

**Information from last year's briefing is included below.
Please keep in mind that these sections may change.**

General Information

Climate Change and Caterpillars in Arizona

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Research Site: Chiricahua Mountains region, Arizona, United States

The Research

Climate Change and Caterpillars in Arizona



THE STORY

On this project, we examine the factors that affect interactions among plants, caterpillars, and their natural enemies. This is an important area of study for both agricultural and basic ecology. This three-tiered study system allows for insights into “tri-trophic” interactions— in other words, it examines the relationships among three distinct levels of the food web. You will conduct caterpillar research in the deserts and mountains around the Southwest Research Station in the Chiricahua Mountains and the nearby Santa Rita Experimental Range in the Coronado National Forest. Other Earthwatch teams conduct work throughout the year in forests and mountains in Nevada and California; a rainforest at La Selva Biological Station in Costa Rica; a cloud forest at Yanayacu Biological Station in Ecuador; and in urban areas, swamps, and bottomland hardwood forests around New Orleans, Louisiana.

The natural enemies of caterpillars that the project studies are called “parasitoids.” They include many species of wasps and flies that kill caterpillars by depositing their eggs on them. This ensures that the parasitoids’ offspring will have both a safe environment in which to grow (inside the caterpillar) and a good supply of food (caterpillar tissue). We are rearing caterpillars of over 300 species and recording the mortality caused by the parasitoids. In addition, we isolate specific chemical compounds from some species of caterpillars and food plants to examine them as potential defenses against parasitoids.

By comparing the results from different sites, we can test hypotheses about the effects of climate on interactions between caterpillars and parasitoids. Our study also collects essential natural history information about plants, caterpillars, and parasitoids. Based on our data, we are developing models to predict which parasitoids might be used to control specific insect pests of human crops, which will benefit farmers who are attempting to control pests without using pesticides. Some of the species that we study (such as army worms and owl butterfly caterpillars) are agricultural pests; others (such as some rare day flying moths) are threatened by habitat loss and fragmentation.

The caterpillars you'll work with are fascinating: they come in a spectacular diversity of shapes, colors, and forms that function to defend them against their enemies. Many of the species found by this project will be new to science.

RESEARCH AIMS

To effectively protect and manage diminishing natural ecosystems, we need as much information as possible about the interactions of organisms within ecosystems, especially organisms as diverse and important as parasitoids. Our most significant accomplishment is the compilation of natural history data on approximately 9,500 species of caterpillars, plants, and parasitoids (from all sites). We are sharing this information both with other scientists and with local communities; for example, we work with local schoolteachers and high school students to help them incorporate the results from this project into their classes.

The project is also studying the effect of climate change on the interactions among plants, caterpillars, and parasitoids. Global climate change includes both increases in average temperature and atmospheric carbon dioxide content and increased climatic unpredictability and variability (such as floods and droughts). To address the first effect of climate change, we have shown by laboratory experiments that increases in the temperature and carbon dioxide content of the air-changes that are occurring worldwide-caused dramatic decreases in the rates of parasitism by increasing caterpillar development rates enough to allow the caterpillars to pupate before the parasitoids could finish their development. The reduction in parasitism in turn caused an increase in the population of caterpillars and thus a decrease in the biomass of the plants that they ate. To address the second effect, we have compared data from our sites and 11 other sites in the Americas and found that the intensity of parasitism decreased as year-to-year variation in total precipitation increased. We hypothesize that this decline is caused by the disruption of synchronization between the life cycles of caterpillars and their parasitoids so that the caterpillars are unavailable to specialized parasitoids during their host- searching phase. Our research thus suggests that global climate change may result in decreases in the intensity of attacks by parasitoids and hence increases in caterpillar populations.

HOW YOU WILL HELP

All of the teams at the five research locations have the same duties and spend plenty of time in the forest gathering and identifying caterpillars and food plants and conducting experiments, as well as time in the laboratory raising caterpillars and working on chemical analyses. You will be involved with most aspects of the project. The project especially welcomes anyone with computer and web design skills.

[You will spend about 70% of your time in the field searching for caterpillars, collecting host plants, collecting material for laboratory or computer analyses, and conducting experiments.](#) Searching for caterpillars in the forest is very straightforward, and you will be given plenty of tips on how to find them. Host plant collection involves hiking to previously located sites of host plants and gathering leaves to feed to caterpillars being reared in the laboratory.

[You will spend the rest of your time \(about 30%\) in the lab entering data, computer work, and helping to rear caterpillars.](#) Rearing caterpillars involves placing them in clean bags, checking them for parasitoids, moving pupae to different bags, and collecting adults or parasitoids from the bags. Adults are either released or preserved for further identification. The station has a laboratory as well as an outdoor tent for caterpillar rearing, which has lines for hanging caterpillar bags, tables for processing and observing caterpillars, and great views.

Your Destination

About Arizona

PHYSICAL ENVIRONMENT

The Southwest Research Station (SWRS) is located in the Chiricahua Mountains (see Chiricahua National Monument on the map below), surrounded by woodlands of oak, juniper, and pinyon pine trees. The area offers incredible diversity. Within a short drive up the Chiricahua Mountains, which reach nearly 9,800 feet, five life-zones (areas of similar plant and animal communities) can be encountered: Lower Sonoran, Upper Sonoran, Transition, Canadian, and Hudsonian. The uniqueness and diversity of the region are well recognized by the birdwatchers who visit Cave Creek Canyon, one of the top birding sites in the U.S. The great diversity in this area is partly due to the unique geographic position of the Chiricahua and surrounding mountains. These mountains have been called “sky islands” because of their isolation from nearby mountain ranges by expanses of desert valley. This isolation results in many endemic species exclusive to the island.

The Santa Rita Experimental Range (SRER), managed by the University of Arizona, is located in the Coronado National Forest (near Kartchner Caverns State Park on the map below). It was founded in 1903, which makes it one of the five oldest field stations in America. Because scientists have conducted research there for over 100 years, the range can provide a wealth of information on the surrounding vegetation, which can help researchers distinguish permanent changes to the natural environment from changes that are part of long-term, cyclical processes.

CULTURAL, SOCIAL, AND POLITICAL ENVIRONMENT

The region in Arizona where you will work is sparsely populated. This area was important to Native Americans and early settlers because of a number of natural springs occurring in the otherwise dry region. The Butterfield Stagecoach Line ran from Fort Bowie to Tucson along the north edge of the Chiricahuas and was the major southern immigration and trade route for European settlers. The Dragoon Mountains, to the west of the Chiricahuas, served as an invaluable refuge for Apache groups under the command of Chief Cochise in the 1860s and 1870s, from which they attacked stagecoaches and military installations. Today the Cochise Stronghold is part of the Coronado National Forest and is a great place for hiking, rock climbing, and experiencing solitude.



Project Conditions

The Field Environment

GENERAL CONDITIONS

The field sites range in elevation from 3,000-9,000 feet above sea level; SWRS is situated at about 5,400 feet and SRER is about 3,600 feet above sea level. The trails can be quite steep, but are normally dry. The team will be collecting in forests as well as desert habitat. Temperatures range from the high 90s°F during the day to the low 60s°F at night. August is the monsoon season at both sites, so although the annual rainfall is low, the area can receive very heavy rains and flash floods at any time.

The weather is expected to vary within the limits below.

Humidity: 0% to 20%

Temperature Range: 60°F to 100°F

Rainfall: 21 inches per year

ELIGIBILITY REQUIREMENTS

All participants must be able to:

- Independently follow verbal and/or visual instructions.
- Traverse over uneven, forested, mountainous or hilly terrain for two to four hours for a distance of three to 12 miles per day, often in high temperatures.
- Enjoy being outdoors all day in all types of weather including high temperatures, but usually low humidity.
- Enjoy being outdoors in the potential presence of wild animals, snakes, and insects.
- Carry personal daily supplies, such as water, lunch, and camera.
- Enjoy working as a team and function cohesively within a group.
- Get low enough to access and collect samples on the ground and in the brush.
- Sit during data entry, zoo, or laboratory tasks for up to two to three hours per day.
- Sit and ride, with seatbelt fastened, in project vehicles for up to approximately three hours per day.
- Tolerate working at high altitude.



POTENTIAL HAZARDS

Hazard Type	Associated Risks and Precautions
Transportation	The team will travel on some rough dirt roads, some of which have many curves and steep drop-offs. Team members must wear seatbelts at all times. If you get carsick or suffer from vertigo you should bring appropriate medication.
Terrain	<p>The fieldwork will require moderate hiking, and the team may also go hiking on recreational days. There may be the opportunity to collect caterpillars at night around the research station. Risks include tripping/falling and getting lost. Be sure to walk slowly and carefully, stay close to the project leaders and to follow their instructions and advice carefully. Bring comfortable hiking shoes/boots.</p> <p>There are rock cliffs surrounding both research stations. Climbing up on these rocks or approaching them within one meter is extremely dangerous and is not permitted.</p>
Altitude Sickness	<p>Different people react in different ways to working at high altitude. Even people who are very fit at sea level can find themselves struggling as they walk at higher altitudes. Take the first few days slowly (project staff will provide activities that require less exertion at the beginning of the expedition), and report any illness (headache, lethargy, appetite loss, nausea, etc.) to staff immediately. Also remain well hydrated. The sun is strong at these altitudes, so a high factor sun cream and protective clothing (wide-brimmed hat, sunglasses, long sleeves) are essential. If you have any condition that might be affected by increased sun exposure or if you are sensitive to heat, please consult a physician. Many common prescription medications can increase your sensitivity to sun and heat.</p> <p>Illnesses that may be aggravated by altitude include sickle cell anemia and chronic heart and lung diseases. Those with asthma or other breathing problems may experience altitude related discomfort and may wish to consult with their doctors in advance.</p>
Animals/Plants	Though unlikely, you may see rattlesnakes in the desert habitats. Other hazards include cacti with sharp spines, scorpions, stinging wasps, and ants. Some plants and arthropods in the collecting areas are dangerous. Avoid grabbing cacti or arthropods. Wear appropriate footwear, e.g., hiking boots, and watch your step as you hike in these areas. If you are allergic to any insect bites or stings, please bring medication with you into the field (i.e. at least two EpiPens, antihistamines, etc.) as appropriate.
Climate/Weather	It will be very hot and dry, so heat exhaustion, dehydration, and sunburn are serious hazards. Working at high altitude puts team members at risk for altitude sickness and at greater risk of sunburn and dehydration. Be prepared to drink plenty of water, wear protective clothing (such as long sleeves and a wide-brimmed hat), and use lots of sunscreen. There will be plenty of time to relax, eat, and drink.
Swimming	Swimming may be possible during recreational time (at the hotel in Tucson) and typical water-related risks will be present. A certified lifeguard is unlikely to be available so swimming will be at your own risk. Always inform a staff member of where and when you will be swimming. Swimming alone is not permitted.

Safety

Health Information

ROUTINE IMMUNIZATIONS

All volunteers should have the following up-to-date immunizations: DPT (diphtheria, pertussis, tetanus), polio, MMR (measles, mumps, rubella), and varicella (if you have not already had chicken pox). Please be sure your tetanus shot is current.

Medical decisions are the responsibility of each volunteer and his or her doctor, and the following are recommendations only. Earthwatch can only provide details regarding suggested vaccinations, and we are not a medical organization.

EMERGENCIES IN THE FIELD

A project vehicle will be available to provide emergency transportation if necessary. The injured or ill individual would be quickly and safely transported to the closest facility by the Earthwatch scientist or project staff.

Staff certified in safety training:

Angela Smilanich, Wilderness First Aid

Nearest clinic:

Southeast Arizona Medical Center

2174 W. Oak Avenue

Douglas, Arizona 85607

Tel: +520 364 7931

Distance: approximately two hours drive from the station

Nearest full-service hospital:

University Medical Center

1501 N. Campbell Avenue

Tucson, Arizona 85724

Tel: +520 694 0111

Distance: approximately three hours drive from the station (45 minutes by helicopter)

