



**Description:** Students interpret the bosque on a field trip using individual informational clue cards.

**Objective:** To help students learn to observe and make inferences from their observations about the ecological processes in the bosque.

**Materials:** photocopies of clue cards  
appropriate field trip equipment (water, hat, etc.)

**Background:** When we read, we interpret many symbols (letters) that make up the words. The words make up sentences that express ideas. Reading is a process of understanding others' thoughts by making sense of many smaller symbols. We use reading or decoding skills in other areas as well. For example, musical notes on a scale are symbols we translate into melodies and songs.

Naturalists are adept at "reading" the landscape. That means that they can infer what is happening, or has happened, or might happen in the future, by looking at the clues and translating them into a larger understanding of the ecosystem. Reading the landscape requires building an understanding about what your observations mean. For example, a person looking at tracks in a trail might say, "Look, an animal walked here." A more experienced observer might be able to identify the animal based on the shape of the track. An expert might add when the animal came by, what other animals it was with, and maybe even what it was doing. Like any other kind of reading, the more you read the landscape, the better you can interpret what you see. Unlike reading words, landscape reading is not an exact science. People often interpret ecosystem "stories" in different ways.

## 11. Reading the Bosque



**Grades:** 4–12

**Time:** one field trip to the bosque, about two hours

**Subjects:** science

**Terms:** *cohort, forbs, germinate, meander, riparian, sediment, snags, water table*



As you go through this activity with students, they will develop knowledge and a better understanding of how to “read the bosque,” or how to interpret the riparian area to tell a story about the past and the present.

**Procedure:** Introduce the idea that from our observations we know things. For example, if the box is empty, we know that all the cereal is gone. If the sun is streaming through our window, and our parents are yelling at us to get up, we know it is morning. Much of what we know about the world around us is by observation through our senses (sight, smell, hear, taste, touch.) Explain that what we know about the bosque comes from our observations. By learning what our observations mean, we can know the bosque better.

In reading we use words, together in sentences, to share ideas. In reading the bosque landscape, we learn to identify the elements of the bosque, such as a type of plant, but in order to learn about the larger ecosystem we use observations and put together many elements to understand a bigger story.



fall

winter

spring

summer

There are 24 Clue Cards. Use one per student or pair of students. A few cards are seasonal, such as when the cottonwoods are sending out seeds and it seems like it is snowing; but cottonwood cotton can usually be found year-round if you look. Symbols for the appropriate seasons are on each card.

Hand out the cards to students and explain that *they will be the experts* as they walk in the bosque. Each card has an introductory question or something to look for. They should read through and figure out what that is. You should go over terms they will be using. As you walk, when they see the item referred to, the whole group should stop and learn from the expert about it. They can read the paragraph or, better, having read it before, they tell the information to the whole group in their own words.

As facilitator, you may have to stop the group and say, “Does someone have some information about \_\_\_\_?” in order to remind the students that this is a good place to share a particular card.

**Adapting to younger students:** Some of the items are fairly simple. You could take the theme of looking for stumps as a focus for a trip, and at each stump you think about what happened for that tree to fall. Looking for antlion pits, stumps, harvester ant hills, pocket gopher mounds, seasonal signs, bark beetles, jetty jacks, lacy leaves and isopods, tracks and scat would be within the realm of younger students. You will need to summarize the information for their level.

**Resources:** The “Changing River” activity (#13) will give an overview of the concepts in this activity.

# Clue Cards

139



What this tells us:

Cottonwoods usually live where water is abundant. This would be true in the riparian zone of a river in its natural condition. When cottonwoods do not get enough water, they become unhealthy. They often have dead branches with dry, brown leaves. Some of their branches may fall off due to drought stress. In some trees you can see a dark liquid coming from where a branch fell off. These trees may be more susceptible to attacks by insects. Healthy trees have full leaves and branches.

(1) Look at the state of individual cottonwoods. How can you tell a healthy from an unhealthy cottonwood?



The presence of these shrubs (that typically grow up on the mesas) in the bosque suggests that the water table is fairly deep or that the area no longer floods. Upland shrubs do well in the bosque when the ground water level drops. This is typical along regulated rivers (dams regulate the flow of the river). These shrubs do not require as much water as the typical riparian shrubs like New Mexico olive or coyote willow. Juniper is a good indicator of a deep water table in the bosque, because it does not do well in moist soil.

(2) Look for shrubs such as juniper, snakeweed or saltbush in the bosque. What does their presence indicate?



What this tells us:

If the tree stump is cut straight across and even, it was cut by a person using a saw. Sometimes trees are taken from the bosque for the wood. In some areas a tree might be cut down so that it does not fall on people using a trail.

(3) Look for a tree stump that is cut flat across.





4) Look for a tree stump with teeth marks along the cut.



What this tells us:

It was cut by a beaver. Along the Rio Grande, beavers cut trees to use for food. After the tree falls, if it is a large tree they take off the branches to use, but they do not eat the trunk. For small trees, they take the whole tree. They eat the layer of tissue underneath the bark, called the cambium.

5) Look for a tree stump with jagged edges.



What this tells us:

The tree blew over, perhaps in a strong wind. This often happens to trees that are damaged by fires or by drought stress. Often these tree stumps are different heights, as the trees break off at different places.

(6) Look for piles of soil about 1 foot (30 centimeters) across.



What these tell us:

These are gopher mounds. They are very common in the bosque, because gophers are able to dig easily in the soil near the river. The gopher digs a tunnel underground, then pushes all of the soil taken from the tunnel up through the hole to the surface. It usually fills in the hole so that predators can't get in as easily, so typically you will not find a hole in the pile of soil. Gophers spend most of their lives underground. Many desert plants have enlarged roots or other underground storage parts that store nutrients and water for the plants. Gophers tunnel to get to these underground parts of plants, which are their favorite foods. Being underground also helps the gopher avoid predators, as well as extreme hot and cold temperatures.



Some examples:

- a) Spring—cottonwood flowers. Cottonwoods flower only in the spring, usually around April in the Middle Rio Grande Valley. The exact date varies among years, and flowers come out earlier in more southern areas. The red catkins of male flowers are easier to see than the green female flowers.
- b) Winter—flock of crows roosting in cottonwoods. Large numbers of crows roost in the bosque during the winter. In the summer, most of them head north to breed, but some stay in the valley.
- c) Fall or spring—V of cranes flying overhead. Large numbers of waterfowl (ducks, geese, cranes) migrate along the Rio Grande. In the spring, they can be seen flying north. They fly south in the fall.

(7) What things do you notice in or near the bosque that tell you what time of year it is?



What these tell us:

An antlion larva (also called a “doodlebug”) lives here. Antlion larvae (which eventually become adults that fly) hide at the bottom of small, conical pits that they make in sand or fine dirt. They wait to catch ants and other small insects that fall into the pit. Antlions have large jaws to catch their prey. What other holes can you find in the bosque? Can you tell what made them?

(8) Look for small pits in the sand—2 inch (5 centimeter) funnel-shaped depressions.



What this tells us:

When the snow melts high in the mountains and the streams swell with water, the river naturally swells as well. When so much water comes down the river that it no longer stays in the channel but flows over the banks, this is called overbank flooding. Today we have several reservoirs that capture and hold this spring runoff to make water available later in the summer for farming. Therefore, not as many places in the bosque today experience overbank flooding. There are special places close to the river’s edge that still flood on a regular basis. One way to identify these spots is to look for mud rings on the trees. The spring water carries many sediments that are deposited in the forest. The height of the mud rings indicates the depth of the flood water. Soils that are wetted regularly also develop cracks when they dry out. What other signs of regular flooding do you see?

(9) Look for cracks in the soil and rings of mud at the base of the trees.





(10) Look for animal chew marks on trees. Are they left by a beaver or by a porcupine?



What this tells us:

a) Trees are cut by beavers. Beavers cannot climb trees, so they only bite as high as they can reach while standing on the ground. They often chew trees completely through.  
b) Porcupines can climb high into trees, and they prefer to eat up high where they are safe from predators. Porcupines may chew the bark off all the way around a branch or trunk, but they do not cut the whole tree down like beavers do. They often chew the bark off in large patches that do not go around the tree.

Both animals eat the inner bark, the growing part called cambium. Beavers cut trees down to get to the tender branches to eat, porcupines climb up into trees to get the same food.

(11) Do you see any charred stumps or snags (standing dead trees)?



What this tells us:

The site was burned by a fire. Fires may not have been an important part of the bosque ecosystem before the river ecosystem was changed and flooding was reduced. When the bosque flooded regularly, the wetter ground did not carry fire, the branches that fell decomposed faster with the added moisture—a log that would take 70 years to decompose today took only 10 years when there was regular overbank flooding. This downed wood contributes to very hot fires that do a lot of damage in the bosque today. A fire will often kill the main cottonwood trees; though some will re-sprout at the stump or roots after a fire. Most bosque fires are started by humans. What can you do to help reduce the risk of fires damaging the bosque?

(12) Look for a mound of sand with a wide circle of bare ground around it—and lots of ants!



What this tells us:

This mound with a hole in it was made by harvester ants. Harvester ants build large, underground nests over nine feet (three meters) deep with many storage chambers. They eat seeds, which they collect from the area around the nest and then carry underground. Sometimes they also eat other small animals such as isopods, which they sting and carry underground. The ants carefully tend the mound outside the nest. They place bits of dead plant material, small stones, and, sometimes, tiny bits of leaves on the surface of the mound, probably to trap warmth from the sun. Sometimes there are also skeletons from isopods. Often small trails can be seen going out from the nest; worker ants forage along these, looking for seeds.



What this tells us:

The trails were made by bark beetles. Adult bark beetles bore through the bark of a tree and make tunnels between the bark and wood, in which they lay their eggs. The young, called larvae, also make tunnels under the bark. Sometimes, if there are enough of them, the beetles can kill a tree by making these tunnels. If the numbers of beetles are low, this will not kill the tree.

(13) Inspect fallen logs carefully. Can you find any small trails cut into them where bark is falling off?



What we can learn:

The river flows faster on the outside edge of a bend, or meander. The swift water cuts into the outer bank, eroding away some of the soil and cutting a sharp bank on that side. On the inside of the bend, the water moves more slowly. This slower-moving water drops some of the sediment (dirt) it carries, along the edge of the meander. The sediment gradually builds up, pushing the inner bank out into the river to form a sand bar. This is how the course of a river moves, by eroding and depositing sediment.

(14) Look for a meander of a river. Can you tell which side of the river is moving faster?



What this tells us:

Cottonwood seeds germinate (sprout) on sand bars or open areas where conditions are favorable—with plenty of light and moisture available. Typically, when conditions are good, many seeds will germinate along the same stretch of ground. This results in a whole group of trees growing-up together in a patch that are the same age. We call this group of same-aged trees a “cohort.” Trees the same age are not necessarily the same size. The diameter can vary. However, trees the same age are generally in the same size class. This means that although the diameter may vary, they are generally the same height and roughly the same size.

(15) Look at a group of cottonwood trees. Are they all the same age?





(16) What are the big metal structures in the bosque?



These are called Kellner jettys, jacks, or “jetty jacks.” Jetty jacks were put in along the river by the U.S. Army Corps of Engineers and the U.S. Bureau of Reclamation, starting in the early 1950s. They helped to straighten the river and protect the levees. They work by slowing the speed of the river, which causes sediment (dirt) to drop out of the water. As the dirt builds up, riparian plants can start to grow. This helped keep the river bank in one place, and prevent it from moving across the floodplain. This also protected the levees in case of a flood, so floodwater wouldn’t erode the levees. Today, engineers say they are not needed and some are being removed. Levees can be built to withstand floodwaters without the jacks.

(17) Look for cottonwood trees with a single trunk and ones with several trunks from the base. What causes the difference?



A cottonwood can grow from a seed, by sprouting from an existing trunk or a shallow root. The cottonwood with a single trunk grew from a seed. The group or cluster of trunks grew from sprouts called “suckers.” Cottonwoods grow suckers in response to many types of disturbances that cut down the original tree. Examples include being cut by a beaver, being burned by a fire, or being knocked over by a flood. Usually the underground roots are not bothered by these things, and the tree is able to sprout again. When it does, it typically sends up several stems instead of just one. This results in clusters of trees that come out of one base. Sometimes they look like separate trees because dirt has covered up the area where the trunks are joined, but you can still see that the trees are grouped close together.

(18) Can you find a “lacy” leaf? Look at the fallen leaves on the ground.



What this tells us:

This leaf was eaten by isopods (pillbugs, woodlice). The isopods eat away the soft tissue of the leaf and leave behind the tougher veins, giving the leaf a lacy appearance. Isopods are crustaceans (related to shrimp and crabs). They have gill-like structures for breathing, so they need to be in moist areas. The most common type of isopod in the bosque rolls up when disturbed. Another kind cannot roll up and instead moves faster. Females can hold 200 eggs in a brood pouch on their undersides. Isopods are the main chewer of fallen cottonwood leaves in the bosque. They start the process of decomposition that is an important part of the nutrient cycle—providing necessary nutrients to plants and animals in the bosque ecosystem.






What this tells us:

This leaf was rolled by the caterpillar of a leaf-roller moth. The caterpillar folds the leaf around its body and ties it with silk. Sometimes more than one leaf is tied to other leaves. The larva lives inside this rolled leaf until after it changes form (metamorphoses) – first into a pupa and then into a moth. Sometimes if you unroll these leaves you will find the old skin from the pupa that changed into a moth.

(19) Can you find a rolled-up cottonwood leaf?



What this tells us:

These tracks were made by a raccoon—they tell you that a raccoon was here. The tracks left by the front feet of raccoons look like small hands, so they are easy to identify. Raccoons often walk along the mud or wet sand in the riverbed, or along the shore, as they look for food. They like to eat aquatic animals such as frogs and crayfish.

What other tracks can you find in the bosque and along the river?


(20) What do raccoon tracks tell you? Can you find any?



What this tells us:

Yerba mansa (*Anemopsis californica*) grows in moist areas, or places with a high water table. The presence of this plant in the bosque tells you that the water table is probably fairly high (or near the surface). It has been used medicinally for generations. Maybe you can ask an elder about this plant.

(21) Look for yerba mansa, a thick-leaved, succulent, low plant. What does this plant tell you?





(22) Can you find any coyote scat (droppings) and what can you tell from them?



What this tells us:

“Scat” is a name used by biologists for “poop.” You can tell a lot about what an animal eats by looking at its scat. For example, coyote scat will have small bones and fur in it if the coyote has been eating mice, or it may have the hard shells from beetles if that is what the coyote has been eating. Or, it may have berries or other bits of plant material. The shape of an animal’s scat can often identify the type of animal—look in a book of animal tracks or signs to learn to identify them.

What kinds of scat can you find in the bosque?

(23) Does it look like snow in the summer? Find some cottonwood cotton and inspect it carefully.



What can we learn about these:

Cottonwoods have separate male and female trees. The flowers on male trees are bright red as they emerge, the flowers on female trees produce pea-like fruit that open to release hundreds of cottony seeds. Cottonwood seeds are then carried by the wind on the chance that some will land in the right conditions. They need bare, wet soil to germinate, with lots of sunlight. The roots must stay in the water as the water table drops through the summer.

(24) Can you find baby cottonwoods?



The conditions needed by baby cottonwoods (seedlings) are more rare now, due to flood control and other conditions that have altered the river. As a result there are very few young cottonwoods along the Rio Grande, and many that start are washed away with each year’s high water. Land managers are now changing their approach and trying to make conditions so cottonwoods can again thrive in our bosque—allowing overbank flooding in high water years, creating secondary channels and planting cottonwoods.