

Fungal Diversity in the Clemson Experimental Forest

Julia Kerrigan, Dept. Entomology, Soils, and Plant Sciences
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Fungi are an integral part of forest ecosystems. Many fungal species are saprobic, recycling nutrients by decomposing dead woody tissues, leaves, and other organic matter into simple compounds used by other organisms in the ecosystem. Fungi may also be mycorrhizal, establishing a mutually beneficial association with plants in which the plant benefits from the efficient uptake of mineral nutrients and water, while the fungus obtains excess vitamins and sugars produced by the plant. Neither the plant nor the fungus can survive without the other. About 90% of the higher plants have some type of mycorrhizal relationship. Forest-associated fungi can also be pathogenic on plants or animals, important constituents of the diets of small mammals and insects, or foods enjoyed by humans.

The proposed Creative Inquiry project is a survey to document fungal species, beginning with the macrofungi, in the Clemson Experimental Forest. Macrofungi are distinguished as forming fruiting bodies that are visible to the naked eye, such as mushrooms, morels, puffballs, and shelf fungi. Like most fungi, the major part of these organisms consists of a mass of thin, microscopic threads, collectively termed mycelium (plural mycelia), which grows in a substrate adjacent to the fruiting structure. Because fungi are an indispensable component of the forest ecosystem, information on which species are present and the specific role that they play is necessary for better understanding and management of our forests. Currently, no species list of fungi has been generated for the Clemson Experimental Forest. Potentially thousands of fungal species are present. This project would be a starting point for documenting the fungal diversity in the Forest and an important addition to the preexisting species lists of flora and fauna.

Macrofungi will be sampled more intensively because of their relative ease in handling and identification. Cryptic fungi, microfungi, and fungi that require specific conditions for isolation will be investigated on a limited basis, primarily to introduce students to these organisms and the techniques to find and identify them. Study sites will be selected based on forest community types, with preference to sites where other surveys are currently being or have been conducted. Different fungi fruit at different times of the year, so continued sampling is necessary for a thorough survey. Samples will be described, photographed, and identified. For specimen identifications that are uncertain, DNA sequence analysis will be performed for molecular identification. Voucher specimens will be dried for long-term storage and deposited in the herbarium at the Bob and Betsy Cambell Museum of Natural History.

The mechanism for providing students with course credit for participation

Students can receive course credit, 1-3 credits a term, through BIOSCI 494 or F N R 470 Creative Inquiry. Requirements to earn course credit are mentioned below.

Expected student activities over four or five semesters

Field trips to collect fungal specimens (1-2 per month) will be done as a group. Research plots will be set up in a variety of different forest community types. A weekly one-hour meeting will be held to teach students about the topics and techniques listed below in the learning outcomes section and

to discuss project progress. Students will work on their projects independently, during time periods when I will be available to provide assistance. Project topics will be selected by the students, who may choose to focus on fungi in a particular forest community type, a particular ecological association (e.g. plant pathogens), or a specific taxonomic group of fungi. Students will be expected to regularly update their ePortfolios and to write-up and present their results.

Anticipated student learning outcomes

- Learn about different types, ecologically and morphologically, of fungi and gain an understanding of their role in forest ecosystems.
- Know how to identify fungi using dichotomous, synoptic, and web-based keys; this knowledge could be applied to the identification of different types of organisms in addition to fungi.
- Learn basic principles and tools of DNA sequencing, including DNA extraction, amplification, and sequence alignment using NIH's database of all publicly available DNA sequences (GenBank[®]).
- Know how to effectively collect, catalog, photograph, and preserve fungal specimens and deposit voucher specimens into Clemson University's herbarium.
- Gain an understanding in experimental design, sampling methodologies, results preparation, and project presentations.

Use of Blackboard ePortfolios for documentation of student learning

Students will post information about their projects, including a description of their project objectives and methods, in their electronic portfolio. Throughout their Creative Inquiry, students will be required to update their portfolios with research progress, such as species identifications, photographs, and descriptions. Students will also be encouraged to present their results at the SC Academy of Science or other regional scientific meetings as posters or oral presentations, which will be placed in the student's electronic portfolio.