DEAD WOOD IN UNDERGRADUATE RESEARCH, OUTREACH AND CITIZEN SCIENCE

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WHY INVOLVE NON-EXPERTS IN DEAD WOOD RESEARCH?

- **Good for students:**
  - Unique skill set
  - Competitiveness when applying for colleges, graduate schools (especially if there is a published paper)

- **Good for professors:**
  - Career advancement
  - Publications
  - NSF (and other foundations) broader impact

- **Good for society:**
  - Influx of new fresh people in dead wood research
  - More people care about biodiversity, ecology, nature conservation

UNDERGRADUATE RESEARCH

HOW TO INCLUDE UNDERGRADS?

- **Less administrative support:**
  - Develop exercises and class activities for the courses you teach

- **More administrative support:**
  - Develop and teach a CURE: Course-based Undergraduate Research Experience
  - Work with students via Independent Research courses

Both may result in publications: open education resources, teaching modules, educational research

EXERCISES AND CLASS ACTIVITIES EXAMPLES

- **Biochemistry Laboratory course:**
  - A two-week lab project sequence plus home assignment on DNA barcoding of fungi
  - Includes intro into dead wood fungi, DNA isolation, PCR, electrophoresis, Sanger sequencing and BLAST search. Students submit lab report in a form of research paper
  - Covers necessary skills for the biochemistry course and introduces dead wood fungi

- **Publications:**
  - Shumskaya, M. (2024). DNA barcoding for an undergraduate class. In: DNA Barcoding. Methods in Molecular Biology (p. 537-550). Humana, USA.
  - Suarez Casanova, V. M.; Shumskaya, M. (2021) Exploring DNA in Biochemistry Lab Courses: DNA Barcoding and Phylogenetic Analysis. Biochemistry and Molecular Biology Education, 49(5): 789-799.
  - Shumskaya M., Mishra S., Lorentzen L. (2020) Online Low Stakes Assignments to Support Scientific Lab Report Writing in Introductory Science Courses. Journal of Microbiology and Biology Education. *21* (3), 21.3.73.

EXERCISES AND CLASS ACTIVITIES EXAMPLES

- **Bioinformatics course:**
  - A two-week assignment on introduction to R and statistical methods
  - A dataset from our research was used: fungi occurrence across New Jersey state

- **Publications:**
  - **GBIF dataset:** Shumskaya M., Zambell C., Mishra S., Bell E., Blue S., Yearwood-Marut J., Marut W., Vindas-Cruz A., Jennings A., Hylton N., Burghardt J. (2019). Survey of saproxylic fungi across parks of New Jersey. Kean University. GBIF Occurrence dataset https://doi.org/10.15468/ngpb5m
  - **Article:** Niepielko, M. G.; Shumskaya, M. (2021) Early Requirement for Bioinformatics in Undergraduate Biology Curricula. Frontiers in Bioinformatics, *1*, 12.
  - **Open Education Resource**: Shumskaya, M., Zambell, C. (2019). NMDS to Study Dead Wood Fungi Communities in Parks of New Jersey. NEON Faculty Mentoring Network, QUBES Educational Resources. doi:10.25334/A2ME-QH70. https://qubeshub.org/qubesresources/publications/1367/about?v=1

CURE AND INDEPENDENT RESEARCH EXAMPLES

- **Research Experience in Biology: an undergraduate course for 2 credits**
  - Students concentrate on the current research agenda of the lab
  - Collect samples; work with DNA (isolation, purification, PCR, electrophoresis); prepare samples for Sanger and NGS sequencing; analyze data; write reports and papers

- **Publications:**
  - **Data paper:** Shumskaya, M., Lim, J., Apgar, S., Gayathri, M. S., Inoa, A., & Schigel, D. (2025). Progression of saproxylic fungal communities in fine woody debris in boreal forests of Oulanka, Finland, assessed by DNA metabarcoding. Biodiversity Data Journal, 13, e1555520.

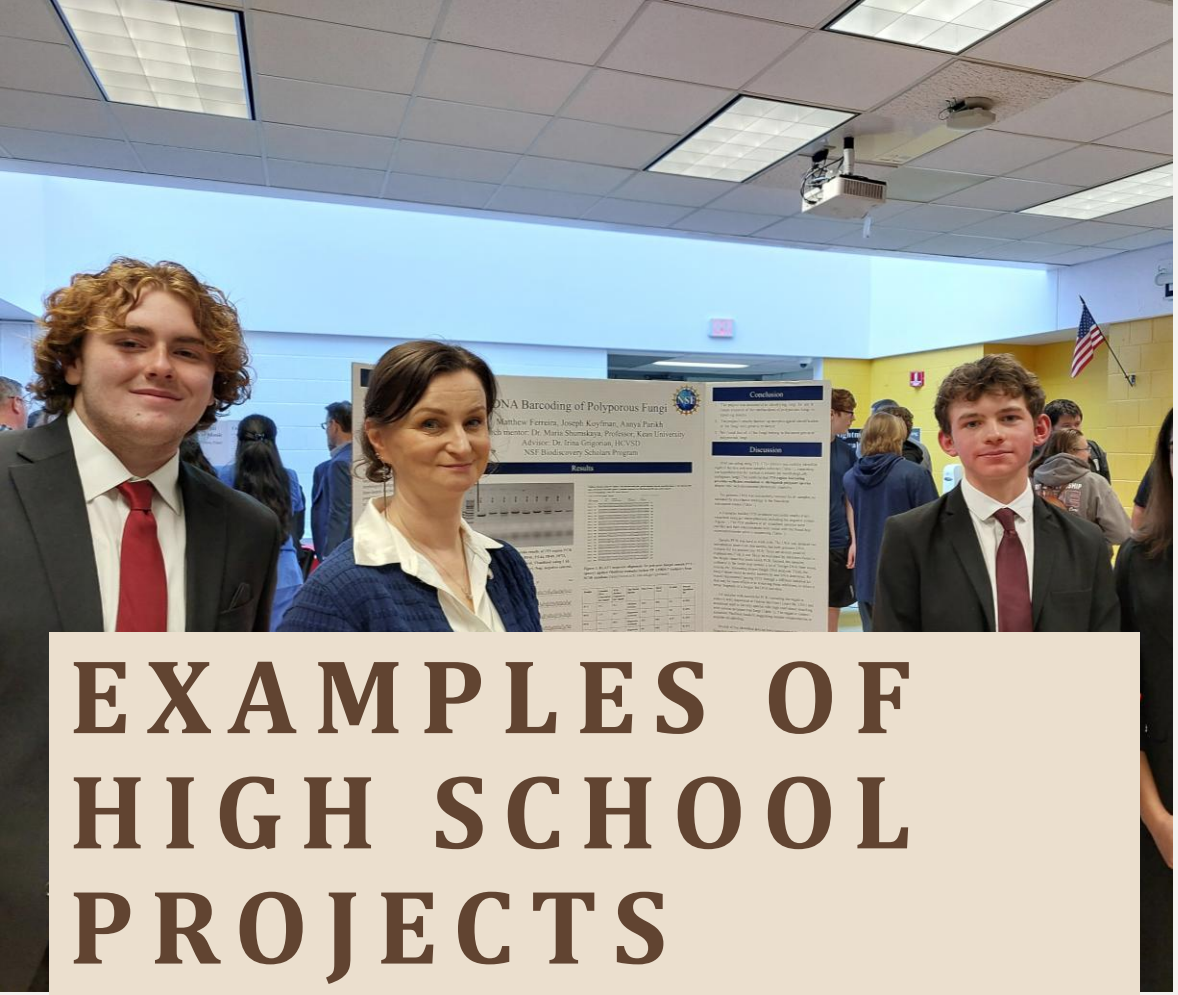
  - **GBIF dataset:** Shumskaya, M., Lim, J., Saarinen, P., Apgar, S., Hoyte, B., Nunez, M., Gayathri, M. S., Vengine, L., Salib, C., Seidle, M., Nguen T., Twdroos J., Luna A., Herrera-Juarez J. & Inoa, A. (2024). Saproxylic fungi of fine woody debris studied by metabarcoding-based MycoPins method in Oulanka, Finland, 2022-2023. Version 1.6. Kean University. GBIF Sampling event dataset https://doi.org/10.15468/yfemwn

OUTREACH

OUTREACH OPPORTUNITIES

- **Work well if supported by internal or external funding (e.g. NSF):**
  - High school after school programs
  - High school summer programs

- **Work well if you have strong community ties:**
  - Local groups of fungi enthusiasts
  - Biodiversity, sustainability, conservation initiatives



EXAMPLES OF HIGH SCHOOL PROJECTS

- **NSF BioDiscovery Scholars Program**
  - Supported as a part of NSF grant, broader impact
  - We work with 6 high school students each academic year
  - Fall: preparation stage (lectures, research project development)
  - Spring: students come to Kean U lab and work with DNA barcoding
- **Publication by high school students: submitted!**
  - International Journal of High School Research
- **Kean U offers a summer program for high school students, 2 or 4 weeks**
  - Group Summer Scholars Research Program (GSSRP)

EXAMPLES OF LOCAL COMMUNITY PROJECTS: CITIZEN SCIENCE

- **New Jersey Mycological Association** www.njmyco.org
  - They organize forays and fests for public
  - We attended the events, made some connections and brought the dead wood fungi agenda
- **Publications**:
  - **Data paper**: Shumskaya, M., Filippova, N., Lorentzen, L., Blue, S., Andrew, C., & Lorusso, N. (2023). Citizen science helps in the study of fungal diversity in New Jersey. Scientific Data, 10(1), 1–10.
  - **GBIF dataset**: Shumskaya M, Safonov I, Burghardt J, Burghardt N, Smithson J, Patino M, Barg J, Richards J, Grobman M, Broderick E, Patterson P, Smullen D, Bierman S, Giannotti K, Hugerich L, Hugerich P, Itagaki K, Kelly R, Tomat V, Karvois A, McClary S, Michleski M, Niciporciucas M, Wise B, Zeme E, Lorusso N (2022). Fungi of parks, forests and reserves of New Jersey (2007-2019). Version 1.2. Kean University. Sampling event dataset https://doi.org/10.15468/vereeh

OPEN DISCUSSION