AUBURN UNIVERSITY- FOREST HEALTH COOPERATIVE

FY 2024 ACCOMPLISHMENTS

As presented to the Forest Health Cooperative Advisory Committee

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AUBURN UNIVERSITY - FOREST HEALTH COOPERATIVE

FY 2024 WORK PLAN

GOAL A: RESEARCH

Objective 1. Identify research projects

Mitigating Needle Blight: A growing Economic Threat to Pine Forests – USFS – increase by $94,800 for salary and travel of 2 undergraduate students. Year 1

- ***Accomplishments: Funded by USFS***

United Against Brown Spot Needle Blight: Collaborative Strategies for Protecting Southeastern Loblolly Pine Forests – USFS for travel, supplies, graduate students $498,080 – Joint with Mississippi State University (Dr. John Riggins) *Year 1

- ***Accomplishments: Funded by USFS***

Mitigating Needle Blight: A growing Economic Threat to Pine Forests – Senate Appropriations – Proposal requested by Senator Shelby's office. $3,000,000 ($2,100,000 to Auburn). *Year 2

- ***Accomplishments: Funded by USFS (Senate Appropriations)***

Sudden Oak Death (*Phytophthora ramorum*) Detection Survey (Stream Sampling) in AL and MS – FHM, USFS for all travel, supplies and laboratory technician. *Year 14

- ***Accomplishments: Refunded by USFS Forest Health Monitoring grant***

Wood chemistry and disease resistance – CFWE, Forest Products Development Center. *Year 13

- ***Accomplishments: Refunded by Forest Products Development Center***

Pinus related diseases and molecular aspects - Collaboration between SFWS and FABI – University of Pretoria South Africa for travel and supplies and a graduate student stipend at UP. *Year 12

- ***Accomplishments: Funded by CFWE and FABI***

Objective 2. Recruit graduate students

Three graduate students were hired in respect to the Senate Appropriations Grant through the USFS as follows: (1) Component 1 – MS student Emmanuel Nyarko; Component 2 – PhD student Jaden King and PhD student Sharmin Toa; Component 3 – PhD student Swati Singh; Component 4 – PhD student Gabriel Sylva and PhD student Temitope Folorunso.

Two graduate students were hired under the "Wood Chemistry and Disease Resistance" joint project with the Forest Products Development Center. Christian Caicedo working on a NIR project that compliments the Senate Appropriations Grant and Laura Neito working on decay fungi.

Objective 3. Initiate research projects: Determine location, cooperators, and set up research plots dependent upon projects chosen by the membership.

Mitigating Needle Blight: A growing Economic Threat to Pine Forests

- ***Accomplishments:*** A total of 14 forest health monitoring plots have been established in Alabama at two sites: South - Stallworth Property and Longleaf property in Chatom, Washington County, AL, and North - Osco Forest on Glover Property, Cullman AL. in year 1, and there were 8 more established on National Forest land (CNF-2, TNF-3, BNF-3) in 2024. *Component 1:* As of now, 580 trees have been sampled and processed for media plating sporulation chambers and DNA extraction for PCR. The sample processing involves surface sterilization and subsequent plating onto four different media types: MEA, PDA, CMA and PNA. Currently, MEA is the best media for recovering *L. acicola* conidia. The different fungi cultures obtained from plated needles are sub-cultured and examined microscopically. The shapes of conidia seen under the microscope are noted and compared with a manual of fungal structures described by Barnett and Hunter (1972). So far, the predominant fungi identified are *Pestalotiopsis, Alternaria, Hendersonia, Cladosporium* and a few *Lecanosticta acicola.* The second objective of this component is to assess the susceptibility of different loblolly pine seedlings to *Lecanosticta acicola*. The experiment is being conducted in Osko Forest, and at the Atmospheric Deposition Site of Auburn University. Seedlings of seventeen different families of *Pinus taeda* were obtained from IFCO, Westervelt, and Aborgen in January 2024. Seedlings were deployed and monthly measurements are being taken. *Component 2 (Part 1):* In 2024, 8 more plots were established on National Forest land in Conecuh, Tuskegee, and Bankhead, bringing the total to 22 plots across Alabama. The private land plots have 1266 trees, while the national forest land plots have 460 trees, making a total of 1726 trees in the study. All plots follow the same data collection, which depends on the year of the study. For private land plots, year 1 data collection is complete and year 2 is currently being collected. For national forest land plots, year 1 measurements are currently being collected. *Component 2 (Part 1):* For the

analysis of the spread of tree pathogenicity in relation to hurricane paths, comprehensive hurricane data has been gathered from the ArcGIS Living Atlas, tracing back to the origin of the disease. Data on infected counties in the southeastern USA was gathered from the United States Forest Service and field visit records from the Forest Health Diagnostic Lab. The spread of the disease toward inland areas has been meticulously analyzed by mapping the hurricane paths against the locations of infected counties. This analysis considers the trajectories and intensities of hurricanes, examining how these storms may contribute to the dispersal of pathogens from coastal regions to interior areas. *Component 3:* Year 1 data are currently being processed to extract variables for subsequent analysis. GPS data were also gathered and are being cleaned and combined with tree measurements (field data) and will be used for further processing lidar point clouds for tree-level analyses. Year 2 data collection is currently underway. *Component 4:* Sequencing of the fungal genomes.

Investigating Tree Growth Patterns and *Lecanosticta acicola* Infection

- ***Accomplishments:*** This study is taking place at Osko Forest, Cullman, AL. A significant component of this study involves tree coring to assess the health and growth patterns of loblolly pine (*Pinus taeda*) and how they are affected by fungal pathogens such as *Lecanosticta acicola*. A total of 300 tree cores have been collected from various trees across the study site to analyze growth rings, which provide valuable data on the tree's age, growth rate, and historical climate conditions. The analysis of tree core data is currently ongoing, with 126 tree cores already examined.

Lecanosticta acicola Spore Dispersal in Burned and Unburned Areas

- ***Accomplishments:*** The spore trap study is being conducted in Osko Forest, Cullman, Alabama. Twenty spore traps are set up in Loblolly Pine (*Pinus taeda*) plantation areas, with the study beginning in late February. These traps are placed in 5 unburned and 15 burned forest areas to examine the correlation between spore dispersal in managed versus unmanaged forest areas affected by fire. Each spore trap holds two microscope slides with an area of 18 cm^2, divided into 12 quadrants and coated with a thin layer of petroleum jelly. Weather data, including rainfall and temperature from March onward, is being collected from PRISM Climate Data or NOAA to analyze the effects of climate on spore abundance and dispersal. The spore slides are being changed weekly. Collected spore slides are analyzed in the laboratory using a 40x microscope. Numerous conidia of *Lecanosticta acicola* are being identified, along with other fungal pathogens such as *Hendersonia, Pestalotiopsis, Coleosporium*, and *Diplodia*.

Lecanosticta acicola Spore Viability on Pine Straw

- ***Accomplishments:*** Needles were collected from felled trees in the fall and the spring. Needles have been monitored and processed on a weekly basis that will continue until 11/20/2024 for the fall needles and 3/8/2025 for the spring

collected needles. All pathogens encountered on the needles were documented; however, only the fruiting bodies of *L. acicola* were documented with a numerical value. Spores are still present seven months after initial harvest.

GOAL B: TECHNOLOGY TRANSFER

Objective 1. Serve as a clearinghouse of information related to forest health issues.

Maintain and Update Forest Health Cooperative Web Site

The Forest Health Cooperative Staff will continue to update the Forest Health Cooperative website for use by Forest Health Cooperative Members. (Baldwin)

- ***Accomplishments:*** The website is currently being updated. Advisory agendas with each speaker's presentation will be available for Forest Health Cooperative Members. Changes in Forest Health Cooperative staff updated and current. Brown spot needle blight webpage launched and up to date.

Objective 2. Efficiently and regularly transfer the results of cooperative research to the membership.

Research Reports (Staff)

None produced FY24

Newsletters (Staff)

Newsletter was distribution Spring 2024 (January) and is planned for Spring 2025. Members are encouraged to submit articles.

Objective 3. Provide a limited consultancy function to the membership in the area of forest health.

Individual and Organized Contacts

An on-going activity is handled as individual situations as cases arise. (Staff)

	Eckhardt	Baldwin
Phone calls	**30**	**1**
Letters	**2**	**13**
Emails	**79**	**18**
Site Visits	**10**	**4**
Diagnosis	**82**	**34**

Short Courses

Forest Health Short Course will be offered in odd years. A Short Course in Forest Health will be planned for October/November 2023 if there is interest. (Staff)

GOAL C: COOP DEVELOPMENT

Objective 1. Provide for the continual relevancy and efficiency of the Cooperative research and technology transfer programs.

Advisory Committee Meeting

The FY24 Advisory Committee Meeting will be held in the last week of July 2025. A 2-day meeting will be planned. If there are any meetings that conflict with this time frame, let us know and we can try and accommodate Advisory Members. (Eckhardt/Baldwin/Bowersock).

- ***Forest Health Advisory Meeting FY25 being held*** **Aug 13-14, 2024**
- ***Forest Health Advisory Meeting FY24 was held*** **Aug 2-3, 2023**

Forest Health Cooperative Membership

The Forest Health Cooperative staff should make an effort to recruit new members. (Staff)

- ***Looking for new members.***

Update the Cooperative Membership Directory

An on-going activity. (Baldwin/Eckhardt)

- ***Accomplishments: Membership directory updated and loaded onto website.***

Objective 2. Increase the visibility and effectiveness of the Cooperative as a source of information on issues related to forest health.

Presentations at Meetings

Forest Health Cooperative staff will continue to be encouraged to participate as a speaker or attendee in regional and national meetings. (Staff)

- ***Accomplishments:*** Forest Health Cooperative Staff gave 18 presentations and published 1article on the subject of Forest Health**.**

1. King, J., Cale, J., Shearman, T., Fan, Z., and Eckhardt, L.G. 2024. Anatomical response to brown spot needle blight severity in loblolly pine. The 26th International Union of Forest Research Organizations (IUFRO) World Congress, Stockholm, Sweden
2. Folorunso, T.R., Eckhardt, L.G., Narine, L., Willoughby, J. King, J., Silva, G., and Singh, S., 2024. A multidisciplinary investigation of brown spot needle blight in

southeastern forests: how do we mitigate the effects of this emerging pathogen? Southern Forest Health Work Conference, Greenville, SC

3. Folorunso, T.R., Silva, G., Eckhardt, L.G., and Willoughby, J. 2024. Mitigating brown spot needle blight disease using genetics approach. Evolution Conference. Montreal Canada
4. Nyarko, E., Newell, A., Olatinwo, R. and Eckhardt, L.G. 2024. Isolation and identification of *Lecanosticta acicola* and other foliar pathogens associated with brown spot needle blight. Auburn University Graduate Student Symposium, Auburn University, AL
5. Folorunso, T.R., Eckhardt, L.G. and Willoughby, J. 2024. Using genetic variants and pathogenicity of the fungal pathogen *Lecanosticta acicola* to combat needle blight in loblolly pine (*Pinus taeda*). Auburn University Graduate Student Symposium, Auburn University, AL
6. King, J., Cale, J., Shearman, T., Fan, Z., and Eckhardt, L.G. 2023. Anatomical response to brown spot needle blight severity in loblolly pine. International Forum on Research Excellence, Long Beach, CA
7. Baldwin, J. and Eckhardt, L.G. 2024. Pine decline and brown spot needle blight. CEs by the SEA, Orange Beach, AL (**Invited**)
8. Eckhardt, L.G. 2024. Emerging pests and pathogens of urban trees. City Forests Webinar Series, AECS, Auburn University (**Invited**)
9. Nyarko, E., Newell, A. Olatinwo, R. and Eckhardt, L.G. 2024. Isolation and identification of *Lecanosticta acicola* and other foliar pathogens. Student Research Symposium, Auburn University, AL
10. Folorunso, T.R., Eckhardt, L.G., and Willoughby, J.R. 2024. Using genetic variants and evolutionary history of the fungal pathogen *Lecanosticta acicola* to understand needle blight. Student Research Symposium, Auburn University, AL
11. Nieto Arciniegas, L.M., Via, B., Erramuspe, I.V., Eckhardt, L.G., Gallagher, T., Thomas, B., and Marquez, A.R. 2024. Advancing the early stages of brown rot fungi detection: NIR spectroscopy integrated with chemometrics. Student Research Symposium, Auburn University, AL
12. Eckhardt, L.G. 2024. Pine Decline Workshop. Monroeville, AL (**Invited**)
13. Eckhardt, L.G. 2024. Common pests and pathogens of longleaf pine. Longleaf Academy: Longleaf 101, Atmore, AL (**Invited**)
14. Eckhardt, L.G. 2024. Brown spot needle blight update. 2024. SGSF Forest Management Chief Winter Meeting. Orange Beach, AL (**Invited**)
15. King, J., Cale, J., Shearman, T., Fan, Z., and Eckhardt, L.G. 2023. Growth effects of *Pinus taeda* in the presence of *Lecanosticta acicola*. Auburn University Graduate Students' Council 3MT competition.
16. Eckhardt, L.G. 2023. Loblolly pine decline across the southeast. Mississippi Society of American Foresters Annual Meeting, Hattiesburg, MS (**Invited**)
17. King, J., and Eckhardt, L.G. 2023. Trustee Aderholt Visit: Pine forests needle blight disease research funded by the US Forest Service. Auburn University College of Forestry, Wildlife and Environment - Office of the Dean.
18. Eckhardt, L.G. 2023. Brown Spot Needle Blight in Alabama. AFA Connect Webinar Series, Alabama Forestry Association, Montgomery, AL (**Invited)**

Publications

Forest Health Cooperative staff are encouraged to publish research results in scientific journals. (Staff)

Published, in press or accepted:

1. Datta, D., Eckhardt, L. and Brodbeck, A. (*Accepted*) Forest Health Highlight: Diplodia Tip Blight Identification and Control. Alabama Cooperative Extension System.

In Revision:

1. Carter, E.A., Brunson*, B.A., Loewenstein, N.J., Enloe, S.F., Held, D.W., and Eckhardt, L.G. Soil and foliar characteristics of loblolly pine stands impacted by cogongrass in Mississippi. For Ecol Mgmt
2. Ahl*, J.B. and Eckhardt, L.G. Identifying fungal spores on a pine bark beetle with hyperspectral interferometry. Agric For Entol

In Review:

1. Mensah, J. K., Sayer, M. A. S., Nadel, R. L., Matusick, G., & Eckhardt, L. G. Foliar nutrients response of *Pinus taeda* L. to *Leptographium terebrantis* infection. For. Sci.
2. Mensah, J. K., Sayer, M. A. S., Nadel, R. L., Matusick, G., & Eckhardt, L. G. Effect of *L. terebrantis* on the production of defensive chemical compounds. For. Path.
3. Menanyih, S.A., Cale, J., and Eckhardt, L.G. Allelochemical production from loblolly seedlings inoculated with ophiostomatoid fungi. Fungal Ecology
4. Wahl*, A.C., Nadel, R.L., Slippers, B. and Eckhardt, L.G. Effects of growth rate on *Amylostereum* spp. For Path
5. Duong, T.A., de Beer, Z.W., Wingfield, B.D., Eckhardt, L.G., and Wingfield, M.J. Phylogeny and taxonomy of species in the *Grosmannia huntii* complex. Fungal Biology
6. Eckhardt, L.G., Duong, T., Marincowitz, S., de Beer, Z.W., and Wingfield, M.J. Ophiostomatoid fungi associated with rostrums of wild pig (*Sus scrof*), including two new species. Fungal Biology

Extramural Funding of Forest Health Cooperative Projects

Forest Health Cooperative staff will continue to be encouraged to locate and generate extramural funding opportunities directly related to forest health. (Staff)

- ***Accomplishments*:** Forest Health Cooperative Staff were awarded the following grants totaling $1,092,538.80

- Mitigating Needle Blight: A growing Economic Threat to Pine Forests – USFS – increase by $94,800 for salary and travel of 2 undergraduate students.

- Sudden Oak Death (*Phytophthora ramorum*) Detection Survey (Stream Sampling) in AL and MS – FHM, USFS for all travel, supplies, and laboratory technician $47,000
- Collaboration between SFWS and FABI – University of Pretoria South Africa to work on *Pinus* related diseases and molecular aspects. $5,000 per participant (*extend 3 more years 2022-2025*)
- Wood chemistry and disease resistance – SFWS and Forest Products Development Center $105,000
- Mitigating Needle Blight: A growing economic threat to pine forests – USFS (through Senate Appropriations from Senator Shelby) for travel, supplies, graduate students and technicians $2,100,000 (Y1 – $1,016,066.58; Y2 – $840,738.80; Y3 $483,151.46)