# 8. Pitfall Trapping

***Description:*** Students set out pitfall traps to collect and identify arthropods, releasing animals to their original trapped areas once they are counted and identified.

***Objectives:***
- to sample surface-active arthropod populations in the bosque;
- to examine and identify different types of arthropods; and
- to use observation skills.

***Materials:*** Pitfall installation materials:

eight plastic cups, 16-ounce (473 ml) size. (Solo brand P-16 cups work fine)

eight plastic cups, 16-ounce size, with a hole popped in the bottom of each cup with a 16-penny nail or like object

meter tape or measuring stick (optional)

permanent marker (optional)

hand trowels

compass (optional)

eight pitfall trap covers (optional). Materials:

exterior, 3″ (7.5 cm) wood screws

eight pieces of $^{3}/_{8}$″ (1 cm) thick exterior grade plywood cut into 6″x6″ (15x15 cm) pieces. (A 4′x8′ sheet of plywood yields 128 6″x6″ squares.)

enough exterior-grade paint to cover the plywood

## *8. Pitfall Trapping*

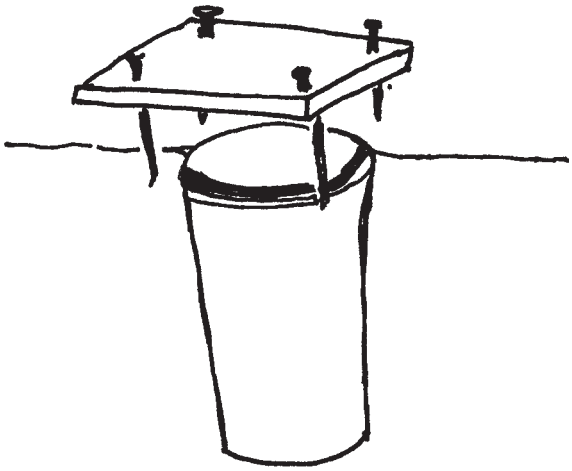
***Grades:*** 4–12

***Time:*** One or two 30-minute classroom planning sessions; one hour to set up traps; 30 minutes to collect arthropods; 30 minutes to one hour to identify and count arthropods; one or two 30-minute classroom sessions to examine results, state conclusions, draw inferences, and make recommendations. Pitfall trap monitoring is a two-day task. Traps are opened on Day 1; trap contents are collected 48 hours later.

***Subjects:*** science

***Terms:*** *arthropod, population, habitat, invertebrate, vertebrate, inter dependence*

Pitfall trap cover construction details: A completed pitfall trap cover looks like a small table. It should be assembled and painted prior to going into the field. Or for less sturdy or permanent trap covers, substitute cardboard for the plywood. Cardboard lids will not withstand weathering or intense rainfall, but are generally suitable for one trapping period (two days).



Day 1 supplies:

log book and pen to record data

all materials for installation

Day 2 supplies:

one to eight plastic one-quart self-sealing plastic bags

marker to record on bags

insect identification charts or field guides

small blunt tweezers (optional)

log book and pen to record data

plastic wrap (optional)

eight rubber bands (optional)

***Background:*** Schoolyards, wetlands, fields, woodlands, and other outdoor areas are homes for a host of small animals—insects, spiders, centipedes, etc.—that you rarely see. These invertebrates are called surface-active arthropods. They provide information about habitat conditions. The presence, absence, abundance, and diversity of particular arthropods can provide a wide array of information about forest conditions. A pitfall trap can be used to capture these small creatures so you can examine their numbers and varieties. Pitfall traps are used for sampling animal populations by:

(a) capturing species which are difficult to obtain by other methods;

(b) estimating relative abundances and species richness or for catching particular types of animals; and

(c) determining movement patterns of individual animals.

The pitfall trap is a relative method of estimating animal numbers and species, thus it cannot be used to estimate absolute population sizes or overall species richness of an area. It produces an "index" by which several areas can be compared. It is a "passive" form of sampling which relies on the animal rather than the observer making the action that leads to capture and enumeration.

***Procedure:*** If traps will be used from year to year, permanent pitfall trap covers should be installed. To make them:

1. Drill one wood screw into each corner of each plywood piece. The screws should be about a half-inch in from the corner sides. The screw head should be nearly flush with the top of the plywood.
2. Paint both sides and all edges of the cover. Use the paint to seal around the wood screws and the board.
3. Allow covers to dry.

**Pitfall installation directions:**

1. Locate pitfall and select a site to place the pitfall trap.
2. Using a hand trowel, dig a hole about 6" (15 cm ) deep.
3. Stack an intact cup (one without a hole in its bottom) on top of a cup with a hole in its bottom. The bottom cup maintains the form of the hole and has a drain hole in its bottom. The top cup is the trap cup and must remain intact without any holes or cracks. Place the stacked cups in the hole that was just dug.
4. The trap should be set so that the rim of the top cup is level with the ground surface. The rim of the top cup should be neither above nor below ground surface.
5. Backfill the hole around the two cups with soil. Using materials from the immediate area restore the surface debris around the trap to a state that matches the site's previous condition.
6. Leaving the bottom cup in place, gently remove the top cup and dump out any debris that fell into the trap when it was being installed. Reset the top cup in the bottom cup.

7 Using the permanent marker, record on the underside of the trap cover the trap number and its location. Number the traps from 1 to 8.

8. Place pitfall trap cover over trap. To close the trap lid, push the lid down so that it is flush with the rim of the top cup. This

should prevent creatures from getting into the trap while it is closed. (To open the trap, follow the directions outlined in the "setting and collecting procedure" below.)

9. Move to the next trap site and repeat Steps 1 through 8. Traps can be set in systematic arrays or randomly. For systematic sets measure a known distance, such as 33 feet (10 meters) in a square or 33 feet apart along a line. Setting up two sets of traps in two different locations will allow for comparisons between sites. If plywood trap lids are used, traps can be left in place and set for occasional trapping so students can compare results through the school year or in different weather conditions.

**Setting and collecting procedure:**

Day 1

1. Each trap consists of two cups and a cover. The top cup should be intact and free of holes and cracks. The bottom cup should have a small hole punched in the bottom to drain water. When setting a trap that has already been installed, remove the cover by opening it away from yourself. (This way if something is in the trap you are not expecting, it is less likely to come toward you.) Lift out the top cup, but leave the bottom cup in place to hold the form of the hole. You may need to hold the rim of the bottom cup as you pull the top cup out. Clean out the top cup. Scatter any contents and debris. Leaving the bottom cup in place remove any dirt that might have fallen into it. Replace the top cup into the bottom cup.
2. Confirm that the cup is level. The rim of the top cup should be level with the ground surface. If it is not level, take out both cups, redig the hole and replace the cups so that they are at the right level. This is important for accurate trapping.
3. The lid, designed to reduce predation and limit rainfall, should be lifted about 3 to 4 cm (1.5 inches) above the cup rim. Once it is set you should be able to slide two fingers between the cup and the cover. Record in the logbook when the trap was set.

Day 2 (48 hours later)

4. Remove the cover by opening it away from yourself. Lift out the top cup, but leave the bottom cup in place to hold the form of the hole.
5. Empty the entire contents (bugs, leaves, dirt, etc.) of each trap into a plastic bag. Record in log book or report form when the trap was emptied. If you find an empty trap, record that finding in your logbook.

6. Examine the contents of the trap carefully and make notes on the quantity and type of arthropods. You can use the key provided to identify some common surface active arthropods found in the bosque. For animals you cannot identify, include a description. Magnifying glasses and identification books can also help you identify the captured animals. If you are concerned about what has been captured, you may want to make your observations without opening the plastic bag. NOTE: This may reduce the accuracy of your count so do it carefully.
7. If a vertebrate species has been caught, do not handle it (there can be a health risk). Record the animal type and release it. If you catch shrews, which rarely happens, they will most likely be dead. Place them away from the study area out of reach.
8. After identifying and examining (or drawing) any arthropods, release them in the same vicinity where they were captured.
9. Remove trap completely from ground and leave the area as it looked before you dug the traps. Pack out all materials. If the traps are going to be used again, close them. Put the top cup into the bottom cup. Place a piece of plastic wrap or a cup lid over the cup and secure it with a rubber band. Close the trap lid so that it is flush with the rim of the top cup. This should prevent creatures from getting into the trap. To reduce the potential for disturbance the trap lid can be covered with leaves and dirt, but if you do this, place an upright stick or pin flag next to the trap to mark the location.
10. Create a data table to display your results.

***Assessment:*** What types of animals did you find in the traps? Did the outside temperature have any impact on the number of animals caught? What types of animals may not enter a pitfall trap and what types might easily escape from one? Would you expect to find the same animals in the traps all year round? How could you test your predictions experimentally? This should become a team exercise. Each group might develop and write a hypothesis, list the materials they would use, the number of each item, and a procedure. An excellent way to assess this activity is to have the teams check another team's work to see if they achieve the same results. This will also replicate the real-world challenges facing a research scientist.

***Extension:*** Set up traps in your schoolyard.

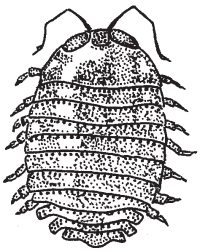
Have students pick one of the species captured and learn more about it. Write a report or present findings to the class.

***Resource/ Reference:*** Bosque Ecosystem Monitoring Program Manual

# Pitfall Arthropods

Here are drawings (not to scale) and descriptions of some common surface-active arthropods encountered in pitfall traps in the Rio Grande bosque. (Specialized terms and species names in *italics*. Artists: B=Bosque School student; M=New Mexico Museum of Natural History & Science; E= Ernie Pyle Middle School student)

sow bug
ROLAND SHAW (B)

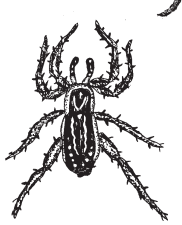


pillbug
CLAIRE EBERT (B)

Class: Crustacea
Order: Isopoda.....pillbugs or roly polys and sow bugs or woodlice

While most isopods are marine some, such as the widely distributed pillbugs ("roly polys") and sow bugs (woodlice), are terrestrial. All have somewhat flattened and multi-segmented bodies. Actually, none are either bugs or lice. Terrestrial isopods have 14 legs used for walking and crawling. In the bosque there are two species: a pillbug *(Armadillidium vulgare)* that rolls into a ball when stressed and a sow bug *(Porcellio laevis)* that cannot. Both species, like nearly all of their relatives, are scavengers and require moist habitats.

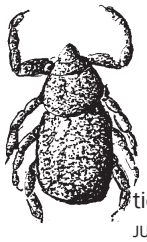
black widow spider
WILL COUTRET (B)



spider
LAURA ROSENBERG (B)

Class: Arachnida
Order: Araneae.....spiders

Spiders and other arachnids have two obvious body sections: a *cephalothorax* or *prosoma* (consisting of a segmentally fused area with anterior mouthparts [*chelicerae*] and eight legs behind them) and a clearly segmented abdomen or *opisthoma* that in spiders bears silk-spinning s*pinnerets* on the underside. Arachnids have a pair of appendages on either side of the mouth called *pedipalps*; in male spiders these act as copulatory organs. Spiders are predators of other arthropods, which they pierce with their chelicerae. They externally digest their prey into a liquid state, then suck out the tissues. Spiders and other arachnids come in many body styles, sizes, and colors.

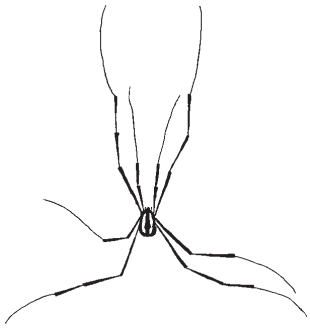


tick
JUSTIN HERTEL (B)

tick
AVIANNA MECK (B)

Order: Acarina.....ticks and mites

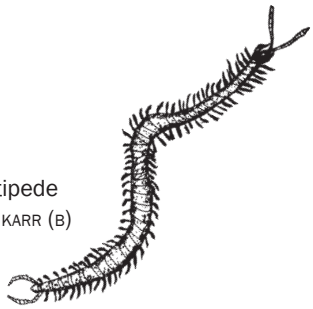
With eight-legged adults and what appears superficially as a single body unit, mites and ticks range in size from tiny to as large a human fingertip. Many are parasites of animals and plants. Many others are predators, especially of other arthropods, or are scavengers. Many mites found in bosque pitfall traps are brown or nearly white, while some are bright red. It is no exaggeration to say that mites are almost everywhere.



daddy-long-legs
TRAVIS LAY (B)

Order: Opiliones.....harvestmen or daddy-long-legs

Most people recognize daddy-long-legs by their eight long legs, which except for their apparently unsegmented body make them resemble *pholcid* spiders (which also show up in our pitfall traps). Most harvestmen are predators; however, some are scavengers.



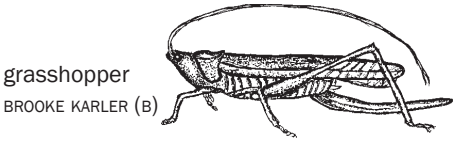
centipede
EVAN KARR (B)

Class: Chilopoda.....centipedes
Centipedes are flattened and have many body segments, each with one pair of legs. They are usually brown, tan, or yellowish. The head bears *antennae*, and just behind and to the side of the head is a pair of poison fangs. Occasionally one finds small brown *lithobiomorph* centipedes in bosque pitfall traps. The large local *scolopendromorph* species in the bosque is *Scolopendra polymorpha*. Like other centipedes, it is mainly a predator of other arthropods. Handle it carefully: it moves very fast and has a painful bite.

millipede
JAY KORY JOHNSON (B)

Class: Diplopoda .....millipedes
Millipedes are not very common in bosque pitfall traps. Unlike centipedes, they have two pairs of legs per rounded body segment. They move slowly and smoothly, using their short antennae to sense to check for environmental information. Millipedes eat mainly dead vegetation and are not poisonous, but many species secrete foul-smelling chemicals from abdominal glands.

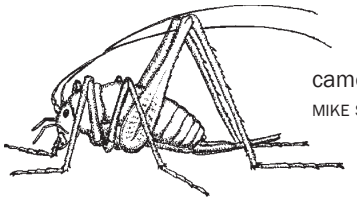
Class: Insecta
Order: Orthoptera .....grasshoppers, crickets and other groups
Although common in the bosque, grasshoppers are only occasionally found in pitfall traps. Adults of these and most insects bear six legs and a pair of wings on the *thorax,* which is behind the *head* and in front of the *abdomen*. The often colorful hind wings are held lengthwise along the back and are covered by the more drab and leathery front wings. Grasshoppers themselves are of many colors—including brown, tan, yellow, and green—that can match background colors. Grasshoppers are essentially *herbivore*s and chew plant material with their strong mandibles.
Crickets and their close relatives are mostly nocturnal scavengers. The common field cricket is black in color with large hind legs and long antennae. The brownish tan or gray camel crickets have long, curved antennae and an arched back. They often hide under logs and stones or in dark moist places. The Jerusalem cricket, or child of the earth, has a large head with powerful jaws that can cut plant roots and unwary fingers. Its antennae are short. The rest of its body other than its tan legs is pale yellowish with dark stripes. It spends much of its day in loose soil.



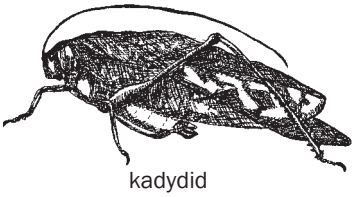
grasshopper
BROOKE KARLER (B)

field cricket
KENDRA CROWLEY (B)

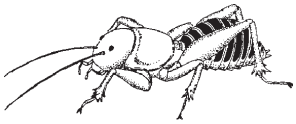
field cricket
JUSTIN STEWART (B)



camel cricket
MIKE SANCHEZ (M)

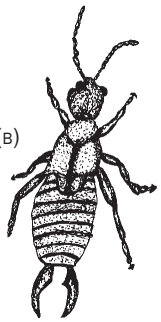


kadydid
KATIE SHAW (B)



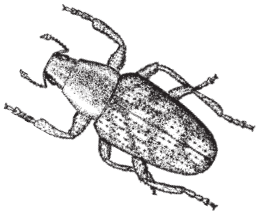
jerusalem cricket
MIKE SANCHEZ (M)

earwig
MAX STRASBURGER (B)



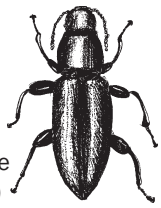
Order: Dermaptera .....earwigs
Earwigs are identified by their scissors-like pincers (*cerci*) at the tip of the abdomen. Their back wings are folded under very short, hard front wings. Their elongate, rather flat bodies are generally light brown to black in color. Although they do not bite or sting, these mainly scavenging insects can pinch. But they don't get into people's ears, as their name would suggest.

weevil
HELEN HASKELL (M)



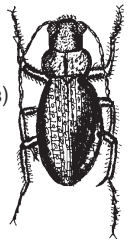
weevil
MIKE SANCHEZ (M)

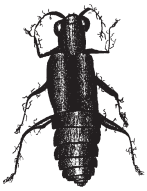
Order: *Coleoptera* .....beetles
Beetles, which make up the most species-rich order of animals on earth, are extremely diverse structurally. However, like the orthopterans and earwigs, they have chewing mouthparts, which in the plant-feeding weevils (curculionids) are located at the end of a sometimes long proboscis or beak. The hard front wings (*elytra*) of beetles cover the hind wings and abdomen. The generally predaceous ground beetles (carabids) tend to be indicators of relatively moist environments. In contrast, the darkling beetles (tenebrionids) are often found in drier environments. The rove beetles (staphylinids), which range from medium size to quite small, have short elytra that resemble the short front wings of the unrelated earwigs. However, unlike earwigs, rove beetles do not have prominent cerci at the tip of the abdomen. They are mainly predators, not scavengers. Species of these beetle families showing up in bosque pitfall traps are often dark in coloration.



darkling beetle
CAROLYN BARR (B)

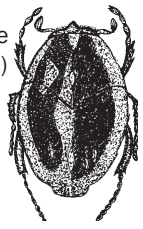
ground beetle
JAREN TROST (B)

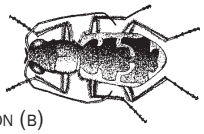




rove beetles
MARIO DELGADO (E)

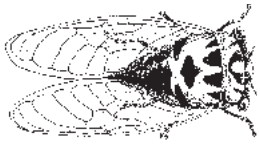
scarab beetle
ANNA RYBURN (B)



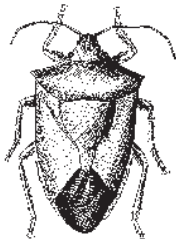


tiger beetle
MAX RICHARDSON (B)

cicada



Order: *Homoptera*.....leafhoppers, aphids, cicadas and other groups
Homopterans and the next order, Hemipterans, have sucking mouthparts and are highly variable in body shape and size. The front wings of homopterans are uniform in texture and tend to cover the back like a roof.

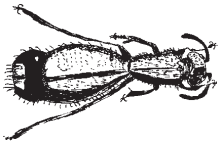


stink bug
HELEN HASKELL (M)

assassin bug
HELEN HASKELL (M)

Mostly plant feeders, these insects keep their short beaks between their front legs when not in use.
Order: *Hemiptera*.....true bugs
True bugs are have front wings that are relatively thick at the base and membranous at the tip. (The name *Hemiptera* means "half-wing.") Their feeding habits are highly variable, but most are plant feeders. Stink bugs and squash bugs are among a range of bugs found in bosque pitfall traps.

velvet ant
JIMMY SCANTLIN (B)



ant
MARIA SOCHA (B)

ant
ANNA HEINTZMAN (B)

Order: *Hymenoptera*.....wasps, bees and ants
Even though some wasps and bees live in the ground, they are rarely found in pitfall traps because they can fly out. The most common hymenopterans by far in the traps are ants, which have important and diverse ecological roles worldwide. So-called velvet ants, which are really wasps and can like many ants deliver a painful sting, are sometimes found in pitfall traps as well. They