AUBURN UNIVERSITY- FOREST HEALTH COOPERATIVE

FY 2025 ACCOMPLISHMENTS

As presented to the Forest Health Cooperative Advisory Committee

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AUBURN UNIVERSITY - FOREST HEALTH COOPERATIVE

FY 2025 WORK PLAN

GOAL A: RESEARCH

Objective 1. Identify research projects

Biological invasion detection via sentinel gardens in Alabama – USFS for travel, supplies, undergraduate students. *Year 2

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

Mitigating Needle Blight: A growing Economic Threat to Pine Forests – USFS – increase for salary and travel of 2 undergraduate students. *Year 2

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

Dual diagnostic system for *Lecanosticta acicola*: amplification-free CRISPR-based strain detection and aptamer-based biosensors for toxin detection – USFS for travel and supplies. *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 – Joint with Mississippi State University (Dr. John Riggins) *Year 2

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

Mitigating Needle Blight: A growing Economic Threat to Pine Forests – Senate Appropriations – Proposal requested by Senator Shelby's office. *Year 3

- ***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 15

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

Wood chemistry and disease resistance – CFWE, Forest Products Development Center. *Year 14

- ***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 13

- ***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 (Graduated 2025); Component 2 – PhD student Jaden King; 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 (Graduated 2024) working on a NIR project that compliments the Senate Appropriations Grant and Laura Neito working on decay fungi (Graduated 2024).

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:* Completed and student graduated. Manuscripts are being prepared for publication. *Component 2:* All BSNB plots were established in 2024, with no new plots added in 2025. We collected third-year data from private land plots and second-year data from national forest plots. Notably, the second-year data includes soil and needle nutrient information, meaning we now have this data for all plot locations. In March, we began examining the anatomical traits of pine needles. Samples for the anatomical study were collected from the BSNB plots, a resistance trial conducted in Auburn, AL, plots near Pineville, LA, and a plot from ArborGen. These samples have all been collected from the field, and approximately 75% have been processed. *Component 3:* 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. Study has been completed and manuscript being prepared.

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 2024 – November 2024 and then again in February 2025 – November 2025. 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. Year 1 data is complete and still working on Year 2 data. 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 twelve months after initial harvest. Project has been completed, data is being analyzed and manuscript being prepared.

Biological invasion detection via sentinel gardens in Alabama

- ***Accomplishments:*** In 2025, three locations (2 in Mobile and 1 in Auburn) were selected and two designs were approved. Three listening sessions were held to develop of survey of economically, ecologically and culturally important plants. Surveys went out to stakeholders and 17 species of trees and shrubs were selected.

The selected seedlings are being acquired and propagated for planting. Site preparation was conducted with herbicide and marking paint at the Auburn site. Local interest (participation and donation) has been encouraged through presentations and outreach.

Dual diagnostic system for *Leconosticta acicola*: amplification-free CRISPR-based strain detection and aptamer-based biosensors for toxin detection

- ***Accomplishments:*** Samples collected and diagnostics methods being worked out.

Advancing brown spot needle blight prevention: A non-destructive approach for early detection of pathogen tolerance – FPDC for supplies

- ***Accomplishments:*** In 2025, a previously calibrated portable NIR model has been used to collect and scan pine needles from 120 trees in Sylacauga, and 30 trees across 6 plots located in Pineville and surrounding areas, bringing the total to 510 trees scanned and expected to reach up to 630 by the last collection in December. Sample collection follows the same field and lab procedures used in the calibration phase. Preliminary results demonstrated acceptable relationship between NIR predictions and laboratory measurements, suggesting the model is progressing in the right direction and providing a solid basis for further refinement.

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. (Gordon)

- ***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)

1. Nyarko, E. and Eckhardt, L.G. 2025. Detection of *Lecanosticta acicola* spore load using spore traps. Research Report 2025-04. Forest Health Cooperative, College of Forestry, Wildlife and Environment, Auburn University
2. Nyarko, E. and Eckhardt, L.G. 2025. Assessment of seedling susceptibility of different loblolly pine families to *Lecanosticta acicola* using open-top chambers. Research Report 2025-03. Forest Health Cooperative, College of Forestry, Wildlife and Environment, Auburn University
3. Nyarko, E. and Eckhardt, L.G. 2025. Seedling susceptibility of different loblolly pine families to *Lecanosticta acicola* in brown spot needle blight-infested plots. Research Report 2025-02. Forest Health Cooperative, College of Forestry, Wildlife and Environment, Auburn University
4. Nyarko, E. and Eckhardt, L.G. 2025. Isolation and identification of *Lecanosticta acicola* and other foliar pathogens associated with needle blight on loblolly pine. Research Report 2025-01. Forest Health Cooperative, College of Forestry, Wildlife and Environment, Auburn University

Newsletters (Staff)

Newsletter was distributed Spring 2025 (January) and is planned for Spring 2026. 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	Gordon
Phone calls	**33**	**3**	**3**
Letters	**5**	**10**	**1**
Emails	**81**	**18**	**2**
Site Visits	**8**	**4**	**2**
Diagnosis	**79**	**34**	**3**

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 FY27 Advisory Committee Meeting will be held July 14-15, 2026. 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 FY26 being held*** **Nov 4-5, 2026**
- ***Forest Health Advisory Meeting FY25 was*** **Aug 13-14, 2024**

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 25 presentations and published 4 articles on the subject of Forest Health**.**

1. Singh, S., Narine, L.L., and Eckhardt, L.G. 2025. Detecting brown spot needle blight disease severity in loblolly pine using remote sensing and machine learning. International Conference on Forest Carbon & Resilience 2025, Auburn, AL
2. Arciniegas, L.N., Caicedo, C.R., Vega, I., Via, B., and Eckhardt, L.G. 2025. Evaluating a portable NIF-based model to detect susceptibility in loblolly pine trees affected by needle blight. International Conference on Forest Carbon & Resilience 2025, Auburn, AL

3. Folorunso, T., Silva, G.A., Eckhardt, L.G., and Willoughby, J.R. 2025. Evolutionary divergence of pathogens causing brown spot needle blight in *Pinus* species. Evolution 2025, Athens, GA
4. King, J., Cale, J., Shearman, T., Fan, Z., and Eckhardt, L.G. 2024. The foliar response of loblolly pine (*Pinus taeda* L.) to different infection levels of brown spot needle blight (*Lecanosticta acicola*). International Forum on Research Excellence, Washington D.C.
5. Folorunso, T., Silva, G.A., Eckhardt, L.G., and Willoughby, J.R. 2024. Evolutionary divergence of pathogens causing brown spot needle blight in *Pinus* species. Evolution 2024, Montreal, Canada
6. King, J., Cale, J., Shearman, T., Fan, Z., and Eckhardt, L.G. 2025. Epidermal traits may be the key to resistance of brown spot needle blight in loblolly pine. I.E. Melhus Graduate Student Symposium, Plant Health 2025, Honolulu, HI (**Invited**)
7. Eckhardt, L.G., Newell, A., Baldwin, J., Gordon, P. and Schatz, L. 2025. Biological invasion detection via sentinel gardens in Alabama. 33rd USDA Interagency Research Forum on Invasive Species, Annapolis, MD (**Invited**)
8. Singh, S., Narine, L.L., Eckhardt, L.G., and Willoughby, J. 2025. Remote sensing detection and severity mapping for brown spot needle blight in southeastern pine forests. 15th Southern Forestry and Natural Resource Management GIS Conference, Athens, GA
9. Eckhardt, L.G. 2025. Forest Health. 2025 Land Tour. Millry, AL (**Invited**)
10. King, J. and Eckhardt, L.G. 2025. Brown spot needle blight. Know your enemies: How to Spot and Manage Forest Health Threats in the Southeast. Auburn, AL (**Invited**)
11. Eckhardt, L.G. 2025. Update on brown spot needle blight on loblolly pine research. Natural Resource Webinar Series, Montgomery, AL (**Invited**)
12. Eckhardt, L.G. 2025. Brown spot needle blight update. Annual Meeting of the Southeastern Society of American Foresters. Auburn, AL (**Invited**)
13. Eckhardt, L.G., Newell, A., and Gordon, P. 2025. Biological invasion detection via sentinel gardens in Alabama. Mobile Rotary Club, Auburn, AL (**Invited**)
14. Eckhardt, L.G., Newell, A., and Gordon, P. 2025. Biological invasion detection via sentinel gardens in Alabama. Auburn Rotary Club, Auburn, AL (**Invited**)
15. King, J., Cale, J., Shearman, T., Fan, Z., and Eckhardt, L.G. 2025. Foliar response of loblolly pine (*Pinus taeda* L.) to different infection levels of brown spot needle blight (*Lecanosticta acicola*). 23rd Biennial Southern Silvicultural Research Conference, Greenville, SC (*Poster*)
16. Goldsby, G., King, J., and Eckhardt, L. 2025. Using dendrochronology to evaluate the impacts of brown spot needle blight. Biennial Southern Silvicultural Research Conference, Greenville, SC (*Poster*)
17. King, J., Eckhardt, L.G., Narine, L., Willoughby, J. Folorunso, T., Silva, G., and Singh, S., 2025. 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, Tulsa, OK (**Invited**)
18. Folorunso, T., Eckhardt, L.G., Narine, L., Willoughby, J., King, J., Silva, G., and Singh, S., 2025. Using genetic variants and evolutionary history of the fungal pathogen *Lecanosticta acicola* to understand needle blight. Southern Forest Health Work Conference, Tulsa, OK (*Poster*)

19. Singh, S., Narine, L.L., Eckhardt, L.G., and Willoughby, J. 2025. Remote sensing detection and severity mapping for brown spot needle blight in southeastern pine forests. Southern Forest Health Work Conference, Tulsa, OK (*Poster*)
20. Newell, A., Baldwin, J., Gordon, P., Schatz, L. and Eckhardt, L.G. 2025. Biological invasion detection via sentinel gardens in Alabama. Southern Forest Health Work Conference, Tulsa, OK (*Poster*)
21. Folorunso, T., Eckhardt, L.G., Narine, L., Willoughby, J., King, J., Silva, G., and Singh, S., 2025. Using genetic variants and evolutionary history of the fungal pathogen *Lecanosticta acicola* to understand needle blight. Student Research Symposium, Auburn University, AL
22. Anglin, J., King, J., and Eckhardt, L.G. 2025. Effects of control burns and weather on *Lecanosticta acicola* spore dispersal. Student Research Symposium, Auburn University, AL (*Poster*)
23. Goldsby, G., King, J., Eckhardt, L.G. 2025. Using dendrochronology to assess the effects of brown spot needle blight on loblolly pine growth. Student Research Symposium, Auburn University, AL (*Poster*)
24. King, J., Cale, J., Shearman, T., Fan, Z., and Eckhardt, L.G. 2025. Effects of brown spot needle blight on the growth of loblolly pine. Student Research Symposium, Auburn University, AL
25. Nyarko, E., Newell, A. Olatinwo, R. and Eckhardt, L.G. 2025. Isolation and identification of *Lecanosticta acicola* and other foliar pathogens. Student Research Symposium, Auburn University, AL

Publications

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

Published, in press or accepted:

1. Singh**, S., Narine, L.L., and Eckhardt, L.G. (*Accepted*) UAV-multispectral imaging and machine learning for brown spot needle blight severity assessment in southeastern U.S. pine forests. Environ. Res. Letters
2. Folorunso**, T.R., Sundaram, M., Potnis, N., Stevison, L., Eckhardt, L.G., and Willoughby, J. (2025) Plant pathogen disease severity is shaped by genetic factors and pathogen life cycle strategies across many pathogen-host systems. J. Plant Path. 10.1007/s42161-025-02011-z
3. Wang, Q.C., Zhan, C.J., Satter, A., Wang, H.N., Zhou, L.F., Eckhardt, L.G., Li, G.Q., Liu, F.F., Xu, H.C. and Zhou, X.D. (2025) *Pestalotiopsis* (Amphisphaeriales, Sporocadaceae) species including six new taxa inhabiting pines from different climate zones in China. IMA Fungus 16: e151614 (2025) DOI: 10.3897/imafungus.16.151614
4. Singh**, S., Narine, L.L., Eckhardt, L.G. and Willoughby, J. (2025) Remote sensing-Based detection of brown spot needle blight: a comprehensive review and future directions. PeerJ

In Revision:

1. Silva, G., Folorunso, T., Paez, A.M., Lamka, G.F., Singh, S., King, J., Henderson, L., Persyn, M., Mwema, T., Lindow, T., Amiri, N., Eckhardt, L., Narine, L., and Willoughby, J. Biology, detection, and management of *Lecanosticta acicola* causing brown spot needle blight in pine forests. For. Path.
2. 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

In Review:

1. Mensah, J.K., Sayer, M. A. S., Nadel, R. L., and Eckhardt, L.G. Effects of *Leptographium terebrantis* inoculation and drought on oleoresin and soluble phenolic levels in plantation *Pinus taeda*. For. Ecol.
2. Folorunso**, T.R., Silva, G., Giron, M.E., Lindow, T., Persyn, M., Eckhardt, L.G., and Willoughby, J. Optimized protocol for culturing and extracting DNA from fungal isolates associated with brown spot needle blight. PLOS ONE
3. 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
4. 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 $1,073,012.46

- Mitigating Needle Blight: A growing Economic Threat to Pine Forests – USFS – increase by $94,800 (Y2 - $47,400; Y3 - $47,400) 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)

- Sentinel Garden – USFS for travel, supplies, and technician $260,265
- Dual diagnostic system for *Lecanosticta acicola*: amplification-free CRISPR-based strain detection and aptamer-based biosensors for toxin detection $125,196