EARTHWATCH INSTITUTE

EARTHWATCH 2019

CLIMATE CHANGE AND CATERPILLARS IN COSTA RICA

PLANNING CHECKLIST

PLANNING CHECKLIST

IMMEDIATELY

- ❑ Make sure you understand and agree to Earthwatch's **Terms and Conditions** and the **Participant Code of Conduct**.
- ❑ If you plan to purchase additional travel insurance, note that some policies require purchase at the time your expedition is booked.

6 MONTHS PRIOR TO EXPEDITION

- ❑ Log in at **earthwatch.org** to complete your participant forms.
- ❑ If traveling internationally, make sure your passport is current and, if necessary, obtain a visa for your destination country.
- ❑ Bring your level of fitness up to the standards required (see the Project Conditions section).

90 DAYS PRIOR TO EXPEDITION

- ❑ Pay any outstanding balance for your expedition.
- ❑ Book travel arrangements (see the Travel Planning section for details).
- ❑ Make sure you have all the necessary vaccinations for your project site.

60 DAYS PRIOR TO EXPEDITION

- ❑ Review the packing list to make sure you have all the clothing, personal supplies, and equipment needed.

30 DAYS PRIOR TO EXPEDITION

- ❑ Leave the Earthwatch 24-hour helpline number with a parent, relative, or friend.
- ❑ Leave copies of your photo ID and flight reservation number with a parent, relative, or friend.

READ THIS EXPEDITION BRIEFING THOROUGHLY. It provides the most accurate information available at the time of your Earthwatch scientist's project planning, and will likely answer any questions you have about the project. However, please also keep in mind that research requires improvisation, and you may need to be flexible. Research plans evolve in response to new findings, as well as to unpredictable factors such as weather, equipment failure, and travel challenges. To enjoy your expedition to the fullest, remember to expect the unexpected, be tolerant of repetitive tasks, and try to find humor in difficult situations. If there are any major changes in the research plan or field logistics, Earthwatch will make every effort to keep you well informed before you go into the field.

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NOTE FROM THE PI

DEAR EARTHWATCHER

Welcome to the *Climate Change and Caterpillars* expedition! I hope that the expedition will be interesting, challenging, and fun for everyone involved.

This project includes a large, international, collaborative team that is focused on understanding plant, caterpillar, and parasitoid interactions in forests from Brazil to Canada. The unique combination of research sites allows us to use a comparative approach to address many interesting questions about how forests respond to climatic variation. This is a particularly important area of research, given the significant ecological impacts of global change. The most important attribute that attracted us to the study sites in this project is what attracts most naturalists, ecologists, botanists, and entomologists to complex ecosystems: biodiversity. We are especially interested in interaction diversity—the types of regulatory pressures exerted by populations of different species on one another, such as the effects of hawks on foraging behaviors of jays. The interaction diversity of the Costa Rican forest is remarkable, and I am sure that you will leave the project with a long list of animal sightings, favorite species, and intriguing interactions.

Get ready for a fun project! We are going to be outside a great deal, hiking along roads and on trails, searching off-trail, and getting into various kinds of trouble. There will also be a variety of interesting jobs back at the station, doing state-of-the-art chemistry, caring for caterpillars, or entering data. I look forward to working with you out in the field.

Sincerely,

Lee Dyer, Earthwatch scientist

THE RESEARCH

CLIMATE CHANGE AND CATERPILLARS IN COSTA RICA

THE RESEARCH

Caterpillars eat an incredible amount of plant matter—some caterpillars can eat up to 27,000 times their body weight in just a few weeks. One of the main environmental checks to this ravenous hunger is a group of insects called "parasitoids." This group, which includes many species of wasps and flies, kills caterpillars by using them as a nursery for their larvae. Using a special organ called an ovipositor, these insects deposit t heir eggs either onto the backs or into the bodies of living caterpillars. This ensures a safe environment for the eggs to develop and plenty of food, as the larvae consume their host once they've outgrown the nursery. This relationship creates a system of checks and balances in the ecosystem: the parasitoids keep the caterpillar population from growing too large, and therefore prevent them from overeating their host plants.

This intricate interaction involves three levels of the food chain (plants, caterpillars, and parasitoids), making it a 'tri-trophic' interaction. These multi-level relationships are essential to keeping many environments healthy and functioning, but increasing climatic variability is poised to disturb these interactions. Climate-driven shifts in the timing of plant and herbivore seasonal development will likely throw off the signals that govern these relationships. Studying these types of multilevel ecosystem interactions is a new approach to understanding biodiversity, and is quickly expanding our understanding of the interplay between ecosystem function, biodiversity, and climate change.

While studying the impacts of climate change on this delicate ecosystem, you will have the chance to experience fascinating and spectacular diversity—and, like many Earthwatch teams before you, you may even have the chance to encounter species new to science!

THE STORY

Earthwatch volunteers have assisted in this collaborative project every year since 1996, including over 1,000 volunteers aiding in long-term research [Dyer et al. 2012]. The data collected in Costa Rica is complimented by similar research being conducted around the world. Other Earthwatch teams on this project conduct work throughout the year in Ecuador, Arizona, Nevada, California, and Peru. Although interaction diversity is a new area of exploration, using information from Earthwatch projects and collaborators, we have learned that interaction diversity is particularly sensitive to climate change.

Changes in global temperatures and levels of CO2 as a result of climate change are likely to disrupt how ecosystem elements interact with each other. Because these changes will affect many different interactions between organisms, interaction diversity is likely to decline at a higher rate than species diversity [Stireman et al. 2005]. These changes in interaction diversity are likely to have a strong effect on ecosystem stability and function [Thompson 1996, Dyer et al. 2005]. By understanding the mechanics of the plant-caterpillar-parasitoid interaction and how it is altered by climate variations, we can better understand they dynamics of ecosystem interactions and how they could potentially be impacted.

Parasitoids provide an essential, yet little studied, ecosystem service. By collecting natural history information and the results of long-term studies, this project will maximize the effectiveness of plant-caterpillar-parasitoid diversity databases and their analyses globally. Quantifying these relationships and collecting further data will give scientists the knowledge they need to enhance, restore, or maintain these relationships.

RESEARCH AIMS

With the help of volunteers, this projects aims to understand how the regulation of caterpillars by parasitoids is affected by increases in climate variability and extreme weather events associated with climate change. This study focuses on collecting essential natural history information about host plants, caterpillars, and parasitoids to create a database of the diversity in these interactions. In addition to observational data, volunteers may assist in collecting data from long-term experiments conducted in the study area. These experiments are focused on small plots of forest, called piper plots, where the plant community has been specifically selected by researchers. Volunteers will record leaf abundance, spend 30 minutes searching the plants within the plot for caterpillars, and collect samples of the plants. These experiments collect data on how interaction diversity and productivity are affected by simulated effects of climate change, primarily drought. Additionally, volunteers will collect any caterpillars encountered in the study areas, as well as the host plants they were found on. This includes 38 different families of caterpillars, including a spectacular diversity of shapes, colors, and forms that function to defend against their enemies. All of the caterpillars collected will be reared, and their waste will be chemically analyzed.

This project has three overarching goals:

- Continue to collect data on patterns of interaction diversity between plants, caterpillars, and associated parasitoids.
- Test specific hypotheses about how climate change parameters affect interactions, including:
- The number of interactions is lowest in areas where the number of species is lowest.
- The diversity of interactions varies with changes in environments, climate, and disturbances.
- As climate variability increases, interactions will decline more quickly than the number species in an environment.
- The diversity of interactions affects the stability and function of an ecosystem.
- Explore plant-caterpillar-parasitoid relationships through large-scale experiments, population genomic data, natural history data, and metabolomics data

HOW YOU WILL HELP

Costa Rica accounts for only 0.03% of the earth's surface, yet contains nearly 6% of its biodiversity. Volunteers will spend much of their time in the field, experiencing this rich diversity while working on this project. The rest of their time will be spent at the field station, aiding in rearing caterpillars and data entry. Volunteers will be involved with almost all aspects of the project. The project especially welcomes anyone with computer and web design skills. As part of this team, you will:

Collect and identify caterpillars: You will spend about 70% of your time in the field, hiking along an intact rainforest that contains some of the highest measured biodiversity on the planet. You will be trained to recognize evidence of caterpillar activity, and will conduct visual searches, collecting any caterpillars encountered along with some of the plant they were found on.

Collect and identify plant material: During long-term experiment data collecting, you will search plants for caterpillars in designated areas, then collect host plants, quantify leaf abundance, and collect material for laboratory or computer analyses. Much of the work for this project is focused on examining and interacting with the beautiful plant life of Costa Rica.

Process and monitor caterpillars: You will spend the rest of your time in the lab helping 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 bag. Adult specimens are either released or preserved for further identification. Your interaction with different life stages of caterpillars and parasitoids will vary depending on their development during your time there. 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 spectacular views.

Record and enter data: You will spend some time helping to enter data recorded in the field and observed in the lab by your team,

DAILY LIFE IN THE FIELD

PLANS FOR YOUR TEAM

During the first two days, you will go on an orientation hike with the Earthwatch scientist or a staff member and spend time in the laboratory learning the techniques to be used. You will then practice the various jobs under staff supervision. You will also be given lectures on topics such as an introduction to caterpillars, the theory behind the project, the methods to be used, and the plan of action; natural history and ecology of parasitoids; caterpillar taxonomy; and natural products chemistry and the role of plant compounds in ecological interactions. It is very common for other researchers to present lectures on their projects at the station, so you will have the opportunity to learn about other ecological research projects.

The team will be divided into groups, with the composition changing frequently to allow everyone to get to know each other. The tasks are varied enough that each volunteer will usually find a niche and feel satisfied with his or her contribution to the team effort.

When the team is not working, there are many activities that contribute to team development. Each evening there will be time for discussions about the progress of the research and feedback from the volunteers.

In the exciting world of ecological field and laboratory research, there is often a blurry line between work and play. Many volunteers find the "work" to be enjoyable, and some have even found it to be a life-changing experience. You will most likely experience a steep learning curve over the first few days of the project and will be pleasantly surprised at how much you have learned and accomplished by the end of the project.

RECREATIONAL TIME

Volunteers are encouraged to consult staff at the research station, local residents, or guidebooks about ideas for activities on the recreational days. While the Earthwatch scientists will not be arranging group excursions or activities for recreational days, one or two activity options will be described, including taking a taxi to Volcan Arenal (La Fortuna) to spend the night. Birding activities on this project are among the best in the world and interested volunteers will be able to hire a local guide to take them birding during their free time. There are also many things to do at Tirimbina. Most day excursions will cost you approximately US$50–300 (including transportation) are not included in the cost of your expedition. Enjoying the forest is free.

DAILY ACTIVITIES

Weather and research needs can lead to changes in the daily schedule. We appreciate your cooperation and understanding.

TYPICAL EXPEDITION SCHEDULE

DAY 1

Arrive at rendezvous hotel, introductions, and dinner.

DAY 2

Travel to La Tirimbina Rainforest Reserve, orientation walk, evening talk followed by planning.

DAYS 3–4

Training for caterpillar searching, taking care of caterpillars ("zoo"), photographing caterpillars, and measuring diversity in plots.

7:30 a.m.	Breakfast
9:00 a.m.	Fieldwork
12:00 p.m.	Lunch
1:00 p.m.	Fieldwork for half of the team, lab work for the other half
3:30 p.m.	Recreational time (excellent time for birding, swimming, playing soccer, hiking, etc.)
6:00 p.m.	Dinner
7:30 p.m.	Discussion and planning time
8:30 p.m.	Recreational time (good time for night walks, talking to other biologists or visitors, trips into town or the local bar, and catching up on emails)

DAYS 5–6

One-and-a-half recreational days (these days are not fixed). On Day 6 the team will travel from La Tirimbina to La Selva Biological Station.

DAYS 7–8

7:30 a.m.	Breakfast
9:00 a.m.	Fieldwork
12:00 p.m.	Lunch
1:00 p.m.	Fieldwork for half of the team, lab work for the other half
3:30 p.m.	Recreational time
6:00 p.m.	Dinner
7:30 p.m.	Discussion and planning time

DAY 8

Finish all projects and prepare labs for maintenance by staff, travel to San Jose

DAY 9

Depart

ACCOMMODATIONS AND FOOD

ABOUT YOUR HOME IN THE FIELD

SLEEPING

TIRIMBINA RAINFOREST RESERVE: This field station is small, and Earthwatch volunteers will likely be the only people using the accommodations. Single rooms are not available. Couples rooms may be requested (but are not guaranteed) by contacting Earthwatch before the start date of the team. To get to the station, the team will hike through the forest (luggage will be brought in by car). Cabins have gorgeous views and new bedrooms with two single-gender bunk beds per room. Sheets, towels and fans are provided.

LA SELVA BIOLOGICAL STATION: La Selva is a larger and very modern research facility, and the accommodations are considered luxurious by most tropical biologists (bear in mind that a tropical biologist's idea of luxury may not match your own!). Team members will stay in comfortable bunk beds in single gender, dormitory-style rooms that house two to five people. Sheets and towels are provided. At La Selva, each room also has a lockable cabinet for valuables.

BATHROOMS

Bathrooms at both field stations are unisex and shared. They have flush toilets and private shower stalls with changing anterooms. Showers have electric hot water heads that usually work, while the sinks have only cold water.

ELECTRICITY

All rooms have electricity at both sites. It is 120 volts, 60 hertz, and uses plugs with two flat prongs (some also have a third round grounding pin). These are the same as U.S. outlets.

PERSONAL COMMUNICATIONS

TIRIMBINA RAINFOREST RESERVE: There are no computers or phones.

LA SELVA BIOLOGICAL STATION: Free Internet access is usually available. There are also public telephones; international phone cards can be purchased at the station's gift shop.

The study areas usually have some cell coverage (Verizon and AT&T seem to be the best).

FACILITIES AND AMENITIES

TIRIMBINA RAINFOREST RESERVE: The station has a small football (soccer) field for friendly games, a covered outdoor area for evening festivities, and a swimming hole where you can cool off after your day in the field.

LA SELVA BIOLOGICAL STATION: Laundry facilities (washers and dryers) are available in the afternoons and evenings, free of charge.

DISTANCE TO THE FIELD SITE

La Selva is a one-kilometer (0.6 miles) walk from the caterpillar lab, down a paved trail through the forest. Not all volunteers will need to walk to this lab every day.

SERVICES AND RESTAURANTS IN WALKING DISTANCE

From La Selva, volunteers can walk to two small bars with one kilometer (0.6 miles) from the station, down a dirt road. Tirimbina has nothing in walking distance.

FOOD

At Tirimbina, volunteers will help with the cooking. At La Selva staff will cook primarily typical Latin American food. Food at both sites is varied due to the international crew of researchers. The cooks are amazing and meals are always enjoyable and communal. From La Selva, it is also possible to get a taxi into town (a 5-minute drive) and eat at any of several good restaurants. For long field days, bagged lunches consist of sandwiches, fruit, juice, and cookies.

The following are examples of foods you may find in the field. Variety depends on availability. We appreciate your flexibility.

TYPICAL MEALS

BREAKFAST	Beans, rice, eggs, fruit, cereal, and coffee
LUNCH AND DINNER	Beans, rice, soup, potatoes, salad, meat (substitute for vegetarians), vegetables, fruit, dessert
SNACKS	Cookies, ice cream and yogurt available for sale at La Selva
BEVERAGES	Water, fruit juices (beer and soft drinks available at La Selva at your own expense). Please bring a reusable personal bottle for carrying drinking water to field sites. Tap water throughout La Selva is potable.

SPECIAL DIETARY REQUIREMENTS

Please alert Earthwatch to any special dietary requirements (e.g., diabetes, lactose intolerance, nut or other food allergies, vegetarian or vegan diets) as soon as possible, and note them in the space provided on your volunteer forms.

PROJECT CONDITIONS

THE FIELD ENVIRONMENT

The following are averages. Please check weather resources for your team dates for more accurate weather predictions. Projects have experienced unseasonable weather at all times of year.

GENERAL CONDITIONS

HUMIDITY: 70%–100%
TEMPERATURE RANGE: 21°C/70°F–29°C/85°F
ALTITUDE: 183-m/600 ft.–305-m/1,000 ft.
ANNUAL RAINFALL: 122 cm/48 in–472 cm/186 in

ESSENTIAL ELIGIBILITY REQUIREMENTS:

All participants must be able to:

- Follow verbal and/or visual instructions independently or with the assistance of a companion.
- Independently follow verbal and/or visual instructions.
- Walk over uneven, forested, mountainous terrain for two to four hours for one to three miles (1.6 to 4.8 kilometers) per day, often in high temperatures and high humidity.
- Enjoy being outdoors all day in all types of weather, including high temperatures and high humidity.
- Carry personal daily supplies, such as lunch, water, and camera.
- Get low enough to access and collect samples on the ground and in the brush for at least one hour a day every day.
- Do without C-PAP machines for the length of the project, as you may not have a reliable source of electricity throughout the night.
- Sit and ride, with seat belt fastened, in project vehicles for up to approximately three hours per day.
- Enjoy teamwork and function cohesively within a group.

POTENTIAL HAZARDS

CLIMATE CHANGE AND CATERPILLARS IN COSTA RICA

HAZARD TYPE	ASSOCIATED RISKS AND PRECAUTIONS
Transportation	The bus that takes volunteers from San José to La Selva travels on a wet, winding, paved mountain road that is subject to minor landslides. Participants must wear seatbelts whenever they are available and may not drive project vehicles.
Terrain	The terrain at La Selva and Tirimbina is very hilly, and some trails are quite steep. The cement and wood trails can get very slippery, and the mud trails are sometimes difficult to navigate due to water and deep mud. Walking slowly and carefully can prevent injury. Bring appropriate footwear and remember that the hiking can be as strenuous or easy as you feel is appropriate.
Animals/Plants	There are poisonous snakes, some irritating plants, and plenty of biting and stinging insects. Snakebites are not common at La Selva, but the use of tall rubber boots in the field and flashlights at night are necessary precautions. Insect repellent can be used to ward off mosquitoes, chiggers, biting flies, and other insects. Most of the plants are harmless to people, but there are some plants that are poisonous and can cause rashes, and these will be pointed out to the volunteers.
Chikungunya Virus (CHIKV), Dengue or Zika virus	These viruses are present in Costa Rica and carried by the Aedes mosquito, which is active during the daytime. Long sleeves and insect repellant should be worn to protect against bites. Participants who are pregnant should consult their doctors before travelling due to the adverse effects the Zika virus could have on the fetus.
Climate/Weather	There will be a lot of rain, so please bring appropriate rain gear. When it is not raining, the sun will be very intense; therefore, a wide-brimmed hat, sunscreen (SPF 30 or higher) and staying well hydrated are critical. Because of the high humidity, those persons using a hearing aid device may find it doesn't work properly. You should consider purchasing a hearing aid dehumidifier.
Project Equipment	Volunteers will use pruning clippers, which can cause injuries. You will be instructed in their proper use to minimize the risk of injury.
Personal Security	Some volunteers have had items stolen that they stored at the hotel or left unsecured in their rooms at the station. Please leave valuables at home where possible, or properly secured while at the hotel or research site.
Swimming	Swimming may be possible during recreational time and typical water-related risks will be present. A certified lifeguard will not be available. Volunteers should not swim alone—always inform staff when swimming.
Distance from Medical Care	This project site is remote with limited emergency response in case of medical concerns. If you are pregnant or have other conditions that could require emergency medical care, you should discuss with your physician before joining this project.

HEALTH & SAFETY

CLIMATE CHANGE AND CATERPILLARS IN COSTA RICA

EMERGENCIES IN THE FIELD

At La Selva phone and email are available for emergency communications; no field communication devices are available. There are no phones or email facilities at Tirimbina.

For emergency assistance in the field, please contact Earthwatch's 24-hour emergency hotline number on the last page of this briefing. Earthwatch is available to assist you 24 hours a day, 7 days a week; someone is always on call to respond to messages that come into our live answering service.

IMMUNIZATIONS & TRAVEL VACCINATIONS

Please be sure your routine immunizations are up-to-date (for example: diphtheria, pertussis, tetanus, polio, measles, mumps, rubella and varicella) and you have the appropriate vaccinations for your travel destination. Medical decisions are the responsibility of each volunteer and his or her doctor, and the following are recommendations only. Visit the **cdc.gov** or **who.int** for guidance on immunizations.

If traveling from countries or region where yellow fever is endemic, you must have a certificate of vaccination.

TRAVEL TIPS

SUGGESTIONS FOR THE ROAD

YOUR DESTINATION

LANGUAGE: Spanish. All project staff members speak English and will conduct the project in English.

TIME ZONE: GMT/UTC -6.

CULTURAL CONSIDERATIONS: Costa Rica is a tourist destination and the capital city is very modern. Western-style swimsuits are fine. San José is a large city, and as in all big cities, one should be aware of his/her surroundings while walking around. During the day, it is safe to travel alone in the city, but at night you are advised to go out with other volunteers and to take taxis between destinations.

TELEPHONE DIALING CODES: When calling Costa Rica from another country, dial the country's international dialing code, followed by (506) and the number. When calling within Costa Rica, omit the (506) and dial the number. When calling another country from Costa Rica, dial (00), followed by the other country's country code and the number. **NOTE:** in Costa Rica, a 2 precede landlines and cellphones are preceded by an 8 (following the country code if necessary). Check with your cell phone provider to obtain any carrier-specific dialing codes you may need.

MONEY MATTERS

LOCAL CURRENCY: Costa Rican colones.

PERSONAL FUNDS: Bring some cash for snacks, extra drinks (e.g., beer or soda) and any trips you may plan for the recreational days. Most day excursions will cost US$50–300 (including transportation). ATMs are not easily accessible in the field, so please change money at the hotel on the first evening or take colones out of an ATM at the airport. You can pay for your taxi from the airport in U.S. dollars or colones. Tips are normally included in restaurant bills, so it is not customary to leave a tip.

DEPARTURE TAX: The Costa Rica airport tax is currently $29 and must be paid at the airport when leaving the country. It is payable in U.S. dollars, colones, or with a VISA card. (Fees and payment methods are accurate as of time of publication but are subject to change.) In 2015, some airlines were able to include the departure tax in the ticket price to expedite the process—check with your airfare provider.

COUNTRY AND PROJECT ENTRY REQUIREMENTS

Entry visa requirements differ by country of origin, layover, and destination, and do change unexpectedly. For this reason, please confirm your visa requirements at the time of booking and, again, 90 days prior to travel. Please apply early for your visa (we recommend starting 6 months prior to the start of your expedition). Refunds will not be made for volunteers cancelling due to not obtaining their visa in time to meet the team at the rendezvous. You can find up to date visa requirements via the following site:

www.travisa.com

If a visa is required, participants should apply for a TOURIST visa. Please note that obtaining a visa can take weeks or even months. We strongly recommend using a visa agency, which can both expedite and simplify the process.

Generally, passports must be valid for at least six months from the date of entry and a return ticket is required.

You must keep the immigration card issued to you upon arrival in Costa Rica! Visitors are advised to keep it with their travel documents, as you will be required to present it to an Immigration Officer upon your departure.

CONTACT INFORMATION

You may be required to list the following contact information on your visa application and immigration form, or if your luggage does not make it to baggage claim at your destination:

DoubleTree by Hilton Hotelx
San Antonio de Belen Ciudad Cariari
San Jose, Costa Rica
TEL: +506-2-239-0022
FAX: +506-2-239-0285

http://doubletree3.hilton.com/en/hotels/costa-rica/doubletree-by-hilton-hotel-cariari-san-jose-costa-rica-SJODTDT/index.html

EXPEDITION PACKING CHECKLIST

WHAT TO BRING

EXPEDITION PACKING CHECKLIST

GENERAL

- ❑ This expedition briefing
- ❑ Your travel plans, rendezvous details, and Earthwatch's emergency contact information
- ❑ Photocopies of your passport, flight itinerary, and credit cards in case the originals are lost or stolen; the copies should be packed separately from the original documents
- ❑ Passport and/or visa (if necessary)
- ❑ Certification of vaccination (if necessary)
- ❑ Documentation for travel by minors (if necessary)
- ❑ Calling card or mobile phone (Note: the campus does not have good cell phone reception, but does have wireless internet available throughout)
- ❑ Credit card that may be used in the event of an emergency (travel delays, etc.)

CLOTHING/FOOTWEAR FOR FIELDWORK

- ❑ Lightweight, quick-drying, long-sleeved shirts
- ❑ Lightweight, quick drying pants (jeans do not work well in the field)
- ❑ T-shirts
- ❑ Teva-like water shoes
- ❑ Knee-high rubber boots or Wellingtons/gumboots (fancy leather hiking boots are not advised)
- ❑ Lots of socks
- ❑ Swimsuit
- ❑ Soft (foldable) hat with a broad brim to protect against sun and rain
- ❑ Rain poncho or jacket (rain pants are also useful but not required)

CLOTHING/FOOTWEAR FOR LEISURE

- ❑ Sandals for relaxation around the research stations
- ❑ One set of warm clothes for cool evenings
- ❑ One nice set of clothing for evening in town or to keep clean for end of expedition

FIELD SUPPLIES

- ❑ Small daypack/rucksack
- ❑ Drybag or plastic sealable bags (good for protecting equipment such as camera from dust, humidity, and water)
- ❑ Insect repellent
- ❑ Headlamp (preferred) or flashlight with extra batteries and bulbs (essential for fieldwork at night, to find your way to your room, and to avoid snakes and other hazards)
- ❑ Waterproof wristwatch
- ❑ Well worn-on (NOT brand new) comfortable walking shoes or hiking boots
- ❑ Camera, film or digital memory storage, extra camera batteries (rechargeable batteries are preferred as there are no disposal facilities for used batteries)
- ❑ Pocket knife (pack in checked luggage, not carry-on)—useful for cutting food plants, cutting tape, cutting cord for plots in the field, or other field related issues.
- ❑ At least two one-liter water bottles
- ❑ Umbrella
- ❑ Sunscreen lotion with SPF 30 or higher (waterproof and sweat proof advised)

BEDDING AND BATHING

NOTE: the project will provide linens, pillows, towels, blankets, etc.

PERSONAL SUPPLIES

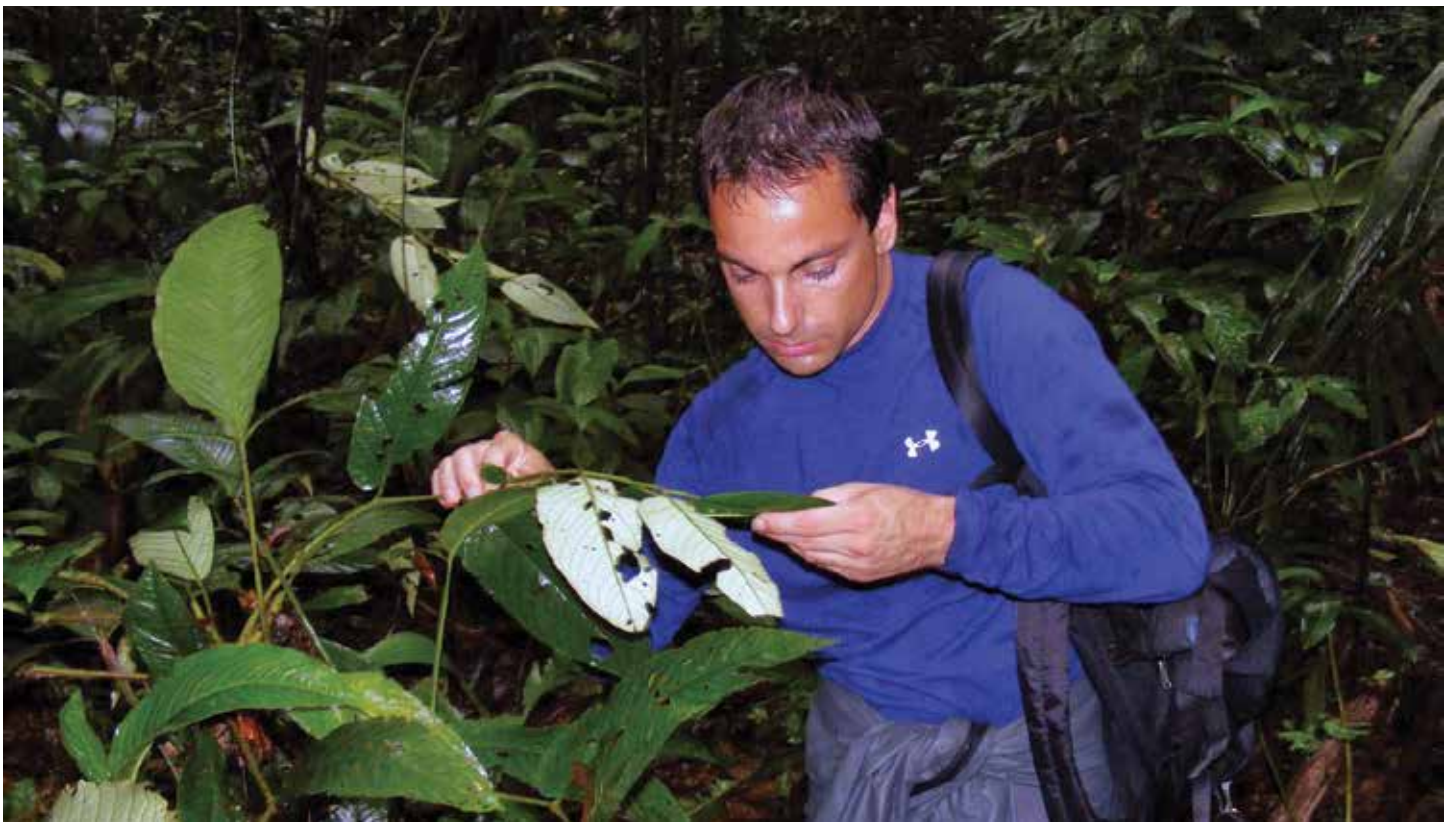
- ❑ Personal toiletries (biodegradable soaps and shampoos are encouraged)
- ❑ Antibacterial wipes or lotion (good for cleaning hands while in the field)
- ❑ Personal first aid kit (e.g., anti-diarrhea pills, antibiotics, antiseptic, itch-relief, pain reliever, bandages, blister covers, etc.) and medications
- ❑ Spending money
- ❑ Roll of toilet paper
- ❑ Quick-drying, easily packable towel

EXPEDITION PACKING CHECKLIST

OPTIONAL ITEMS

- ❑ Travel guide
- ❑ Waterproof pants
- ❑ Waterproof alarm clock (battery operated or digital watch with alarm works best)
- ❑ Favorite snack foods
- ❑ Sunglasses with retainer strap
- ❑ Compass
- ❑ Binoculars
- ❑ Guidebooks, especially bird books, for Costa Rica
- ❑ Some duct tape (this is always handy, but a whole roll is not necessary)
- ❑ Camera, film or memory card(s), extra camera battery
- ❑ Hardware for sharing digital photographs at the end of the expedition
- ❑ Dry bag or plastic sealable bags (e.g. Ziploc) to protect equipment like cameras from dust, humidity, and water
- ❑ Books, games, art supplies, etc. for free time
- ❑ Earplugs for light sleepers

NOTE: Do not bring more luggage than you can carry and handle on your own. If traveling by air and checking your luggage, we advise you to pack an extra set of field clothing and personal essentials in your carry-on bag in case your luggage is lost or delayed.



PROJECT STAFF

YOUR RESOURCES IN THE FIELD

EARTHWATCH SCIENTIST DR. LEE DYER is an ecologist who has worked with a variety of organisms in the tropics for the past 26 years and in temperate areas for the past 30 years. He received a B.S.in biochemistry and English from the University of California at Santa Barbara and a Ph.D. in ecology from the University of Colorado, Boulder. Lee was previously a postdoctoral researcher at UC Santa Cruz and a professor at Mesa State College in Colorado and Tulane University in New Orleans. He is now a professor in the Biology Department at the University of Nevada, Reno. Lee spends his free time hanging out with his sons, rock climbing, listening to music, and reading books. He is in charge of all aspects of the project, and his specialties relevant to the project are statistical modeling, community ecology, caterpillar natural history, and basic natural products chemistry.

DR. ANGELA SMILANICH is an ecologist who has worked with lepidopteran larvae (caterpillars!) for the past 14 years. Starting as an undergraduate majoring in biology at Colorado Mesa University in Colorado, she has pursued a career studying how and why a caterpillar chooses to eat certain plants and not others. She received her PhD in 2008 from Tulane University in New Orleans, Louisiana, enduring yearly hurricanes and Mardi Gras. Her dissertation work focused on the causes of variation in the caterpillar's immune system. As a postdoctoral scholar at Wesleyan University in Connecticut focused on the self-medication behavior of woolly bear caterpillars. She is currently an assistant professor at UNR where she continues to study the insect immune response and the evolution of dietary preference. In her free time, Angela enjoys running, reading, traveling, eating delicious chocolate, and spending time with her sons. Angela will be in charge of team activities, fieldwork and lab work on the caterpillar immune system.

HUMBERTO GARCIA is a Costa Rican naturalist and gusanero (caterpillar collecting and rearing expert). He grew up in Sarapiqui and has been rearing caterpillars for this project for the last eight years. When he's not finding and caring for caterpillars, Humberto enjoys playing the guitar and spending time with his family.

All staff members are scheduled to be present for this team. In addition, La Selva Biological Station has a very large and excellent logistics staff that will take care of all concerns, including meals. At Tirimbina Rainforest Center, volunteers will participate in cooking. Staff schedules are subject to change.

NOTE: Staff schedules are subject to change.

RECOMMENDED READING

YOUR RESOURCES AT HOME

RESOURCES

BOOKS

- Wagner, D.L., 2010. Caterpillars of eastern North America: a guide to identification and natural history. Princeton University Press.

ARTICLES

- The first article is highly recommended. Link to these papers: **wolfweb.unr.edu/~ldyer/papers.htm**
- Dyer, L.A., Wagner, D.L., Greeney, H.F., Smilanich, A.M., Massad, T.M., Robinson, M. Fox, M., Hazen, R., Glassmire, A., Pardikes, N., Fredrickson, K., Pearson, C., Gentry, G.L., and J.O. Stireman III. 2012. Novel insights into tritrophic interaction diversity and chemical ecology using 16 years of volunteer supported research. American Entomologist 58:15-19.
- Stireman, J.O. III, L.A. Dyer, D.H. Janzen, M.S. Singer, J.T. Lill, R.J. Marquis, R.E. Ricklefs, G.L. Gentry, W. Hallwachs, P.D. Coley, J.A. Barone, H.F. Greeney, H. Connahs, P. Barbosa, H.C. Morais, and I.R. Diniz. 2005. Climatic unpredictability and parasitism of caterpillars: Implications of global warming. Proceedings of the National Academy of Sciences 102:17384-17387.

PROJECT-RELATED WEBSITES

- **Caterpillar website:** caterpillars.org and gusanos.org
- **La Silva Station:** ots.duke.edu/en/laselva
- **Tirimbina Station:** tirimbina.org

EARTHWATCH SOCIAL MEDIA

- **FACEBOOK:** facebook.com/Earthwatch
- **TWITTER:** twitter.com/earthwatch_org
- **INSTAGRAM:** instagram.com/earthwatch
- **BLOG:** https://blog.earthwatch.org/
- **YOUTUBE:** youtube.com/earthwatchinstitute

LITERATURE CITED

YOUR RESOURCES AT HOME

LITERATURE CITED

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- Dyer, L.A. and D.K. Letourneau. 2013. Can Climate Change Trigger Massive Diversity Cascades in Terrestrial Ecosystems? Diversity 5:1-35.
- Forister, M. L., Novotny, V., Panorska, A. K., Baje, L., Basset, Y., Butterill, P. T., Cizek, L., Coley, P. D., Dem, F., Diniz, I. R., Drozd, P., Fox, M., Glassmire, A., Hazen, R., Hrcek, J., Jahner, J. P., Kama, O., Kozubowski, T. J., Kursar, T. A., Lewis, O. T., Lill, J., Marquis, R. J., Miller, S. E., Morais, H. C., Murakami, M., Nickel, H., Pardikes, N., Ricklefs, R. E., Singer, M. S., Smilanich, A. M., Stireman, J. O., Villamarín-Cortez, S., Vodka, S., Volf, M., Wagner, D. L., Walla, T., Weiblen, G. D., and L. A. Dyer. 2015. Global distribution of diet breadth in insect herbivores. Proceedings of the National Academy of Sciences 112:442-447.
- Glassmire, A. E., Jeffrey, C. S., Forister, M. L., Parchman, T. L., Nice, C. C., Jahner, J. P., Wilson, J. S., Walla, T. R., Richards, L. A., Smilanich, A. M., Leonard, M. D., Morrison, C. R., Simbaña, W., Salagaje, L. A., Dodson, C. D., Miller, J. S., Tepe, E. J., Villamarin-Cortez, S. and Dyer, L. A. (2016), Intraspecific phytochemical variation shapes community and population structure for specialist caterpillars. New Phytologist 212:208-219.
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- Rodríguez-Castañeda, H.G. Connahs, T.R. Walla and L.A. Dyer. 2010. Tropical forests are not flat: How mountains affect herbivore diversity. Ecology Letters (in prep).

NOTES

CLIMATE CHANGE AND CATERPILLARS IN COSTA RICA

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CLIMATE CHANGE AND CATERPILLARS IN COSTA RICA

EMERGENCY NUMBERS

AROUND-THE-CLOCK SUPPORT

MESSAGE FROM EARTHWATCH

DEAR EARTHWATCHER,

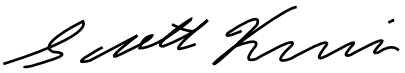
Thank you for joining this expedition! We greatly appreciate your decision to contribute to hands-on environmental science and conservation. It is volunteers like you who fuel our mission and inspire our work.

While at Earthwatch, I've had the opportunity to field on a few expeditions, most recently in Kenya with one of my daughters. Each expedition has touched me deeply, and made me proud to be able to roll up my sleeves alongside my fellow volunteers and contribute to such meaningful work.

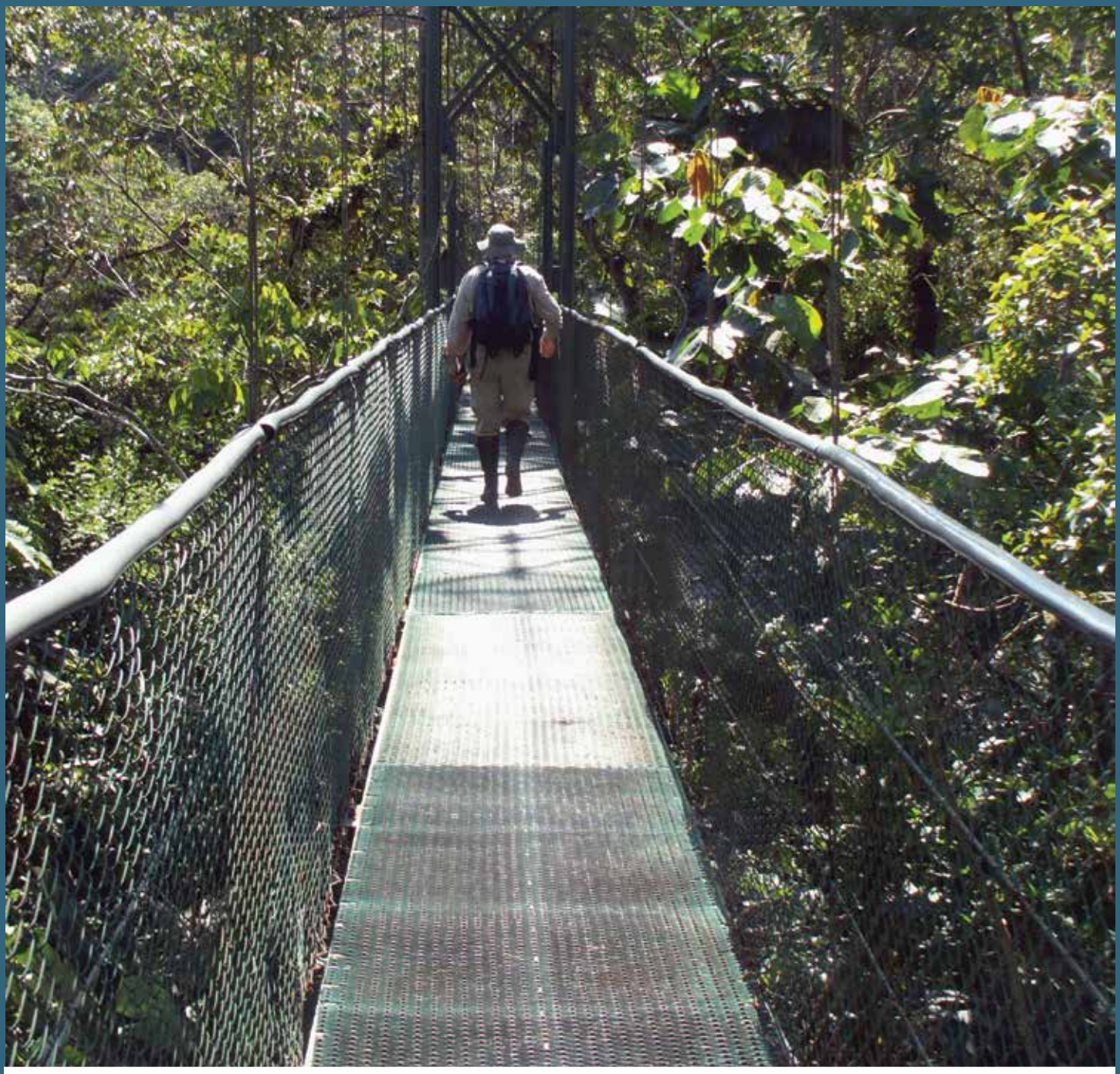
As an Earthwatch volunteer, you have the opportunity to create positive change. And while you're out in the field working toward that change, we are committed to caring for your safety. Although risk is an inherent part of the environments in which we work, we've been providing volunteer field experiences with careful risk management and diligent planning for nearly 45 years. You're in good hands.

If you have questions as you prepare for your expedition, we encourage you to contact your Earthwatch office. Thank you for your support, and enjoy your expedition!

Sincerely,



Scott Kania
President and CEO, Earthwatch



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