1. Introduction:

- Plants are living things made up of cells. They need food and water to live and grow and need air to breathe. They grow, reproduce, and eventually die.
- Unlike animals, plants can make their own food. They are the primary producers that sustain all other life forms on Earth.
- Plants take energy from the sun, carbon dioxide from the air, and water and minerals from the soil to make food. This process is called photosynthesis and it takes place in the leaves in presence of a green pigment called chlorophyll.
- During photosynthesis, plants give out oxygen into the air which is used by animals for respiration.
- There are thousands of different species of plants on Earth. They come in many sizes, from tiny organisms to huge trees.
- How plants produce food and grow depends on many environmental factors. Sunlight, temperature, moisture from rain/snow, and soil are some of the important factors.
- A habitat is any place where a particular animal or plant lives. (Ex. a lake, a desert, a forest, etc.) Habitats of similar climate (temperature and precipitation) are grouped together in biomes. The important biomes in the world are: tundra (arctic, Antarctic, alpine), taiga (coniferous/boreal forests), tropical rainforests, temperate deciduous forests, hot and cold deserts, grasslands (savannahs, steppes, pampas, and prairies), chaparrals, freshwater (lakes, rivers, ponds), wetlands (marshes and swamps), and saltwater (marine/oceans, coral reef). These biomes are spread throughout the Earth.
- Plants have adaptations to help them survive in different biomes. Adaptations are special features that allow a plant or animal to live in a particular habitat. Each adaptation develops through evolution. This means that a long period of slow change over many generations results in a plant’s adaptation(s). Each plant has a different set of adaptations to survive and thrive in the habitat it lives in.

2. Arctic Moss

- Arctic moss thrives in the freezing cold temperatures of arctic tundra. It can grow in places with low-nutrient soils, almost no sunlight and layers of thick snow.
- Arctic moss can grow on the bottom of freshwater lakes covering lakebeds like a blanket. As it is underwater, it is sheltered from the cold, wind and the dry air of the tundra. It is able to survive on less nitrogen which is essential for most underwater plants.
- Arctic moss can also grow low on the tundra grounds, shallow soil on rocks, and between cracks in rocks. Because it stays close to the ground, it is protected from the drying wind and at the same time, gets warmth from the soil.
- Arctic moss does not have true roots. It has rhizoids which are small rootlets that allow the moss to absorb nutrients from the soil (even rocks) and hold onto the rocks in the windy tundra.
- Arctic moss has many tiny leaves and non-woody stems. These help the plant conserve moisture. The large number of leaves help the plant to photosynthesize more which is useful because the days in the tundra are short.
- Arctic moss grows very slowly but lives for many years. The plant stores most of the nutrients it makes and absorbs from soil. These stored nutrients are used by the plant to grow new leaves the following spring.

3. Birch trees

- Birches are small to medium-sized deciduous trees. They grow in the tundra and temperate regions of Europe, Asia, and North America.
- Birches have barks on their trunks that separate into thin papery plates. They protect the inner wood from damage and from drying out. The inner wood is hard and strong, and does not break easily during windy winters. The bark contains oils that make it long-lasting and prevents it from decay.
- Many species of birch are adapted to the coldest climates of the northern hemisphere. They grow in open land after glaciers melt.
- They lose their leaves in the winter which saves energy and eliminates the need to protect their soft tissues.
- Birch twigs and branches are very flexible. This makes them unlikely to break from the weight of snow that collects on them during snowfalls.
- Its leaves are small and triangular shaped with tooth-like edges. They have minimal surface area reducing water loss in drying winds. The leaves are found on high branches to get enough sunlight.
- The root system of the birch is shallow and spreads wide. This gives it the ability to reach out for the moisture and oxygen in the upper layers of soil.
- As the winter approaches, the tree goes through some changes in the structure of its cells. This is called acclimation. This prepares them to survive the harsh winters.

4. Cacti
- Cacti are succulent plants that are well adapted to live in hot and dry regions like deserts.
- Cacti stems are modified into pads covered with prickly spines and a waxy coating. These stems have the ability to store water which helps to keep the plant nourished during the droughts.
- Leaves are modified into prickly spines to reduce the evaporation of water. They also prevent herbivorous animals from chewing on them.
- The spines also direct rainwater to the plant’s root, thereby greatly utilizing the rainwater which is in a very short supply in the deserts.
- In hot temperatures, some cacti (like the saguaro cactus) fold their stems so that there is less surface area exposed to the Sun, thereby reducing the amount of evaporation. But when there is oncoming rain, the stems expand and expose more surface area so that they can absorb and store more rainwater.
- The water is stored in the plant in the form of a thick viscous fluid.
- The bluish wax coating over its skin reduces evaporation and preserves moisture during extremely hot temperatures.
- The stomata of many cacti lie deep in the plants’ tissues. Stomata open up only at night when it is cooler so that less moisture is lost through transpiration.
- In cacti, photosynthesis happens in the green stems (pads) in a slightly different form. Stomata let the carbon dioxide gas to enter the stems during the nighttime and store it until morning. When the Sun comes out, the stems use the stored gas to complete the photosynthetic process.
- The root system of most species of cacti (like the barrel cactus and prickly pear cactus) is very shallow and widely spread. Their roots grow laterally instead of deeper into the soil. This lets the root system absorb maximum amounts of minerals and rainwater from the upper parts of the soil. But some cacti have long roots that grow deeper into the soil.
- In most cacti, small lateral roots called rainroots start growing as soon as the rain starts falling. These new roots help to absorb the rainwater quickly. But when the soil becomes dry, they dry up and fall off so that they don’t cost the plant any extra energy to keep them nourished.

5. Carnivorous Plants
- Carnivorous plants eat insects. There are many carnivorous plants in tropical rainforests. (sundew, bladderworts, pitcher plants, and pinguicula). Venus fly trap are native to a small wetland region in the USA.
• Sundew has tiny reddish leaves with little dew drops of nectar at its ends which glisten in the sunlight. This nectar attracts the insects to come close. Once the inset sits on the sticky nectar and gets stuck, the plant’s leaves (tentacles) start wrapping around the insect. As they tighten, the insect dies out of suffocation or tiredness. Once the insect dies, the plant’s digestive juices start acting on it.

• Pitcher plants grow as vines on trunks of other trees in the rainforest. They climb as much as thirty feet. They got their name form the shape of their leaves which are shaped like pitchers. The edges of the leaves are waxy, slippery, and covered with nectar. Insects get attracted to the smell of the nectar, but slip and fall in when they land on its slippery sides. The inside of the pitcher is filled with a digestive fluid that traps and digests its prey. While they are mostly known to trap insects, some of its larger varieties are big enough to eat rats!

• Venus flytraps are an endangered species. They are mostly grown in greenhouses. They have leaves that open wide and stiff trigger hairs on their insides. If an insect touches these hairs, the two lobes of the leaf close in together in less than a second trapping its prey. The Venus fly trap is very selective in what it eats. It does not trap very small insects so fast, but lets them escape because they don’t provide enough food. Things that it cannot digest, like nuts or stones, the plant spits out after about twelve hours.

6. Cedar Trees

• The original cedar trees, also called true cedars (Lebanese cedar and Himalayan cedar) grow in the Mediterranean and the Himalayas. But the false cedar trees (western and eastern red cedars) are found abundantly across North America.

• The false cedars do not belong to the family of true cedars, but they are called cedars because they have aromatic wood, just like the true cedars.

• The cedars are evergreen coniferous trees which can grow very tall. They have conic shape when young, but the branches level out as they age.

• The cedar trees have a pleasant aroma. This aroma prevents insects from attacking it and therefore is favored by people to make furniture, fences etc.

• The aroma also prevents the wood from decay and rot.

• The wood breaks down very slowly in wet environments, so cedars are suited for wet climates.

• Eastern red cedar is not adapted to fire. As the base of the underground shoot does not possess buds, it cannot resprout after the fire destroys the top part of the plant.

7. Coconut Trees

• The coconut tree belongs to the family of palm trees. It is also called coconut palm. It grows in rainforests, coastal regions, and other tropical climates.

• The tree’s very tall trunk allows it to reach higher than the other trees to receive sunlight. It can grow up to be fifty to eighty feet tall.

• The trunk supports its entire weight. It is flexible and strong allowing the coconut tree to lean over slightly. The flexible trunk and the strong network of roots allow the tree to sway in the wind without falling over.

• The long and flexible leaves are actually fronds composed of numerous thin and long leaflets. The drip-tips at the ends of the leaflets and their slightly waxy nature allows rainwater to drain off the leaf quickly.

• Its flexible stem and flexible leaves make it highly tolerant to fast blowing wind. They can even survive tropical storms. They can also tolerate hot and humid conditions.

• The coconut seeds are big. They have a hard shell containing white pulp and whitish juicy liquid inside them. Each seed has a very strong air filled fibrous outer shell (called a husk), that protects the seed inside.
• The seeds can float on water. The fibrous outer shell protects the seed from getting damaged by seawater or dry weather. This ensures that the seed remains healthy enough to germinate later.
• When a seed falls from a tree, it gets transported by water or wind to other places. The seed can then sprout wherever it lands. The food and water contained inside the seed provide nutrition and moisture to the seedling when it sprouts.
• The root system of the coconut tree grows laterally, usually in the top five feet of soil.
• The bark of the tree is very thin and smooth. The bark does not need to protect itself against the loss of moisture because there is plenty of it already in its environment.
• The coconut tree can survive almost any type of soil, as long as it is not too compact. The tree will grow well as long as the soil or sand drains easily and is lightly acidic.

8. Coneflowers

- Coneflowers thrive in the grasslands of eastern and central North America. Its many varieties include grey-headed (yellow) coneflower and purple coneflower.
- They have large showy heads of multiple flowers. They can grow in poor soil conditions.
- Its leaves have tiny hairs and bumps which act as the main entry system for dew or other moisture that nourish the plant.
- Its stem is upright, rigid, and covered with fur. The fur prevents moisture from evaporating quickly allowing the plant to have more time for absorption of minerals and moisture.
- Coneflowers are fire-tolerant (don’t get easily destroyed by fire). Sometimes, intense fire can kill the plant above ground, but the plants can regrow from the base.
- The extreme heat of fire actually helps the germination of coneflower seeds. The seeds are more active and germinate quickly after a fire.
- The plant protects itself against most herbivores by growing tall (3-5 feet). Most animals that try to feed on them, like rabbits, cannot reach this height.
- Their prickly seedhead and bad tasting leaves discourage most animals from eating them. In spite of that, some animals do eat them. But the plant’s healthy root system helps the plant to quickly spring back up.
- The pollen of this plant is very attractive to insects which help in pollination.
- Coneflowers have a large root system which can absorb the tiniest amounts of moisture in the dry soil. The root system has rhizomes, which are storage structures that can produce offshoots (extra shoots) when needed to keep the plant alive. The root system of the grey-headed coneflower also stores food to be used when needed.

9. Coral Reef Plants

- Corals are created from the bone-like deposits containing calcium carbonate. The small marine animals that produce these deposits are called polyps. These coral deposits accumulate over time in layers to form coral reefs. The upper part of the coral deposits is occupied by the polyps living in colonies.
- Coral reefs are made up of a large number of plants and animals which live together to create an ecosystem.
- Some of the plants living in coral reefs are marine algae, sea grasses, and mangroves.
- The coral polyps share a symbiotic relationship with a type of algae called zooxanthellae. The algae live inside the coral polyps and get nitrogen and carbon dioxide needed for photosynthesis from the polyps. The polyps in turn get oxygen and nutrients form the algae.
- Coralline algae are red algae that live on the underside of coral reefs. They produce calcium carbonate which cements the corals together and maintains the stability of the coral reef.
- Seagrasses live in the crevices and open spaces left by corals. They have strong roots that can anchor the plant to the sol on the ocean floor. This helps to hold the soil sediments tightly on the ocean floor and keep
the water clear. They produce lots of food and oxygen used by the other organisms in the coral reefs ecosystem. Dead seagrasses form the base for further plant growth.

- Mangroves grow along the shorelines and behind the beds of coral reefs and sea grass. Their roots reach deep down and protect the coral reef by preventing sediments and debris from shore from clogging the coral reef area.

10. Eucalyptus Trees
- Eucalyptus trees are native to Australian savannas. Some species are also found in other parts of the world.
- They are also called gum trees because of the gum-like sticky substance they have on their trunks. It is produced by the vascular tissues that transport water and nutrients to various parts of the plant.
- The tree protects itself using the powerful toxic oil that it produces in its leaves. This oil is volatile because it evaporates when exposed to the air at normal temperatures. Some animals, like possums and koalas, are unharmed by this oil and eat eucalyptus leaves.
- The tree also has hard and woody seedpods that are unique to each eucalyptus species.
- After a bush fire, eucalyptus trees are able to regenerate from seeds and even shoots, thereby increasing its chances of survival.
- The plant also produces a special cap, called the operculum, which protects the petals and stamen before the flower fully opens. When the flower starts opening, this operculum gradually sheds.

11. Green Grass
- There are many types of grasses which grow in a variety of places, from the mountain tops to the seashores.
- Grass is a healthy and sturdy plant that can survive even the toughest of climates.
- In normal plants, the new leaves grow from the branch tips; but in grasses, they grow from the base.
- Grasses have complicated and solid root systems that spread deep, especially during the droughts to ensure that the plant can get enough water.
- Fires, which are common in grasslands, destroy the plant above the ground, but not the root system and the base. This allows the plants to resprout after a fire.
- Similarly, when animals graze the grass, they eat only the top part of the grass without damaging the base. So blades of grass can quickly sprout from their bases.
- Some varieties of grass require intense fires to begin the germination process. Therefore, while some grass plants receive a new lease on life after a fire, others just begin their journey.
- Its leaves, called blades, are long and narrow which helps it to lose less water through transpiration than plants with bigger leaves.
- Sod grasses have stems that creep along just above the ground (stolons) or underground (rhizomes). These stems send up new leaves at regular intervals. Bunch grasses grow in a bunch and often grow tall.
- Most grass varieties have silica, a substance found in sand, which adds to its strength. Silica makes it harder for animals to digest the grass. It wears down the teeth of grazing animals.
- Grasses are mostly pollinated by wind, but sometimes by insects. Wind pollination is well-suited to the exposed windy conditions of the grasslands. Its seeds are small and easily dispersed by wind or animals.

12. Kelp
- Kelp is a type of seaweed found in cold seas. It is brown colored with long ruffled tentacles that attach easily to rocks.
- Kelp forests are underwater areas with a high density of kelp. Areas with less kelp density are called kelp beds.
• The body of kelp, known as thallus, is held strongly to the ground by its huge root-like mass called the holdfast. This root only performs the task of an anchor and does not deliver nutrients like roots do in other plants.
• The stem of kelp is called stipe. Stipe allows the plant to stand straight in high-pressure water. The stipe lengthens upward and supports the entire plant’s framework. The stipe is a flexible, but tough, structure that allows kelp to move with the currents without tearing.
• The stipe has leaves attached to it which extend outward that are called fronds. These fronds make food for the plant by photosynthesis.
• Kelp has gas-filled bladders, called pneumatocysts, located at the bottom of the fronds. They act as floating devices keeping the plant in its upright position. When these bladders are active, the plant is able to rise to the ocean’s surface to capture light for photosynthesis.
• Kelp can withstand turbulent water currents. The soft, flexible fronds can sway with the currents, without being torn apart. In fact, kelp thrives in such conditions because it provides them with a steady supply of nutrient rich water, coming from the depths of the ocean floor.

13. Labrador Tea
• The labrador tea, also called the marsh tea, grows in the tundra. Its leaves are brewed to make tea.
• Its leaves are narrow, smooth on the top, and furry on the underside. The fur gives them insulation against the cold tundra climate.
• The leaves are drooping with their edges rolled in. This helps them to retain as much moisture as possible.
• The leaves are evergreen (don’t fall off in winter). Their dark green color absorbs lots of sunlight and heat. So the leaves can carry on with photosynthesis even during cold temperatures and low sunlight.
• They can grow in dry soils with fewer nutrients. Their root system is very shallow allowing the plant to avoid deeper frozen soil (permafrost) of the tundra.
• Labrador tea can adapt its growth rate to suit the climate. In warmer places, the tree can grow up to about four feet. In colder places, it grows closer to the ground to keep itself warm.
• The plant multiplies in two ways: by seeds and by rhizomes.
• The plants produce seedpods with many tiny seeds. This increases the chances of at least a few seeds sprouting out.
• Rhizomes are shoots that creep along underground. They can grow new shoots which develop into new plants. If the part of the plant above the ground is destroyed for any reason, rhizomes provide an alternate way of growing new plants.
• The plant has large flowers which attract insects that act as pollinators to the plant.

14. Lichens
• Lichens can withstand great extremes of temperature and are found in arctic, antarctic, and tropical regions. They are abundantly found in the alpine regions.
• These plants grow on the ground, on rocks as well as on trees, bones, rusty metal, and many other things. Soil is not necessary for them to grow.
• Lichens are slow-growing organisms composed of fungi and green algae or cyanobacteria living together in a symbiotic relationship. Some lichens include multiple species of fungi.
• Fungi cannot make their own food, so they depend on green algae or cyanobacteria, which can make food by photosynthesis.
• Lichens can produce many biochemical compounds that help them to control light exposure, repel herbivores, kill attacking microbes, and discourage competition from other plants.
• Lichens are able to grow faster in abundant moisture and light.
Three types of lichen grow in the alpines. The crustose lichen forms a crust-like covering over anything it grows on. The fruticose lichens have shrub-like qualities and the foliose lichens produce leaf-like lobes.

Lichens are hardy and can even grow under the snow. They can absorb water vapor from snow and ice. They are able to photosynthesize even under freezing temperatures.

During droughts, these plants stop functioning completely. They conserve all their energy until it is safe for them to start producing food again.

The fungi produce acids that disintegrate rocks. This helps the lichens to hold onto the rocks, but eventually they turn rocks into soil.

### 15. Mangrove Trees

- Mangrove forests are found along coastal shorelines and in rainforests especially where the rainforests meet the ocean. They also grow on river deltas and in salty wetlands between land and sea.
- They prevent erosion of coastlines by collecting sediments from rivers and streams and by slowing down the flow of the water.
- A mangrove that grows in deep waters, like the red mangrove, has a root system that makes the plant look like it is on stilts. It has special aerial roots, or prop roots, that keep the trunk and leaves above the water protecting it from the ocean tides. The tree also has a number of support roots that securely anchor the tree down. This is to make sure that the tree will not float away.
- Some mangrove trees, like black and white mangroves, have less elaborate root systems that do not anchor them to earth. This is because they grow at higher elevations in drier soils.
- Aerial roots in red mangroves have pores that help them breathe. White mangroves have peg roots stick out of the ground and act like breathing tubes.
- The roots of some mangroves, like red mangroves, have a unique filter system to separate the salt out of the salty water they grow in. They are able to absorb only the water content from the salty water and keep the salt out. Some mangroves, like black and white mangroves, remove salt through little glands located on their leaves.
- The seeds of the mangrove plant are not damaged by salty water. The seeds start to grow while they are still attached to the parent tree. When they mature, the seeds break free from the tree and fall into the water. Some seeds may stick into the mud around the parent tree and begin to grow. Some float with the tide and grow new trees far away. Seeds of red mangrove look like long sticks.

### 16. Milkweeds

- Milkweeds are usually found in grasslands of North and South America.
- Milkweed species include: common milkweed, butterfly milkweed, tropical milkweed, and swamp milkweed.
- This plant is adaptable to different types of soils like rocky, clay, sandy, and to wet, moist, dry, and cold or hot conditions.
- It produces an extremely bitter milky sap that is unpalatable to the herbivores in order to prevent them from eating it. This sap is toxic in most species.
- The plant reaches a relatively medium height of two to six feet. It has a single flexible stem that allows milkweed to sway in the wind without breaking. Its leaves are smooth on top, but have little furry fibers at the bottom. These fibers limit the damage caused by caterpillars.
- This perennial plant produces flowers in a wide range of colors. These flowers develop into teardrop shaped seedpods. The seeds, which are arranged in overlapping rows, have a silky tuft of hair. This allows them to be blown by the wind like little parachutes helping in seed dispersal.
- Its roots grow deep into the ground and cannot easily be uprooted. In case it does get uprooted, the root leaves a small part of itself behind to that after some time, the plant is able to grow back.
The plant can also grow laterally as it has rhizomes (underground stems). Rhizomes store food for the plant to produce new sprouts that come out of the earth every year or so. Rhizomes keep the plant alive underground when a fire burns the parts of the plant above the ground.

Its sweet tasting nectar attracts many insects like bees, butterflies, and beetles. When drinking nectar, the pollen of the milkweed gets stuck onto the insects’ feet. The insects carry this to other flowers and help pollinate the plant.

Milkweed acts as a host to monarch butterflies which lay eggs on the sticky underside of the plants leaves. When the larvae are born, they feed on the toxic plants. This toxicity allows them to prevent attacks from potential predators when they grow into butterflies.

17. Oak Trees
- An oak tree is a big, deciduous tree that loses its leaves in the fall to save energy.
- Oak trees can survive even in areas with poor growth factors like light, water, and nutrition.
- During fires that occur in these areas, the top seedlings and saplings of the oak tree get destroyed. However, the tree is able to form new seedlings as quickly as within a year and then they continue to grow fast. Sometimes large oak trees appear dead for years, but eventually grow back.
- The tree’s thick solid bark is its armor. It protects the tree from the harsh heat of fires and therefore the fire does only minimal damage.
- The root system of an oak tree allows it to withstand the harsh winters and lack of water. It has a taproot that burrows deep into the earth. But if the tree received too much water, it develops a disease called “root cellar rot”, which as the name suggests, is the rotting of its main root.
- The tree also has a large lateral root system that spreads wide up to about ninety feet from its trunk. During heavy winds, this system anchors the tree and does not let it fall.
- The leaves that fall during the cold weather serve as natural fertilizer for the tree enriching the soil.
- The oak tree produces abundant acorns every two to four years. It is believed that it skips the years between to keep the seed eating animals, like squirrels, away.
- Acorns establish their root system even before they fall down to the ground. They have high germination rate (75% - 90%), and begin germinating almost immediately after falling from the tree.

18. Olive Trees
- Olive trees are medium sized evergreen trees native to the Mediterranean chaparrals. They are also found in other parts of the world along with their related species.
- A mature olive tree can reach a height of 25 to 30 feet and live for hundreds of years.
- Olive trees bear long green opposite leaves, white flowers, and small edible fruits.
- Olive trees grow in nutrient-poor but well-drained soils. It needs full sun for fruit production, but also needs a slight winter chill for the fruit to set. They flourish in calcium-rich soils like on limestone slopes and coastal regions.
- The tree does not like rich soils where there is a higher chance of developing a disease.
- The olive tree has an extensive root system that grows very deep into the ground in search of moisture and nutrients. They are extremely drought resistant.
- To be able to survive in a hot and dry climate, leaves of the olive tree are small and have a protective coating. Their hairy undersides slow down transpiration.
- The leaves of the olive tree constantly produce nutrients. Leaves fall every two to three years and are replaced quickly.
- The tree grows very slowly and its gray bark is rough and gnarled. This bark also prevents water loss.
- Olive trees have the ability to grow back from wherever they are chopped off.
These plants are self-pollinating (do not need other olive trees nearby for pollination) assisted by the wind. Cross-pollination happens when pollination occurs between two trees growing nearby.

19. Orchids
- Orchids are epiphytes that grow on top of the tree branches in the canopy layer of the rainforests.
- Growing high up on a tree allows an orchid to get more sunlight than it would on the floor of the rainforest. They can even grow with indirect sunlight.
- The frequent rain in the rainforests washes away the nutrients from the ground. Plants growing on the floor of the rainforests pick up the leftover nutrients quickly. Orchids get their nutrients from the tree they live on, so they do not compete with the plants on the rainforest floor.
- Even though orchids need a lot of humidity to survive, they don’t like to be in constant contact with water. Growing on top of trees helps them to get enough humidity and at the same time stay away from water.
- Orchid roots anchor the plant to the tree and help in the absorption and storage of water and nutrients. The roots are exposed to the sunlight and also help in photosynthesis. They have chlorophyll in their cells and look green when they are wet.
- Orchids have smooth and waxy leaves. This allows the water to run off the leaves so that the plant does not rot or get sick. The leaves are broad which allows the plant to expose more surface area to the sunlight.
- Some orchids have modified stems called pseudobulbs used for storing water and nutrients. Some other orchids have thick succulent leaves. These adaptations allow the plants to flourish in areas with seasonal rainfall where the plants experience months without rainfall.
- Orchids are also grown in greenhouses.

20. Palo Verde
- The palo verde trees are found mainly in the Sonoran Desert, but are also found in deciduous areas.
- Its stems and branches are covered with a green bark with a waxy appearance. There are protruding thorns on the stems and branches. Its leaves are actually a small series of leaflets.
- The tree sheds its leaves (and sometimes some of its stems) during hot and dry seasons to prevent water loss through transpiration. This is called being drought-deciduous.
- The green bark has chlorophyll which is the main ingredient in photosynthesis. This allows the plant to carry out photosynthesis in the stems even after the leaves have shed during hot and dry periods.
- The word “palo verde” means “green wood” in Spanish.
- The root system of the tree goes deep into the ground in search of water extending about 100 feet down.
- The plant grows lots of small yellow flowers in the spring. This attracts many insects like bees that play a vital role in the pollination of the plant.
- Its small green seedpods provide food to many birds. These birds help to disperse the seeds which are strong and immediately start germinating wherever they fall.

21. Pasque flower
- The Pasque flower, a member of the buttercup family, is a furry plant and grows along the alpine tundra of Europe, Asia, and North America.
- The plant is a low growing perennial. It grows only to about eight to twelve inches in height. This allows it to survive the cold climate better by being closer to the ground than being higher and facing the cold winds. This height also protects it from most grazing herbivores.
- The fur (fine hair) on its stem, leaves, and buds keeps the plant warm during the cold winter season during which time it is sleeping (dormant).
The Pasque flower has many stems. It spreads its seeds by the forces of the winds. It pulls up the stem that is bearing the seed heads to a height higher than other surrounding vegetation. This gives it a better chance to spread its seeds in the wind.

The Pasque flower is poisonous to the humans, but some animals like rabbits and caterpillars do eat it.

22. Pine Trees

- Pine trees are usually found in the taiga biome of the northern hemisphere.
- The pine trees adapt very well to extreme cold weather, fires, and even droughts. They can thrive in shallow soils and even on rock.
- Pine trees are coniferous (cone-bearing) and evergreen which means that they do not lose their leaves in the winter and their leaves do not change color.
- Their leaves are modified into needles which require less energy to grow. The needles are arranged close together so that there is less air movement around the needles. This reduces evaporation. The needles have a waxy coating which also reduces evaporation and keeps the snow from accumulating.
- The tree makes a substance called antifreeze which is transported to the leaves in the tree sap. This keeps the leaves from freezing up in the winter. The needles continue to produce food by photosynthesis even in the winter.
- As pine trees age, they lose their needles and the rate of photosynthesis decreases. But older trees have carbon dioxide stored as much photosynthesis as younger trees.
- Pine trees have an ability to shed extra snow from their branches. Their branches spread down outward creating a slope allowing snow to slip away and preventing the branches from breaking under the weight of snow. Also, their branches are very flexible, so they can bend without breaking easily under heavy snowfall.
- Pine trees grow very tall. As they grow tall, they lose the lower branches. Their thick barks and high branches protect the needles from catching fire so that they can continue photosynthesis.
- Some varieties of pine, like Jack Pine, need the intense heat of a fire to release seeds from their cones. The seeds use the nutrients from the ash of the forest fire and grow well.
- Pine tree’s taproot goes deep into the earth in search of water and keeps the tree hydrated. The root system anchors the tree to protect it against the strong winds. In shallow soil and rocky places, the root system spreads wide in search of water.
- Water is transported in trees through water columns called xylem. In winter, water in these columns can freeze breaking the columns in most trees. But conifers have adaptations that prevent this from happening. The water columns in conifers don’t break even when water freezes and become reusable after the ice melts.

23. Sea Oats

- Sea oats grow in sandy soil near the oceans. They are one of the few plants that inhabit sand dunes on coastal islands and along coastlines.
- Sea oats are very hardy plants that can withstand ocean tides, ocean waves, wind, and sometimes storms and hurricanes. They have round, hollow, and jointed stems. This way the grasses bend but do not break in the wind.
- Sea oats can resist the drying effects of the wind, sandy soil, and salt spray from the ocean. Its leaves curl tightly in dry and hot weather to reduce the loss of moisture from the pores on its leaves. The leaves are long and narrow and grow in vertical direction so that the area exposed to the drying sun and salty winds is reduced.
- Sandy soil makes it very hard for the plants to absorb water. But sea oats have long and extensive roots that help to absorb the moisture and nutrients from the sand. The root system has rhizomes that help to stabilize the sand around them.
• Their roots are long and flexible which helps to anchor the plant tightly to the sand dunes against strong winds and ocean waves.
• They actively grow in the summer and can withstand very hot temperatures.
• The flowers of sea oats are pollinated by the wind. The seeds that develop in the seedpods get dispersed by the wind to other sand dunes.

24. Strangler Figs
□ Strangler fig, also called killer tree, is a large tropical tree that belongs to the fig family. It starts out growing slowly on a host tree which it gradually encircles and strangles eventually killing the host tree and taking its place in the forest canopy.
□ At first, the sapling grows slowly on the forest floor because there is less sunlight. As it grows in the nooks of a larger tree, it feeds on the leaf litter on the host tree as well as the sun and rain falling on it.
□ Once the seedling has sprouted, it sends roots down the trunk and branches of the host tree. When these roots reach the ground, they soon weed themselves in competing with the host tree for nutrients.
□ These roots then begin to encircle the host tree, fusing together, and growing thicker and stronger. They strangle the host plant for their nutrients.
□ The fig tree eventually grows to be taller than the host (about 150 feet). The host tree eventually dies because of a lack of nutrients. The fig tree is then wrapped around just a hollow center of the dead host tree.

25. Tumbleweeds
□ Tumbleweeds, also called Russian Thistles, are native to the steppes of Eurasia and the European Ural mountains. Their related species are found in many other parts of the world.
□ Tumbleweeds separate from their roots when they become mature and their seeds become ripe. Then they are tumbled by the winds that are quite strong in the steppes. The tumbling habit of the plants helps them to scatter ripe seeds for regrowth.
□ The plant produces at least 250,000 seeds at a time. These seeds are short-lived but grow rapidly. They germinate within a few days of being scattered everywhere.
□ These seeds are quite poisonous and therefore they are not eaten by herbivorous animals grazing in the region.
□ Tumbleweeds produce tube shaped leaves during the seedling phase. The tube shape reduces the surface area for evaporation just like cacti.
□ They have taproots that absorb moisture and nutrients from the soil just enough for them to survive. These plants do not adapt well to moist soil.
□ During daytime, tumbleweeds close the pores on their leaves to reduce water loss through evaporation. This also cuts off the intake of carbon dioxide from the air needed for photosynthesis. But they make up for this loss by storing carbon dioxide in their leaves during the night and using the stored gas for photosynthesis during the day.

26. Water Lily
□ Water lilies grow in freshwater lakes and ponds. They can root themselves to the bottom of the lakes and ponds and can cover the whole surface of water with their broad circular leaves.
□ The leaves are large and flat and spread out the weight of the leaves making it easier for them to float. The floating leaves allow the plant to absorb more light from its upper surface for photosynthesis.
□ The leaves are firm but slightly flexible so that the water waves do not tear them.
- The stomata are found on the upper surface of the leaves. This allows them to get exposure to the air and to help them breathe. The upper surface of the leaves is waxy to let the water slip away. This helps to keep the stomata open and clear.
- The stem is long and flexible so that the height of the plant can adjust to the level of the water. These flexible stems are also tough to allow the plant to be moved by the flowing water without breaking. The stems are filled with air to keep their large leaves afloat.
- Strong roots allow the plant to stay anchored to the floor of the pond. The roots do not absorb any nutrients from the ground. Instead, the nutrients are absorbed by the leaves from the water. The leaves then make food by photosynthesis which feeds the whole plant.
- The flowers usually open only during daytime. This attracts the insects that help to pollinate the plant.

27. Whistling Thorns
- The whistling thorn is a type of acacia tree commonly found growing over the African savannah regions.
- The whistling thorn got its name because when wind passes through the holes in the thorns made by ants, it makes a whistling sound.
- As its name suggests, this tree is full of thorns coming out of its branches which protects it from herbivores. The thorns are white in color and grow as long as three inches.
- Some of the thorns are modified such that they are joined at the branches by hollow bulb-shaped black swellings about an inch in diameter. These are called stipular spines.
- The stipular spines have four different kinds of ants living in them that pierce the thorns to get in. These holes make a whistling sound when wind passes through them.
- One of the animals that can cause the most damage to the whistling thorn is the elephant. But when an elephant tries to grab the leaves, the ants swarm out of their nests and quickly get into the elephant’s trunk and bite it causing tremendous pain. This way, ants help to protect the tree from herbivores like elephants.
- But sometimes, some ant species damage the tree by pruning the branches and flowers of the tree so that other enemy ant colonies cannot come to live in that tree. This pruning causes the tree to produce a sugary juice at the ends of its leaflets which the ants feed on. This pruning also damages the growth tips of the tree which causes its stunted growth.
- Its leaves are evolved into tiny leaflets which can turn to sunlight for photosynthesis, or turn away from the sun to avoid transpiration. This way, the tree can save moisture in hot and dry climates.
- The tree sheds leaves during dry seasons to save on water and nutrients. The fragrant creamy white flowers grow just before leaves grow back in the rainy season.
- Like most trees in the savannah, the whistling tree too is fire-adapted which means that it can easily grow back after a bush fire has burned it to the ground.
- It is also believed that when herbivores are around, the tree slowly lengthens its spines and when they are not around, these spines slowly reduce in length.

28. Yucca
- Yucca includes about forty species of plants that are usually found in hot and dry deserts. But many species of yucca are adapted to live in a variety of habitats including rocky barren lands, grasslands, mountains, and coasts.
- They have evergreen stiff sword-shaped leaves and clusters of whitish waxy flowers. They look rough and craggy.
- Yuccas are found as both shrubs and trees. They are succulent plants that store water and nutrients in their stems, leaves, or roots and release them slowly as they need them.
- Some yucca species, like the Joshua tree, drop their leaves during drought to prevent the loss of water through transpiration. They let the dead leaves collect against their trunk thereby shielding the plant from the Sun’s harmful rays.
- Similar to the cacti, the yuccas have a wax coating that preserves moisture by preventing evaporation.
- The Mojave yucca’s leaves preform much the same task as the spines of cacti in that they direct rainfall to the plants roots to maximize on the limited rainfall. The Mojave yuccas grow rapidly after wildfires and are therefore said to be fire adapted.
- Yucca plants are pollinated by the yucca moth at nighttime. Yucca moths and yucca plants have a symbiotic relationship.
- Female moth gathers pollen from one yucca flower and packs it into a ball. It then flies to other yucca flowers mainly by smelling with her antenna. She visits several flowers each time laying some eggs in the base of the pistil. Then she pushes some of the pollen from her pollen ball down the pistil for her young to feed on. This process also fertilizes the yucca flowers at the same time. Yucca flowers are only pollinated by yucca moths and yucca moth young only feed on yucca pollen.