AUBURN UNIVERSITY- FOREST HEALTH COOPERATIVE

FY 2017 ACCOMPLISHMENTS

As presented to the Forest Health Cooperative Advisory Committee

Dr. Lori G Eckhardt - Director

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AUBURN UNIVERSITY - FOREST HEALTH COOPERATIVE

FY 2017 WORK PLAN

GOAL A: RESEARCH

Objective 1. Identify research projects

Quantifying the impact of pine decline in the southeastern United States – FHC and SFWS. *Year 3

- ***Accomplishments: Funded by FHC and SFWS***

Novel analytical tools for the selection of superior loblolly pine genotypes for improved plant health, fuels, and chemicals – SFWS, Forest Products Development Center and AU-IGP (Good to Great Grant). *Year 3

- ***Accomplishments: Funded by AU-IGP (Good to Great Grant)***

Seedling production and forest health in the Southeastern United States – in cooperation with the Southern Forestry Nursery Management Cooperative. *Year 5

- ***Accomplishments: Funded by NSF***

Testing of a rapid PCR Screening test for the presence of *Fusarium circinatum*, the causal agent of pitch canker on pine planting material – FHM for supplies, travel and postdoc. *Year 5

- ***Accomplishments: Funded by USFS Forest Health Protection grant.***

Sudden Oak Death (*Phytophthora ramorum*) Detection Survey (Stream Sampling) in AL and MS – FHM, USFS for all travel, supplies and laboratory technician. *Year 7

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

Wood chemistry and disease resistance – SFWS, Forest Products Development Center. *Year 5

- ***Accomplishments: Funded 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 5

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

Objective 2. Recruit graduate students

Currently there are no openings for a graduate students in the Coop.

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

Quantifying the impact of pine decline in the southeastern United States.

- ***Accomplishments:*** **During the 2016, a preliminary study on the Pathogenicity of *Leptographium terebrantis* to loblolly pine trees under field conditions was completed. The study tested the pathogenicity of the test fungus and the effectiveness of the inoculation method using colonized toothpicks. A second study was conducted to determine how *Leptographium terebrantis* infection affected water status of loblolly pine in naturally regenerated habitat. Insects have been collected biweekly and are being identified and processed. Microbial biomass, soil cores and foliar samples have been taken and are being processed.**

Ecology of siricids and fungal associates in southeastern pine forests: potential for biological control and competition.

- ***Accomplishments: Study complete and manuscripts being worked on and submitted. Research reports being completed.***

Response of different mature loblolly pine families to *Leptographium terebrantis* and *Grosmannia huntii.*

- ***Accomplishments: Data is being analyzed and manuscript/report is under preparation.***

Virulence of *Leptographium terebrantis* and *Grosmannia huntii* on loblolly pine families under drought stress.

- ***Accomplishments: Two families one susceptible and one tolerant to Grosmannia huntii and Leptographium terebrantis were chosen and seedlings were planted in moisture stress boxes. Three different levels of moisture treatments: (a) drought (b) moderate drought and (c) normal moisture have been applied. The fungal inoculations completed. Final physiological and***

pathogenicity measurements have been completed. Data analysis completed and manuscript preparation is underway.

Resistance of *Pinus taeda* families under artificial inoculations with native and non-native *Leptographium* species involved in premature mortality. Working with the Tree Improvement Cooperative to determine families to be tested for tolerance/resistance.

- ***Accomplishments: Year four screening and data analysis is complete. Year 5 data collection and analysis is underway.***

Mature root inoculation of families from seedling screening study to look at reliability of seedling screening.

- ***Accomplishments: Manuscripts and research reports being prepared.***

Wood chemistry and disease resistance – SFWS, Forest Products Development Center.

- ***Accomplishments: Families selected from the screening study and LGEPop on Plum Creek and Rayonier property. Trees harvested on Plum Creek and Rayonier property Spring 2014 and Spring 2015, processed in the forest products lab. Data currently being analyzed and manuscripts and research reports being prepared.***

Identification of Climate Effects on Microbial Symbionts of Longleaf Pine - in collaboration with CERL personnel and University of Mississippi for all travel and supplies.

- ***Accomplishments: Manuscript and research report being prepared.***

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. (Eckhardt)

- ***Accomplishments: The website is updated. Advisory Agenda's with each speaker's presentation available for Forest Health Cooperative Members. Research Reports and Technical Notes are updated. Changes in Forest Health Cooperative staff updated and current.***

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

Research Reports (Staff)

We plan on producing Research Reports and Technical Notes in FY12 now that research projects are underway.

- ***Accomplishments: Research Report 2016-1 and several currently being written which will be online before the end of the year.***
- Devkota, P. and Eckhardt, L.G. 2016. Variance in tolerance of different families of loblolly pine (*Pinus taeda* L.) to *Grosmannia huntii* and *Leptographium terebrantis.* Research Report 2016-01. Forest Health Cooperative, School of Forestry and Wildlife Sciences, Auburn University.

Newletters (Staff)

Newsletter distribution will be planned for March FY2016. Members are encouraged to submit articles.

- ***Accomplishments: A Spring2016 Newsletter was sent to all Forest Health Cooperative Members, approximately 20 on the mailing list.***

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

Individual and Organized Contacts

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

	Eckhardt	Smith	Nadel
Phone calls	**34**	**6**	**0**
Letters	**1**	**0**	**0**
Emails	**65**	**23**	**1**
Site Visits	**10**	**3**	**0**
Diagnosis	**29**	**8**	**0**

Short Courses

Forest Health Short Course will be offered in odd years starting with FY2009. Not enough members signed up for the course in FY2009 or FY2011 and if there is enough interest, a Short Course in Forest Health will be planned for August 2017. (Staff)

- ***Accomplishments: A short course was held August 15-16 at the request of membership with 45 participants. The next short course will be planned for summer 2017 if there is interest.***

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 FY18 Advisory Committee Meeting will be held the last week in June 2018. 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/Bowersock).

- ***Forest Health Advisory Meeting was held in Auburn on June 29-30, 2016.***

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. (Bowersock/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 43 presentations and published 6 article on the subject of Forest Health.***

*Wahl, A.C., Nadel, R.L., Slippers, B. and Eckhardt, L.G. **2017**. The effect of *Amylostereum* spp. on forest health in Alabama. IUFRO 125th Anniversary Congress, Freiburg, Germany

*Wahl, A.C., Nadel, R.L., Slippers, B. and Eckhardt, L.G. **2017**. A survey for *Sirex noctilio* and native woodwasps in Alabama. IUFRO 125th Anniversary Congress, Freiburg, Germany

*Devkota, P. and Eckhardt, L.G. **2017**. How do different mature *Pinus taeda* families respond to root-infecting fungi? IUFRO 125th Anniversary Congress, Freiburg, Germany

*Duwadi, S., Nadel, R., Feng, Y., and Eckhardt, L.G. **2017**. One year study of soil microbial biomass and soil moisture in loblolly pine (*Pinus teada*) stand. IUFRO 125th Anniversary Congress, Freiburg, Germany

*Devkota, P. and Eckhardt, L.G. **2017**. Induced systemic resistance of *Pinus taeda* to *Leptographium terebrantis* and *Grosmannia huntii* by plant growth-promoting rhizobacteria. This is Research: Student Symposium, Auburn, AL

*Wahl, A.C., Nadel, R.L., Slippers, B. and Eckhardt, L.G. **2017**. Competitiveness of *Amylostereum* spp. fungi against *Leptographium* spp. fungi. This is Research: Student Symposium, Auburn, AL

*Acquah G. E., Via B. K. and Eckhardt L. G. **2017**. Screening elite loblolly pine families for structural integrity with near infrared-based chemometric models. Southeastern Society of American Foresters Annual Meeting, Sandestin, FL

*Wahl, A.C., Nadel, R.L., Slippers, B. and Eckhardt, L.G. **2017.** The effect of *Sirex* species on Alabama forest health. Southeastern Society of American Foresters Annual Meeting, Sandestin, FL

*Mensah, J.K., Sword Sayer, M.A., Nadel, R.L., Matusick, G., Fan, Z., and Eckhardt, L.G. **2017**. Effect of *Leptographium terebrantis* on tree physiology and growth of loblolly pine. This is Research: Student Symposium, Auburn University, Auburn, AL

*Duwadi, S., Nadel, R., Feng, Y., and Eckhardt, L.G. **2017**. Study of soil microbial biomass and soil moisture in loblolly pine (*Pinus teada*) stand. This is Research: Student Symposium, Auburn University, Auburn, AL

*Ahl, J., Beach, J., Nadel, R., Held, D. and L. Eckhardt. April 2017. Insect Populations associated with *Leptographium terebrantis*, a Fungus that Contributes to Southern Pine Decline. This is Research: Student Symposium, Auburn University, Auburn, AL

*Duwadi, S., Nadel, R., Feng, Y., and Eckhardt, L.G. **2017**. Study of soil microbial biomass and soil moisture in loblolly pine (*Pinus teada*) stand.

*Mensah, J.K., Sword Sayer, M. A., Nadel, R. L, Matusick, G., Fan, Z., and Eckhardt, L.G. **2017**. Impact of *Leptographium terebrantis* on loblolly pine trees in naturally regenerated forest. Sigma Xi Student Research Showcase. (Virtual)

*Devkota, P. and Eckhardt, L.G. **2017**. Loblooly pine and vascular-inhabiting fungi. Sigma Xi Student Research Showcase. (Virtual)

*Wahl, A.C., Nadel, R.L., Slippers, B. and Eckhardt, L.G. **2017**. *Sirex* woodwasps and their symbionts in Alabama forests. Sigma Xi Student Research Showcase. (Virtual)

*Ahl, J.B., Eckhardt, L.G. and Beach, J.M. **2017**. Can you identify spores of fungal species on coleopteran with hyperspectral interferometry? Sigma Xi Student Research Showcase. (Virtual)

*Ahl, J.B., Eckhardt, L.G. and Beach, J.M. **2017**. Can you identify spores of fungal species on coleopteran with hyperspectral interferometry? Weaver Lecture Graduate Student Poster Session, Auburn University, Auburn, AL

*Devkota P., Nadel R.L., & Eckhardt L.G. **2017**. How do different mature *Pinus taeda* L. families respond to root-infecting fungi? Weaver Lecture Graduate Student Poster Session, Auburn University, Auburn, AL

*Wahl, A.C., Nadel, R.L., Slippers, B. and Eckhardt, L.G. **2017**. A survey for *Sirex noctilio* and native woodwasps in Alabama. Weaver Lecture Graduate Student Poster Session, Auburn University, Auburn, AL

*Mensah, J., Duwadi, S., Ahl, J. and Eckhardt, L.G. **2017**. Quantifying southern pine decline: the role of *Leptographium terebrantis.* Weaver Lecture Graduate Student Poster Session, Auburn University, Auburn, AL

*Wahl, A.C., Devkota, P. and Eckhardt, L.G. **2017**. Foes of the forests in the southern United States. SFWS Open House Poster Session, Auburn, AL

*Mensah, J., Duwadi, S., Ahl, J. and Eckhardt, L.G. **2017**. Quantifying southern pine decline: the role of *Leptographium terebrantis*. SFWS Open House Poster Session, Auburn, AL

*Ahl, J.B., Eckhardt, L.G. and Beach, J.M. 2017. Can you identify spores of fungal species on coleopteran with hyperspectral interferometry? Southeastern Branch of the Entomological Society of America. Memphis, TN

*Wahl, A.C., Nadel, R.L., Slippers, B. and Eckhardt, L.G. **2017.** The effect of *Sirex* species on Alabama forest health. Southeastern Branch of the Entomological Society of America. Memphis, TN

*Devkota P., Singh A., & Eckhardt L.G. **2017**. Phenotypic Screening of Loblolly Pine Families Tolerant to Pathogenic Root-feeding Bark Beetle Vectored Fungi. Alabama Natural Resources Council, Outreach Symposium and Landowner Awards Banquet, Tuscaloosa, AL

*Devkota P., Kloepper J.W., & Eckhardt L.G. **2017**. Induction of Systemic Resistance in *Pinus taeda* to Root-infecting Fungi by Plant Growth-promoting Rhizobacteria. Alabama Natural Resources Council, Outreach Symposium and Landowner Awards Banquet, Tuscaloosa, AL

*Devkota P., Nadel R.L., & Eckhardt L.G. **2017**. How Do Different Mature *Pinus taeda* L. Families Respond to Root-infecting Fungi? Alabama Natural Resources Council, Outreach Symposium and Landowner Awards Banquet, Tuscaloosa, AL

*Devkota P., Enebak S., & Eckhardt L.G. **2017**. Virulence of Ophiostomatoid Fungi to Loblolly Pine under Varying Soil Moisture Levels**.** Alabama Natural Resources Council, Outreach Symposium and Landowner Awards Banquet 2017, Tuscaloosa, AL

*Ahl, J.B., Eckhardt, L.G. and Beach, J.M. **2017**. Can you identify spores of fungal species on coleopteran with hyperspectral interferometry? Alabama Natural Resource Council Outreach Symposium, Tuscaloosa, AL

*Wahl, A.C. Nadel, R.L., Slippers, B. and Eckhardt, L.G **2017.** The effect of terpenes emitted by *Pinus* spp. on *Amylostereum areolatum*. Alabama Natural Resource Council Outreach Symposium, Tuscaloosa, AL

*Wahl A.C., Nadel R.L., Slippers B., Eckhardt, L.G. **2017**. *Sirex* woodwasp and their symbionts in Alabama forests. Alabama Natural Resources Council, Tuscaloosa, AL

*Wahl A.C., Nadel R.L., Slippers B., Eckhardt, L.G. **2017**. Competitiveness of *Amylostereum* spp. fungi against *Leptographium* spp. fungi. Alabama Natural Resources Council, Tuscaloosa, AL

*Essien, C., Via, B., Gallagher, T., McDonald, T., and Eckhardt, L. **2017**. Applying discriminate analysis and acoustic tool to assign loblolly pine families into susceptibility classes. Alabama Natural Resources Council, Tuscaloosa, AL

*Devkota P., Enebak S., & Eckhardt L.G. **2017**. Does Pathogenicity of *Leptographium terebrantis* and *Grosmannia huntii* to *Pinus taeda* L. Alter under Varying Soil Moisture? Southeastern Society of American Foresters Annual meeting, Sandestin, FL

*Devkota, P., Singh, A., and Eckhardt, L.G. **2017**. Response of different *Pinus taeda* L. families to root-infecting ophiostomatoid fungi. Southeastern Society of American Foresters Annual Meeting, Sandestin, FL

*Devkota, P., Kloepper, J.W., and Eckhardt, L.G. **2017**. Induced systemic resistance of *Pinus taeda* L. to *Leptographium terebrantis* and *Grosmannia huntii* by plant growth-promoting rhizobacteria. Southeastern Society of American Foresters Annual Meeting, Sandestin, FL

*Essien, C., Via, B., Gallagher, T., McDonald, T., and Eckhardt, L. **2017**. Acoustic stiffness characterization of loblolly pine (*Pinus taeda* L.) families used for improved forest health. Southeastern Society of American Foresters Annual Meeting, Sandestin, FL

*Acquah G. E., Via B. K., Fasina O. O., Adhikari S., and Eckhardt L. G. **2017**. Rapid assessment of forest biomass for biofuel applications: A comparative study of three analytical tools. Southeastern Society of American Foresters Annual Meeting, Sandestin, FL

*Devkota, P., and Eckhardt, L.G. **2017**. Does pathogenicity of *Leptographium terebrantis* and *Grosmannia huntii* to *Pinus taeda* L. alter under varying soil moisture? Southeastern Society of American Foresters Annual Meeting, Sandestin, FL

*****Wahl, A.C**.** Nadel, R.L., Slippers, B. and Eckhardt, L.G **2017.** *Sirex noctilio* in the southern pine forest. USDA Forum on Invasive Species, Annapolis, MD

*Wahl A.C., Nadel R.L., Slippers B., Eckhardt, L.G. **2016**. Effect of Growth Rate on Amylostereum spp. Fungus by Terpenes. Sigma Xi Annual Meeting and Student Research Conference, Atlanta, GA

*Devkota, P., and Eckhardt, L.G. **2016**. Variation in tolerance of *Pinus taeda* families to ophiostomatoid fungi *Grosmannia huntii* and *Leptographium terebrantis*. Sigma Xi Annual Meeting and Student Research Conference, Atlanta, GA

*Devkota, P., and Eckhardt, L.G. **2016**. Virulence of Ophiostomatoid Fungi on Loblolly Pine Families under Drought Stress. Society of American Foresters Annual Convention. Madison, WI

Publications

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

*Chieppa, J.J., Eckhardt, L.G., and Chappelka, A.H.. **2017**. Simulated summer rainfall variability effects on loblolly pine (*Pinus taeda*) seedling physiology and susceptibility to root-infecting ophiostomatoid fungi. Printed online first: DOI 10.3390/f8040104. Forests 8:000-000.

*Acquah, G., Via, B.K., Fasina, O., Adhikari, S., Billor, N., and Eckhardt L. **2017**. Chemometic modeling of thermogravimetric data for the compositional analysis of biomass. Published online first: DOI:10.1371/journal.pone.0172999. PLOS-1 00:000-000.

*Essien, C., Via, B.K., Eckhardt, L., Cheng, Q., Gallagher, T., McDonald, T., and Wang, X. **2017**. Multivariate modeling of acusto-mechanical response of fourteen year old suppressed loblolly pine (*Pinus taeda*) to variation in wood chemistry, microfibril angle and density. Published online first: DOI 10.1007//s00226-017-0894-9. Wood Sci. and Technol. 00:000-000.

*Trautwig, A. Eckhardt, L.G., Hoeksema, J., Carter, E.A., and Loewenstein, N. **2017**. Mycorrhizal communities in *Imperata cylindrical* invaded and non-invaded commercial *Pinus*

taeda stands. Printed online first: http://www.ingentaconnect.com/content/saf/fs/pre-prints/content-forsci16016. For. Sci. 62:000-000.

*Acquah, G., Via, B.K., Fasina, O., and Eckhardt L. **2016**. Raped quantitative analysis of forest biomass using Fourier transformation spectroscopy (FTIR) and partial least squares (PLS) regression. J. Anal. Meth. Chem. 00:000-000. Published online first doi:10.1155/2016/1839598.

*Acquah, G., Via, B., Billor, N., Fasina, O., and Eckhardt, L. **2016**. Identifying plant part composition of forest logging residue using infrared spectral data and linear discriminant analysis. Sensors. Published first online: DOI: 10.3390/s16091375.

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 $656,500.***

- Eckhardt and Enebak. 2017. Sudden Oak Death – *Phytophpora ramorum* surveys - $36,000.
- Eckhardt, Nadel, Matusick, Sword, Cater. 2015. Quantifying loblolly pine decline – FHC and SFWS – SFWS portion $60,000
- Eckhardt and Enebak. 2016. Sudden Oak Death – *Phytophpora ramorum* surveys - $34,000.
- Enebak and Eckhardt. 2014. Testing of a rapid PCR Screening test for the presence of *Fusarium circinatum*, the causal agent of pitch canker on pine planting material – FHM - $150,000.
- Enebak and Eckhardt. 2014. Seedling production and forest health in the Southeastern United States – NSF-CAFS - $300,000 ($150,000 to FHC).
- Eckhardt. 2014. Root disease model – SFWS - $64,500.
- Hoeksema and Eckhardt. 2014. Mycorrhizal fungal colonization and disease resistance – SFWS and University of Mississippi - $25,000.
- Via and Eckhardt. 2014. Wood chemistry and disease resistance. SFWS - $5,000.
- Eckhardt and Wingfield. 2015 *Pinus* related diseases and molecular aspects. SFWS and FABI – University of Pretoria South Africa for travel and supplies and a graduate student stipend at UP - $30,000.
- Via and Eckhardt. 2015. Novel analytical tools for the selection of superior loblolly pine genotypes for improved plant health, fuels, and chemicals – IGP - $100,000.