Arthropod Protocol & CAP LTER

The primary goals of the CAP LTER arthropod project are to determine how communities of insects and arachnids vary among different habitat types within Phoenix, and how these patterns change over time. Arthropods are logical choices for long-term monitoring because 1) they are diverse and thus provide a fairly quick picture of biological diversity, 2) they respond quickly to habitat/disturbance/soil/vegetation changes and hence fit well with monitoring by other groups, 3) they are fairly easy to collect, 4) they represent a spectrum of feeding (trophic) levels, including decomposers, herbivores, predators, and parasites and 5) they are important sociological, economical and agricultural components of human altered habitats. Although several sampling methods can be used to collect arthropods, CAP LTER scientists settled on pitfall traps for ground/litter insects since they are relatively low tech and easy to use. The CAP LTER scientists have selected 28 study sites within and around the metropolitan Phoenix area, with the goal of monitoring arthropod communities in representative habitat types. Four sites have been selected in each of the following habitat categories: desert outside city boundaries, desert parks (remnants), xeric (dry) urban yards, mesic (heavily irrigated) urban yards, combination xeric and mesic yards, agricultural fields, and industrial/commercial sites. This project generates a large number of samples (>1000 sample jars per year), each with an enormous diversity and abundance of arthropods (frequently >1000 individuals of >20 species in each sample pitfall trap). The results from this study lend insight into the implications of transforming native Sonoran Desert into a major metropolitan area for an important group of animals.

Comments on the Protocol:

The K-12 Ground Arthropod sampling protocol is consistent with the design being used by the CAP LTER researchers--yes, they use Solo© cups too!!! The students are asked to identify spiders, scorpions, and insects and then to order within the insects classification group. The key is fairly limited but represents the most common insect orders.

Insects should be handled with forceps and not by hand. Place the collected samples in a freezer or ice chest to make sure that the insects are dead before allowing students to handle them.

Grade Level:

Collecting insects appeals to many children although being able to use the key requires reading and sorting skills. Earlier grades may benefit from being paired with older students when trying to identify the insects.

web page content

Arthropods

What Bugs Are Crawling Around Your Schoolyard?

What are arthropods?

Arthropods are insects and arachnids, including spiders, ants, ticks, beetles, flies, scorpions. They are important components of our desert and urban food webs.

What do arthropods tell us about our urban ecosystem?

By comparing arthropod populations among different types of land use, we may see how different human activities (farming, industry, building residential communities, watering lawns) affect biological diversity.

How are CAP LTER scientists studying arthropods?

First scientists ask questions, such as:

•How has urbanization affected the number and diversity of arthropod species?

•Are there areas within urban Phoenix that attract more arthropods?

Next, to answer these and other questions, CAP LTER scientists are investigating ground arthropod populations (number and diversity) at several different habitats:

- desert remnant (inside the city)
- desert outside city boundaries
- industrial
- xeric (dry) residential yards
- mesic (heavily irrigated) residential yards
- xeric/mesic combination residential yards
- agricultural fields

Your research adds another habitat type: schoolyards (and/or a wider variety of backyards). Because not all schoolyards are the same, your schoolyard map will be REALLY important when you begin to analyze your data. The vegetation survey also will be important.

web page content

Study Arthropods

What are arthropods?

Arthropods are insects and arachnids, including spiders, ants, ticks, beetles, flies, scorpions . . .

Why study arthropods?

- They are important components of any food web.
- There are many different kinds and in a single collection you can find arthropods which are decomposers, herbivores, predators, and parasites.
- Because they have short life cycles, they respond quickly to habitat disturbance and changes in soil and vegetation
- They are fairly easy to collect.

What kinds of scientific investigations can be developed from this protocol?

Using the protocol, you will record the arthropods collected in your schoolyard. From your observations you can investigate how the population compares to those found at other landscape types where CAP LTER scientists are collecting data. You can also investigate what characteristics of the schoolyard are attracting the kinds of arthropods you are finding.

What materials will you need?

- Bulb planter
- Metric ruler
- Magnifying glass
- 16-ounce Solo© cups and lids
- Ziplock© bags
- Cooler with blue ice (if you have a freezer in which to store samples, you'll only use the cooler when you're outside. If you don't have a freezer or you don't want to put your samples in it, then be sure to check the ice periodically).
- Metric measuring tape
- Tweezers
- Pencils
- Data sheets

web page content

Arthropod Protocols

How to survey ground arthropods

1. Use pitfall traps to collect arthropods once a month. The pit traps consist two 16-ounce Solo© cups, one inside the other, buried in the ground so that the top of the cup is ever so slightly below the surface of the soil. (If the top of the cup is above the ground, the bugs will walk around your trap instead of into it.)

2. Use a trowel to dig 10 holes in a line, 5 meters apart.

> If the area in your schoolyard is not long enough for this kind of arrangement, use a grid pattern, but be sure to keep 5 meters between the traps. And be sure to indicate the arrangement on your data sheet. Don't worry if the line goes from lawn to shrubs or by trees.
>
> Assign a number to each trap. Let's say that you're collecting 10 samples from the northeast area and 10 others from the west end of the schoolyard at Jone's Middle School. You could name the first 10 traps Jone's NE1 - Jone's NE10 and the second 10 Jone's W1 - Jone's W10.

3. Complete a habitat description for each of your traplines. Record your findings on the site description data sheet. You will need to do this before entering data into the CAP LTER database. YOU ONLY NEED TO DO THIS ONCE PER TRAP LINE.

4. Place the pit traps (Solo© cups) in the ground. Remember to use two cups, one inside the other.

5. Leave the traps alone for 72 hours.

> Why so long? Imagine how long it takes a bug to crawl 5 meters. If you want to get a good picture of arthropod diversity, you need to give the critters time to fall in.

continued...

web page content

6. After 72 hours, empty the traps into resealable plastic bags. Use a different bag for each trap (all arthropods collected in one trap is called a "sample") and include a label indicating the collected sample's corresponding trap site number.

> To empty the pit trap, take the inside cup out of the second cup, leaving the second cup in the ground (to preserve the hole you dug). Empty the contents of this cup into the Ziplock© bag then replace it in the ground cup. Cover it with a plastic lid or fill it with rocks until you start the next collection cycle.
>
> Once the sample is bagged and sealed, place it in the freezer or ice chest. This will kill any organisms that may have survived the fall into the cup. Leave the samples in the freezer to preserve the arthropods until you have finished identifying them. (As you're identifying the samples, you may decide to pin and display a collection of some of the larger arthropods.)

7. Take the collected arthropods to your indoor workspace for identification.

8. Download the data sheet and identification key and use them to record your observations.

Describing Habitat Structure: Estimating Land Cover Along Your Trap Line

The following technique can be used to estimate the habitat structure around your trap line:

1. Take a piece of 50 m-long string and mark every 2.5 meters. Lay the string across the trap line. *

2. Starting at 0m, at each point place a meter stick. In the first column of the data table, record the type of cover beneath your feet and less than 0.15m. Also, in the appropriate column, record the vegetation that is between 0.15m to 1.5m tall and/or is taller than 1.5m. Only write down the type of land cover that is at that point and touching your meter stick. The land cover type can be "building" or "cement" as well as plants.

3. For each type of ground cover, add the number of times it was recorded, divide by the total number of points and multiply by 100. For example if you recorded "shrubs" at 5 of the points and there were 20 points, then shrubs would be 25% of the land cover (5/20 times 100).

*Your trap line is actually 45m, so you will have 5 m of string left a the end of the line. Measuring from the first cup every 2.5 meteres to the last cup will give you 19 points, you can take one more measurement 2.5 m after the last cup to give you a total of 20 points.

Data Table for Describing Land cover Along Your Trap Line

Point	0 - 0.15 m				0.15m – 1.5m	>1.5m
	Lawn	Gravel	Pavement or Building	Other Vegetation	Shrubs	Tree Canopy
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						

TOTALS:

Lawn _____ x 100 = _____% **Other Vegetation** _____ x 100 = _____%
20 20

Gravel/Soil _____ x 100 = _____% **Pavement/Building** _____ x 100 = _____%
20 20

Shrubs _____ x 100 = _____% **Tree Canopy** _____ x 100 = _____%

Site and Habitat Description

Protocol: Ground Arthropods

Provide a site and habitat description of your pitfall trap line. For example, if you are collecting data at seven pitfall trap lines on your campus, you will enter seven different sites. The description includes the amount and type of vegetation (or non-vegetation) at different heights in your trap line area.

SITE DESCRIPTION

Teacher: _____ **Class:**_____

School: _____

Street Address: _____

City: _____ **Zip code:** _____

Site Name: _____

Create a name to identify the trap line for which you are collecting data. (e.g. Playground South Corner)

Site ID: _____

Create a 3 – 5 letter and/or number code to identify this site. (e.g. Playground South Corner – PGSC)

Site Location Write a brief description of where your site is located. (i.e. SW Corner of playground):_____

_____

Description Write a description of your site so that a visitor to your school would be able to find your trap line:_____

_____

_____

HABITAT DESCRIPTION

Recording Date: _____ **Area surveyed (m^2):** _____

Number of traps: _____ **Trap arrangement:** _____

Vegetation >1.5 m	_____% Tree Canopy
Vegetation 0.15m—1.5 m	_____%Shrub
Vegetation and non-Vegetation <1.5m (should be equal to 100%)	_____% Gravel or soil
	_____% Lawn
	_____% Paved or Building
	_____% Other Vegetation

Arthropod Data Sheet

Teacher: _____ **Class:**_____

Site ID: _____

Collection Date: _____

Observer's Name: _____

Comments/Observations: _____

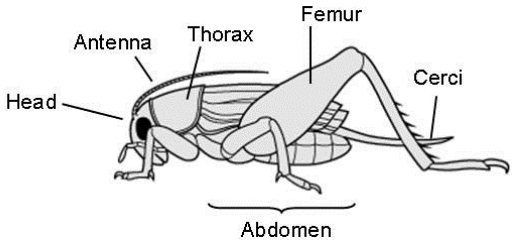
_____

_____

Survey Data

Trap ID	Order	Tally Number

Identification Key Used to Identity Orders of Common Ground Arthropods (adults > 2-5 mm in total body length)



1a	6 legs, three body sections……..	Go to 3
1b	Not exactly as above……...	Go to 2
2a	8 legs, two body segments, no tail……..	Araneae (spiders)
2b	10 legs, stinging tail, pinchers on front appendages……..	Scorpiones (scorpions)
3a	Wings and/or hard (or leathery) covering……..	Go to 4
3b	Wings absent……..	Go to 11
4a	Two wings (or two wings with tiny, hind wings), no horny or leathery sheath……	Diptera (flies)
4b	Four wings (two wings may be covered by horny or leathery sheath)…….	Go to 5
5a	Hind-wings partly or entirely covered by horny or Leathery sheath…….	Go to 6
5b	Both pairs of singes entirely membranous……	Go to 10
6a	Tube-like mouthparts (for sucking not chewing)……..	Hemiptera (stinkbugs)
6b	Biting/chewing mouthparts……	Go to 7
7a	Body flattened; antennae long and uniformly thing……..	Blattodea (cockroaches)
7b	Body rounded or square-like rather than flattened…….	Go to 8
8a	Hind legs enlarged (drumstick like) for jumping……	Orthoptera (crickets)
8b	Hind femurs, not enlarged……..	Go to 9
9a	Leathery sheath is short, vest-like, visible cerci……	Dermaptera (earwigs)
9b	Leathery sheath long, can cover entire hindwing, no cerci…….	Coleoptera (beetles)
10a	Tube-like mouthparts (sucking, not chewing)……..	Homoptera (cicadas, aphids)
10 b	Biting/chewing mouthparts……	Hymenoptera (bees, wasps)
11a	Elbowed antennae and distinct dorsal bump on Slender segment connecting thorax and abdomen…….	Formicidae (ants)
11b	Antennae not elbowed or no dorwal bump…….	Other Hymenoptera