Title Page

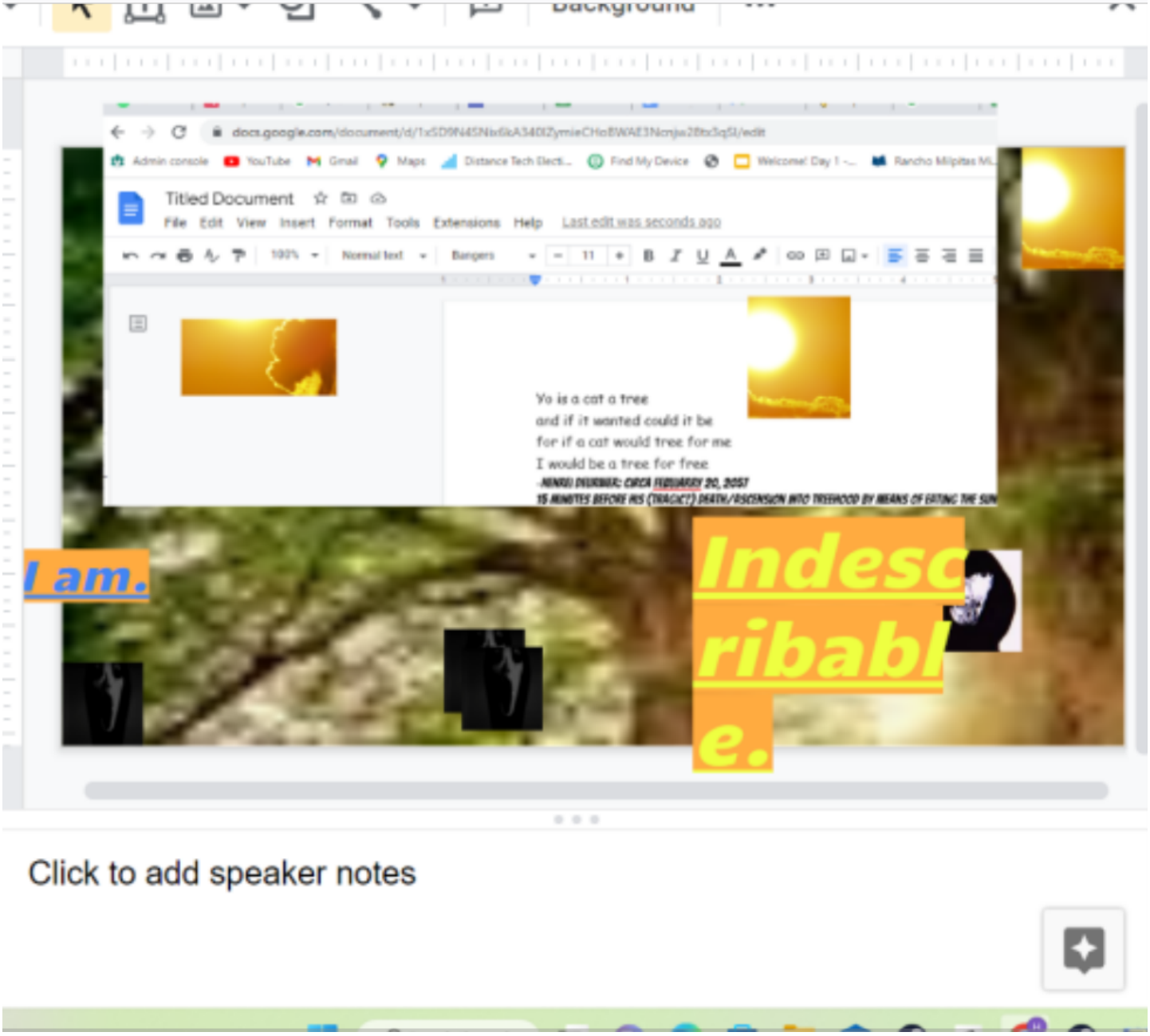

Image by Henry Duewer, Milpitas High School ‘26

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If you have any questions, comments, or complaints, please contact us at:
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This is a single 50-minute test without stations. Images are on the image sheet.
Hope you enjoy!

Question Set 1:

These questions are relating to **Images A-K**.

Context: A group has done roughly 40 botanical surveys by Round and Tamarack Valleys at Mount San Jacinto, a high-elevation mountain in Southern California (Mount San Jacinto is circled in a map of Southern California in **Image A**. A Satellite View and a USGS topo of the survey region are shown in **Images B & D**, respectively).
NOTE that these surveys was done primarily over certain lines (looks like trails, peaks, and some other notable areas for the most part), so, as without knowing where the surveys took place, you would perceive patterns which didn't exist, the map of every point where something was recorded is at **Image C**, which should give you a general idea of where the survey took place.

1. The maps in **Images E, F, G,** and **H** are lists of points where the surveyors encountered some tree species. Match each of these 4 species to the image that shows the points where the surveyors encountered them. (4 points, 1 point each)

a. Cercocarpus ledifolius	1. **Image E**
b. Pinus flexilis	2. **Image F**
c. Salix scouleriana	3. **Image G**
d. Abies concolor	4. **Image H**

2. Give the **common name** of the species in **Image I**. (1 point)

3. The map in **Image J** is a list of the points where they encountered the species from **Image I**. Explain if this differs from the type of place this plant is usually found in, and if so, how. (2 points)

4. Give the **common name** of the conifer in **Images K** and **L**. (**Image L** is a zoomed in version of **Image K**) (location hint in next question) (1 point)

5. The species in **Image K** (and **Image L**) is found on the north slope of Mount Konocti, a mountain in Northern California near Clear Lake, while the south slope generally has plants that need less water (like *Adenostoma*). This is the case for the north side of mountains and ridges in most of the USA. Explain why plants that need more water can survive in the north side of these mountains and ridges compared to the south side. (2 points) (Hint: Think about shadows and where the sun is in the sky)

6. **Image M** is a topographic map of a canyon in Henry W. Coe Park outside of Morgan Hill, California. One of these points (A or B) is at an area with trees that need more water (like Madrones and Coast Live Oaks) while the other mostly has shrubs and grassy areas. Which point is the one with the more-water-needing trees? (1 point)
NOTE: In the topo map, North points up the page (the direction of this arrow ↑)

7. True or False: This effect from Question 5 is reversed in the Southern Hemisphere. (1 point)

8. True or False: This effect from Question 5 is more intense in tropical areas. (1 point)

Question Set 2:

These Questions relate to **Image N.**

1. Give the **scientific name** for this plant. (1 point)

2. This plant is invasive to the USA. Where did it originate from? (1 point)

3. What is the definition of an invasive species? (1 point)

4. Another invasive plant on the tree list originated from the same place as the plant in **Image L**. Give its common name. (1 point)

5. How has this plant affected the United States law?

6. This plant has begun to hybridize with its family offshoot (a member of its family) that's native to North America, worrying ecologists. Why is this hybridization worrying, and how will it affect the ecosystems the plants are found in? (2 points)

Question Set 3:

These questions relate to **Images O-W.**
Context: The absolute BIRB in **Images O & P** is a Red-Cockaded Woodpecker (Picoides borealis/Leuconotopicus borealis). That's what this section will nominally be about. (It's actually about southeastern pines but it has a cameo from this birb and we're coping because Ornithology is dieded)

1. Images Q and R are images of the same species of tree. The other two pairs (Images S and T and Images U and V) are also pairs of two images of the same species. Each pair is of a different species. Match the pairs of images to the correct species. (3 points total, 1 point each)

a. **Images Q and R**	1. Pinus taeda
b. **Images S and T**	2. Pinus echinata
c. **Images U and V**	3. Pinus palustris

2. The Red-cockaded woodpecker usually drills nest cavities in living pine trees with heartwood that's rotten by some types of fungus (red heart fungus). Your friend <Insert name here> says that the Red-cockaded Woodpecker mostly drills cavities in very old trees. Do you agree or disagree? Why? (2 points)

3. The Red-cockaded Woodpecker is often found in places which have frequent (like once every 1-5 years) surface fires. Which of the images of forests (**Images Q, S, or U**) looks like the least likely to have been subjected to frequent surface fires in the recent past? (1 point)

Right underneath their nest cavities, Red-cockaded Woodpeckers drill small wells (holes) which makes resin ooze out. (This is shown in **Image P**) This stops rat snakes coming in to eat eggs and babies. (Note: resin's pretty flammable)

4. How does this sort of tree resin act as a defense from bark beetles? (1 point)

5. Name 2 uses for tree resin (1 point total, 0.5 each)

Now let's shift to a non-sequitur about Longleaf Pines in general.
6. Longleaf Pines (and a lot of other fire-adapted pines) have very thick bark that protects them from fires. Why does the thick bark help them survive low-intensity fires? (2 points)

(Hint: Usually trees with thin bark that are killed by a fire often are still standing but dead)

Now let's look at Image W, an image which shows the ages of Longleaf Pine trees in two different plots of land, the Boyd Tract and the Wade Tract and their relative abundance. (An age class is a set of trees whose age is within a range of ages (like the age class 0-25 is between 0 and 25 years old))
One of these plots was burned regularly every few years with surface fires while the other was not burned for a very long time.

7. Which plot (the Boyd Tract or the Wade Tract) was the one which was burned regularly? How do you know? (3 points)

(Hint: There also exist trees that aren't Longleaf Pines)

8. Red-cockaded Woodpeckers generally prefer to not excavate cavities for their nests low in the trunks of trees even though it's usually wider there. Why might that be? (The reason is NOT directly related to rat snakes or other nest predators) (1 point)

(Hint: Look at **Image O**)

Question Set 4:

These questions relate to **Images X-Y**
Let's talk about the Saguaro, your favorite(?) tree(?).

1. Saguaro doesn't photosynthesize using its spines (which are their modified leaves). What parts of it photosynthesize? (1 point)

2. Saguaro use a metabolic pathway called CAM in which they only open their stomata to get CO_2 at night, convert it into an organic acid, and do the photosynthesis (the calvin cycle) during the day. How might this help the tree (you ain't stoppin' me) prevent water loss? (1 point)

Image X is a diagram that's a really basic overview of CAM Photosynthesis.

3. CAM stands for "Crassulacean Acid Metabolism." "Crassulacean Acid" does not appear on the diagram. What is it, and what is its purpose? (0.0 Points)

Look at **Image Y.**
CALVIN CYCLE JUMPSCARE

Sometimes, in the Calvin Cycle, rubisco attaches an O_2 molecule to RuBP instead of a CO_2. This is called "photorespiration" and wastes energy. One benefit of CAM Photosynthesis is that the PEP Carboxylase that turns the CO_2 into the organic acids (like malate) can discriminate between O_2 and CO_2.

4. Some other desert plants, even some that don't do CAM photosynthesis like Honey Mesquite, keep their stomata closed during the hottest parts of the day. How might this cause more photorespiration when compared to a tree with open stomata? (1 point)

[I GIVE UP AAAAAAAAAAAAAAAAAA]

7. Dendrochronologists are sometimes able to date a tree that's no longer living. Name one way they can do this. (1 point)

Question Set 5: Oops! All Pines!

These questions relate to **Images Z-AH.**

1. Give the **common name** of the tree **ON THE RIGHT** in **Image Z**. (1 point)

2. Give the **common name** of the tree **ON THE LEFT** in **Image Z**. (1 point)
(Hint: they are both wild trees)

3. Give the **common name** of the tree in **Image AA**. (1 point)

4. Give the **common name** of the tree in **Image AB**. (1 point)

5. Give the **common name** of the tree in **Image AC**. (1 point)

6. Give the **common name** of the tree in **Image AD**. (1 point)
(Hint: Image **AD** was taken in the Ruby Mountains, Nevada)

7. Give the **common name** of the tree in **Image AE**. (1 point)

8. Give the **common name** of the tree in **Image AF**. (1 point)

9. Give the **common name** of the tree in **Image AG**. (1 point)

10. Give the **common name** of the tree in **Image AH**. (1 point)

Question Set 6:

1. João studied a bunch of yellow pine trees (subgenus *Pinus*), and found that the ones that have thick bark also tend to also be ones which self-prune (drop their lower branches) and grow really tall. João also says that these traits make them more resistant to fires. Give one reason why **each** trait helps a tree be fire-resistant. (3 points, 1 per trait)

2. Give the **common name** of a yellow pine (subgenus *Pinus*) from **Question Set 6** with those traits mentioned in Question 1. (1 point)

3. Your friend Arvind says that most trees with serotinous cones should also have those characteristics mentioned in question 1 because they're adapted to fire. However, João found a lot of trees with serotinous cones with lots of lower branches. Explain 2 ways why not self-pruning traits helps those trees even though it hinders survivability. (2 points)

4. Name one species of the tree in Question Set 5 which has at least some individuals with serotinous cones. (1 point)

5. One of these characteristics that tends to appear heavily in trees which have serotinous cones is that they tend to start making cones relatively early. Why might that be particularly advantageous to those trees? (2 points)

6. Fire suppression is a thing which exists and is worth talking about. However, I want to bring up the flip-side thing which is also happening as well. There's a lot of places which have much more frequent fire ignition intervals than during pre-settlement because of increased things that cause fires (power lines, campfires, arson, etc.). Which set of pines (those in Question 1 or those in Question 5) would you expect to be more damaged by this increase in ignition of fires and why? (3 points)

7. When doing further investigation in pines outside of subgenus *Pinus*, João found that pines adapted to high alpine areas or deserts tend to not be adapted to fire. He believes that this is because fires don't happen as often in high alpine places or deserts. Why might fires not be frequent in deserts and high alpine areas? (1 point)

Question Set 7:
(miscellaneous section)

1. Every Christmas, the United States Government takes a tree from USDA National Forest lands, cuts it down, and transports it to the White House, where it is displayed as a Christmas tree. There was one year when they took a Lutz Spruce, a hybrid between White Spruce (*Picea glauca*) and Sitka Spruce (*Picea sitchensis*). Which U.S. State was this hybrid taken from? (1 point)

2. Your friend Sukhad now goes to school at LSU (Louisiana State University) (he doesn't but let's just say he does). Last Christmas, he worked with the folks at his College to get one of the Longleaf Pines with the folks at a local forest cut down and put it in front of his college as a Christmas tree. He says that this is a bad Christmas tree. Why might this be? (1 point)

Gerrick Olliwander, an Ollivander impersonator and professional scammer, sells fake wands. To make his fake wands, he goes to a tree, gets a twig, and then sells it for a fortune.

3. Parry Otter, a professional Harry Potter impersonator, wants to buy a wand that looks vaguely similar to that of Harry Potter. Which **ONE** of the following trees would be the **WORST** one to use for a wand? (Hint: There are multiple bad choices, but there's only one **really bad** choice can't even be theoretically usable for a wand) (1 point)

a. Blue Palo Verde
b. California Fan Palm
c. Black Cherry
d. Honeylocust

4. Being Bri*ish, Gerrick Olliwander doesn't know anything about American forests and, instead of finding a forest with the tree species he wanted (*Ilex* sp. because Harry Potter had a holly wand), he ended up going into a coniferous forest, where there aren't any broadleaf plants. Olliwander remembered Parry Otter complaining that the previous wand that he had was rough and scratched his hand, so wanted to bring a twig that's more smooth. (NOTE: Debarking a twig is frowned upon in Gerrick's wand-making circle because it's too much work, so that isn't a possibility). Which **ONE** of these genera would be the best for Gerrick Olliwander to harvest a twig off of? (1 point)

a. *Pinus*
b. *Abies*
c. *Picea*
d. Larix

(Lore tidbit: Parry Otter is Gerrick Olliwander's only repeat customer because, unlike most people who wish to buy wands, Parry Otter doesn't actually *do* magic)

5. A Native American porridge or drink is made out of this tree. Which is the used tree? (1 point)

a. Osage-Orange
b. Pacific Yew
c. Shagbark Hickory
d. American Holly

6. A rocks and minerals expert tried to do forestry for the first time. He couldn't figure out the difference between pines, spruces, and firs. Help this rocks and minerals expert figure out the differences between these trees by listing two characteristics unique to each genus. (3 points)

7. The California Buckeye at the front of Milpitas High School (by the G building)'s bark is covered with initials carved by dolts who feel like their relationship would last longer than the tree and is worth more than the tree itself and its beauty. (as you can see, I feel very strongly about that). Why are California Buckeyes more likely to suffer from this initial-carving "plague" than, say, Ponderosa Pines? (1 point)

Shrudas harvests some ripe American Black Elderberries and cooks them into a pie.
8. **True** or **False**, Shrudas will be very sick afterwards.