Developing Electronic-nose Technologies for Investigations of WNS-susceptible Bat Species – Initial Study Results and Applications

A. Dan Wilson[1], Anna C. Doty[2], Lisa B. Forse[1], and Thomas S. Risch[2]

1-U.S. Forest Service, Southern Research Station, Stoneville, MS; 2- Department of Biological Sciences, Arkansas State University, Jonesboro, AR.

Disease-suppression strategies are much more effective when diseases are detected at early stages, long before symptoms and signs develop. Relatively new disease-detection tools, electronic-nose (e-nose) devices, have been used successfully in the veterinary, agricultural and biomedical fields. E-nose instruments utilize multi-sensor arrays capable of detecting gaseous mixtures containing volatile organic compounds (VOCs) within air samples. Unique complex mixtures of VOCs, released by microbial pathogens and associated diseases, may be detected collectively as an aroma signature (derived from e-nose sensor array responses), allowing early disease detection. We are developing new e-nose applications for the rapid, relatively inexpensive, and noninvasive early detection of White-nose Syndrome (WNS) in bats to facilitate early applications of disease-control measures in hibernacula soon after introduction. Initial research required development of e-nose reference libraries containing aroma-signatures of the WNS-pathogen, *Pseudogymnoascus destructans* (Pd), and healthy bat species with distinct and unique e-nose smellprint patterns. Headspace volatiles derived from Pd were significantly different from those of other genetically-related *Pseudogymnoascus* species. Whole-bat (body + breath) air samples were collected and analyzed from healthy individuals of eight bat species, caught during summer (non-torpor) periods outside of cave hibernacula, to establish aroma signature patterns for both portable and laboratory e-noses. Similar samples were collected in the close vicinity of healthy bats in torpor during winter within hibernacula. Results from principal component analysis (PCA) and smellprint signatures (VOC-profiles) indicated that all eight bat species have unique, distinguishable species-specific VOC aroma profiles. Potential applications of this research, once completed, will likely include capabilities of identifying bat species that are morphologically similar, providing new WNS disease-monitoring tools within hibernacula which are useful for non-invasively determining the health status of individual bats and/or bat clusters within caves, and spatially mapping and monitoring WNS-disease progression over time; all useful for determining the most effective timing and locations for implementations of WNS disease-suppression activities.

Presenter Bio: Dr. Wilson is head research pathologist at the Southern Research Station's Center for Bottomland Hardwoods Research (CBHR). He has 28-years of research experience developing electronic-nose (e-nose) technologies and applications for the agricultural, forestry, veterinary, and biomedical fields, particularly new methods and tools for non-invasive early detection of diseases in plants (trees), wildlife (mammals), and humans.