

# ANSWER KEY

Some comments on using this answer key (and this test in general)

1. The links that say “Source” aren’t to make you somehow blindly trust the validity of the statements. They are for you to click on and look at all this cool articles. These are the awesome rabbitholes we fell into, most of which we weren’t able to milk onto our test. Highly encourage you look through them because they’re interesting and because “further inquiry.”
2. We took most of our images from iNaturalist (“eyenat”). We like this because the images aren’t indexed on google images (so you can’t reverse image search them), they’re easy to filter by location and stuff, and there’s so many of them that you can’t possibly have gone through them all.
3. This was heavily inspired by the 2022-2023 Rickards C Forestry Test. Highly encourage that y’all try it out if you haven’t already done so!!!
4. We gave up on section four sorry :(

**(Answers start on the next page)**

## Question Set 1

1. Survey details + map + other info come from this website:  
[https://tchester.org/sj/species/round\\_et\\_al\\_valleys/index.html#diversity](https://tchester.org/sj/species/round_et_al_valleys/index.html#diversity)
  - a. **Image G** is the one which contains the points at which the surveyors found *Cercocarpus ledifolius* (Curlleaf Cercocarpus).
    - i. Explanation: The Curlleaf Cercocarpus is usually found in dry, rocky, and steep slopes, which matches the points at craggy areas and on the steep Eastern slope of the mountain.
      1. Source (for explanation):  
<https://www.fs.usda.gov/database/feis/plants/tree/cerled/all.html>
  - b. **Image E** is the one which contains the points at which the surveyors found *Pinus flexilis* (Limber Pine).
    - i. Explanation: Limber Pine is a little more of a “generalist” in the elevations at which it exists (to some extent; it likes drier ridgetops and stuff) Absolute elevation ranges aren’t as helpful for this as relative elevations (because of ). It’s (usually) found at higher elevations than *Abies concolor* (the other species of the four which doesn’t have incredibly specific area preferences)
      1. Source (for explanation):  
<https://www.fs.usda.gov/database/feis/plants/tree/pinfile/all.html>  
(sorry couldn’t find better single source than that)
  - c. **Image H** is the one which contains the points at which the surveyors found *Salix scouleriana* (Scouler’s Willow).
    - i. Explanation: Scouler’s Willow is usually found in wet and/or creek (riparian) areas, which is what the dots appear to be.
      1. Source (for explanation):  
<https://gardenshop.symbiop.com/products/fire-willow-salix-scouleriana-1-gallon>
  - d. **Image F** is the one which contains the points at which the surveyors found *Abies concolor* (White Fir)
    - i. Explanation: See part b.
      1. Source (for explanation):  
<https://www.fs.usda.gov/database/feis/plants/tree/abicon/all.html>  
(combine this with the source for (b))
2. **Image I** is a Canyon live oak (accept aliases if they’re specific)
  - a. Explanation: Note the leathery leaves, no lobes, golden-ish hairs on the back-side of leaves
  - b. Image source: <https://www.inaturalist.org/observations/93650966>
3. Is unusual because it’s usually found in canyon bottoms or similar things. Also accept that it’s not unusual because it often grows (as a shrub) on rocky slopes.
  - a. Sources: [https://calscape.org/Quercus-agrifolia-\(Coast-Live-Oak\)](https://calscape.org/Quercus-agrifolia-(Coast-Live-Oak)) and <https://www.fs.usda.gov/database/feis/plants/tree/quechr/all.html>
4. **Image L** is a Common douglas-fir (accept douglas-fir).

- a. Explanation: I'm running on the assumption that [test taker] doesn't know where Mount Konocti is (which would give it away entirely (it's not particularly coastal or montane)) but knows (from question 5) that it's in Northern California.  
Really short needles in the canopy eliminate all pines except for Lodgepole Pine. The bark's really ridged/fissured so it doesn't match the "smashed cornflakes"-y bark of lodgepole pine. Ridged/fissured bark also eliminates Subalpine Fir (smooth bark) and Engelmann Spruce (scaly bark). Ridges are deeper and further apart (and the bark's less grey) than in Grand Fir, which leaves Common Douglas-fir as the only remaining good option
  - b. Image Source:  
[https://www.google.com/maps/@38.9986856,-122.75938,3a,73.3y,183.09h,124.01t/data=!3m7!1e1!3m5!1sSimW2wVHtgkBfNseA2DH-Q!2e0!6shttps:%2F%2Fstreetviewpixels-pa.googleapis.com%2Fv1%2Fthumbnail%3Fpanoid%3DSimW2wVHtgkBfNseA2DH-Q%26cb\\_client%3Dmaps\\_sv.tactile.gps%26w%3D203%26h%3D100%26yaw%3D38.49012%26pitch%3D0%26thumbfov%3D100!7i13312!8i6656](https://www.google.com/maps/@38.9986856,-122.75938,3a,73.3y,183.09h,124.01t/data=!3m7!1e1!3m5!1sSimW2wVHtgkBfNseA2DH-Q!2e0!6shttps:%2F%2Fstreetviewpixels-pa.googleapis.com%2Fv1%2Fthumbnail%3Fpanoid%3DSimW2wVHtgkBfNseA2DH-Q%26cb_client%3Dmaps_sv.tactile.gps%26w%3D203%26h%3D100%26yaw%3D38.49012%26pitch%3D0%26thumbfov%3D100!7i13312!8i6656)
5. The north side gets less direct sun, (because of the shadow of the mountain/ridge on it), which makes it such that there's less evapotranspiration, so then less water loss. I wanted to do something specific to the black forest of Mt. Konocti but I found no sources whatsoever, so I made it a generic question instead :(
  - a. Source (it has a nice diagram explaining it):  
[https://www.researchgate.net/publication/341354955\\_Understanding\\_the\\_role\\_of\\_slope\\_aspect\\_in\\_shaping\\_the\\_vegetation\\_attributes\\_and\\_soil\\_properties\\_in\\_Montane\\_ecosystems](https://www.researchgate.net/publication/341354955_Understanding_the_role_of_slope_aspect_in_shaping_the_vegetation_attributes_and_soil_properties_in_Montane_ecosystems) (This also used for questions 6, 7, and 8)
  - b. Black Forest: <http://www.lakecountylandtrust.org/black-forest.html>
6. **Point B** would have the more-water-needing plants. It has less direct sun from the shadow of the ridge, so there's less evapotranspiration, which means that there ends up being more water there when compared to the other area. The opposite is the case for the south-facing slope (that which point A is on) (no explanation required to get point) I did a slight exaggeration about the slope where point A is on. There's some trees, like Grey Pines (*Pinus sabiniana*) and Blue Oaks, but way less dense than south slope
  - a. Image source:  
[https://coepark.net/images/maps/Trail\\_Conditions\\_local\\_maps/DXT.jpg](https://coepark.net/images/maps/Trail_Conditions_local_maps/DXT.jpg) (you get there from the trail conditions page:  
<https://coepark.net/planning-your-visit/trail-conditions>)
7. **True**, in the southern hemisphere, there's shadow from the ridge (the sun is on the north side unlike in the Northern Hemisphere), so . The diagram in the source illustrates it pretty well. (No explanation required to get point)
8. **False**, in tropical areas, the sun's more "straight up" (well not far to the north or south), so then the mountain doesn't much shade the north or south side of the ridge thing. (No explanation required to get point)

## Question Set 2

1. *Morus alba*
  - a. Explanation: The leaf is pretty large and somewhat heart-shaped (though more elongated and lighter in color than, say, Basswood (Basswood also has a different color)). The leaf margins are serrated, which eliminates most other heart-looking things that aren't mulberries. You can eliminate Red Mulberry from the questions that say that it's an invasive species.
  - b. Image Source:
2. China (and India???)
  - a. Source:  
<https://naturewalk.yale.edu/trees/moraceae/morus-alba/white-mulberry-102#:~:text=Origin%20and%20Habitat%3A%20The%20Morus,and%20in%20the%20United%20States>.
3. an introduced, nonnative organism (disease, parasite, plant, or animal) that begins to spread or expand its range from the site of its original introduction and that has the potential to cause harm to the environment, the economy, or to human health
  - a. Source:  
<https://www.usgs.gov/faqs/what-invasive-species-and-why-are-they-problem>
4. Ailanthus (Tree-of-heaven)
  - a. Source:  
<https://wildlife.ca.gov/Conservation/Plants/Dont-Plant-Me/Tree-of-Heaven>
5. In 1624 the legislature of Virginia required every male resident to plant at least 4 white mulberry trees to promote a North American silk industry. By the 1830s, the potential for a silk industry prompted a horticultural phenomenon known as "mulberry mania" in the eastern United States
  - a. Source:  
<https://www.fs.usda.gov/database/feis/plants/tree/moralb/all.html>
6. The White Mulberry is just *better* in a lot of ways, so it has better survival than the red mulberry in most places. When it hybridizes with red mulberry, the hybrids grow faster than the red mulberry in most of the places where they are, which could result in the more fit hybrids leaving no more red mulberries left.
  - a. Source:  
<https://besjournals.onlinelibrary.wiley.com/doi/full/10.1111/j.1365-2745.2006.01152.x>

### Question Set 3

- Image O source: <https://www.inaturalist.org/observations/138399966>
  - Image P source: <https://macaulaylibrary.org/asset/156288161>
1.
    - a. ***Pinus palustris*** (Longleaf Pine) is the species in **Images Q and R**
      - i. Explanation: Note the REALLY LONG leaves, the open cone, the tree being in a very open grassland type of place (suggests frequent fires)
      - ii. Image Q source: <https://www.inaturalist.org/observations/149602655>
      - iii. Image R source: <https://www.inaturalist.org/observations/147004814>
    - b. ***Pinus taeda*** (Loblolly Pine) is the species in **Images S and T**
      - i. Explanation: Note the long but not insanely-long 3-fascicle needles and the conical (idk how to describe it) cone
      - ii. Image S source: <https://www.inaturalist.org/observations/149591175>
      - iii. Image T source: <https://www.inaturalist.org/observations/149679078>
    - c. ***Pinus echinata*** (Shortleaf Pine) is the species in **Images U and V**
      - i. Explanation: Note the small cones when compared to the other species and the relatively short needles (especially visible in img. U) (in comparison to the really long ones in the other two at least) and the small cones.
      - ii. Image U source: <https://www.inaturalist.org/observations/137896731>
      - iii. Image V source: <https://www.inaturalist.org/observations/144645184>
  2. Answers may vary. One possible answer could be agree because only old trees have heartwood that's wide enough to fit a woodpecker cavity.
    - a. Source: [https://www.srs.fs.usda.gov/pubs/ja/ja\\_conner030.pdf](https://www.srs.fs.usda.gov/pubs/ja/ja_conner030.pdf)
  3. Image S is probably the image which is most likely to have not been subjected to extremely frequent surface fires. It has a significant understory of trees that is usually absent when there's frequent enough surface fires (because trees that height usually end up contributing to ladder fuels or burning up)
  4. When the bark beetles drill into the tree the resin comes out and the bark beetles get stuck in or get kicked out due to the resin.
    - a. Source: [https://www.srs.fs.usda.gov/pubs/ja/ja\\_conner035.pdf](https://www.srs.fs.usda.gov/pubs/ja/ja_conner035.pdf)
  5. Answers will vary. Possible answers may include turpentine, instrument rosin, turpentine, varnish, and more.
    - a. <https://www.fs.usda.gov/wildflowers/ethnobotany/resins.shtml>
  6. Thick bark insulates the tree, preventing the vascular cambium that's inside the tree from getting too hot and dying. If the vascular cambium is dead, the tree can't make any more new growth after the fire.
    - a. Source: <https://fireecology.springeropen.com/articles/10.4996/fireecology.1101074#:~:text=In%20pyrogenic%20ecosystems%2C%20thick%20bark.1997%2C%20Hoffman%20et%20al.>
  7. The Wade Tract (the black one) was the one which was burned regularly. There's way more younger plants in the Wade Tract than there are in the Boyd Tract. There being less new growth of Longleaf Pines in the Boyd Tract is pretty consistent with a place at

which other species of trees (like oaks and hickories and stuff) mostly take over which makes it hard for new longleaf pines to germinate. (Cool thing: The reason why there's still longleaf pines in early stages in the frequently burned area is because of this thing called the "Grass Stage" which means that it can build up roots while the growth bud isn't exposed enough to catch fire so then after it gets strong enough it can shoot up and thicken its bark to get fire resistant really fast (usually only takes a few years))

a. Source + Image Source:

[https://www.researchgate.net/publication/226751727\\_Effects\\_of\\_long-term\\_fire\\_exclusion\\_on\\_tree\\_species\\_composition\\_and\\_sand\\_structure\\_in\\_an\\_old-growth\\_Pinus\\_palustris\\_Longleaf\\_pine\\_forest](https://www.researchgate.net/publication/226751727_Effects_of_long-term_fire_exclusion_on_tree_species_composition_and_sand_structure_in_an_old-growth_Pinus_palustris_Longleaf_pine_forest)

b. "Cool thing" source:

<https://longleafalliance.org/what-is-longleaf/the-tree/life-stages/>

8. Frequent surface fires mean that there'd be resin (which is flammable (a lot more so than the bark)) in a place which it might burn up.

a. Source: [https://www.srs.fs.usda.gov/pubs/ja/ja\\_conner030.pdf](https://www.srs.fs.usda.gov/pubs/ja/ja_conner030.pdf)

Question Set 4

1. The stem/trunk is where photosynthesis happens.
  - a. Source:  
<https://www.azed.gov/sites/default/files/2019/02/Saguaro%20Fun%20Facts.pdf>
2. The night's colder than the day, so there's less evapotranspiration, so when the tree opens its stomata in the night, it'd lose less water to evapotranspiration.
3. Crassulacean Acid does not exist MWAHAHAHAHAHAHAHAHAHAHA >:)
4. As photosynthesis happens with closed stomata, the amount of CO<sub>2</sub> in the stomata decreases, so then the fraction of O<sub>2</sub> increases, which makes it more likely for the rubisco to bind O<sub>2</sub> to RuBP instead of CO<sub>2</sub> because there's just more O<sub>2</sub> than CO<sub>2</sub> than something with open stomata.
  - a. [https://www.nps.gov/parkhistory/online\\_books/natural/4b/nh4bg2.htm](https://www.nps.gov/parkhistory/online_books/natural/4b/nh4bg2.htm)
  - b. <https://www.khanacademy.org/science/biology/photosynthesis-in-plants/photorespiration--c3-c4-cam-plants/a/c3-c4-cam-plants>
5. AAA
6. :(((
7. Answers will vary. Some possibilities might be radiocarbon dating and/or dating using events that significantly changed stuff that you can detect (like solar storms and stuff!!)
  - a. <https://www.nature.com/articles/s41586-021-03972-8.pdf>

## Question Set 5

1. Sugar Pine is the tree **on the right** on **Image Z**.
  - a. Note orange bark, elongated cones, and relatively short needles
    - i. Image Source: <https://www.inaturalist.org/observations/148269050>
2. Ponderosa Pine is the **on the left** on **Image Z**.
  - a. There's the ridging in rectangles of the kinda-orange bark. Needles are also longer and slightly lighter than in Sugar Pine. It shares range with Sugar Pine, so is Ponderosa Pine
    - i. Image Source: <https://www.inaturalist.org/observations/148269050>
3. Pitch Pine is the species in **Image AA**.
  - a. Note the mid-sized needles (eliminates virginia), presences of lower branches (eliminates shortleaf and other sudestern), tiny cones
4. Jack Pine is the species in **Image AB**
  - a. Note the **VERY** short 2/fascy needles and the spineless cones
    - i. Image Source: <https://www.inaturalist.org/observations/147165476>
5. Longleaf Pine is the species in **Image AC**
  - a. Needles are really long, lack of lower branches
    - i. Image Source: <https://www.inaturalist.org/observations/150705970>
6. Whitebark Pine is the species in **Image AD**
  - a. 5/fasc needles, too short to be western white pine, not dense enough to be (also separated by range by) rocky mountain bristlecone pine, scarlet cones eliminate limber pine
    - i. Image Source: <https://www.inaturalist.org/observations/89911055>
7. Singleleaf Pinyon is the species in **Image AE**
  - a. One needle per bunch, needles being longer than those of spruces, kinda silvery leaves, fascicle sheaths visible if look closely
    - i. Image Source: <https://www.inaturalist.org/photos/259901621>
8. Limber Pine is the species in **Image AF**
  - a. Cones are diagnostic. 5 needles/fascicle + relatively short needles also help but can't eliminate whitebark
    - i. Image Source: <https://www.inaturalist.org/observations/150365384>
9. Western White Pine is the species in **Image AG**
  - a. Long cones + lighter-colored branches + mid-sized needles
    - i. Image Source: <https://www.inaturalist.org/observations/150789017>
10. Knobcone Pine is the species in **Image AH**
  - a. Note the large cones directly attached to the trunk and the bark. (the cones are opened because of the CZU fires!)
    - i. Image Source: <https://www.inaturalist.org/observations/137233104>

## Question Set 6

1. Thick bark prevents insulates the vascular cambium, protecting it from dying from too much heat (which means that they will still be able to survive and make new growth) (ya ever been to Big Basin after the CZU fires? A lot of trees were top-killed but have tonnes of sprouts everywhere because the cambium wasn't killed so it can make new growth) Growing tall and removing lower branches prevents fire from getting to the crown where it can deal a lot of damage.
  - a. Source:  
<https://www.semanticscholar.org/paper/Flammability-and-serotiny-as-strategies%3A-correlated-Schwilk-Ackerly/9327b42feb3f3e29d286a2280a21fc6e08d25dcc/figure/5> (article's paywalled but diagrams aren't)
  - b. Source:  
<https://fireecology.springeropen.com/articles/10.4996/fireecology.1101074#:~:text=In%20pyrogenic%20ecosystems%2C%20thick%20bark,1997%2C%20Hoffman%20et%20al.>
  - c. Source:  
<https://www.britannica.com/list/5-amazing-adaptations-of-pyrophytic-plants> (mid source but I'm in a hurry)
  - d. Source:  
[https://www.researchgate.net/publication/257805652\\_Ecology\\_and\\_evolution\\_of\\_pine\\_life\\_histories](https://www.researchgate.net/publication/257805652_Ecology_and_evolution_of_pine_life_histories)
2. Accept Longleaf Pine or Ponderosa Pine
  - a. AAAAAAA im in too much of a hurry to find sources but im p sure it's there in the relevant feis entry
3. It makes the fire stronger and higher, which helps in killing other trees. It also spreads the seeds of the tree in question, which needs hot fires which go into the crown to melt the resin to spread the seeds to colonize the mostly-cleared area (because the other trees die from the hot, high fire). That tree probably would die, but it doesn't really matter *that* much because
  - a. Source:  
[https://www.researchgate.net/publication/257805652\\_Ecology\\_and\\_evolution\\_of\\_pine\\_life\\_histories](https://www.researchgate.net/publication/257805652_Ecology_and_evolution_of_pine_life_histories)
  - b. Source: <https://besjournals.onlinelibrary.wiley.com/doi/10.1111/1365-2745.12691>
4. Accept Pitch Pine, Jack Pine, or Knobcone Pine
  - a. AAAAAAA im in too much of a hurry to find sources but im p sure it's there in the relevant feis entry
5. If they start making cones early, you can stockpile more cones before a fire (especially because the intervals can be unpredictable).
  - a. Source:  
[https://www.yosemite.ca.us/library/cone-bearing\\_trees/knobcone\\_pine.html](https://www.yosemite.ca.us/library/cone-bearing_trees/knobcone_pine.html)
6. The types of trees in question 3 would be more vulnerable to these changes than those in question 1. These trees generally burn in crown fires, which means that during the fires, they usually die (because of their lower branches which make fuel ladders which

push fire up). If you get fires in quick succession, this harms this species because then they don't have much time to regenerate the seed bank to make new plants.

- a. Source: <https://www.nytimes.com/2017/09/13/climate/yellowstone-western-fires-in-two-for-ests.html>
7. Both areas don't have much plant density for a fire to spread so fires are a lot more unlikely.
  - a. Source: <https://www.nature.com/articles/s41598-022-11451-x>
  - b. Source: <https://www.frontiersin.org/research-topics/11815/fire-regimes-in-desert-ecosystems-drivers-impacts-and-changes>

## Question Set 7

1. Alaska because it's the only place where the ranges overlap (besides British Columbia, which is not a U.S. state)
2. It's a tall, spindly tree with no lower branches, so it very much does *not* have the conical shape usually characteristic of Christmas trees.
  - a. Source: <https://blogs.ifas.ufl.edu/pinellasco/2018/01/11/a-pine-in-my-neck/>
3. C, The California Fan Palm (*California Washingtonia*) because it almost never has lateral branching so it doesn't even *have* twigs. Sure, the honeylocust wand would be thorny and annoying, but it'd at least look vaguely like a wand. Palm leafstalks are NOT the way.
  - a. Source: <https://edis.ifas.ufl.edu/publication/EP473>
4. B, *Abies* (Firs). Spruces (*Picea*) have pulvini/sterigmata (peg-like structures) which are left behind when leaves (needles) fall off. Pines (*Pinus*) have leaf (needle) scars that form when leaves fall out. Meanwhile, fir (*Abies*) needles attach to the twig by "suction-cup"-like structures, which doesn't result in rough scars being left behind.
  - a. <https://ohioline.osu.edu/factsheet/anr-80>
5. C, Shagbark hickory. Pacific Yew and American Holly are mostly poisonous. Osage Orange has edible seeds but everything else is L A T E X.
  - a. Source:  
<http://nativefoodblog.blogspot.com/2013/10/pawcohiccora-shagbark-hickory-soup.html>
6. Answers will vary. Possible answers might include: Pines (*Pinus*) having needles in bunches and harder cones, Firs (*Abies*) having upright cones that disintegrate and needles that attach right to the stem, Spruces (*Picea*) having pendent but still papery cones and pokey needles that attach on peg-like structures (pulvini/sterigmata).
7. Answers will vary. One possible answer could relate to that the California Buckeye has smooth, light-coloured bark, so when people stab it they see more color contrast. Also, Ponderosa Pine bark is more scaly so harder to carve in general.
8. False, American Black Elderberries are edible when cooked.
  - a. <https://www.wildedible.com/wild-food-guide/elderberry>