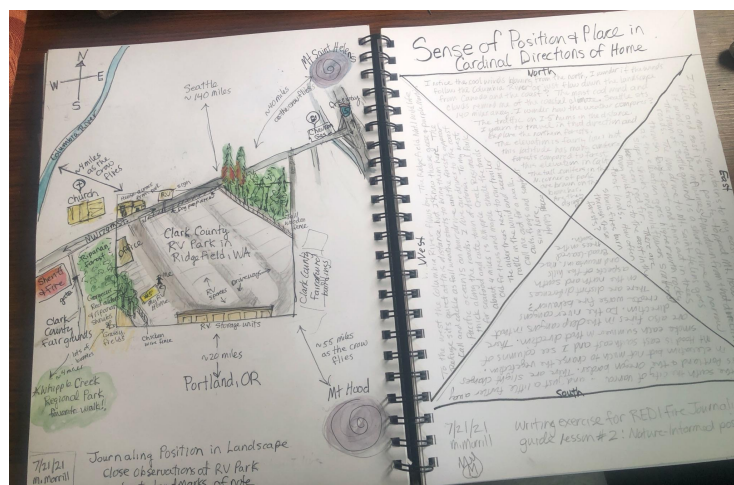


2- NATURE-INFORMED LANDSCAPE LOCATION (POSITIONAL AWARENESS)

INTRODUCTION

This lesson will focus on observing, measuring and journaling spatial elements and position within the real-world and over Google Earth or a printed map. Where you are positioned has meaning for the fire regime and fire behavior you might expect. Positional awareness is foundational for fire awareness and readiness activities such as evacuation planning. Information and exercises will utilize the cardinal directions, points of reference and distance estimates, as well as natural elements that help identify location (eg. forest type and species associated with elevation and aspect). Several illustrations will be used to observe elevational gradients and landscape aspects with the associated forest zones, vegetation types, and environmental conditions in Butte County. The lesson will end with a creative writing exercise that integrates the location data and observations with remembered experiences and senses associated with their position within the landscape.



Not everyone has the same spatial perception capabilities but the exercises should be relative and general enough that most people can engage and explore the lesson. Spatial perception exercises can engage multiple parts of the brain and body, including the visual and the vestibular system. This lesson could be expanded to engage more of those neural systems, including adding mathematical information and exercises focused on the experienced sense of

space and position.

OVERVIEW & TIME (60 minutes/ 70 with extra credit)

- Background information (review prior to implementing lesson)
- Field safety and lesson Introduction (**5 minutes**)
- Cardinal directions and points of reference exercise (**20 minutes**)
- Distance measures and landscape map features exercise (**15 minutes**)
- Position description and creative writing exercise (Nature-informed position and sense of place (**20 minutes**))
- **Extra Credit:** Distance estimates & the Rayleigh Effect exercise (**10 minutes**)

MATERIALS

- Journal or notebook
- Graphite pencil and eraser. Optional to add color with crayons/colored pencils and or watercolors.
- Ruler

- Printed area map (optional/alternative to Google Earth)
- Compass or compass app on mobile device
- Extra Credit/Optional but good to have as reference- AlertWildfire camera name and location from previous lesson and distance to view points in previous landscape sketch.
 - Sheet or piece of tracing paper

LOCATION

This exercise should be done outside at a school, business, camp or home location with the use of Google Earth or a map for visual information on additional spatial features around the area.

BACKGROUND & NATURAL PHENOMENA INVESTIGATED

Understanding and describing location and orientation are critical to relate elements in the environment and navigate through physical and mental space. They are also important for reasoning, remembering, and imagining things in your mind. Location - or as we are referencing in this lesson, position - tells us where something or someone is within a space and in relation to a frame of reference (i.e., a global origin and a set of coordinate system axes). The orientation of objects tells us if things are facing north, south, down, or up.

Mathematical/Cartesian orientation or Points of Interest are two primary ways to relate position to the environment. In mathematics, the Cartesian coordinate system is used to uniquely determine each point in the plane through two numbers, usually called the *x-coordinate* and the *y-coordinate* of the point. Vectors use a similar notation to Cartesian coordinates: distances along lines of reference but are representations of direction. A vector can be visually represented as a line with an arrow on one end. Direction can be either **relative** or **absolute**.

- **Relative** directions are in relationship to an object's current location and orientation. For example, if a person is facing north, west is to their left and east is to their right. Directions such as *left/right*, *forward/backward*, and *up/down* are relative to an object's current orientation.
- **Absolute** directions are relative to a fixed frame of reference and always point in the same direction, regardless of their location. Directions like *north/south* and *east/west* are examples of absolute direction.

Recognizing our personal perspective is also important in evaluating and conveying information. Whether you are viewing a scene from far away or close up can change how observations are perceived. For instance, foreshortening techniques are used in drawing to better convey the position of something based on perspective.

One natural phenomenon referenced in this lesson is the influence of the **Earth's magnetic fields** on a compass. Another phenomenon is **Phototropism**, which is a directional response that allows plants to grow towards (or in some cases away from) a source of sunlight. **Photoperiodism** regulates the physiology or development of plants in response to day length and can be applied to orientation in a landscape. **Elevational**

and altitudinal influences on tree growth and slope aspect influences on plant communities and growth are other phenomena integrated in this lesson. And lastly, the **Rayleigh effect** is a phenomenon where sunlight is scattered by atmospheric conditions over different distances, conditions (pollution) and times affecting which colors are seen and giving landscape features different appearances that can be used as reference in estimating distance.

This lesson introduces general location and orientation concepts but focuses more on the experienced sense of position using our seen and known points of reference and associated natural features and conditions related to location (elevation) and orientation (aspect) such as the Butte County forest zones associated with elevational gradients and different vegetation communities found on northern versus southern aspects.

SAFETY TALK & EXERCISE INTRODUCTION (5 minutes)

- Give safety talk appropriate to location and conditions. See guide introduction section with Safety Discussion overview.
- Explain to students that in this lesson, we are learning how to determine and describe our position in the landscape. We will be creating a simple map around the school/home with key elements to the north, south, east and west. This is what we call the four cardinal directions and is the primary way we navigate our space at ground level along with using points of reference. We will also be learning about elements in nature that can help determine our position in the landscape and how we can use creative writing to describe our position and travel through a landscape.
- Tell students that they will want to use their journal and a graphite pencil. Colored pencils or pens can be used to accentuate the map but are not required for the exercises.

CARDINAL DIRECTIONS & POINTS OF REFERENCE EXERCISE (20 minutes)

- Go out to the north side of the school, facility or vehicle and find an open place for the group to sit.
- Tell students that in this exercise we will be mapping points of reference around us.
- Ask students if they know how to describe and follow directions for their position and navigation around a landscape?

Discussion: When you want to describe where you are located in the environment, you need to use points of reference around you and terminology and measurements for map-making (cartography). What key buildings, roads, landscape elements like mountains and canyons are around you? What direction is the sun now and which direction is it moving? For us to move from points of reference we need to know the orientation (direction facing) and navigation route (path of travel). When describing and following a path we most often use terms like right or left and up or down, but that changes when you move. So, it's important to learn and use the four main directions which include north (N), east (E), south (S), and west (W). The direction words are found on maps, street

signs, and in many other places. The cardinal directions help people travel from place to place. You can find north, east, south and west when you're outdoors by using a compass.

- Ask students to close their eyes. When they have closed their eyes, ask them to answer the following (or similar) questions and point their hands in the correct direction:

Discussion: Where does the sun set? Which way is north? *Ask the students to keep their arms pointing north and open their eyes. When they see arms pointing in every direction, they quickly realize how disoriented they are as a whole.*

- Show students the compass or compass wheel and talk about the four cardinal directions.

Discussion: What's really cool is that a compass works because of the magnet floating inside which moves based on the Earth's magnetic fields at the north and south poles. There are other tools that can help you find direction including Global Positioning Units (GPS) which many smart phones now have embedded. There are also things in nature that can help us determine which direction we are facing. Can you think of a really big thing that helps us tell which direction is East and West? Do you know which direction the sun rises and sets? If it's early or late in the day, you can get an idea of which direction is East or West. There are nature observations that can help us find north and south, but we'll talk about that a little later.

- Ask students to open their journals and get their pencils ready.

Discussion: When nature journaling, the cardinal directions can be displayed on a page or map using a **compass rose** to indicate the direction on your page which should match the direction you are facing.

- Demonstrate how to draw the compass rose in a corner on the page and draw a large square filling the page and a smaller square in the middle of that circle - have students do the same.

Discussion: The standard rule is that your map should have north facing at the top of the page. So when drawing your map, you'll want to orient your body facing north, then diagram, sketch and or write your observed elements within the appropriate orientation.

- Check the compass and have everyone move to face in the direction of North.

Discussion: The compass rose uses the letters for each direction, N, E, S, W and you can also add those into different elements on your journal such as showing an "N" with squiggle lines to show wind coming from the northern direction. There are many different designs of compass roses, but all point to the north, east, south, and west.

- Ask students to point to where the sun rises and sets. Point to west and east and have students follow as you show them how to add a visual and note about where the sun rises and sets on their map in the journal.
- Ask students if they know what type of elements to add to a map?

Discussion: There are many different types of maps based on the scale of the area and the types of elements you want to find and navigate to.

- Ask students if they can name some different types of maps (topographic map, city map, state road map, map of the mall, etc.)

Discussion: For this exercise we want to get a sense of where we are and what is around us. If you were to describe where you were sitting to someone on the phone, what would you tell them? We don't want to have too much information that can be confusing and complicates the map, but we do want large, unique features that are easy to see and commonly known.

- Ask students to put a symbol or sketch of themselves in the center of the small square (their map) to indicate their location and show them how to create a legend for the symbols they use.
- Tell students that they have around ten minutes to put the key map features they see using words, numbers and pictures for each direction on their map, starting with the direction they are facing- north.
- Offer tips and support and add a few elements to your own map to help demonstrate different approaches such as a symbol that could be used to represent a building or tree, etc.
- Give students a two minutes warning when it's time to wrap up this exercise.
- When the exercise is wrapped up, ask if anyone had insights or questions they'd like to share about what they observed and added to the map.

DISTANCE MEASURES & LANDSCAPE MAP FEATURES EXERCISE (15 minutes)

- Gather students together somewhere open outside.
- We are now going to consider how we can map and describe distant landscape elements around us.
- Ask students if they can list some of the different types of metrics we use to measure distances.

Discussion: We know that distance is the space between two or more things but how do you describe and measure distance? Any guesses? What are some distance measurements used between small things (millimeters, inches, centimeters, etc.)? What about distances between people (feet, yards, etc.)? What about things far apart like mountains (miles, kilometers, etc.)? These measurements can also be used to describe the length and width of an object.

- Ask students if they can think of other ways to describe distance without using metrics.

Discussion: We can use comparisons to help us describe distance too. For instance you could say that there are three car lengths between one car and another car or you can use travel time as an indication of distance like saying that I am located 20 minutes from the school. This form of measurement is not precise and can be misleading but is a quick and relative way to describe distance. We can also use our body to help us measure things. You can hold your hand and arm out to an object and see if it's smaller or larger than your arm or maybe it's an arm and a half in length. Objects, of the same size, that are farther away from you always appear smaller than the object closer. You can use this principle in sketching to give the sense of distance.

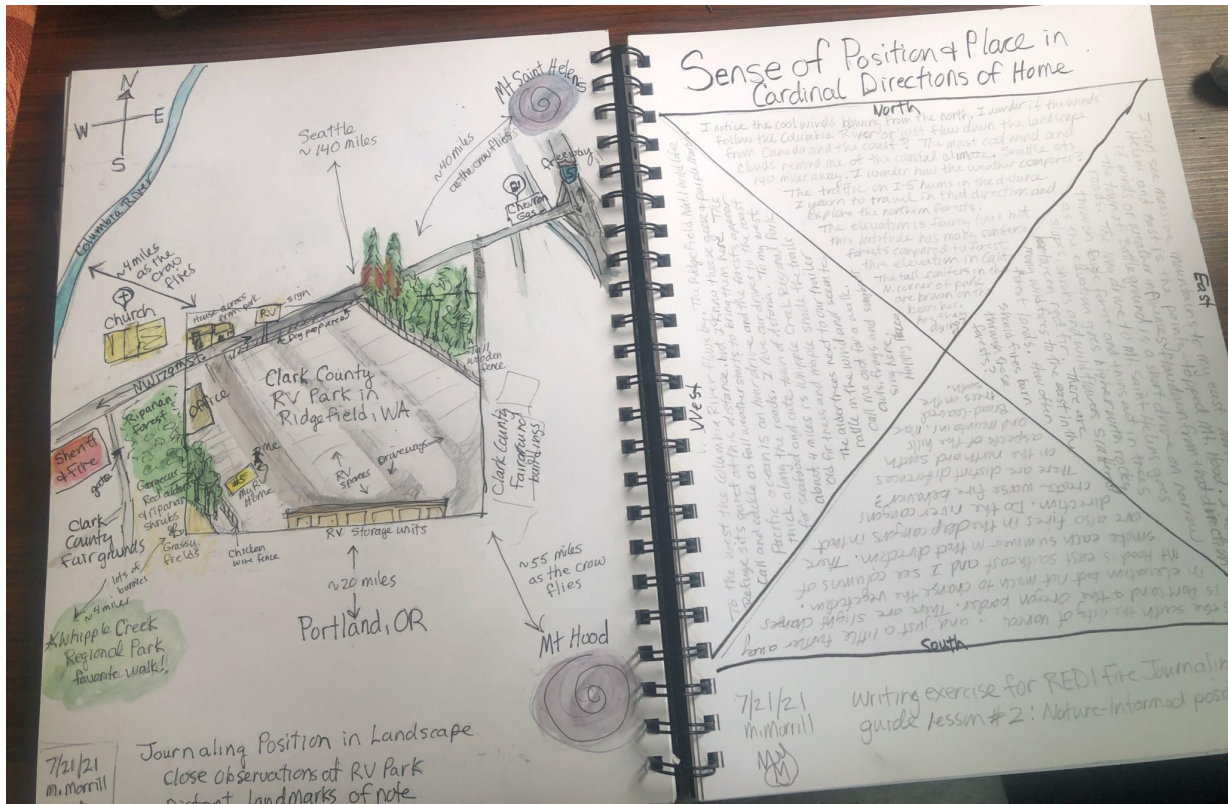
- Ask students if they can see or remember any key landscape or community features further away (stores, restaurants, river roads, etc.)
- Reference a printed or Google map to see travel routes, big landscape or urban features out 50 to 100 miles in each cardinal direction and have students describe out loud how they perceive distance to those features.

Discussion: For instance, if you are currently located in the foothills, which direction and how far away is the valley and other neighboring towns. What direction and distance is the biggest mountain you can see? What major roads run north to south?

- Tell students they have ten minutes to add a few distant map features in the outer square on their page- what they can see, what they remember or ask for teacher input on map points. Ask students to use words, numbers or pictures in their journal to describe a few key features and the perceived, estimated and or known distances from them to those elements. Keep the second page in the journal spread open for the next exercise.
- As students work, walk around and demonstrate how to sketch or symbolize different map features and how to then add to their map legend. Remind students that this is not about creating art, as long as you can understand your map and that you have words, symbols, and sketches in the right area, you are doing it right.
- Give students a one to two minute warning when it's time to start wrapping up their journaling.

- When the exercise is wrapped up, ask if anyone had insights or questions they'd like to share about what they observed and added to the map.

POSITION DESCRIPTION & CREATIVE WRITING: NATURE-INFORMED LOCATION & SENSE OF PLACE (20 minutes)



- Have students gather together somewhere comfortable and inspiring. If comfortable and still in a group, have them stretch for a few minutes before jumping into this next exercise. Students can spread out after they have received instructions or stay in one location.
- Tell students that in this exercise we are going to learn about a few nature-informed ways to understand and define our position within the landscape. This information is also helpful for gaining a sense of fire on the landscape.

- Ask students if they can list some ways to describe our physical position in the landscape. Discussion: We talked about how we can use points of reference for our directions. We can also use those to better describe our location. For instance, we can say that we are high on the mountain, far down in the valley, next to the school and below the waterfall. We can also say that we are located next to or within a certain type of vegetation community like pine forest or open grassland. It is helpful to start by thinking about our position on the planet and work our way down to where we are specifically located.
- Ask students if they can name different ways we can describe where on the planet, in the state and in the county we are located?

Discussion: When describing our position on the planet, we consider that the earth is a sphere and that we can split that in half. Those halves are called the northern and southern hemispheres; North America is in the northern hemisphere. We also use what is called longitude and latitude. A longitude is an angle from an imaginary north-south line that runs through Greenwich, England, measured to the east (longitudes to the west are negative). Latitudes measure an angle up from the equator (latitudes to the south are negative). In describing our position we also use the term elevation to describe how high up the land is from sea level and aspect to describe which side of a hill or mountain we are located. In different states and local locations we use other elements and points of reference to describe where we are located in relation to the coast, Central valley, foothills, and mountain ranges like the Cascades and the Sierra Nevadas. Below are some basic principles about the conditions of the environment that can help you determine where you are; nature-informed position.

- Highlight a few things in the Nature-Informed Location table and tell them they can reference this during the exercise.
- Ask students to look at the Butte County Forest Zone Illustration while we discuss some of the observations we can make to describe our position within the landscape and what that means for fire.

Discussion: Each color zone on the landscape represents an elevational range and area within Butte County that has certain forest types that are more common or widespread in that area. Those zones also have a certain fire regime.

 - A fire regime is the pattern, frequency, and intensity of fires that prevail in an area over long periods of time. It is an integral part of fire ecology, and means renewal for certain types of ecosystems.
- Explain to students that in this exercise, they will use another page in their journal (next to their map) and write expressive and creative descriptions and or questions about their location in each direction.
- Demonstrate to students how to split up their journal page into quadrants with the cardinal directions and discuss how they will start at the outside of the quadrant and work their way inward on the page with a description, guess or question that includes discussion on:
 - global, regional and or state location,

- within Butte County and the forest zones including elevation and fire regime and
- within their map zones
- Explain how they should describe in words their position within the close and distant landscape (e.g. close to the school, 25, 50 and or 100 miles away to encompass key landmarks and elements). In this exercise they should be creative and can write as a poem or other expressive ways. Also point out that they don't have to put the answers, but can frame questions around the location and nature-informed observations. In nature journaling it is even more important to think about and question things rather than just label something.
- Explain how they should try to add something about that location with a memory or experience (e.g. where we went fishing, where my friend lives, where we saw a bear, where a fire burned).
- Give students a one to two minute warning when it's time to start wrapping up their journaling.
- When the exercise is wrapped up, ask if anyone had insights or questions they'd like to share about what they observed and added to the map.

Table 1: Nature-Informed Location Tips

LOCATION TERM	NATURE-INFORMED LOCATION DESCRIPTION
Hemisphere :	There's a natural phenomenon that can help inform you of which hemisphere you are located in. Phototropism is the orientation of a plant or other organism in response to light and in plants: differential cell elongation occurs to optimize photosynthesis. This causes the shape and form of some plants to grow differently based on which direction the sun has the strongest influence based on which hemisphere you're located. You will not likely see a sign of this effect on fir or pine trees, it's more observable in deciduous trees. In the northern hemisphere the southern side of a tree the branches typically grow closer to a horizontal position whereas the northern side of the tree has branches typically growing closer to the vertical. You cannot always tell if it is phototropism or something else, but if you can see this "checkmark" effect (asymmetrical form), as author and adventurer Trinstin Gooley calls it, you can make assumptions and see if that is the most likely cause.
Latitude:	In general, the further north in latitude you go, the colder the weather. These colder conditions change the types of plants and animals that you are likely to see. We will not go into latitude and longitude in this lesson but this is important to learn when considering map navigation.

Landforms:	In California, you have the coastal mountain ranges, Cascade range and Sierra Nevada running from north to south along the state. The Central Valley covers much of the northern valley region of the state and within that is the Sacramento Valley where part of Butte County is located. You can describe where you are in relation to those mountain ranges and valleys. Are you north, south or east of the mountain range or within the valley?
Butte Landform	Butte County lies within north central California in the northern part of the Sacramento Valley, 70 miles north of Sacramento. About half of the county is valley grassland with river and riparian corridors. The Sacramento River and Butte Creek run along the western side and Honcut Creek along the southeast side of Butte County. The other part of the county is foothills and mountain ranges including the northern tip of the county which is located in the southern portion of the Cascade mountain range which includes part of the Lassen National Forest. Here, Humboldt Peak is the highest elevation point in Butte County at 7,044 feet. The mountains within the southern part of the county are in the northern part of the Sierra Nevada range and include part of the Plumas National Forest. The Feather River canyon runs in a northeast to southwest direction and Lake Oroville sits in the southern part of the valley in Butte County. In the Feather River Canyon, there are strong upcanyon winds in the morning and down canyon winds in the evening (diurnal- influenced by sunrise and sunset temperature influences on the landscape creating winds). In general most of the higher elevation rivers flow in an east (higher elevation) to west (lower elevation) toward the valley rivers which carry water south and westward to the ocean. The smaller canyons in Paradise foothills run north to south.
Elevation:	In general, the higher the elevation has cooler air temperatures. The higher the elevation, plant height and number of different types of tree species decreases the higher up in elevation and increases the number of understory plant species (herbs and ferns). The tree forms and shapes are often different as the elevation changes as well. In California the highest zone is called the alpine zone and the trees usually have needles and not the larger leaves you see on trees in the valley. These alpine trees look shorter than lower elevation trees but can be very old due to the slow growth rate. In California's upper mountain zone, below the alpine area, trees typically grow in an columnar form (apical dominance) like a Christmas tree (not multiple bases or widely branching). Apical dominance is when growth is concentrated at the tip of the plant shoot, where the terminal bud partially inhibits the axillary bud growth. This allows the trees to survive snow and resist decay. NOTE: With climate changes, we may see some changes in these plant forms and community distribution patterns but this may take a long time to occur for some species and is already occurring for some others. What we can expect is change.

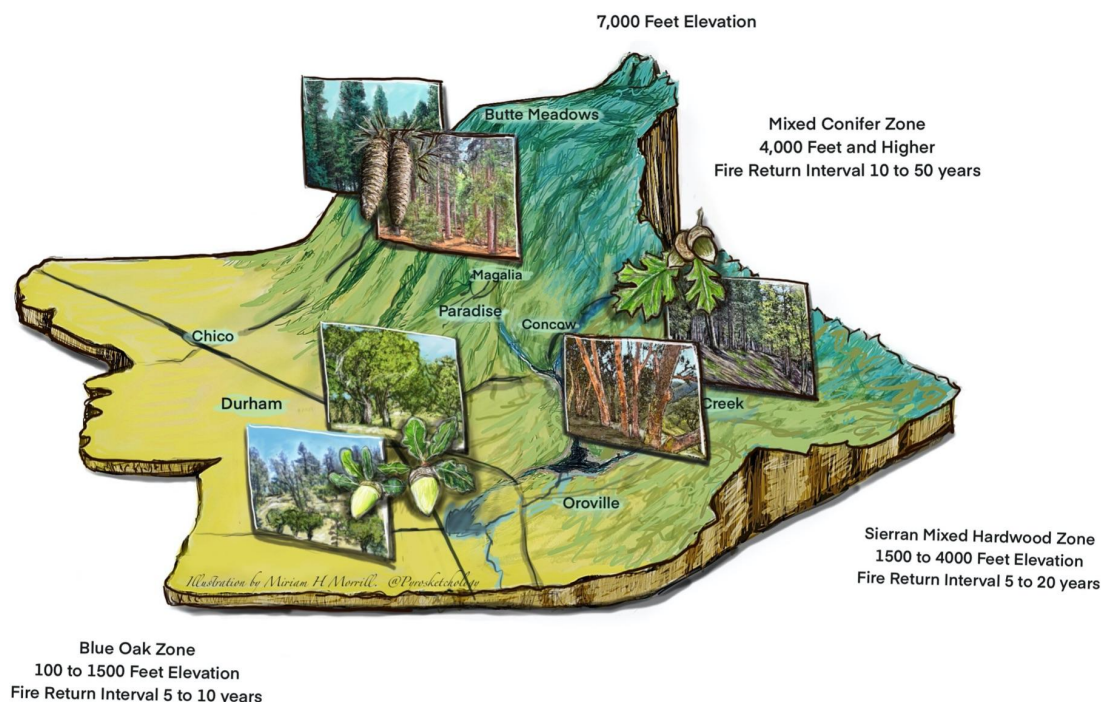
<p>Butte Mixed Conifer Zone Elevation</p>	<p>Elevational range between 4,000 and 7,000 feet elevation. Rainfall 60 inches and more. Wildfires naturally occur and the plant communities have adapted to fires returning within 10 to 50 years. A natural or “informed” fire regime (prescribed fire and cultural burning) in this zone will generally be of high complexity (patches and pattern of burned area after the fire) with varying? levels of fire severity. This would create many patches and patterns over the landscape with some patches completely burned and others with moderate burn impacts or none. In this zone you’ll see sugar pines, Douglas firs, incense-cedar and white fir (needle type trees). You can see these forest and vegetation communities in Cohasset, Forbestown and Maglia.</p>
<p>Butte Sierran Mixed Hardwood Zone Elevation</p>	<p>Elevational range between 1500 and 4000. Rainfall 32 to 65 inches a year. Wildfires naturally occur and the plant communities have adapted to fires returning within 5 to 20 year intervals. A natural or “informed” burning regime, using prescribed fire and indigenous practices, in this zone would generally be of moderate complexity (patches and pattern of burned area after the fire) and mixed severity (how hot and large) where you might see some patches and patterns but also areas with similar low level complexity burning. You’ll find black oak, madrone, tanoak, bay laurel, Douglas-fir, incense-cedar and dogwoods (mixed needle and leaf trees and shrubs). You can see these forest and vegetation communities in Forest Ranch and Paradise.</p>
<p>Butte Blue Oak Zone Elevation</p>	<p>Elevational range from the valley floor to 1500 feet in elevation. Rainfall 12 to 36 inches a year. Wildfires naturally occur and plant communities have adapted to fires returning within 5 to 10 year intervals. These types of fires are typically lower intensity and lower complexity, meaning that they have a fairly consistent impact across this landscape type (e.g., grasses, shrubs and small trees burned but larger trees only partially scorched). You’ll find blue oak trees in open grassy areas with some groupings of shrubs. Blue Oaks are also mixed with Gray Pines which is an important and enduring relationship for both species (mixed needle, leaf, shrub and grass). The Butte County Forest Health Guide Book discusses the traditional ecological knowledge about this relationship. Imagine Butte Valley, Big Chico Creek Ecological Reserve and Lime Saddle vegetation and you’ll have a mental picture of this zone. Blue oaks are very fire tolerant with low intensity fires and grasslands benefit from frequent fires. When the blue oaks become too crowded with branches touching other trees, fire impacts will be worse.</p>

Aspect:	In the northern hemisphere the northern aspect of a mountain is typically cooler and has more moisture and thus usually has thicker forests and more vegetation while the southern aspect is typically warmer and drier with less concentrations of forest and vegetation. There are also differences in some of the plant forms and adaptations that you can observe. For instance, in warmer drier areas like the southern aspect, you may see smaller and thicker leaves than some areas with more moisture.
Butte Mixed Conifer Zone Aspects	You should see more of the fir and needle-type trees on the northern aspects. You should see more sugar pines, oaks, shrubs and openings on the southern aspects of this zone, with fire returning more frequently than on the northern aspects of the zone.
Butte Sierran Mixed Hardwood Zone Aspects	You'll see more fir and needle-type trees on the northern aspects along with some broader-leafed shrubs in the understory like dogwood. You should see more of the black oak, ponderosa pines, madrone, tan oaks, maple and bay laurel and other shrubs preferring drier sunnier conditions in the southern aspects. You should also see more open areas in the southern aspect areas and expect fire to return more frequently than on the northern aspects of this zone. The riparian corridors may cross into different aspects but have plant species more suited to the higher moisture such as dogwoods and willows.
Butte Blue Oak Zone Aspects	In the northern aspects you should see more blue oak trees and open grassy areas with some groupings of shrubs. Blue Oaks are also mixed with Gray Pines in certain areas, with the pines preferring the drier southern aspects along with chaparral like manzanita, red bud, and white thorn. Riparian corridors may have more cottonwoods than the higher elevation zones.

DISCUSSIONS & QUESTIONS

Feel free to use similar student discussion and question framing as the previous lessons to the end, if there's time.

Butte County Forest Zones



OPTIONAL EXTRA EXERCISE

RAYLEIGH EFFECT DISTANCE ESTIMATES EXERCISE (added to the zine sketch from lesson #1) (10 minutes)

The **Rayleigh effect** is an observed phenomenon describing how landscape features farther away appear to lighten in shade, shift to cooler colors, and lose details and focus. You may have noticed this effect while doing your sketch in the first lesson with the foreground, midground and background. The **Rayleigh effect** happens when sunlight is scattered by atmospheric conditions over different distances, conditions (pollution) and times affecting which colors are seen and giving landscape features different appearances that can be used as reference in estimating distance (faded blue mountains in the distance).

In this exercise we will go back to our zine sketch from lesson #1 and apply the estimated distances over a piece of tracing paper.

1. Teacher Note: If you'd like to add the actual miles or something close to the viewpoints in the previous lesson's sketching exercise use the AlertWildfire camera name and location in Google Earth and see if you can determine how far away your viewpoints are in the background. Otherwise, put the distance estimates as a question in this exercise.

2. Take a piece of tracing paper and lay over the landscape zine sketch in the first lesson.
3. Sketch a box on the tracing paper to frame the sketch underneath.



4. Look at the background area of the previous sketch. This should have been where the sky meets the land and the landscape features. If you were looking out to thirty miles or more away this distant landscape should be faded and light-purple or light-blue in color (e.g. purple mountains majesty). In good air quality conditions this may be **thirty miles or more away**.

- In the tracing paper frame, add a simple outline for the top of the farthest feature in the background part of the previous sketch. Put down the estimated distance as a question based on the Rayleigh effect and, if desired, add the known miles on your tracing paper above the outline.

5. Look at the midground in your zine sketch. Depending on air quality conditions you may be seeing out **ten to twenty miles away**. You should still be able to see green, brown and blue colors and some shapes and patterns but should have trouble seeing the details of individual plants.
 - Follow the same process as above and put an outline over the top of the midground feature with the estimated distance as a question.
6. Look at the foreground in your story zine sketch. This is the area where you should be able to see with a full range of colors and the details that allow you to see individual plants and animals.
 - Follow the same instructions and add some estimates and or questions about distance within that range of the foreground.