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ESA Position Statement on the Importance of Entomological Collections

First Approved on January 11, 2016
Redrafted December 9, 2019
Valid through December 9, 2023

The Entomological Society of America (ESA) recognizes the value of entomological collections and the staff who maintain them. Collections are a rich source of data for modern research and an irreplaceable historical reference for science. They represent an archive of the natural world, uniting and preserving representative samples of increasingly fragmented and threatened biodiversity, and can serve to predict the spread of invasive species globally. It is vitally important that we implement protections for these irreplaceable resources.

Of the estimated 3 billion specimens housed in biological collections worldwide, approximately 500 million are preserved in U.S. and Canadian entomological collections located in museums, government agencies, and universities, as well as in private collections. The costs of preparing, curating, maintaining, and providing access to these collections are relatively low with a high return on investment for the sciences and human and environmental health.

Benefits of Entomological Collections

- **Collections are a rich resource for research and an essential reference** for all scientific disciplines, providing a basic vocabulary (taxonomy) and organizational system (classification) to effectively communicate about biology across geopolitical, cultural, and language barriers. They represent a vast library of accumulated scientific knowledge about the natural world, organized in a systematic manner that allows for retrieval, study, and education. Preserved collections represent potential samples for future research to study using new analytical methods and technologies, allowing us to study them in ways not yet conceived. Increased digitization efforts are making specimens and their associated data from collections globally accessible. Modern collections include tissue and DNA libraries (*e.g.*, Global Genome Initiative, Barcode of Life), providing additional avenues for research but requiring new expertise as well. Live research collections (*e.g.*, the *Drosophila* Species Stock Center) provide invaluable materials to many other fields such as genetics, medicine, ecology, cellular and developmental biology, physiology, and neurobiology.

- **Collections offer a lens into the past, a snapshot of the present, and a means for predicting the future**, particularly regarding changes to planetary biodiversity and how these changes continue in response to global shifts in climate and land use. The size,

scope, and breadth of entomological collections provide a wealth of data for answering important biological and ecological questions at environmental and evolutionary scales. Collections accumulated over centuries allow for discovery of patterns caused by climate change, biological invasions, habitat modification, etc. Historical specimens can also be tested for the presence of natural and non-natural environmental factors that might have changed over time. These data are also critical in modeling agricultural pests, invasive species, and health-related issues surrounding insect vector distributions in a changing climate. Entomological collections serve as repositories for type specimens (specimens used to describe new species) and voucher specimens (specimens deposited as a record of what species were involved in any particular study) from all entomological scientific endeavors, enabling confirmation and validation of previous work (reproducibility being one of the basic tenets of science).

- **Rapid identification of costly invasive pests that affect agriculture, forestry, and human and animal health**, which can arrive from anywhere in the world, is only achievable with access to a global reference collection for comparison, as is determination of their potential biological control agents. Invasive insect and mite pests can have tremendous economic impacts (estimated at nearly $33 billion annually in the U.S. due to crop losses and mitigation costs) and profound ecological effects across large parts of the country. Spotted Lanternfly, Emerald Ash Borer, and Asian longhorn tick are recent high-profile examples of invasive pests with high potential to negatively impact U.S. agricultural, forestry, and human health interests, respectively. Land-grant university personnel and other collections managers train the next generation of entomologists and provide diagnostic services, yet they face constant pressure to justify the resources and space to maintain these collections and trained personnel who are vital to performing these functions.

- **Exhibit collections** are critical for raising public awareness of biodiversity and harmful invasive species. Natural history collections engage and inspire by helping people discover direct connections between themselves and the natural world and recognize the ecological importance of arthropods. They also provide opportunities to participate in generating new data as citizen scientists, often in collaboration with larger projects. By promoting public engagement, natural history collections are helping to build a scientifically literate society. Relatedly, living exhibit collections function as an important resource for the conservation and recovery of endangered and threatened species such as the Lord Howe Island Stick insect, brought back from the brink of extinction thanks to rearing efforts at the Melbourne Zoo.

Challenges

Collections staff reductions and an insufficient number of current and future taxonomists trained in collections management has led to delays in mission-critical functions particularly in the areas of agriculture, human and veterinary health, conservation, and biodiversity. The unfortunate results of system-wide staff attrition are reduced access for research, longer loan processing times, delayed response to inquiries, loss of diagnostic services, and closing of selected parts or entire collections when staff are not available to support them.

Natural history collections are not static cabinets of curiosities; instead, collections are dynamic centers of research, generating new data to inform us about the natural world and how it is changing. They continue to grow and evolve as curatorial expertise changes over time, as new questions arise, as new methods are developed to address those questions, and as opportunities to explore previously understudied areas improve, so does our understanding of our planet's biodiversity.

Recommendations

ESA strongly advocates for new or revised policies and increased funding that will result in:

- employment of additional well-trained collections staff to support existing collections;
- more opportunities for training in collections management for new and existing collections staff;
- support to improve facilities and infrastructure to maintain collections and capitalize on opportunities for expansion as needs and expertise change;
- the development of new analytical methods and technological advances that further our ability to gain new knowledge through the study of specimens housed in collections;
- improved funding for resources that result in greater physical and virtual accessibility of collections and the data contained therein; and
- increased public awareness regarding the importance of collections to science and society as a whole and more opportunities to engage the public through citizen science initiatives.

For a list of useful references pertaining to the importance of collections, visit http://www.entsoc.org/scipol/background-entomological-collections.

ESA is the largest organization in the world serving the professional and scientific needs of entomologists and people in related disciplines. ESA today has more than 7,000 members affiliated with educational institutions, health agencies, private industry, and government. Members, many of whom utilize collections directly or indirectly but all of whom understand their importance, include researchers, teachers, extension educators, administrators, marketing representatives, research technicians, consultants, students, and hobbyists. Headquartered in Annapolis, Maryland, the Society stands ready as a non-partisan scientific and educational resource for all arthropod-related topics. For more information, visit www.entsoc.org.