teacher.
 - ~~Attention getting signals, classroom expectations, participation expectations, etc.~~
- € Invite teacher to participate throughout lesson and explain when you will specifically need their help during the lesson.
 - Work with Team Lead to assist and monitor students during Vision Board activity.

Assistant Team Lead Set Up:

- € Prep name tags and sharpies for students to make name tags.
- € Cue up 9th Grade Make a Difference Day PowerPoint from teacher portal -OR- bring all visuals to front of classroom:
 - o Community Agreements Poster
 - o Science Discovery Process Poster
- € Cue up 9th Grade Torrey Pines ESRI Map.
 - o <https://tinyurl.com/9thGradeMap>
- € Set up Science Leader-Student Connection space.
 - o Create two areas (one for each Science leader) for students to sit and do the interview.
 - Place a copy of the "Science Leader Questions poster" in each place where students will be able to see it.
 - o If possible, space these far enough apart so that neither group is distracted by the other.

Assistant Team Lead Teaching Notes:

- € During Lead Team Lead's introduction:
 - o Hand out name tags and sharpies.
 - o Prep supplies quickly, then join the class.
- € Help students navigate the ESRI map and understand how to use the filter features

Introduction

Staff and Volunteer Intros

- Name Tags
 - o Have all students create a name tag.
 - Write large
 - Place name tag on front left side.
- Staff and volunteer introductions:
 - o All staff and volunteers take one minute to introduce themselves and share their story.
- Review Community Agreements.
 - o (Show Community Agreements slides.)

Icebreaker

- Explain the expectations:
 - o (Show Icebreaker slide.)
 - o When you hear me say "Science Leader" you must look up and quickly choose ONE person in the circle and make eye contact with them.
 - o If the person you are looking at is looking at someone else: Nothing happens.

- o If the person you are looking at is looking back at you, you both must SCREAM “I am a Science Leader!”: Whoever screams first is “safe” and remains in the circle. Whoever screamed second must step back and is out of the game.
 - o When you hear me say “look down” you must quickly look down at the floor.
- Gather students and all adults into a “circle” around the edge of their classroom to play.
 - o If possible, divide the class in half and play two separate games.
 - o Play until you run out of time -OR- there is a “winner”.

Review Theme of Program

- I can be the Science Leader the World Needs!
 - o (Show Program Theme slide.)
- Review the definition of a science leader:
 - o (Show the Definition of a Science Leader slide.)
 - o Are people of any age who use science to make a difference in their community and our world.
 - o Develop ideas to help solve problems facing our planet, improve human lives, and make our world a better place.
 - o Study science or have careers in science and science-related fields.

Review Science Discovery Process

- (Show Science Discovery Process slide.)
- Review what has been done:
 - o During our first meeting, we explored and wondered about Who is Needed in Science.
 - People like us.
 - o During our field trip, we investigated Torrey Pine trees while learning about Who Does Science.
 - We do.
 - o Today we will focus on analyzing and making a difference while considering **Who can be a Science Leader**.

Data Analysis

Timing:

- Introduction: 3 min
- ArcGIS Map Intro: 5 min
- Data Analysis: 12 min
- Debrief: 5 min

Introduction

- Review data collection.
 - o We will start with analyzing data.
 - o Once science leaders have collected data, they need to take time to look over the data they collected and analyze it.

- Analyze:
 - (Show Analyze slide.)
 - Analyzing includes examining your results and looking for trends in your data.
 - Trends:
 - Define Trend: patterns or similarities in the data.
 - Equate to social media.
 - When something is “trending,” it is because many people mention it on social media. It’s the same with data – if you see something many times in your data, we call it a trend.
 - Example:
 - (Show Example of Trend slide.)
 - Torrey Pine trees on the north-side of the Guy Fleming trail are healthier than those on the south side.
 - Data to support your trend.
 - Once you have found a trend be sure you can show the data to support it.
 - Example:
 - Data to support trees in the north are healthier than trees in the south.
 - There are 6 living trees on the northern part of the trail and only 1 living on the south part.
 - There are no dead trees on the northern part of the trail and 4 dead trees on the south side.

ArcGIS Map Intro:

- While at Torrey Pines State Reserve we collected data on several things related to Torrey Pine trees.
 - Ask students to recall what they collected data about.
 - Location of Torrey Pine trees (GPS).
 - Living/dead.
 - Evidence of bark beetles.
 - Subset of trees:
 - Collected height and circumference data.
 - Explain to students that they either collect data about the location of several trees along the trail OR they collected data about the height and circumference of a small group of trees.
- All the data that both groups collected and entered into the 123Survey app at Torrey Pines has been downloaded into a GIS map.
 - GIS: Graphic Information System
 - Is a computer system used to visualize, analyze, and interpret data that has a geographic component (location).

- Because we took a GPS reading with every piece of data we collected about the Torrey Pine trees, we can create a GIS map of our data.
- Hundreds of thousands of people use GIS in their jobs including scientists, people in public health, engineers, people in real estate, construction, transportation, etc.
- GIS mapping is a powerful and important tool.
- o Review the ERSI Story Map app with students.
 - (Show ESRI Map on SMART board.)
 - The map shows the data you collected during your field trip and the data of all the Hoover students who visited Torrey Pines before you.
 - Orient students to map features.
 - Each dot is a single tree.
 - o Color is related to state of the tree:
 - Alive: Blue
 - Dead: Brown
 - Unsure: Purple
 - Click on the dot for more data about that tree.
 - Dashboard.
 - o Takes data we collected and puts it into a visual format
 - o (Don't review this too much – we want students to figure this out for themselves.)
 - Filters.
 - o By Select a Date
 - Show students how they can look at all the data collected over time or their own data.
 - o Bark Beetle Filter
 - You and your partners will examine the data on the map and answer two questions.
 - o (Show Data Sheet slide.)
 - Review both questions.
 - o Question 1: **What is one *trend* you see in the data from the map?** Show the data that supports your trend.
 - o Question 2: **Based on the map data, should bark beetles be a concern for park staff?** Show the data that supports your answer.
 - Remind students that they will need to show the data that supports the trend they find.

Data Analysis

- Divide students into groups of 2.
 - o Have each group open one Chromebooks and navigate to the ESRI Map.
 - (Show ESRI Map Tiny URL slide.)
 - <https://tinyurl.com/9thGradeMap>

- o Have all students attempt to:
 - Filter by a specific date.
 - Click on a particular tree for data.
- Hand out a data sheet to each group and give them time to work. Talk to students about trends they are seeing:
 - o Potential trends for 2022-2023 School Year
 - ___ Numbers of dead v. living trees in one area v. another.
 - ___ Connection between evidence of bark beetles and state of tree.
 - ___ Number of trees with bark beetle evidence in one area v. another.
 - ___ Height/ circumference differences in one area vs. another.
 - Does tree height/circumference seem to be affected by the presence or absence of bark beetles?
 - o Additional trends starting in 2023-2024 School Year and Beyond
 - ___ Number of dead v. living trees in 2023 vs. 2024, etc.
 - ___ Growth rates height/circumference over time, etc.
 - ___ Evidence of bark beetles increasing/decreasing over time, etc.
 - o Are Bark Beetles a concern?
 - ___ Students can respond in anyway as long as they have data to back it up.
 - ___ One way to answer this question is using the graph of “Bark Beetle evidence” on the dashboard.

Debrief

- Review 1-2 responses to each question on the Torrey Pine Tree Data Analysis Sheet.
 - o Explain that there are many trends in the data that your group may have uncovered in addition to those we discussed.
- Think-Pair-Share: Why is it important for science leaders to collect this data?
 - o Be sure to cover, the importance of protecting Torrey Pine trees:
 - They are endangered, so there are few of them left.
 - Tie into biodiversity which student have been talking about in 9th grade.
 - Biodiversity: variety of life on Earth.
 - Biodiversity is essential to supporting all life on Earth, including humans. Without a wide range of animals, plants and microorganisms, we cannot have the healthy ecosystems that we rely on to provide us with the air we breathe, the food we eat, and the water and shelter we need. Having Torrey Pine trees contributes to the biodiversity of the planet.
 - Trees are essential to combating climate change (tie back to Ocean Discovery Middle School Program).
 - Ask students to describe how trees help to combat climate change:
 - o Trees absorb carbon dioxide during photosynthesis. Rising CO₂ levels are what contributes to climate change and its impacts.
 - Ask student to describe how tree can help prevent heat islands.

- o Trees provide shade.
- o Trees absorb less heat so they are a good material for landscaping in urban environments.

Make a Difference**Assistant Team Lead Teaching Notes:**

- € Help students create vision boards.
 - Check in with students who are working and ask questions.
 - Work with students who are struggling to get started.
 - Help student to consolidate long responses (greater than three sentences).

Timing

- Introduction (3 min)
- Prep for Science Leader Vision Board (4 min)
- Create Science Leader Vision Board (15 min)
- Debrief (3 min)

Introduction

- Make a Difference:
 - Making a difference makes the world a better place.
 - There are many ways science leaders can make a difference.
 - (CHOOSE TWO EXAMPLES TO REVIEW)
 - Build knowledge about our world.
 - (Share Building Knowledge About our World slide.)
 - Science leaders learn how spider silk is made by studying spiders and spider webs. Spider silk is one of the world's strongest biological materials and it only generates water as a by-product. In contrast, synthetic fiber production, which is used to create most human clothing, needs oil to be manufactured and creates oil by-products that contribute to climate change.
 - Develop innovative technology.
 - (Share Develop Innovative Technology slide.)
 - Example: Creating a way to recapture water vapor from the cooling towers of manufacturing and power plants. These industrial plants use 40% of all water in the United States for cooling processes, and much of that water is lost to water vapor. Science leaders have saved those companies millions of dollars and freed up hundreds of millions of gallons of water for other uses by creating a way to capture much of that water vapor.
 - Solve problems facing our planet.
 - (Share Solve Problems Facing Our Planet slide.)
 - Example: Developing a car that can turn food waste into energy. There is a significant trash issue in our world. Humans are creating more trash than we have places to put it. Additionally, cars using gasoline create carbon dioxide, which contributes to climate change. By creating a

vehicle that can turn food waste into energy, two problems are being solved – we are getting rid of the trash that would sit in a landfill, and we are lowering carbon dioxide emissions by creating a car that doesn't need gasoline to run.

- Improve human lives.
 - (Share Improve Human Lives slide.)
 - Example: Develop a 3D printer that can make prosthetic devices much more cheaply and quickly. This will make prosthetics available to more people who need them and improve their quality of life.
- You can imagine that making a difference in all the above ways takes a lot of creativity and a diversity of thought.
 - Review definition of diversity: variety; many different types
 - Just like the Earth needs biodiversity to remain healthy, science needs a diversity of people to make a healthy science leader community.
 - If everyone in science looked the same, came from the same background, and had the same experiences, they would most likely have the same ideas. If we only have a couple of ideas, it's unlikely we will be able to solve all the world's problems.
 - People from lots of different backgrounds, races, ethnicities, countries, languages, cultures, etc. create lots of different ideas and the more ideas we have the more likely it is we can use those ideas to make a difference.
 - One of the most amazing things about Hoover High School is the diversity of students that attend this school. Students of many different backgrounds, races, cultures, ethnicities, etc. attend here. Students who have had a wide range of background experiences attend this school. Students from all over the world attend this school. Hoover High is an incredibly diverse school!
 - Therefore, it is important that we showcase students like yourselves to the scientific community. They need to hear your voices and know why you are the next generation of science leaders.
 - Today you will use your voices to make a difference. To educate the science leader community about why they need people like you. Why they need to hear your voices, your ideas, and your thoughts on how to solve the world's problems. One of the best ways to make a difference is to educate others – and today each of you will do that by creating a vision board that you can share with the world.
- Science Leader Vision Board
 - Our goal today is for each of you to create a vision board that highlights what makes you the science leader the world needs.
 - Describe a vision board: a vision board is a collage of images and words.
 - (Show Vision Board slide.)
 - This vision board is an opportunity for you to make a difference by showing the world, that you can be the science leader the world needs.

- It will be a chance for you to highlight experiences, parts of your background, ideas, skills, talents, etc. that you have that would help create the diversity of thought necessary in science.
- Think about the videos you watched of the Hoover Alumni during the scavenger hunt. Each of those people were unique individuals who contribute to the growing diversity of thought in science.
- Similarly, think about what makes you stand out, highlight the things that make you unique, and share your ideas about making the world a better place.
- Remember, you don't have to want to become a scientist to be a science leader! Hundreds, if not thousands, of careers are science related, and even those that aren't can have a science focus.

Prep for Science Leader Vision Board

- Jam Board:
 - Each of you use Jamboard to create your Vision Board.
 - On your Jamboard will need to respond to the four statements on your Vision Board Worksheet (blue sticky notes).
 - (Show Science Leader Vision Board slide.)
 - On each blue sticky there is a question you need to respond to. Once you are done writing, feel free to delete the original question.
 - Try to keep your responses short.
 - You don't want to fill your entire vision board with text.
 - Once you have answered the four prompts, you can add additional things to your Jamboard that express you as a science leader – yellow sticky note (photos, quotes, artwork, etc.).
 - (Show Example Vision Board.)
 - If you are struggling with responding to your prompts we will provide you with additional scaffolding questions on a worksheet.
 - Clarify – prompts and scaffolding questions.
 - You do not need to write responses to the scaffold questions. They are there if you are struggling to answer the prompt.
 - You can write directly on these sheets – jot down notes/ideas, etc.
 - Walk students through how to use the Jamboard tools.
 - Change the background
 - Pen functions (size and color options)
 - Eraser option
 - Sticky note option (how to add text, change colors)
 - Add images using Google Images (resize, spin)
 - Shapes (color and outline fill)
 - Text box (text size, color)

- Clear frame

Create Science Leader Vision Board

- Have students take out Chromebooks and open Google Classroom.
 - Have students look for Ocean Discovery Institute Science Leader Vision Board assignment on Google Classroom.
 - (Show Assignment slide.)
- Have all students name their Jamboard in top right-hand corner.
 - (Show Naming Vision Board slide)
- Allow students to work on vision boards.
 - Assist students in using Jamboard and creating concise responses to each query.
 - Encourage students who finish responses early to add pictures, artwork, color, quotes, etc., to their vision board.
 - Give students a five-minute warning.

Debrief

- (Partner students up.)
- Have partner pairs show their jamboards to each other.
 - Share 2-3 things you included on their jamboard with your partner.
- When time is up, have students:
 - Let students know they may have more time to work on their Vision Boards with their teacher.
 - You are welcome to revisit and add to your Jamboard at any time- it is yours.
 - Have students close Chromebooks.

Science Leader – Student Connection

Assistant Team Leads Teaching Notes:

- € Assistant Team Leads will:
- Walk students to alternate space for Science Leader-Student Connection.
 - Divide the students in half.
 - Each Assistant Team Lead will take half the students to sit with a Science Leader.
 - Do the “Introduction” for this portion of the lesson.
 - Act as moderator for the interview.
 - Help more the conversation along.
 - If students do not have question of their own – ask a student to choose a question from the poster/handout and ask it.
 - Make connections to what the science leader talks about and what the student have done/are doing.
 - ~~Monitor time and give a two minute warning to start wrapping up.~~
- € Walk students back to the classroom at agreed up on time.

Timing

- Walk students to Science Leader – Student Connection location (3 min)
- Introduction (5 min)
- Science Leader – Student Connection (17 min)

Walk student to Science Leader- Student Connection location

- (Divide students in half.)
 - Send half of students to interview Science Leader A and the other half to interview Science Leader B.
- Have students sit/stand in a circle that includes the Science Leader.
 - Once students are settled begin introduction.

Introduction

- At this station, you will interview a science leader who is a Hoover High School alumnus.
 - This will be an opportunity to talk with someone who went to the same high school as you and became a science leader.
 - This person will share their story of becoming a science leader and what they do for work, then you will be able to ask them questions.
 - This person recognizes the power of YOU.
 - They know you are the future of science and they want to talk with you because they believe each of you can be the science leaders the world needs.
- Interview Overview:

- We will start by having me ask a few questions so everyone can get a general idea of the science leader's background and their journey to becoming a science leader, and then we will open it up to questions from you.
- You will be able to ask any of your own questions or a question from our Science Leader Questions poster.
- Expectations: Be Your Best Self.
 - Be curious – ask questions, share ideas, etc.
 - Be respectful – listen, raise your hand to ask questions, share something, etc.
- Introduce Science Leader:
 - This is xx. They are a science leader currently working at (job title and company).

Science Leader – Student Connection

- Interview questions:
 - (When possible, tie Science Leader answers to the students' experience.)
 - (Bold questions MUST be asked.)
 - **Can you tell us about your pathway to becoming a science leader? For example, what got you interested in science, what schools did you attend, etc.** (2 minutes)
 - **Tell us a little about your job and what you enjoy about it.** (2 minutes)
 - **Can you tell us about a challenge you faced going to college that you didn't expect and how you dealt with that challenge?** (2 min)
 - **What background/experiences/skills/etc. do you have that make you a science leader the world needs?** (2 min)
 - **Why do you think it's important for the students here to become science leaders?** (2 min)
- Student Q & A:
 - Open it up to student questions.
 - Remind students about the Science Leader Questions poster and let them know they can ask any question of their own or one of the ones on the poster.
 - If students are struggling to ask questions, choose a student to ask a question from the poster.
- Thank You:
 - Have students say thank you and clap for the science leader before switching to next activity.

Closing

Being a Science Leader Today

- Thank students for their contribution as science leaders.
 - Your work in Torrey Pines is contributing to a long-term data set on the health of Torrey Pine trees.
 - Your data is a piece of a larger puzzle.
 - Other students from Hoover High will come throughout the year to add to this data set.
 - Next year, a new group of 9th graders will come to Torrey Pines to add to this data set.
 - Long-term data sets are important because they can provide an early warning of changes happening in an ecosystem through reduced growth of trees (height and circumference), loss of trees (mapping), and infestations (bark beetles).
 - When science leaders know about changes, they can sometimes prevent tree loss.
- The great thing is that you can continue to be a science leader!
 - (Show the Definition of a Science Leader slide.)
 - Point to definition of Science Leader and specifically “people of any age”.
- Examples of student science leaders at Hoover:
 - (Show the Hoover Student Science Leader slides.)
 - There are students here at Hoover who are already science leaders:
 - Mussie & Casey (current 11th & 12th graders): Casey and Mussie worked as mentors in the University of San Diego STEAM Academy program this summer. They worked with 5th – 9th graders facilitating games and activities related to Science, Technology, Engineering, Art and Math that helped students develop their problem-solving and critical thinking skills.
 - Dannia (current 11th grader): Dannia took part in STEAM Academy this summer, in a different way, through the lab research program. She researched and observed how butterflies prone to viruses affect plants, caterpillars, and other butterflies. Dannia learned how to collect, enter, and analyze scientific data – all important things for a future scientist.
 - If you are interested in applying for this program next summer simply Google “USD STEAM Academy”.
 - All of these Hoover High students are science leaders, and you can be also!
- Share opportunities to stay involved.
 - (Show Opportunities slide.)
 - Avenues for Success: is a program to help students enroll in college, explore career options, and help with financial aid process.
 - Cardinals Interact: a program to help students get involved with community events and other San Diego programs, they provide one-on-one mentoring to help with academics.

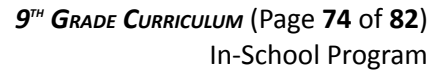
- Aaron Price Fellows: students visit government, cultural, and non-profit organizations. During each visit, Fellows learn about the role these organizations play in the community and career opportunities.
- Outdoor Outreach: is a program that offers different outdoor activities, such as surfing, biking, kayaking or climbing. Through these outdoor experiences you will receive work experience and develop leadership skills.

Go Awesome!

- Thank you for working with us today and taking the time to consider if “You can be the science leader the world needs!”. We hope you realize that any one of you can be a science leader if you choose to be, and the world needs more science leaders like you!
- We will see you again in 10th grade when we continue looking at how you can be the science leader the world needs.
- At Ocean Discovery Institute, we **BELIEVE** that science is something you can do and a science leader is someone you can be, that you can **ACHIEVE** in science and think critically about our world, and you can **LEAD** in science and conservation and make a difference in the world. Because we believe this, we do a “Believe! Achieve! Lead! Go Awesome!” cheer at the end of every program so that you will continue to do awesome things after we leave.
- (Show Go Awesome slide.)
- On the count of three, we will yell, “Believe! Achieve! Lead! Go Awesome!”

Upon Return to Living Lab

- € Turn in completed rosters and waivers to the Program Manager or Program Coordinator.
- € Debrief with the Program Manager
 - Report any broken or missing supplies
 - Report any supplies with low inventory remaining
 - Share good student stories
 - Report any issues/coaching to avoid these in the future



Directions: Use the data from the ArcGIS map to answer the questions below.

1. What is one *trend* you see in the data from the map? Show the data that supports your trend.
(*Trend*: patterns or similarities in the data)
¿Cuál es una tendencia que ves en los datos del mapa? Muestre los datos que respaldan su tendencia. (Tendencia: patrones o similitudes en los datos)
2. Based on the map data, should bark beetles be a concern for park staff? Show the data that supports your answer.
¿Según los datos del mapa, ¿los escarabajos descortezadores deberían ser una preocupación para el personal del parque? Muestre los datos que respaldan su respuesta.

Activities for Extra Time

These are quick 5-10-minute activities to be used if a lesson ends early.

Quick Focus:

- Stand in a circle. Have student close their eyes and take three deep breaths. Ask students to name three things they hear/smell/feel.
- Stand in a circle. Have students keep their eyes open and take three deep breaths. Ask students to be silent for 10 seconds and try to count as many different sounds as they can hear.

Charades/Pictionary/Taboo:

Charades:

- The Team Lead will whisper something for a student to act out without using any sounds. The rest of the students have to try and guess that the student is acting out.
- The student who guesses correctly can be the next “actor” to come up and try to act out a word given to them by the Team Lead.

Pictionary:

- Give students a word they must draw, and their group will guess. Examples: fish, ocean, waves, sun, plankton, shark, whale, fishing, fins, fish egg, sea star, sea urchin, etc.

Taboo:

- Like Pictionary, the GROUP is given the word, and they must communicate hints to the “guesser.”
- This can be done by having the “guesser” stand in front of the board, and the teacher can write the word behind the guesser.
- You can continue down a list of words and see how many each group can get in 1 minute. See the example list in Pictionary.

Idea Bank for Charades, Pictionary, and Taboo (ideas should ideally tie into the program):

- Science Leader
- Doing science
- Diversity
- Torrey Pine tree
- Bark Beetle
- Measuring a tree’s height
- Measuring a tree’s circumference
- Biology
- Go Awesome!
- Reflecting
- Science Discovery Process
- Make a Difference
- Explore and Wonder
- Investigate
- Analyze
- Communicate

9th Grade Curriculum Benchmarks

Design Principle	Benchmarks
Ocean Science Is Our Platform.	✓ Platform is Torrey Pines – students see the ocean when visiting Torrey Pines. ✓ Students spend time studying the Torrey Pine – a tree whose morphology is directly connected to the ocean.
Our Programming Reflects Community Priorities.	✓ The entire program is educational and fun. ✓ Staff focuses on safety through ASC – Accountability-Safety-Communication. ✓ Students learn to love the environment and through this experience build a love for nature and the ocean which will allow them to make more informed decisions in the future and share this information with their families.
We Share the “Spark”.	✓ Students participate in a scavenger hunt using GPS technology on their high school campus. ✓ We provide “Explorer Backpacks” filled with scientific equipment that can be used by students throughout their experience. ✓ Students spend half a day exploring Torrey Pines State Reserve one of only 14 reserves in the entire state of California. ✓ Students collect data on the Torrey Pine tree. The rarest pine tree in North America and an endangered species. ✓ Students hike at least two trails in the state reserve with time to observe nature and wildlife in addition to doing science. ✓ Students collect and enter data that is populated in an Arc GIS map which they then use to analyze their data and propose solutions to issues they see. ✓ Students create individual Vision Boards to help them visualize themselves as the Science Leaders of tomorrow. ✓ Students meet multiple Science Leaders from their own high school and hear about their pathway to becoming science leaders.
Our Programming Is Hands-On.	✓ All aspects of the program are hands-on from Community Day to Explore Day to Make a Difference Day.
Our Students Make a Difference.	✓ Students share their thoughts about what makes them the Science Leaders the world needs and why industry leaders should hire them. ✓ Students share their ideas about how to protect Torrey Pine trees based on data they have collected and analyzed.

Our Students Model Science Leaders.	✓ Students collect and analyze data about Torrey Pines using scientific tools and protocols. ✓ Students analyze data they collected using Arc GIS maps to determine trends related to Torrey Pine trees and invasive bark beetles. ✓ Students have explorer backpacks filled with scientific equipment which can be used to make real time observations about the surrounding ecosystem. ✓ Students use real scientific equipment – clinometers, GPS, transect tapes, etc.
Mentoring Plays an Important Role.	✓ Students are taught by staff from their own community. ✓ Students meet and interview science leaders who are reflective of their community during the Science Leader-Student Connection. ✓ Students “meet” multiple science leaders who are Hoover High alumni.
Our Educators Are Science Role Models.	✓ Our educators are from City Heights or similar communities which reflect the demographics of City Heights.
Science Leaders Share Their Stories.	✓ Students interview science leaders who share stories about their career and pathway during Science Leader Student Connections. ✓ Our educators share their stories and pathway each time they meet with students.
We Provide Coaching to Practice a Growth Mindset.	✓ We define a growth mindset and share the concept of having a growth mindset at the start of every program day with students. ✓ Staff are trained to look for teachable moments when they can discuss having a growth mindset with students.
We Teach Tools to Support Learning	✓ Time for process reflection is built into every activity.
We Teach Tools to Support Strong Hearts and Minds.	✓ Every program included a Community Building Day to help build belief that students are unique individuals who belong to a community of science leaders. ✓ Each day (Community, Explore, Make a Difference) ends with a 15-20 minute self-reflection. ✓ Students discuss the meaning of our community agreements and agree to abide by them. ✓ Students are told they are part of the Ocean Discovery Institute family and are invited to continue working with Ocean Discovery Institute by returning to the Living Lab to experience other programs. ✓ We end every program with the “Go Awesome!” mantra.
We Teach Tools to Support Healthy Bodies.	✓ Students spend time outdoors during the Community Day Scavenger Hunt.

	✓ Students are outdoors for all of Explore Day and spend part of the day trail hiking. ✓ We share rules and the reasons behind the rules, so students understand why certain behaviors are important. (i.e, staying back from the cliff face because of potential cliff failures).
Our Programming is Connected.	✓ The theme: I can be the Science Leader the world needs! is carried throughout the length of the high school program. ✓ Students investigate Torrey Pines State Reserve for the first time in 9th grade using the lens of biology, they will return to study this ecosystem in 10th grade through the lens of Physics and in 11th grade through the lens of Chemistry. ✓ Students study the Torrey Pine tree which are being heavily impacted by climate change the focus of the middle school program. ✓ Students learn about the importance of plants in combating climate change in the 6th grade program which connects to the importance of protecting Torrey Pine trees in 9th grade. ✓ Students begin to connect with their background and the experiences and traits that can make them the Science Leaders the world need in 9th grade and continue this practice through 10th-12th grade. ✓ The IS Program repeats many of its best practices throughout K-12th grade such as: use of the Science Discovery Process, activities designed using the learning cycle, similar daily program structure, etc.

Instructor Background Material

Torrey Pines State Natural Reserve

- State Parks [website](#).
- Torrey Pines State Natural Reserve [website](#).
 - More detailed information about the park and its history.

Torrey Pine Trees

- SD Zoo Wildlife Alliance work on [Torrey Pine Tree](#) restoration efforts.
- General overview of Torrey Pine Tree. [From the Nature Collective](#).
 - Great general description and lots of information about the Torrey Pine tree.
- Demography Plots and GIS Analysis of the Island Torrey Pine. An Environmental Science and Resource Management Capstone Project. [Paper](#).
- Torrey Pine Tree Management. [USDA Forest Service](#).
 - All you wanted to know about the management of the trees, particularly fire management.

Bark Beetles:

- Beetles cannot fly – they glide from tree to tree.
- Two types of bark beetle (California five-spined ips beetle and red turpentine beetle) pose a substantial threat.
- The Reserve experienced a 12% population decline from 1988 to 1991 and a 12% decline from 2006 to 2018.
 - Each decline coincided with a period of prolonged drought.

Diversity in STEM

- Sea Grant [Article](#).
 - Great short overview with good resources for further reading.
- National Science Foundation: [Science & Engineering Indicators 2018](#).
 - Statistics on education and careers in STEM.



Female Cone



Male Strobili



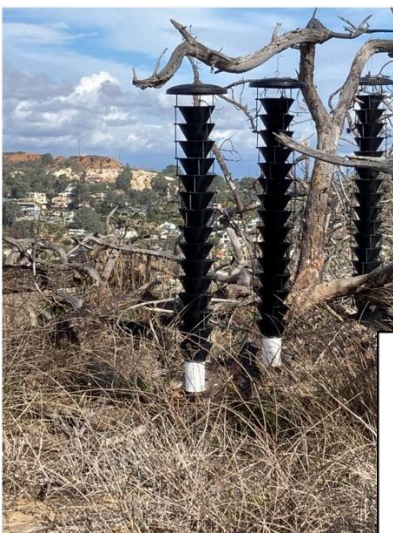
Red Frass (usually found at base of tree)
Scat from Turpentine Beetles



Evidence of Bark Beetle larvae



Yellow Frass - mix of tree sap and Scat
from Beetles



Bark Beetle Pheromone
traps

Look in cups at bottom
for bark beetles.

Geology of Torrey Pines

All of the rock layers at Torrey Pines are sedimentary, made up of pieces of older rocks. The layers are divided into formations that are different enough from each other to be told apart and are big enough to be seen on a geologic map. Starting with the oldest, they are the **Delmar Formation**, the **Torrey Sandstone**, the **Lindavista Formation**, and the **Bay Point Formation**.

- The Delmar formation is exposed only at the base of the sea cliffs.
- Torrey Sandstone
 - The Torrey Sandstone crops out near the top of the sea cliffs and at many other locations in the reserve, for instance on the Fleming Trail, the cliffs by the main Reserve road, and in Canyon of the Swifts.



Dewatering cracks in Sandstone



Sandstone Cliffs

- Lindavista Formation
 - The Lindavista Formation is the hard red rock on top of the flat areas in the Reserve.
 - About a million years ago, the ocean cut a marine terrace into the Torrey Sandstone. The cobbles along the base of the Lindavista helped the cutting just as similar cobbles on the beach today help the ocean cut into present cliffs.
 - The Lindavista was deposited as the ocean retreated. It has both marine shells and land fossils from streams.
 - The rock is red because the sandstone is cemented with iron oxide. When the Lindavista erodes, marble sized concretions are left on top of the rock because they are more resistant to erosion than the rest of the rock.



Lindavista Formation



- Bay Point Formation
 - The Bay Point Formation is made of poorly cemented, light brown sandstone.
 - Part of it, deposited in the ocean, has layers of shells up to 100 feet above present ocean level. The layers above 100 feet have no shells so are probably material washed down slopes by streams.
 - The scenic badlands formations are all Bay Point.



Badlands of the BayPoint Formation