

Term Information

Effective Term Summer 2027
[Previous Value](#) Summer 2020

Course Change Information

What change is being proposed? (If more than one, what changes are being proposed?)

Modification of course description, removal of Honors designation, adjustment of prerequisites.

What is the rationale for the proposed change(s)?

The description has not been updated in many years. It specifies Panama as a course location and this offering will be in Costa Rica, so we are changing it to "the Neotropics". Adjustment of prerequisites is in order to be more inclusive while still maintaining a minimum preparation level for success in the course.

What are the programmatic implications of the proposed change(s)?

(e.g. program requirements to be added or removed, changes to be made in available resources, effect on other programs that use the course)?

None

Is approval of the request contingent upon the approval of other course or curricular program request? No

Is this a request to withdraw the course? No

General Information

Course Bulletin Listing/Subject Area Evol, Ecology & Organismal Bio
Fiscal Unit/Academic Org Evolution, Ecology & Org Bio - D0390
College/Academic Group Arts and Sciences
Level/Career Undergraduate
Course Number/Catalog 4420
[Previous Value](#) 4420H
Course Title Tropical Field Studies
Transcript Abbreviation Trop Field Studies
Course Description A course-based undergraduate research experience (CURE) that will build science literacy and critical thinking focused on a tropical research system. Immersed in a Neotropical rainforest at a world-renowned field station, students will engage in tropical field studies with an emphasis on evolutionary and behavioral ecology, while interacting with a global community of field biologists.
[Previous Value](#) *This course will give students first-hand knowledge of tropical biology with an emphasis on evolutionary and behavioral ecology. This is an intensive foreign study tour in Panama, a country renowned for its biological diversity. The course includes travel to several tropical habitats and experiences with common field methods in ecology and animal behavior.*
Semester Credit Hours/Units Fixed: 3

Offering Information

Length Of Course 6 Week, 4 Week
[Previous Value](#) 8 Week, 7 Week, 6 Week, 4 Week
Flexibly Scheduled Course Never
[Previous Value](#) Always
Does any section of this course have a distance education component? No
Grading Basis Letter Grade
Repeatable No
Course Components Lecture, Field Experience
Grade Roster Component Field Experience

Credit Available by Exam	No
Admission Condition Course	No
Off Campus	Always
Campus of Offering	Columbus

Prerequisites and Exclusions

Prerequisites/Corequisites	Three credits in biological sciences and permission of instructor.
<i>Previous Value</i>	<i>Prereq: Honors standing, and 3310 or 3410; or permission of instructor.</i>
Exclusions	
Electronically Enforced	No

Cross-Listings

Cross-Listings

Subject/CIP Code

Subject/CIP Code	26.1301
Subsidy Level	Baccalaureate Course
Intended Rank	Sophomore, Junior, Senior

Requirement/Elective Designation

The course is an elective (for this or other units) or is a service course for other units

Course Details

Course goals or learning objectives/outcomes	<ul style="list-style-type: none">• Students will understand the organismal interactions and evolution in tropical ecosystems• Students will be able to identify major groups of tropical plants and insects
<i>Previous Value</i>	<ul style="list-style-type: none">• <i>Students will understand the organism interactions and evolution in tropical ecosystems</i>• <i>Students will be able to identify major groups of tropical plants and insects</i>
Content Topic List	<ul style="list-style-type: none">• Tropical diversity and taxonomy• Biotic interactions in tropical communities• Effect of the environment on ecological communities• Humans in the tropics• Research in tropical systems
Sought Concurrence	No

Attachments

- Response letter.docx: responses to comments
(Cover Letter. Owner: Freudenstein,John Vincent)
- EEOB4420_Group Portfolio and Presentation -26Mar25.docx: exercise 1 example
(Other Supporting Documentation. Owner: Freudenstein,John Vincent)
- EEOB4420_Logbook Assignment - 26Mar25.docx: exercise 2 example
(Other Supporting Documentation. Owner: Freudenstein,John Vincent)
- EEOB4420_Jigsaw discussion assignment-26Mar25.docx: exercise 3 example
(Other Supporting Documentation. Owner: Freudenstein,John Vincent)
- EEOB Curriculum Maps 2026.xlsx: EEOB curriculum map
(Other Supporting Documentation. Owner: Freudenstein,John Vincent)
- EEOB4420_Syllabus _Tropical Field Studies _revised.docx: syllabus
(Syllabus. Owner: Freudenstein,John Vincent)

Comments

- Please see Subcommittee feedback email sent 11/8/24. *(by Neff,Jennifer on 11/08/2024 09:03 AM)*

Workflow Information

Status	User(s)	Date/Time	Step
Submitted	Freudenstein,John Vincent	09/24/2024 12:43 PM	Submitted for Approval
Approved	Freudenstein,John Vincent	09/27/2024 11:18 AM	Unit Approval
Approved	Vankeerbergen,Bernadette Chantal	10/18/2024 02:19 PM	College Approval
Revision Requested	Neff,Jennifer	11/08/2024 09:03 AM	ASCCAO Approval
Submitted	Freudenstein,John Vincent	02/08/2026 09:01 PM	Submitted for Approval
Approved	Freudenstein,John Vincent	02/08/2026 09:02 PM	Unit Approval
Pending Approval	Vankeerbergen,Bernadette Chantal	02/08/2026 09:02 PM	College Approval

Reponses to Committee requests for action for EEOB 4420 proposal:

- **Contingency:** The Subcommittee requests that the department provide additional details in the syllabus regarding the group research portfolio to enhance students' understanding of the assignment expectations, including examples of what this project might look like and possible research topics. [Syllabus p. 6] This has now been more fully fleshed out in the syllabus and we have attached example exercises.
- **Contingency:** The Subcommittee notes that the credit hours and work expectations statement in the syllabus mentions that students should expect to spend around 12 hours per week engaging with the course. As a 3-credit course, this should be adjusted to reflect 9 hours of weekly engagement. [Syllabus p. 3] The adjustment to have student engagement time match credit hours has been made.
- **Contingency:** The Subcommittee requests that the department include information beyond the boilerplate language in the syllabus regarding accommodations for students with disabilities. Specifically, it is important to include a clear description of the physical activities involved in the trip, encompassing the types of activities planned, the expected level of physical exertion, and any relevant accessibility considerations. A detailed account of what a day will look like as well as hazards have been described. Furthermore, link to resources provided by La Selva have been added. These will be a topic of discussion in the weeks leading up to the course.
- **Contingency:** The Subcommittee requests that the department use the most recent version of the religious accommodations statement in the syllabus. This updated statement is a result of a directive by the Executive Vice President and Provost and can be found in an easy to copy/paste format on the [Arts and Sciences Curriculum and Assessment Services website](#). Please note that the link to religious holidays, holy days and observances at the end of the statement is also required to be included in the syllabus. [Syllabus p. 12] This has been updated to latest.
- **Recommendation:** The Subcommittee recommends that the department use the most recent version of the university's recently updated diversity statement if they wish to keep it in the syllabus. The updated statement can be found in an easy to copy/paste format on the [Arts and Sciences Curriculum and Assessment Services website](#). [Syllabus p. 10] This section has now been removed.
- **Recommendation:** The Subcommittee recommends that the department use the most recent version of the Student Life Disability Services Statement, which was

updated in summer of 2024. The updated statement can be found in an easy to copy/paste format on the [Arts and Sciences Curriculum and Assessment Services website](#). [Syllabus p. 11] The syllabus now has the standard OSU language as well as a section on disability accommodation specific to this course.

EEOB 4420

Tropical Field Studies in Costa Rica

Course Information

- **Course times and location:** May and June meetings, then June 16-30
- **Credit hours:** 3
- **Mode of delivery:** In person

Instructors

- **Name:** Dr. Rachelle MM Adams (Resident Director, Instructor, and Course Coordinator)
- **Email:** adams.1970@osu.edu
- **Office location:** Museum of Biological Biodiversity, MBD 1500, 1315 Kinnear Road, Columbus, OH 43212; 474 Aronoff

Resident Director

- **Name:** Sammantha Herrmann
- **Email:** herrmann.74@osu.edu

On-site Naturalist and Research Scientist

- **Name:** Andres Vega Alvarado
- **Email:** avegak440@gmail.com

Course Prerequisites

This is a research-intensive course, and so students should have taken Biology 1101, Biology 1113, or Biology 1114 or get permission from the instructor.

Course Description

Curiosity about the natural world is a gateway to developing interest in the analysis of evidence and an appreciation for science. This study abroad program is a course-based undergraduate research experience (CURE) that will build science literacy and critical thinking, by focusing on a research system with close to nothing known about it. While immersed in a Costa Rican



Neotropical rainforest you will build a foundation in tropical ecology methods. With guidance of instructors, the class will dive deep into a recently named tropical ant species and propose and complete novel research projects using Team Science principles. You will have unique opportunities to interact with a global community of scientists and work at the world-renowned La Selva Research Station, Puerto Viejo de Sarapiquí, Costa Rica.

Learning Outcomes

The course will focus on the scientific method, with structured activities that will teach you how to think like a scientist. You will work in groups to attain shared research goals, which will involve data collection, review of specialized literature, development of methods, and interpretation of the results obtained. Your novel scientific discoveries will result in a unique product communicating your findings.

Upon completion of this course, students will be able to understand and articulate scientific methods used in experimental and descriptive research and the importance of connecting society and nature.

1. Describe modern scientific techniques used in field biology;
2. Engage in scholarly exploration of the scientific process and recognize it as something interactive, continuous, and collaborative;
3. Differentiate the components of a scientific study (e.g., observation, hypothesis, data collection and analysis, interpretation of the results);
4. Problem-solve challenges that arise when conducting research;
5. Participate in peer-review processes in a team setting, recognizing constructive feedback and effective debate practices;
6. Use tools to navigate digital and scientific sources and distinguish peer-reviewed science, pseudoscience, and opinions;
7. Describe tropical ecosystems and their importance to the world.
8. Recognize the development of ecological and evolutionary processes and how they are influenced by society;
9. Demonstrate a sense of self as a member of society positively impacted by scientific discovery;
10. Demonstrate understanding of research by formulating clear and objective communication about scientific information and findings.

This course-based undergraduate research experience (CURE) will build science literacy and critical thinking by focusing on captivating ecological relationships. Students will develop proficiencies and content knowledge about tropical field biology by researching an understudied ant species, and gain an appreciation for modern principles, theories, methods and modes of inquiry used when studying nature. Throughout the course, students will participate in various practical activities including literature review, field research, data analysis, and scientific communication. These high-impact research-

focused activities will result in student contributions to public databases and scientific discoveries.

How This Course Works

Mode of delivery: In-person and online. Activities will range from reading scientific literature, group discussions, tutorials, and hands-on field research. Students are required to participate fully to receive participation points and should expect to be outside and in the tropical environment every day. Preventable impairment such as a lack of sleep or alcohol/drug use will not be tolerated, and students may be asked to remove themselves from an activity due safety concern. Some work will take place in Carmen/Canvas or in online discussions.

Credit hours and work expectations: This is a **3-credit-hour course**. According to Ohio State policy ([go.osu.edu/credit hours](https://go.osu.edu/credit-hours)), students should expect around 9 hours of engagement with the class each week to receive a grade of (C) average. Actual hours spent will vary by student learning habits and the assignments each week.

Attendance and participation requirements: Research show regular participation is one of the highest predictors of success. With that in mind, we have the following expectations for everyone's participation:

- **Attendance at all activities**

It is essential that you attend all activities throughout the course, as they are crucial to achieving the proposed objectives and producing the expected outcomes. The activities include discussions and fieldwork (involving collection and biological observation).

Required Materials and/or Technologies

- All course materials will be made available in advance on the Carmen platform.
- Access to technologies capable of interacting with the Carmen platform and viewing documents in PDF format will be necessary. You are not required to bring a computer to the field.

Required Equipment

- **Computer (home use only):** current Mac (MacOS) or PC (Windows 10) with high-speed internet connection, including access to webcam and microphone.
- **Other:** a mobile device (smartphone or tablet) to use for BuckeyePass authentication
- **Field equipment:** Personal logbook, writing supplies, proper field attire including rubber boots. More details will be provided [[LINK](#)].

If you do not have access to the technology you need to succeed in this class, review options for technology and internet access at go.osu.edu/student-tech-access.

Required Software

Microsoft Office 365: All Ohio State students are eligible for free Microsoft Office 365. Visit the [installing Office 365](https://go.osu.edu/office365help) (go.osu.edu/office365help) help article for full instructions.

CarmenCanvas Access

You will need to use [BuckeyePass](https://buckeyepass.osu.edu) (buckeyepass.osu.edu) multi-factor authentication to access your courses in Carmen. To ensure that you are able to connect to Carmen at all times, it is recommended that you do each of the following:

- Register multiple devices in case something happens to your primary device. Visit the [BuckeyePass - Adding a Device](https://go.osu.edu/add-device) (go.osu.edu/add-device) help article for step-by-step instructions.
- Request passcodes to keep as a backup authentication option. When you see the Duo login screen on your computer, click **Enter a Passcode** and then click the **Text me new codes** button that appears. This will text you ten passcodes good for 365 days that can each be used once.
- [Install the Duo Mobile application](https://go.osu.edu/install-duo) (go.osu.edu/install-duo) on all of your registered devices for the ability to generate one-time codes in the event that you lose cell, data, or Wi-Fi service.

If none of these options will meet the needs of your situation, you can contact the IT Service Desk at [614-688-4357 \(HELP\)](tel:614-688-4357) and IT support staff will work out a solution with you.

Accessibility of Course Technology

This course requires use of CarmenCanvas (Ohio State's learning management system) and other online communication and multimedia tools. If you need additional services to use these technologies, please request accommodations as early as possible.

- [CarmenCanvas accessibility](https://go.osu.edu/canvas-accessibility) (go.osu.edu/canvas-accessibility)
- Streaming audio and video
- [CarmenZoom accessibility](https://go.osu.edu/zoom-accessibility) (go.osu.edu/zoom-accessibility)

Technology Support

For help with your password, university email, CarmenCanvas, or any other technology issues, questions or requests, contact the IT Service Desk, which offers 24-hour support, seven days a week.

- **Self Service and Chat:** go.osu.edu/it
- **Phone:** 614-688-4357 (HELP)
- **Email:** servicedesk@osu.edu



Grading and Faculty Response

Assignments and their components are subject to change prior to the start of course and with advance notice from Dr. Adams.

Course evaluation description and point assignment (more details will be provided in class and in Canvas)	Points
Fieldworks and Discussions (online & in-person) <i>Attendance and participation will be noted for full points.</i>	25
Scientific Literacy <i>Lead a group discussion in a Jigsaw-style discussion. Teaching what you know! This assignment will help solidify what you have learned in the assigned readings while prompting further exploration of the topics.</i>	25
Logbook and Data Curation <i>Provide a scan and complete documentation of your research participation (e.g., video, photograph, data sheets, summaries, etc.). This assignment will evaluate your participation, reflection, data collection, and observation skills.</i>	50
Group Research Portfolio <i>As a group you will generate data for your research portfolio that includes organized research products and a flash talk presentation. You will demonstrate an understanding of your topic background, methods, data analysis, results, and future directions. This assignment evaluates your ability to analyze and interpret data based on a group question.</i>	100
Total *See detailed assignment descriptions and due dates in Canvas	200

Written Assignments

Academic integrity and collaboration (also see Academic Misconduct below): Your written assignments should be your own original work. In formal assignments, you should follow the section 'Discussion and Communication Guidelines' (see below), to cite the ideas and words of your research sources. You are encouraged to ask a trusted person or group members to proofread your assignments before you turn them in but no one else should revise or rewrite your work (unless it is for group work). We encourage the use of the tool [iThenticate](#) to check your work for plagiarism (see [OSU Research Misconduct](#) for more details).

All students have important obligations under the [Code of Student Conduct](#) to complete all academic and scholarly activities with fairness and honesty. Our professional students also have the responsibility to uphold the professional and ethical standards found in their respective academic honor codes. Specifically, students are not to use "unauthorized assistance in the laboratory, on field work, in scholarship or on a course assignment" unless such assistance has



been authorized specifically by the course instructor. In addition, students are not to submit their work without acknowledging any word-for-word use and/or paraphrasing” of writing, ideas or other work that is not your own. These requirements apply to all students — undergraduate, graduate, and professional.

Late Assignments

Please refer to Carmen for due dates. Due dates are set for your grade evaluation as well as to help you stay on pace and allow timely feedback that will help you complete subsequent assignments. Due to the collaborative nature of class, late assignments will receive a zero, unless otherwise stated. The only exceptions will be extensions granted ahead of time or serious documented emergencies.

Instructor Feedback and Response Time

Remember that you can call [614-688-4357 \(HELP\)](tel:614-688-4357) at any time if you have a technical problem.

- **Preferred contact method:** If you have a question, please contact instructors first through our Ohio State email address. We will reply to emails within **24 hours on days when class is in session at the university**.
- **Class announcements:** Instructors will send all important class-wide messages through the Announcements tool in CarmenCanvas. Please check [your notification preferences \(go.osu.edu/canvas-notifications\)](http://go.osu.edu/canvas-notifications) to ensure you receive these messages.
- **Grading and feedback:** For assignments submitted by the due date, we will try to provide feedback and grades within **seven days**. Assignments submitted after the due date may not be graded (see assignment details in Canvas) or may have reduced feedback, and grades may take longer to be posted.

Grading Scale

93–100: A	80–82.9: B-	67–69.9: D+
90–92.9: A-	77–79.9: C+	60–66.9: D
87–89.9: B+	73–76.9: C	Below 60: E
83–86.9: B	70–72.9: C-	

Ohio State’s Academic Integrity Policy

See [Carmen/Canvas for Major Course Assignments](#) with specific guidelines about collaboration and academic integrity in the context of this class.

Academic Misconduct

It is the responsibility of the Committee on Academic Misconduct to investigate or establish procedures for the investigation of all reported cases of student academic misconduct. The term “academic misconduct” includes all forms of student academic misconduct wherever committed, illustrated by, but not limited to, cases of plagiarism and dishonest practices in connection with examinations. Instructors report all instances of alleged academic misconduct to the committee (Faculty Rule 3335-5-487). For additional information, see the Code of Student Conduct <http://studentlife.osu.edu/csc/>. We will adhere to this policy.

- Unless otherwise specified for a particular assignment, all submitted work should be a student’s own unique effort. Collaborative efforts are not permitted unless expressly sanctioned for a particular assignment.
- AI-generated materials. *See AI specific policy in next section*
- Reusing past work: In general, you are prohibited in university courses from turning in work from a past class to your current class, even if you modify it. If you want to build on past research or revisit a topic you’ve explored in previous courses, please discuss the situation with me.
- Using others’ verbatim words without the use of quotation marks *and* citation is plagiarism. Paraphrased work requires citation to denote the use of others’ ideas. Copying other’s words without quotation while using citations is still considered plagiarism.
- Use of any technology during a quiz or exam (including but not limited to cell phones, smart watches, headphones, electronic dictionaries, etc.) is strictly prohibited.



In this course, students are welcome to explore innovative tools and technologies for, including generative artificial intelligence (GenAI). Students are permitted to use GenAI tools for most course assignments, except for essays and reflections. Your written assignments, including short essays or reflections, are expected to be your own original work.

- GenAI may be a helpful resource for drafting creative content, brainstorming ideas, creating a “reverse outline” from a rough draft, and enhancing productivity. Yet it is essential to approach its use thoughtfully and ethically. If you use GenAI in any of your assignments, you must include the following 5 items with each assignment in which you used GenAI:
 1. **Application Used:** Specify the GenAI application or tool you used (e.g., Copilot, ChatGPT, etc, etc).
 2. **Intended Purpose:** List the purpose for which you used GenAI (e.g., idea generation, content creation).
 3. **Quality of Initial GenAI Output:** Evaluate the initial output generated by GenAI. For example, was it accurate, biased, coherent, and/or relevant? Why / how did you arrive at this conclusion?
 4. **Iteration and Refinement:** Explain how you revised prompts or adjusted parameters to refine the GenAI output. Did you experiment with different input prompts to improve the output?



- 5. Incorporation in Completed Assignment:** Reflect on how you incorporated the GenAI-generated content into your assignment. How did you edit, adapt, or combine it with other ideas?
- While GenAI can be a valuable tool, remember that academic integrity remains paramount. You are responsible for developing and articulating your own ideas, so addressing how GenAI contributed to those ideas (as you would for any sources you use) is centrally important to your learning. Attribute GenAI-generated content with proper citations and avoid plagiarism. Additionally, consider the accuracy of information incorporated in your assignment and the ethical implications of using GenAI in educational contexts. You are responsible for ensuring that the information you submit based on a GenAI query does not contain misinformation, unethical content, or violate intellectual property laws. Submission of GenAI-generated content as your own work is considered a violation of Ohio State's [Academic Integrity](#) policy and [Code of Student Conduct](#) because the work is not your own. The use of unauthorized GenAI tools or failure to include all 5 required items (as listed above) or failure to provide complete content for the 5 required items (as listed above) will result in referral to the [Committee on Academic Misconduct](#). If it is suspected that you have used GenAI inappropriately on an assignment for this course, you will be asked to explain your process for completing the assignment in question.
 - **Privacy Considerations:** Students should familiarize themselves with the Terms of Use for the GenAI service they use, as well as the service's expectations around data privacy and use. Students should not share private or sensitive information about themselves or others with GenAI services. As indicated in Ohio State's February 2024 Security and Privacy Statement on Artificial Intelligence, "university community members should not enter any institutional data that is categorized above the S1 (public) level into generative AI tools, except when using the protected environment of Copilot, meaning that you logged in with your university credentials and see the green 'Protected' button in the upper right-hand corner. Even when using the protected version of Copilot, it is best practice to put only S1 or S2 (internal) institutional data into the tool. S3 (private) and S4 (restricted) data should not be entered into any AI platform."

If you have any questions about the above policy or what constitutes academic misconduct in this course, please contact me.

Other sources of information on academic misconduct (integrity) to which you can refer include:

- [Committee on Academic Misconduct \(go.osu.edu/coam\)](https://go.osu.edu/coam)
- [Ten Suggestions for Preserving Academic Integrity \(go.osu.edu/ten-suggestions\)](https://go.osu.edu/ten-suggestions)
- [Eight Cardinal Rules of Academic Integrity \(go.osu.edu/cardinal-rules\)](https://go.osu.edu/cardinal-rules)

Other Course Policies

Communication Guidelines

The following are our expectations for how we should communicate as a class. Above all, please remember to be respectful and thoughtful.

- **Writing style:** Although there is no need to participate in class discussions as if you were writing a research paper, you should remember to write using good grammar, spelling, and punctuation. A more conversational tone is fine for non-academic topics.
- **Tone and civility:** Let's maintain a supportive learning community where everyone feels safe and where people can disagree amicably. Remember that sarcasm doesn't always come across online. Instructors will provide specific guidance for discussions on controversial or personal topics.
- **Citing your sources:** When we have academic discussions, please cite your sources to support what you say. For the textbook or other course materials, list at least the title and page numbers. For online sources, include a link.
- **Backing up your work:** Consider composing your academic posts in a word processor, where you can save your work, and then copying into Canvas.
- **In-person sessions:** You may be called on to answer questions and share your thoughts about what is being discussed. You can always say “I pass” if you would rather not share.

Copyright for Instructional Materials

The materials used in connection with this course may be subject to copyright protection and are only for the use of students officially enrolled in the course for the educational purposes associated with the course. Copyright law must be considered before copying, retaining, or disseminating materials outside of the course.

Research Reading Topics (subject to change)

Why Ecology Needs Natural History

https://www.americanscientist.org/article/why-ecology-needs-natural-history?fbclid=IwAR19dgeAq4ldSMXt81yS6qL2vRdOGez7i4JixryBGktUpZthnEHht_Cc6M

“The failure to train a new generation of natural historians goes beyond academic interests and has practical and legal implications.”

“If universities no longer train students in field biology, we will no longer have the core knowledge needed to enforce policies. Furthermore, we will not have teachers who can pass on knowledge and enthusiasm that will get people outdoors with an eye for biological diversity.”

Ten simple rules for reading a scientific paper

<https://journals.plos.org/ploscompbiol/article?id=10.1371/journal.pcbi.1008032>

“Advice typically centers around two main tips: read actively and read often. However, active reading, or reading with an intent to understand, is both a learned skill and a level of effort. Although there is no one best way to do this, we present 10 simple rules, relevant to novices and seasoned scientists alike, to teach our strategy for active reading based on our experience as readers and as mentors of undergraduate and graduate researchers, medical students, fellows, and early career faculty.”

A set of principles and practical suggestions for equitable fieldwork in biology

<https://www.pnas.org/doi/epub/10.1073/pnas.2122667119>

“After reflecting on our own research programs, we propose four general principles to guide equitable, inclusive, ethical, and safe practices in field biology: be collaborative, be respectful, be legal, and be safe.”

Encyclopedia of Social Insects (general reference)

<https://link.springer.com/referencework/10.1007/978-3-030-28102-1#toc>

Building Your Foundation (articles will be provided):

Biodiversity and Conservation

“Currently the planet is inhabited by several million species in about 100 different phyla (Dirzo & Raven 2003). About 1.8 million have been described by scientists (Hilton-Taylor et al. 2008), but conservative estimates suggest that there are 5–15 million species alive today (May, 2000), since many groups of organisms remain poorly studied.”

Tropical Ecology (overview)

“The tropical climate experiences hot, humid weather and rainfall year-round. While many might associate the region solely with the rainforests, the tropics are home to a wide variety of ecosystems that boast a great wealth of biodiversity, from exotic animal species to seldom-found flora.”

Restoring Tropical Forests

“Tropical forest conservation efforts should first focus on conserving relatively intact tropical forests to maintain the ecosystem services (biodiversity, carbon sequestration, erosion control) provided by these forests, as restoring forest is not a substitute for conservation.”

Integrative Research Approach: Tinbergen’s Four Questions



“Nikolaas “Niko” Tinbergen (1907-1988) was a Dutch biologist and is considered one of the founders of modern ethology. In 1963, his seminal paper titled “On aims and methods of Ethology” sought to build a connection between the study of biology and the study of behavior. The resulting framework is known as Tinbergen’s Four Questions.”

Animal behavior: Sensory Ecology—What Functions of Living Systems Underlie Behavior?

“Sensory systems provide information from outside the animal that, when integrated, shape behavior. Internal senses, such as hunger or fear, affect behavioral priorities. Motivation describes how animals make choices among possible behaviors, based on the strength of internal needs and sensory inputs.”

Animal communication

“The ability to communicate effectively with other individuals plays a critical role in the lives of all animals.”

Pheromones

“Pheromones are chemical factors secreted by an organism that transmit information to and elicit a reaction from members of its species to mutual benefit.”

Alarm Communication

“Alarm behavior is highly distinct yet hard to quantify experimentally, especially if the intention is to deconstruct the various components of this behavior.”

Protective Traits: Venom

“Selection pressure has operated on insects to evolve means to avoid becoming dietary fare of large predators, including humans, and our own evolutionary history has imbued us with an aversion to pain or damage. Thus, insects, especially social insects, and large predators have over evolutionary time been engaged in a predator-prey arms contest that continues to this day.”

Life History Evolution

“Life history theory seeks to explain how natural selection and other evolutionary forces shape organisms to optimize their survival and reproduction in the face of ecological challenges posed by the environment (Stearns 1992, Roff 1992, Stearns 2000)”

Variable Life Histories

“A life history is a unique combination of developmental stages and demographic events comprising what an organism goes through from birth to death. At their most basic, life histories may be modeled as series of major life stages, each with its own probabilities of mortality and transition, and rates of fertility.”

Colony Foundation

“A proportion of social Hymenoptera have reduced risks [of colony founding] by evolving two very distinct adaptations: (i) in three large subfamilies of ants (80% of all species), solitary founding queens no longer forage, because the first larvae can develop on their mother’s internal metabolic reserves, or food obtained from mutualistic fungi or scale insects, or food obtained from parasitism of foreign ant colonies; (ii) in many species across all lineages, established colonies can split into daughter colonies, so that founding queens are helped by nestmate workers who feed and protect the brood.”

Measuring traits: Choice Behavior

“...before animals make choices they go through a decision-making process guided by their motivations and preferences. Presumably, this strategy is adaptive, insofar as being advantageous to the animal and favored by evolution via natural selection: Individuals that choose beneficial options, like eating the more nutritious food or resting at the safer nesting site, are also more likely to have offspring that are successful in reproduction and survival (Real 1991).”

Measuring traits: Resource Partitioning

“Similar species commonly use limiting resources in different ways. Such resource partitioning helps to explain how seemingly similar species can coexist in the same ecological community without one pushing the others to extinction through competition. Understanding resource partitioning among species may help us to predict how ongoing species declines will impact the functioning of ecosystems.”

Course Schedule (subject to change)

Before Departure Schedule

(TBD= to be determined)

Group meetings in May and June [dates not set, will be based on student availability]

(all meetings include time for questions regarding Costa Rica preparation)

~May ~3, 9–12 am, 104 Aronoff or on zoom [LINK](#)

- Introduction to field research system
- Tips for reading scientific literature and Zotero
- Exploring scientific literacy ([slides](#))
- Finalizing research questions so that we bring what we need

Readings for discussion: **Why Ecology Needs Natural History; Ten simple rules for reading a scientific paper**

~May ~15, 9–12 am, 422 Aronoff or on zoom [LINK](#)

- Group expectations contract (Rachelle)
- Team science: Vision statements (online collaboration)
- How to prepare for Costa Rica (packing, logbook etc.)
- Brief discussion of what makes a good research question (Rachelle)([slides](#))
- Get reading booklet for Costa Rica trip

~June 2 days TBD, 9–12am, Zoom/Teams [LINK](#)

- Jigsaw Discussion or broad topics
- iNaturalist
- Formalizing our vision statements (online collaboration)
- Deciding our research methods
- Mind-mapping activity to discuss links between course research question(s)

Reading for discussion: **A set of principles and practical suggestions for equitable fieldwork in biology**

What do the day-to-day activities look like?

Most days that we are in Costa Rica there will be large group activities in the mornings and evenings and small group activities during the day. Your time will be spent discussing readings, learning field technique, and independent research activities. This course does not require a computer but phones and/or small tablets are encouraged (take at your own risk). Therefore, you will be provided with readings before departure in a small booklet and in Canvas. Most articles are short and are on broad topics that should prompt curiosity and questions. They are not meant to



provide you with comprehensive knowledge of a topic, rather they are a starting point for your thinking and leaning.

Below is an example of how this course could be organized. Because we are still formulating ideas about our research questions, trainings and discussion topics might change.

Each morning, we will all leave for the field after breakfast by 7:30 am. Because it is the rainy season, it is important to get to the field early. If it is raining at breakfast, we may shift our schedule and work in the classroom. Topic discussions and chalk talks may shift if a full day in the field is not possible due to heavy rains. If we are in the field, we may need to pause an activity and wait for the rain to stop before continuing our research. During this time, we may discuss research progress or reading topics. Therefore, you will be expected to review all readings before departure and refresh your understanding in Costa Rica to ensure productive discussions.

You are also expected to read the La Selva website carefully, including general operation procedures [LINK] and the La Selva Emergency Manual [LINK]. Both can be found at:

<https://tropicalstudies.org/portfolio/la-selva-research-station/>

We may also periodically refer to the UC Field Research Manual [LINK] provided in Canvas

Two-Week Costa Rica Schedule

Jun	Morning/Day Activity	Daily Activity	Evening Activity
16	Students arrive	Students arrive	Welcome Dinner & Night Walk
17	<p>Training: Orientation (OTS led); Forest Safety</p> <p>Reading: Biodiversity and Conservation; Tropical Ecology (overview)</p>	Data collection and logbook practice; Field Sketching & Photography	Dinner Discussion: Check ins (e.g., heat, activity level, worries, questions, etc.)
18	<p>Training: Ant Collection and Leaf Litter Sifting</p> <p>Reading: Restoration; La Selva History</p>	Student-Led Research; iNaturalist practice	Dinner Discussion: Check ins; Rainforest Sounds Night Hike
19	<p>Training: Nest Mapping & Habitat Survey</p> <p>Reading: Resource Partitioning</p>	<p>Student-Led Research</p> <p>Rainy day alternative: Leaf Litter Sample Sorting</p>	Lecture: Guest Scientist (TBD) or Ant Evolution & Behavior (Adams)



Jun	Morning/Day Activity	Daily Activity	Evening Activity
20	<p><u>Training</u>: Foraging Behavior Experiment</p> <p><u>Reading</u>: Integrative Research: Four Questions, Sensory Ecology, Choice Behavior</p>	Student-Led Research	<p>Dinner Discussion: Logbook Checks (Peers and Profs)</p> <p>Frog Night Walk</p>
21	River Excursion (included but optional)	Student-Led Research	Lecture: Guest Scientist (TBD) or Ant Evolution & Behavior (Adams)
22	<p><u>Training</u>: Observing Symbiotic Relationships and Predator-Prey Interactions</p> <p><u>Reading</u>: Animal Communication: Pheromones, Alarm, Venom</p>	Student-Led Research	Dinner Discussion: Logbook Checks (Peers and Profs)
23	<p>Student-Led Research</p> <p><u>Reading</u>: Life History: Evolution, Variability</p>	Student-Led Research	<p>Dinner Discussion: Check ins and stories</p> <p>Lecture: Guest Scientist (TBD)</p>
24	<p>Student-Led Research</p> <p><u>Reading</u>: Life History: Colony Foundation</p>	Student-Led Research	Dinner Discussion: Logbook Checks (Peers and Profs)
25	<p>Student-Led Research</p> <p><u>Reading</u>: Project-focused topics (TBD by groups)</p>	Student-Led Research	Working in groups
26	<p>Student-Led Research</p> <p><u>Reading</u>: Project-focused topics (TBD by groups)</p>	Student-Led Research	Working in groups
27	Student-Led Research	Student-Led Data Processing	Working in groups



Jun	Morning/Day Activity	Daily Activity	Evening Activity
	Reading: Project-focused topics (TBD by groups)		
28	Research Synthesis; Logbook Scans; & Poster Writing	Poster/chalk talk Preparation	Game Night & Team Trivia (based on readings)
29	Student Research Presentations	Course Wrap-Up & Conservation Discussion	Closing Celebration
30	Departure & Farewell	-	-

Other course policies

Academic Misconduct

Academic integrity is essential to maintaining an environment that fosters excellence in teaching, research, and other educational and scholarly activities. Thus, The Ohio State University and the [Committee on Academic Misconduct](#) (COAM) expect that all students have read and understand the University's [Code of Student Conduct](#), and that all students will complete all academic and scholarly assignments with fairness and honesty. Students must recognize that failure to follow the rules and guidelines established in the University's Code of Student Conduct and this syllabus may constitute Academic Misconduct.

The Ohio State University's Code of Student Conduct (Section 3335-23-04) defines academic misconduct as: Any activity that tends to compromise the academic integrity of the University or subvert the educational process. Examples of academic misconduct include (but are not limited to) plagiarism, collusion (unauthorized collaboration), copying the work of another student, and possession of unauthorized materials during an examination. Ignorance of the University's Code of Student Conduct is never considered an excuse for academic misconduct, so please review the Code of Student Conduct and, specifically, the sections dealing with academic misconduct.

Generative artificial intelligence (GenAI) tools should not be used in the completion of course assignments unless an instructor for a given course specifically authorizes their use, and then only in the ways allowed by the instructor. Students are not to submit their work without acknowledging any word-for-word use and/or paraphrasing of writing, ideas, or other work that is not their own. These requirements apply to all students, whether undergraduate, graduate, and professional.

If an instructor suspects that a student has committed academic misconduct in this course, the instructor is obligated by University Rules to report those suspicions to the Committee on Academic Misconduct. If COAM determines that a student violated the University's Code of Student Conduct (i.e., committed academic misconduct), the sanctions for the misconduct could include a failing grade in the course and suspension or dismissal from the University.

If students have questions about the above policy or what constitutes academic misconduct in this course, they should contact the instructor.

Religious Accommodations

Ohio State has had a longstanding practice of making reasonable academic accommodations for students' religious beliefs and practices in accordance with applicable law. In 2023, Ohio State updated its practice to align with new state legislation. Under this new provision, students must be in early communication with their instructors regarding any known accommodation requests for religious beliefs and practices, providing notice of specific dates for which they request alternative accommodations within 14 days after the first instructional day of the course. Instructors in turn shall not question the sincerity of a student's religious or spiritual belief system in reviewing such requests and shall keep requests for accommodations confidential.

With sufficient notice, instructors will provide students with reasonable alternative accommodations with regard to examinations and other academic requirements with respect to students' sincerely held religious beliefs and practices by allowing up to three absences each semester for the student to attend or participate in religious activities. Examples of religious accommodations can include, but are not limited to, rescheduling an exam, altering the time of a student's presentation, allowing make-up assignments to substitute for missed class work, or flexibility in due dates or research responsibilities. If concerns arise about a requested accommodation, instructors are to consult their tenure initiating unit head for assistance.

A student's request for time off shall be provided if the student's sincerely held religious belief or practice severely affects the student's ability to take an exam or meet an academic requirement **and** the student has notified their instructor, in writing during the first 14 days after the course begins, of the date of each absence. Although students are required to provide notice within the first 14 days after a course begins, instructors are strongly encouraged to work with the student to provide a reasonable accommodation if a request is made outside the notice period. A student may not be penalized for an absence approved under this policy.

If students have questions or disputes related to academic accommodations, they should contact their course instructor, and then their department or college office. For questions or to report discrimination or harassment based on religion, individuals should contact the [Civil Rights Compliance Office](#).

Policy: [Religious Holidays, Holy Days and Observances](#)

General Disability Statement (with Accommodations for Illness)

The university strives to maintain a healthy and accessible environment to support student learning in and out of the classroom. If students anticipate or experience academic barriers based on a disability (including mental health and medical conditions, whether chronic or temporary), they should let their instructor know immediately so that they can privately discuss options. Students do not need to disclose specific information about a disability to faculty. To establish reasonable accommodations, students may be asked to register with Student Life Disability Services (see below for campus-specific contact information). After registration, students should make arrangements with their instructors as soon as possible to discuss your accommodations so that accommodations may be implemented in a timely fashion.

If students are ill and need to miss class, including if they are staying home and away from others while experiencing symptoms of viral infection or fever, they should let their instructor know immediately. In cases where illness interacts with an underlying medical condition, please consult with Student Life Disability Services to request reasonable

Your Mental Health

As a student you may experience a range of issues that can cause barriers to learning, such as strained relationships, increased anxiety, alcohol/drug problems, feeling down, difficulty concentrating and/or lack of motivation. These mental health concerns or stressful events may lead to diminished academic performance or reduce a student's ability to participate in daily activities. The Ohio State University offers services to assist you with addressing these and other concerns you may be experiencing. If you or someone you know are suffering from any of the aforementioned conditions, you can learn more about the broad range of confidential mental health services available on campus via the Office of Student Life's Counseling and Consultation Service (CCS) by visiting ccs.osu.edu or calling [614-292-5766](tel:614-292-5766). CCS is located on the 4th Floor of the Younkin Success Center and 10th Floor of Lincoln Tower. You can reach an on call counselor when CCS is closed at [614-292-5766](tel:614-292-5766) and 24 hour emergency help is also available 24/7 **by dialing 988 to reach the Suicide and Crisis Lifeline.**

Intellectual Diversity

Ohio State is committed to fostering a culture of open inquiry and intellectual diversity within the classroom. This course will cover a range of information and may include discussions or debates about controversial issues, beliefs, or policies. Any such discussions and debates are intended to support understanding of the approved curriculum and relevant course objectives rather than promote any specific point of view. Students will be assessed on principles applicable to the field of study and the content covered in the course. Preparing students for citizenship includes helping them develop critical thinking skills that will allow them to reach their own conclusions regarding complex or controversial matters.

Grievances and Solving Problems

According to University Policies, if you have a problem with this class, you should seek to resolve the grievance concerning a grade or academic practice by speaking first with the instructor or professor. Then, if necessary, take your case to the department chairperson, college dean or associate dean, and to the provost, in that order. Specific procedures are outlined in Faculty Rule 3335-8-23. Grievances against graduate, research, and teaching assistants should be submitted first to the supervising instructor, then to the chairperson of the assistant's department.

Creating an Environment Free from Harassment, Discrimination, and Sexual Misconduct

The Ohio State University is committed to building and maintaining a welcoming community. All Buckeyes have the right to be free from harassment, discrimination, and sexual misconduct. Ohio State does not discriminate on the basis of age, ancestry, color, disability, ethnicity, gender, gender identity or expression, genetic information, HIV/AIDS status, military status, national origin, pregnancy (childbirth, false pregnancy, termination of pregnancy, or recovery therefrom), race, religion, sex, sexual orientation, or protected veteran status, or any other bases under the law, in its activities, academic programs, admission, and employment. Members of the university community also have the right to be free from all forms of sexual misconduct: sexual harassment, sexual assault, relationship violence, stalking, and sexual exploitation.

To report harassment, discrimination, sexual misconduct, or retaliation and/or seek confidential and non-confidential resources and supportive measures, contact the Civil Rights Compliance Office (CRCO):

Online reporting form: <http://civilrights.osu.edu/>

Call 614-247-5838 or TTY 614-688-8605

civilrights@osu.edu

The university is committed to stopping sexual misconduct, preventing its recurrence, eliminating any hostile environment, and remedying its discriminatory effects. All university employees have reporting responsibilities to the Civil Rights Compliance Office to ensure the university can take appropriate action:

- All university employees, except those exempted by legal privilege of confidentiality or expressly identified as a confidential reporter, have an obligation to report incidents of sexual assault immediately.
- The following employees have an obligation to report all other forms of sexual misconduct as soon as practicable but at most within five workdays of becoming aware of such information: 1. Any human resource professional (HRP); 2. Anyone who supervises faculty, staff, students, or volunteers; 3. Chair/director; and 4. Faculty member.

Accessibility Accommodations for Students with Disabilities specific to this course

Engagement Expectations

Students in this program can expect a highly experiential, hands-on experience while in Costa Rica. In addition to the classroom experience, you will spend substantial program time in the field in tropical conditions, so care should be taken to prepare for heat, sun, and other possible extreme weather conditions. Activities onsite will likely include traveling long distances on both paved and unpaved paths, approximately 1.5-2 hours each way most days, while experiencing and conducting research in the natural environment of Costa Rica.

Conducting research in the tropical rainforests of Costa Rica presents several hazards that require preparation and caution. The university strives to maintain a healthy and accessible environment to support student learning in and out of the classroom. For example, the high heat and humidity can quickly lead to dehydration, heat exhaustion, or heat stroke if proper hydration and rest breaks are not maintained. Each morning, we will be walking for at least 30-90 minutes to our field site locations. This hike will include areas of rough terrain and hills. We will always hike with another person or in large groups and will take care to ensure that you and your peers are comfortable with the pace. At any point, you can ask the group to stop for yourself or others.

If you anticipate or experience academic barriers based on a disability (including mental health, chronic, or temporary medical conditions), please let me know immediately so that we can privately discuss options.

Shared facility: Students will stay in dormitory-style shared housing and meals are provided by La Selva Research Station. Laundry is done by staff and costs ~\$10/load. Pack enough clothes to maintain reasonable hygiene and extra clothes to wear in the field while your other sets are being washed. If you have any questions or concerns regarding accommodations, please notify Dr. Adams as soon as possible.

Microorganisms: The dense, wet environment fosters the growth of fungi and bacteria, increasing the risk of skin infections and other health issues. If you anticipate sensitivity or a reaction to microbes, make sure that you bring ointments, medications, and limit exposure.

Snakes: Researchers must remain vigilant for venomous snakes, such as the fer-de-lance (*Bothrops asper*), one of the most common and dangerous pit vipers in the region. These snakes are well-camouflaged among leaf litter and often remain motionless, making accidental encounters a serious risk. Wearing protective gear, such as high rubber boots and long pants, and carefully watching each step can significantly reduce the danger.

Other potential hazards: Avoid biting insects by covering your skin at all times (long pants, long sleeve shirts, hat, etc.). Sudden tropical storms are likely. Prepare to get wet and take shelter when possible. An umbrella is preferred rather than a rain jacket due to high heat. Expect rugged terrain and mud. Always wear tall rubber boots or hiking boots with snake guards. To prevent harm and injury, you must use combination of situational awareness, proper gear, and adherence to safety protocols. As a group we will look out for each other to ensure a successful and safe research experience.

You are also expected to read the La Selva website carefully, including general operation procedures [LINK] and the La Selva Emergency Manual [LINK]. These can also be found at: <https://tropicalstudies.org/portfolio/la-selva-research-station/>

We may also periodically refer to, read and discuss the UC Field Research Manual [LINK] provided in Canvas. [these links will be updated to the latest at time of course offering]

Requesting accommodations:

To establish reasonable accommodations, I may request that you register with Student Life Disability Services. After registration, make arrangements with me as soon as possible to discuss your accommodations so that they may be implemented in a timely fashion.

If you are ill and need to miss fieldwork, including if you are staying away from others while experiencing symptoms of a viral infection or fever, please let me know immediately through a WhatsApp text.

In cases where illness interacts with an underlying medical condition, please talk with me to request accommodations. You can also consult with Student Life Disability Services: slds@osu.edu; 614-292-3307; or slds.osu.edu.

Disability Services Contact Information

- Phone: [614-292-3307](tel:614-292-3307)
- Website: slds.osu.edu
- Email: slds@osu.edu
- In person: [Baker Hall 098, 113 W. 12th Avenue](#)

Group Research Portfolio & Flash Talk Assignment

Purpose

Students will collaborate in groups to develop a research portfolio that compiles organized research products and data. They will generate and analyze information related to their assigned topic and present their findings in a concise flash talk presentation. This assignment evaluates students' ability to analyze, interpret, and communicate data effectively.

Instructions and Resources

1. Group Research Portfolio (Written Component) – 60 points

Each group will compile a structured research portfolio that includes information about the following sections (see form below):

- **Background & Research Question (10 pts)**
 - Explanation of the group's topic and its importance in tropical ecology and/or ant biology.
 - A clearly defined research question that the group aims to explore.
- **Methods & Data Collection (10 pts)**
 - Overview of how the group gathered data.
 - Description of field or lab methods used to study their research question.
- **Data Organization & Analysis (15 pts)**
 - Presentation of collected data (tables, graphs, or figures).
 - Interpretation of the data in relation to the research question.
- **Results & Discussion (15 pts)**
 - Explanation of key findings and their ecological significance.
 - Discussion of how results connect to broader tropical ecology concepts.
- **Future Directions (10 pts)**
 - Suggestions for follow-up research or unanswered questions.
 - Potential real-world applications of their findings.

Groups should submit a well-organized digital portfolio with clear, labeled folders.

2. Flash Talk Presentation (Oral Component) – 40 points

Each group will deliver a 5-minute flash talk presentation summarizing their research. The talk should be engaging and concise, covering:

- **Introduction (5 pts)** – The research question and why it matters.
- **Methods & Data (10 pts)** – How data was gathered and key findings.
- **Analysis & Interpretation (10 pts)** – What the results mean.

- **Conclusion & Future Directions (10 pts)** – Takeaways and next steps in research.
- **Delivery & Clarity (5 pts)** – Engaging, well-structured, and clear communication.

Groups may use slides, visuals, or live demonstrations to enhance their presentation. Be creative in your approach. You are not expected to bring a computer to this field course therefore sketches on the chalk board or other visuals are encouraged.

Criteria for Success

Deliverables:

- **Research Portfolio Submission:** (Draft: 30th of June; Final draft: 15th of July)
- **Flash Talk Presentation:** (29th of June)

This assignment encourages critical thinking, teamwork, and scientific communication, helping students apply their knowledge in an interactive and meaningful way.

Research Portfolio & Flash Talk Submission Form

Group Name: _____

Group Members: _____

Expert Topic (brief): _____

Section 1: Background & Research Question (10 pts)

1.1 Describe your topic and why it is important in tropical ecology and/or ant biology.
(3-5 sentences)

1.2 State your research question.
(What specific question did your group investigate?)

Section 2: Methods & Data Collection (10 pts)

2.1 How did your group gather data?
(Describe your research process, field/lab methods, and literature review.)

2.2 What tools, techniques, or strategies were used?

Section 3: Data Organization & Analysis (15 pts)

3.1 Present your data. (Attach tables, graphs, or figures below or on a separate page, including a caption, and list them below.)

3.2 Explain what your data shows. (2-4 sentences)

Section 4: Results & Discussion (15 pts)

4.1 Summarize your key findings (concise statement).

4.2 How do your findings relate to tropical ecology and/or ant biology?

Section 5: Future Directions (10 pts)

5.1 What follow-up research questions would you explore next?

5.2 How could your findings be applied in the real world?

Flash Talk Presentation (40 pts)

Our group will deliver a 5-minute flash talk covering:

- ✓ Introduction (Research Question & Importance)
- ✓ Methods & Data Overview
- ✓ Analysis & Interpretation
- ✓ Conclusion & Future Directions
- ✓ Clear, Engaging Delivery

We will use the following visual aids:

Presentation Date: __29th June_____

Final Submission Checklist:

- ✓ Completed Research Portfolio (Sections 1-5)
- ✓ Data visualizations attached:_____
- ✓ Flash Talk prepared

Submission Date and Team Member Signatures: Date:_____

Discussion Assignment:

Jigsaw Activity on Tropical Ecology & Ants

Purpose

Students will collaborate in expert groups to learn about key topics in tropical ecology and ant biology, then share their knowledge in mixed groups. This jigsaw activity encourages teamwork, critical thinking, and interdisciplinary discussion about the ecological roles and adaptations of ants.

Instructions and Resources

Step 1: Expert Groups (Research & Discussion)

Students will be divided into four expert groups, each focusing on a specific topic. Each group will research and discuss their assigned topic using provided materials and notes.

1. **Tropical Ecology** – Overview of rainforest ecosystems, biodiversity, abiotic factors (climate, soil, rainfall), and ecological interactions that shape tropical communities.
 2. **Ant Behavior & Sensory Ecology** – How ants communicate, navigate, and detect environmental cues using chemical signals, tactile interactions, and vision.
 3. **Life History Trait Evolution** – How different ant species have evolved unique reproductive strategies, colony structures, and developmental pathways to survive in diverse habitats.
 4. **Ant-Insect Interactions** – The relationships between ants and other insects, including mutualisms (e.g., ants and aphids), competition, and predation.
-

Step 2: Jigsaw Groups (Sharing & Discussion)

After becoming "experts" on their topic, students will be reassigned into mixed jigsaw groups, where each member represents a different expert topic. Each student will take turns presenting their findings and leading a brief discussion.

Experts will ask their "students" the following questions as they relate to the field research being planned then will summarize the answers with their group members (see form below):

- What component of this topic do you find interesting and why?
 - What area would you like to learn more about and why?
 - Which research projects do you think relate to this topic?
-

Step 3: Whole-Class Reflection

After the jigsaw discussions, the class will reconvene to reflect on key questions the students formulated after their small group discussions. These questions will be directly associated with research projects.

Broad examples may include:

- How do ants contribute to the structure and function of tropical ecosystems?
- What sensory adaptations allow ants to thrive in their environment?
- How does life history evolution influence the success of different ant species?
- How do interactions with other insects shape ant behavior and ecological roles?

Specific examples may include:

- Why might *M. peetersi* colonies organize spatially in the tropical rainforest?
- What communication modalities should be considered when studying behavior?
- How does queen winglessness impact the life history of *M. peetersi*?
- How might *M. peetersi* compete for resources? How can we study this?

Criteria for Success

Deliverable: Student groups will collaborate and submit a one-page reflection summarizing their key takeaways and posing a follow-up question they would like to explore further.

Assessment: Participation in discussions and completion of the reflection paper.

Topics

Tropical Ecology

Biodiversity and Conservation

“Currently the planet is inhabited by several million species in about 100 different phyla (Dirzo & Raven 2003). About 1.8 million have been described by scientists (Hilton-Taylor et al. 2008), but conservative estimates suggest that there are 5–15 million species alive today (May, 2000), since many groups of organisms remain poorly studied.”

Tropical Ecology (overview)

“The tropical climate experiences hot, humid weather and rainfall year-round. While many might associate the region solely with the rainforests, the tropics are home to a wide variety of ecosystems that boast a great wealth of biodiversity, from exotic animal species to seldom-found flora.”

Restoring Tropical Forests

“Tropical forest conservation efforts should first focus on conserving relatively intact tropical forests to maintain the ecosystem services (biodiversity, carbon sequestration, erosion control) provided by these forests, as restoring forest is not a substitute for conservation.”

Ant Behavior & Sensory Ecology

Integrative Research Approach: Tinbergen’s Four Questions

“[Nikolaas “Niko” Tinbergen](#) (1907-1988) was a Dutch biologist and is considered one of the founders of modern [ethology](#). In 1963, his seminal paper titled “[On aims and methods of Ethology](#)” sought to build a connection between the study of biology and the study of behavior. The resulting framework is known as Tinbergen’s Four Questions.”

Animal behavior: Sensory Ecology—What Functions of Living Systems Underlie Behavior?

“Sensory systems provide information from outside the animal that, when integrated, shape behavior. Internal senses, such as hunger or fear, affect behavioral priorities. Motivation describes how animals make choices among possible behaviors, based on the strength of internal needs and sensory inputs.”

Animal communication

“The ability to communicate effectively with other individuals plays a critical role in the lives of all animals.”

Pheromones

“Pheromones are chemical factors secreted by an organism that transmit information to and elicit a reaction from members of its species to mutual benefit.”

Alarm Communication

“Alarm behavior is highly distinct yet hard to quantify experimentally, especially if the intention is to deconstruct the various components of this behavior.”

Protective Traits: Venom

“Selection pressure has operated on insects to evolve means to avoid becoming dietary fare of large predators, including humans, and our own evolutionary history has imbued us with an aversion to pain or damage. Thus, insects, especially social insects, and large predators have over evolutionary time been engaged in a predator-prey arms contest that continues to this day.”

Life History Trait Evolution

Life History Evolution

“Life history theory seeks to explain how natural selection and other evolutionary forces shape organisms to optimize their survival and reproduction in the face of ecological challenges posed by the environment (Stearns 1992, Roff 1992, Stearns 2000)”

Variable Life Histories

“A life history is a unique combination of developmental stages and demographic events comprising what an organism goes through from birth to death. At their most basic, life histories may be modeled as series of major life stages, each with its own probabilities of mortality and transition, and rates of fertility.”

Colony Foundation

“A proportion of social Hymenoptera have reduced risks [of colony founding] by evolving two very distinct adaptations: (i) in three large subfamilies of ants (80% of all species), solitary founding queens no longer forage, because the first larvae can develop on their mother’s internal metabolic reserves, or food obtained from mutualistic fungi or scale insects, or food obtained from parasitism of foreign ant colonies; (ii) in many species across all lineages, established colonies can split into daughter colonies, so that founding queens are helped by nestmate workers who feed and protect the brood.”

Measuring traits: Choice Behavior

“...before animals make choices they go through a decision-making process guided by their motivations and preferences. Presumably, this strategy is adaptive, insofar as being advantageous to the animal and favored by evolution via natural selection: Individuals that choose beneficial options, like eating the more nutritious food or resting at the safer nesting site, are also more likely to have offspring that are successful in reproduction and survival (Real 1991).”

Ant-Insect Interactions

Measuring traits: Resource Partitioning

“Similar species commonly use limiting resources in different ways. Such resource partitioning helps to explain how seemingly similar species can coexist in the same ecological community without one pushing the others to extinction through competition. Understanding resource partitioning among species may help us to predict how ongoing species declines will impact the functioning of ecosystems.”

Jigsaw Expert Presentation & Discussion Form

Expert Topic: _____

Expert Name: _____

Jigsaw Group Members: _____

Step 1: Expert Summary

Briefly summarize your expert topic for your group (3-5 sentences).

Step 2: Group Discussion Questions

1. What component of this topic do you find interesting and why?
(Summarize responses from group members.)

2. What area would you like to learn more about and why?
(Summarize responses from group members.)

**3. Which research projects do you think relate to this topic?
(List and describe any relevant research ideas discussed.)**

Step 3: Reflection

As an expert, what insights did you gain from your group's discussion?

Did any new questions or ideas emerge that could be useful for field research?

This form ensures that “experts” effectively communicate their topic while also collecting insights from their peers to inform the group’s research planning.

Individual Logbook Scans

Purpose

Writing field logbooks can be creative and personal but there are elements that are important in order for them to be useful in science.

How does it fit within the course? In this course, you are building skills used in science but also in the public sector. Writing a scientific logbook is in many ways similar to writing a report for a technical job or a comprehensive medical chart. It must have accuracy and precision, clear and objective communication, chronological order, and ethical accountability. A well written logbook will serve as a foundation for making decisions, proposing hypotheses, and creative discovery. Understanding the importance of these writing skills is crucial for ensuring transparency but also is helping you develop a sense of self as a member of society impacted by scientific discovery.

There are also elements of creativity and personality of the logbook author that should not be ignored. While we always should strive for scientific rigor, we also want to tap into our creative side. Express your thoughts and experiences through journaling, drawing, poetry, photography, etc. Take moments in the field to sit and reflect on your experiences. Recording your thoughts will help solidify your memories and prompt ideas or understanding that can only happen when you are relaxed and in the moment. Field observations are the first step to the scientific process. Shaping your thinking with background reading will come later, for now, just get curious!

Instructions and Resources

Consider the following:

- **Robustness of observations.** At the end of the day when looking back at a record of observations, we never regret the extra detail. Quantity and quality both matter here.
 - *Have you included observations or focused only on the required metadata?*
- **Approach to observations.** There is no right or wrong approach but consider the various possibilities and their effectiveness. You may have written descriptions, sketches, creative responses to observations such as poems, etc.
 - *Reflect on the approach you took, are your notes effective at representing field observations?*
- **Required metadata.** Make sure your logbook has all appropriate elements and confirm collections will be publication-quality. If you have forgotten something, just make a note in your logbook that you did, NEVER make up data or erase and rewrite (unless transcribing to another logbook)!
 - *Does each collection have the required metadata associated and is it in an organized format that would make it easy to find later?*

- **Evidence of scientific thinking.** The field logbook is by no means a formal research document, but it is a tool to help us think like scientists. Spend some time writing on the last page for the day. Remind yourself later what questions have come up for you.
 - *Did you start framing questions and considering hypotheses? What about ideas for experiments or future studies?*
- **Depth of reflective thinking.** A component of the field logbook is the reflective writing exercise. These are an opportunity for meta-cognition (thinking about thinking).
 - *Can you make some connections across field observations? Have you provided evidence to support your developing ideas from simple, amorphous themes to more clearly developed concepts?*

Criteria for Success

Deliverable: You will upload a pdf of all of your logbook pages in a single file.

Assessment: The following criteria are needed to produce a quality logbook. Robust observations that include creative and effective communication forms (drawings, photos, etc.), required metadata, and evidence of scientific and reflective thinking as it relates to your day or research project. We will have logbook exchange activities to support your development of this task.