

falls as snow during the winter and rain during the summer. The total yearly precipitation in the taiga biome is 10 - 30 inches (25 - 75 cm).

PLANTS: Compared to other biomes, the taiga has less diversity in plant life. The most common type of tree found in the taiga is the conifer, or cone-bearing tree. Conifers, also known as evergreens, include pines, spruces and firs. There may also occasionally be deciduous species present, such as oak, birch, willow, or alder, in a particularly wet or disturbed area. The soil in the taiga is thin, acidic and not very nutrient rich. It also is rocky. Due to these factors, plants in the taiga have different adaptations than the plants we find around Santa Barbara.

The name, evergreen, describes an important adaptation of conifers. Just like Kermit, they are always green! Because they don't drop their leaves in the winter, they don't have to regrow them in the spring. This is good for trees in a tough environment because growing new leaves takes a lot of energy.

Another adaptation of conifers to live in the taiga has to do with their needles. Although the taiga has moderately high precipitation, the frozen winter ground makes it difficult for trees to get water. Having thin needles with a waxy coating limits water loss of the conifer through transpiration. The dark color of the pine needles is also important. What happens when you wear a dark T-shirt on a sunny day? You get hot, right? This is because your dark shirt is absorbing energy from the sun. Well, the dark needles do the same thing for the evergreen. They help the tree absorb the maximum amount of energy from the sun for photosynthesis. Conifers also have that pointy shape for a good reason. The winter snow slides right off of their branches. Without this shape the heavy snow might break or damage the conifer branches.



ANIMALS: The cold climate of the taiga makes it a difficult place for many animals to live. Many have thick coats of fur to insulate against the cold, and some hibernate. Others migrate to warmer areas in the chilly winters. Animal populations are mainly seed-eating squirrels and jays; small mammals like ermine and moles; and larger browsing animals such as deer, moose, elk, and snowshoe hare. The bogs and ponds in the taiga provide a great summertime breeding place for many different insects. Migratory birds often come to the taiga to nest and feed on all these insects. The typical predators for this area are grizzly bears, wolves, lynxes and wolverines. These are pretty ferocious, so their prey must adapt to flourish. Some animals hide from predators by changing color to blend into the different summer and winter habitats. For example, the ermine is dark brown in the summer, but in the winter it turns white. What excellent camouflage!

TEMPERATE FOREST

LOCATION: Most temperate, deciduous (leaf-shedding) forests are located in the eastern United States, Canada, Europe, China, Japan, and parts of Russia. Deciduous forests are broken up into five zones. The first zone is the tree stratum zone. It is the tallest zone and trees here range from 60 to 100 feet (18 to 30 meters) tall. Maple, elm, and oak trees are just some examples of trees found in this zone. The second zone is the small tree and sapling zone. Younger, shorter trees characterize this zone. The shrub zone is the third zone. Shrubs include mountain laurel, huckleberries, and many others. The fourth zone is the herb zone, and contains short herbal plants, like ferns. The Ground zone is the final zone



where plants grow directly near the ground. Some plants that grow here are lichens and mosses.

WEATHER: This biome has four changing seasons including winter, spring, summer, and fall. These seasons happen because of the tilt of the Earth's axis. Throughout the year, rays from the sun hit different parts of the world more directly than others, causing varying temperatures, or seasons. If the Earth were not tilted on an axis, temperatures around the globe would always be the same. Temperate deciduous forests also have quite a wet environment. Following rainforests, temperate deciduous forests are the second-rainiest biome. The average yearly precipitation is 30 - 60 inches (75 - 150 cm). This precipitation falls throughout the year, but in the winter it falls as snow. The average temperature in temperate deciduous forests is 50°F (10°C). Summers are mild, and average about 70°F (21°C), while winter temperatures are often well below freezing.

PLANTS: Trees and plants in deciduous forests have special adaptations to survive in this biome. Deciduous trees are trees with leaves rather than pine needles, and they dominate temperate forests. As the seasons change each year, so do the leaves. Each year deciduous trees lose their leaves, and grow them back. In the summer their broad green leaves capture sunlight and help the trees make food through photosynthesis. As temperatures cool in the fall, the chlorophyll (green pigment in leaves) breaks down, causing the beautiful red, yellow and orange leaf colors of fall. In the cold winter, deciduous trees and plants go into dormancy, kind of like sleep. It is too cold for them to protect their leaves from the damage of freezing in the winter, so they simply lose them and seal up the places where the leaves attach to the branch. The warmer spring days signal to the trees that they can grow new leaves again, and restart the cycle.



ANIMALS: Animals in temperate deciduous forests have to adapt to changing seasons. They must be able to cope with cold winters and hot summers. Some animals hibernate or migrate during the winter to escape the cold. Animals who do not hibernate or migrate must have special adaptations to deal with higher exposure to predators in the winter. When leaves fall, there is less cover for animals in this biome to hide from predators.



The black bear is an animal that is well adapted for the temperate deciduous forest biome. It has a heavy coat made of many layers of fur to deal with the winter cold. Black bears have long claws that help them to climb trees. This is an essential adaptation because black bears often live in hollowed trees. Black bears are omnivores, so they eat plants and animals. Most of their diet is composed of plant material, so their long claws are useful to get their food from trees and shrubs. They also hibernate to avoid having to find food in the snowy, frozen winter.

GRASSLAND

LOCATION: The name for this biome, temperate grasslands, is a great description for what it is like here. The most important plants in this biome are grasses! Temperate grasslands have some of the darkest, richest soils in the world (not in wealth, but in nutrients). People who live in grassland regions often



use these soils for farming. In North America we call temperate grasslands prairies. Major grasslands in North America are the Great Plains of the Midwest, The Palouse Prairie of eastern Washington State, and other grasslands in the southwest. In Eurasia temperate grasslands are known as steppes and they are found between the Ukraine and Russia. In South America they are called pampas, and are located in Argentina and Uruguay. In South Africa temperate grasslands are known as veldts.

WEATHER: Temperatures in this biome vary greatly between summer and winter. The summers are hot and the winters are cold - much colder than Santa Barbara! With cold winters, it's surprising how hot the grassland summers can get! Sometimes the temperature is more than 100°F (37.8°C). Rain in the temperate grasslands usually occurs in the late spring and early summer. The yearly average is about 20 - 35 inches (55 - 95 cm), but much of this falls as snow in the winter. Fire is not foreign in temperate grasslands. They are often set by lightning or human activity. Fire regularly swept the plains in earlier times, and to some extent still does today.



Gerald and Buff Corsi © California Academy of Sciences

PLANTS: Grasses dominate temperate grasslands. Trees and large shrubs are rarely found in grassland areas. There are many species of grasses that live in this biome, including, purple needlegrass, wild oats, foxtail, ryegrass, and buffalo grass. Many animals munch on these grasses, but they survive because the growth point on the grasses is very close to the ground. Also, with underground stems and buds, grasses are not easily destroyed by fire. Shrubs and trees that live in temperate grasslands are not as good as grasses at coping with the flames, and often are destroyed by fire. Wildflowers also grow well in temperate grasslands. Popular flowers that you might find growing on grasslands are asters, blazing stars,

goldenrods, sunflowers, clovers, and wild indigos.

ANIMALS: All grasslands share a lack of shelter from predators, and an abundance of grass for food; therefore, grassland animal populations are similar throughout the world. The dominant vertebrates in grasslands are herbivorous or plant-eating grazers called ungulates. Ungulates are mammals with hoofs, like horses and deer. Their long legs help them run fast to escape grassland predators. The temperate grassland does not have much animal diversity, especially compared to the Savannah. Some animals that inhabit temperate grasslands in North America are bison, antelope, birds, gophers, prairie dogs, coyotes, and insects. On the steppes you'll find similar animals to the Great Plains including lynx, antelopes, falcons, and fox.



Gerald and Buff Corsi © California Academy of Sciences

LOCATION: What do you think of when you hear the word "alpine"? Perhaps mountains or skiing? Well, you are right. Alpine biomes are found in mountain regions worldwide, including the Andes, Alps, and Rocky Mountains. The alpine biome usually lies between an altitude of about 10,000 feet (3,000 meters), and the place where the snow line of a mountain begins. Combined, the Alpine and Arctic biomes cover 16% of the earth's surface area.

WEATHER: In the summer average temperatures range from 40 to 60°F (4.5 to 15.5°C). In the winter the temperatures are well below freezing. Generally, as the altitude increases, the temperature gets colder. Temperatures in the alpine biome are dynamic and can also change from warm to freezing in one day. The winter season lasts from around October to May. The summer season may last from June to September. The alpine biome is fairly dry with an average precipitation of 12 inches (30 cm) each year.

PLANTS: The alpine biome is a tough place for plants to live. It's windy, cold, and the sunlight at these high altitudes is very strong. There are only about 200 species of alpine plants. At the high altitudes where these plants live, there is very little carbon dioxide, which is necessary for plants to carry on photosynthesis. Because of the blustery weather, most plants are small groundcover plants, which grow and reproduce slowly. They protect themselves from the cold and wind by hugging close to the ground. When plants die the cold weather makes it hard for them to decompose quickly. This makes for poor soil conditions. Most alpine plants are adapted to grow in sandy and rocky soil. Plants have also adapted to the dry conditions of the alpine biome. Some of the plants found here are tussock grasses, small-leaved shrubs, and dwarf trees. The bristlecone pine is an amazing plant of the alpine biome. It lives in scattered, arid mountain regions of six western states of America ranging from Colorado to California. Many are found in the Ancient Bristlecone Pine Forest in the White Mountains of California. These trees only grow to about 60 feet (18 meters). That may seem tall, but for its age 60 feet (18 meters) is short! Bristlecone pines can live to be over 4,000 years old. That is almost as old as the Great Sphinx of Ancient Egypt!

ANIMALS: Can you imagine living in a cold, windy place without much shelter? Animals that live in the alpine biome must have special adaptations to survive the cold, snowy conditions. They also have to deal with high UV light exposure from the sun and thin atmosphere. Mostly warm-blooded animals live here, but a few types of insects also make the alpine biome home. Alpine animals adapt to the cold by hibernating, migrating to warmer areas, or insulating their bodies with layers of fat and fur. Their bodies tend to have shorter legs, tails, and ears, in order to reduce heat loss. Alpine animals also have larger lungs, more blood cells, and blood that can deal with the lower levels of oxygen at higher altitudes. Some animals in the alpine biome are mountain goats, sheep, elk, beetles, grasshoppers and butterflies. Which of these animals do you think leaves the alpine biome in the winter?

One interesting alpine animal is the chinchilla. Maybe you've seen one of these small, gray, furry creatures in a nature center or zoo. In the wild, chinchillas live in the Andes alpine regions, but they are not easily found. Chinchillas are herbivores. Their diet in the wild consists of plants, roots, and grasses. As altitude increases, the temperature decreases, so in these regions the



chinchilla has even denser fur. Chinchillas used to be hunted for their soft, beautiful fur. People used their pelts to make coats until they became nearly extinct in the 1940s. It takes over 100 pelts to make one chinchilla coat! Now they are on the endangered species list, and protected by law from hunting and people. The snowshoe rabbit and ptarmigan bird are also alpine animals. They are adapted to be less visible when snow covers the ground through camouflage. The snowshoe rabbit has brown fur in the summer, but in the winter it turns white. What do you think the ptarmigan does to camouflage? It's like the snowshoe hare! In the summer the ptarmigan has brown feathers and in the winter its feathers are white to hide in the snowy environment.

CHAPARRAL

LOCATION: The chaparral biome is found in small sections of most continents, including the west coast of the United States, the west coast of South America, the Cape Town area of South Africa, the western tip of



Australia and the coastal areas of the Mediterranean. In Europe it is called the maquis, Australia has the mallee, Chile the matorral, and South Africa calls it fynbos. It is also called the Mediterranean Forest, Woodland, and Scrub

biome. The chaparral biome has many different types of terrain. Some examples are flat plains, rocky hills and mountain slopes.



WEATHER: The chaparral is characterized as being very hot and dry. The winter is very mild and is usually about 50°F (10°C). Most of the rain in this biome comes in the winter. The summer is hot and dry at up to 100°F (37.5°C). This makes fires and droughts very common.

PLANTS: Most chaparral plants have large, hard leaves, which hold moisture. The plants are also very well adapted to fires. Plants in the chaparral often have root systems designed to get as much water as possible. Shallow roots extend horizontally under the surface of the soils and are good at catching water when it falls as rain; taproots extend deep into the soil to capture groundwater. Some examples of plants in the chaparral are toyon, chamise, poison oak, scrub oak, Yucca and other shrubs, trees and cacti. The maquis contains plants such as myrtle, hawthorn, and broom. The Australian mallee is more open than these other types of chaparral and consists mainly of dwarf eucalyptus trees. The fynbos is also composed mainly of scrub and shrubs, such as heathers and protea plants.

ANIMALS: The animals are all mainly grassland and desert types adapted to hot, dry weather. A few examples from California are: coyotes, jack rabbits, mule deer, alligator lizards, horned toads, praying mantis, honey bees and ladybugs. In Europe one might find wild goats, sheep, cattle, mouflon, horses, lynx, wild boar, rabbits, vultures and eagles. There are also many small mammals, reptiles and insects, just like in California. The fynbos of South Africa also has many butterfly species that rely on this habitat.



DESERT

LOCATION: Although few animals and plants are adapted to the extremely dry desert life, the desert is a vital biome. The desert is important because it covers about a fifth of the earth's surface! There are both hot and cold deserts. Antarctica is the largest desert in the world, while the Sahara in Africa is the largest of the hot deserts. There are also deserts close to Santa Barbara, such as the Mojave the Colorado Desert which encompass parts of Southern California. In North America, there are four major hot, dry deserts, including the Mojave and the Great Basin. Outside the U.S. hot, dry deserts are found in the Southern Asian realm, South and Central America, Ethiopia and Australia.

Another type of desert is the coastal desert, for example, the Atacama Desert in Chile of South America. And then there are cold deserts. That sounds pretty silly! If deserts are supposed to be hot, how can there possibly be a cold desert? Well these deserts are in places like Antarctica and Greenland where vegetation is sparse, just like the more commonly known hot, dry deserts.



WEATHER: Weather is not the same in all deserts. The seasons in hot and dry deserts are usually very hot during the summer and warm during the rest of the year. During winter these deserts get little rainfall. Rain is often light, or in short concentrated bursts. Most of the time evaporation rates are faster than rainfall rates. Sometimes the rain evaporates before even hitting the ground. This is the reason for the dry characteristic of this type of desert. Coastal deserts are in moderately cool to warm areas. Coastal deserts usually have cool winters followed by fairly long, warm summers. The temperature in the winters is generally 41°F (5°C) or below. In the summer the weather heats up to between 55° and 75°F (12 and 24°C). Average rainfall is usually 3 - 5 inches (8 - 13 cm). The Atacama is the Earth's driest desert. In the Atacama 1 millimeter or more of rain falls every 5-20 years. Cold deserts have short, moist and moderately warm summers, and long cold winters like one could expect in Antarctica. The winter temperature ranges from -5°F to -110°F (-20.5 to -79°C), and in the summer it can be a nice, balmy, 32°F (0°C). The coldest day recorded in Antarctica was -113°F (-80.5°C)!



PLANTS: Deserts plants have many adaptations to survive in such a dry environment. They are good at storing and finding water. Some plants have seeds that can stay dormant in the sand for a long time, until there is enough rain for them to grow. In hot deserts, you'll often find Cacti. Cacti are great at storing water. With their waxy coating, water can't escape and their spines protect them from being desert dinner. Their roots are shallow, and widely spread so that any rain can be absorbed immediately! Some other plants you might find in the hot desert are creosote bush, sagebrush, and ocotillo. Coastal deserts house a variety of plants. These plants must adapt to minimal rainfall by having extensive root systems that come up to the surface to absorb any possible rainfall, and go far down to absorb any water saturated in the ground. These plants also have very thick leaves that can absorb and store water whenever it is available. The plants that live in coastal deserts

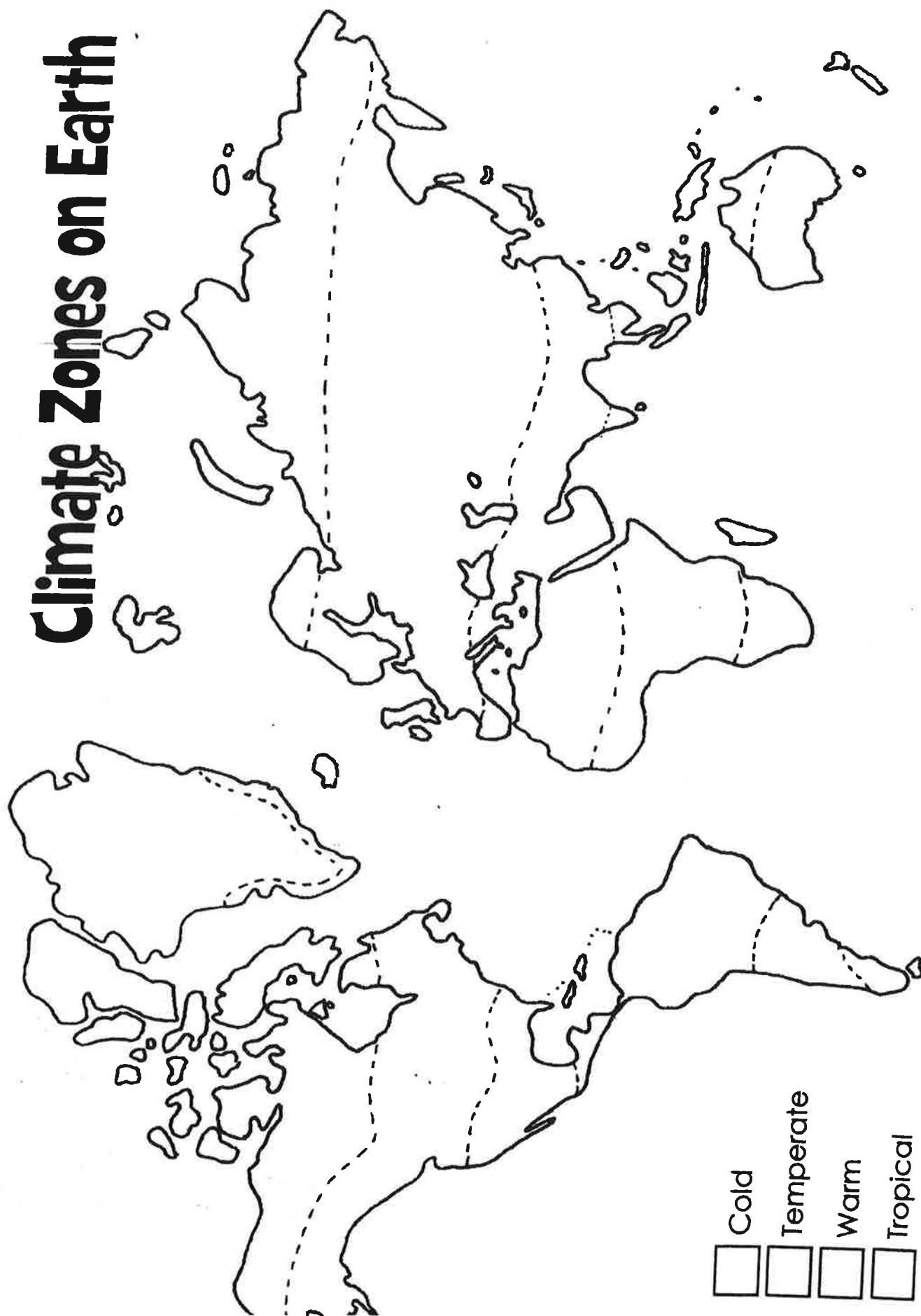
include salt bush, rice grass, black sage and chrysothamnus. Plants can even live in cold deserts, but⁵⁻³⁷ you won't find as many here as in other types of deserts. Plants in cold deserts include algae, grasses, and plants with spiny thin leaves. Usually these plants grow only in the summer.



ANIMALS: Deserts are a very important biome. No, not because of all the sand! Mostly because of all the plants and animals that call the desert "home". Some animals that live in the hot desert are cold-blooded, like snakes, insects, and lizards. Mammals that live in the desert are usually small, such as the kangaroo rat and kit fox. Sometimes it's hard to survive in the desert. Some mice build their home out of fallen cactus spines to protect themselves from predators like coyotes and hawks. In the Eritrean coastal desert in Djibouti, Africa, animals like gazelles, skinks, geckos and dikdiks roam the desert. Fewer animals live in the cold desert. In Antarctica, most of the

animals live near the ocean shore. Because of their ice home, seals, penguins, and other birds rely on fish, squid and other sea creatures for their food.

Climate Zones on Earth



- ☐ Cold
- ☐ Temperate
- ☐ Warm
- ☐ Tropical

Biome Description

Biome Name

Locations Worldwide

Weather

(Temperature & Precipitation)

Plants and Animals

Plants:

Animals:

Examples of Food Chain:

Describe the Biome:

Climates: Charting the Statistics

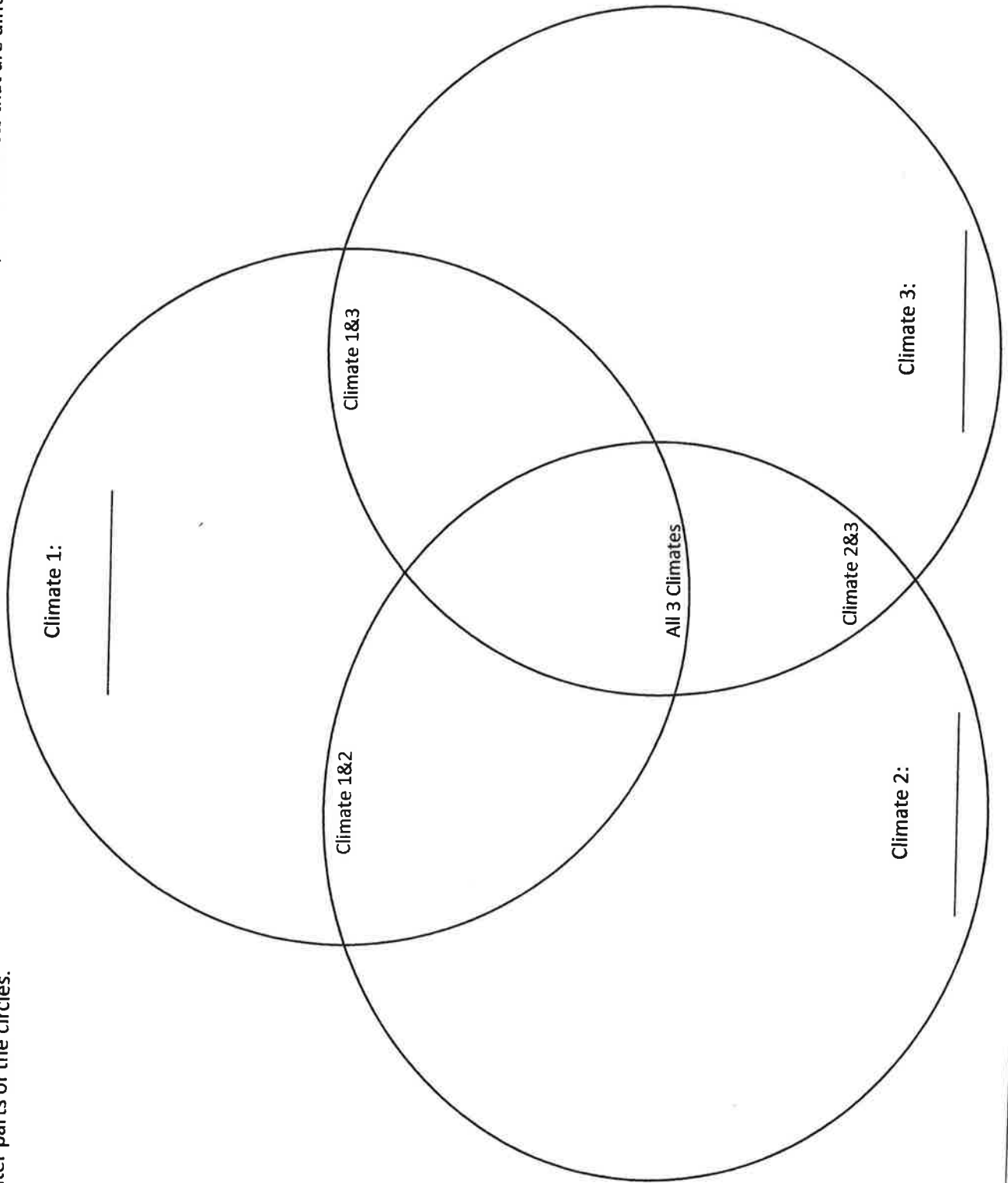
Directions: Choose 3 climates and write them in the first row of boxes below. Then, fill out each category with facts and details about these climates.

Categories	Climate #1	Climate #2	Climate #3
What is the average temperature?			
What kinds of plants are there?			
Where in the world is this climate found?			
How do living things adapt to this climate?			

My favorite climate is _____ because _____

Comparing Climates

Directions: A venn diagram helps you compare (find things that are the same) and contrast (find things that are different) two or more items. Write the name of each climate in the three circles below. Fill out the intersections of the circle with facts and details that are the same; write the facts that are different for each animal on the outer parts of the circles.



Make a Salt Dough Map

Grades: 3rd -8th

Objective: Student will create a salt dough map of their country as a great visual aid for learning the geography of their country. It's a hands-on tool for making the country come alive

Materials:

- Flour
- Water
- One or two boxes of salt
- Blank map of your country, enlarged to 11X17
- Tape
- Pencils for all students
- Markers
- Paint



How to Make a Salt Dough Map:



Step 1: Color the entire back of your map with a lead pencil to make the transfer to the pizza box or cardboard box. The map will be easier to see.

Step 2: Lightly tape the map, pencil-shaded side down, on the pizza or cardboard box (note from experience: don't use packing tape!) and trace the outline of the map, bearing down fairly hard



Make a Salt Dough Map



Step 3: Remove the map to reveal a light pencil outline. Trace this outline with the marker.

Step 4 You can paint, or color over the marker. As long as you don't paint heavily, the outline will still be visible



Step 5: Mix equal parts flour and salt together to make the salt dough. Mix just enough water to create dough that is a Play-doh-like consistency. I usually use the entire box of salt, approximately 3-4 cups.



Place the dough on the box and shape into the outline. When you're finished, you can build the dough up to depict mountains and valleys, using a topographical map as a guide.

while most of your map should be basically to scale, having traced a printed map as your guide, it's fun to add not-so-scaled highlights. For example, Brianna added The Leaning Tower of Pisa to our map of Italy (it's the brown protrusion you'll see) and she added Mt. Fuji to Japan last year.

You can also add toothpicks at points of interest, to which you can later add labels to make flag markers.

Make a Salt Dough Map



Step 6: Place the map in the sun for several hours to dry

Step 7: Paint your map (we use tempera or acrylic paint).

