AUBURN UNIVERSITY- FOREST HEALTH COOPERATIVE

FY 2015 ACCOMPLISHMENTS

As presented to the Forest Health Cooperative Advisory Committee

Dr. Lori G Eckhardt - Director

12/3/2015

AUBURN UNIVERSITY - FOREST HEALTH COOPERATIVE

FY 2015 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 1

- ***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 1

- ***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.

- ***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 3

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

Identification of Climate Effects on Microbial Symbionts of Longleaf Pine - in collaboration with CERL personnel and University of Mississippi for all travel and supplies. *Year 3

- ***Accomplishments: Funded by ERDC-CERL.***

Sudden Oak Death (*Phytophthora ramorum*) Detection Survey (Stream Sampling) in AL and MS – FHM, USFS for all travel, supplies and laboratory technician. *Year 5

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

Wood chemistry and disease resistance – SFWS, Forest Products Development Center. *Year 3

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

Mycorrhizal fungal colonization and disease resistance – SFWS and University of Mississippi for all travel, supplies and graduate student stipend. *Year 3

- ***Accomplishments: Funded by SFWS***

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 3

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

Objective 2. Recruit graduate students

There are three openings for a graduate students in the Coop:

1. Open - Quantifying the impact of pine decline in the southeastern United States

    - ***Accomplishments: Shrijana Duwadi (MS Student) and John Mensah (PhD Student) starting January 2016.***

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

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 three screening and data analysis is complete. Families were chosen and sown at Plum Creek nursery in Georgia for FY16.***

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

- ***Accomplishments: Summer inoculations complete and data being analyzed. Spring inoculations to be done in March.***

Hylastes population dynamics and forest health evaluation in association with thinning and fertilization on new RW19 in Georgia – Funding through FHP and FHC.

- ***Accomplishments: Plots for the RW-19 study were identified in Spring of 2012, on land managed by Rayonier in Georgia. Study plots and insect traps were installed in the summer, and an initial ten weeks of insect data was collected pre-study thinning treatments. The insect traps were reinstalled after treatment application. Insect collections continued for one year once traps were reinstalled. Insect data currently being analyzed. Research Report being written.***

Evaluation of stand health in association with biomass removal and standard silvicultural practices – Funding through USFS National Forest System and Alabama Power.

- ***Accomplishments: Plots identified. Treatments complete. Insect traps installed February 2014. Insect data being analyzed. Research Report being written.***

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, currently being processed in the forest products lab.***

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: Plots identified. Year one and two year sampling at Fort Benning and Eglin AFB completed. Sequencing underway at University of Mississippi.***

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 2015-1 and 2015-6 are on the website.***
- Beach, J., Uertz, J., and Eckhardt, L. 2015. Hyperspectral interferometry: sizing micro-scale surface features in the pine bark beetle. Research Report 2015-06. Forest Health Cooperative, School of Forestry and Wildlife Sciences, Auburn University.
- *Chieppa, J.J., Chappelka, A.H., and Eckhardt, L.G. 2015. Effects of simulated rainfall treatments on loblolly pine seedlings inoculated with ophiostomatoid fungi. Research Report 2015-05. Forest Health Cooperative, School of Forestry and Wildlife Sciences, Auburn University.
- *Chieppa, J.J., Chappelka, A.H., and Eckhardt, L.G. 2015. Effects of elevated tropospheric ozone on loblolly pine seedlings inoculated with ophiostomatoid fungi. Research Report 2015-04. Forest Health Cooperative, School of Forestry and Wildlife Sciences, Auburn University.
- *Brunson, B. and Eckhardt, L.G. 2015. Assessing tree vigor impact of *Imperata Cylindrica* to *Pinus taeda* in southeastern Mississippi. Research Report 2015-03. Forest Health Cooperative, School of Forestry and Wildlife Sciences, Auburn University.
- *Brunson, B. and Eckhardt, L.G. 2015. Assessing soil dynamics associated with *Imperata Cylindrica* in its relation to loblolly pine decline. Research Report 2015-02. Forest Health Cooperative, School of Forestry and Wildlife Sciences, Auburn University.

- *Brunson, B. and Eckhardt, L.G. 2015. Impact of cogongrass (*Imperata cylindrica*) on populations of root-feeding bark beetle species associated with loblolly pine decline. Research Report 2015-01. 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 Spring2015 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	Bauman	Nadel
Phone calls	**39**	**17**	**7**
Letters	**4**	**0**	**2**
Emails	**58**	**10**	**11**
Site Visits	**5**	**0**	**2**
Diagnosis	**28**	**42**	**14**

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 June 2012 at the request of membership with 35 participants. The next short course will be planned for summer 2015.***

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 FY15 Advisory Committee Meeting will be held the last week in July 2015 jointly with the Nursery Cooperative. 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 held in St. Simons Island on July 28-30, 2015***

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

- *Acquah G. E., Via B.K., Eckhardt L.G., Fasina O. O. and Billor N. 2015. Application of near infrared spectroscopy in the screening of disease tolerant *Pinus taeda* (Loblolly Pine) families for chemistry, strength and bioenergy. 19th International Nondestructive Testing and Evaluation of Wood Symposium, Rio de Janeiro, Brazil.

- Eckhardt, L.G. 2015. *Leptographium* species: Tree pathogens and agents of blue stain, and their bark beetle associates [Pine Decline: Is it real? If so, what are its effects?] Clemson Cooperative Extension Landowners Workshop and Field Trip, T & S Farms, Leesville, SC
- Eckhardt, L.G. 2015. An overview of forest health research at the forest health cooperative Auburn University. Entomology and Plant Pathology Departmental Seminar, Auburn University, Auburn, AL
- Clay, N.A., Little, N., Eckhardt, L.G. and Riggins, J.J. 2015. Widespread and complex interactions among bark beetle vectored blue stain (ophiostomatoid) fungi and subterranean termites. Ecological Society of America Annual Meeting, Baltimore, MD
- *Piculell, B.J. Nelson, C.D., Roberds, J., Eckhardt, L.G., and Hoeksema, J.D. 2015. Examining the evolutionary interactions of loblolly pine with both beneficial and pathogenic fungi. Ecological Society of America Annual Meeting, Baltimore, MD
- *Trautwig, A., Eckhardt, L., Hoeksema, J., and Carter, E. 2015. Cogongrass (*Imperata cylindrica*) reduces colonization of mycorrhizal fungi on loblolly pine (*Pinus taeda*) in commercial stands. Ecological Society of America Annual Meeting, Baltimore, MD
- Via, B.K. and Eckhardt, L.G. 2015. Near infrared reflectance (NIR) spectroscopy: dialing stem chemistry for optimal root disease resistance and forest products. Joint Auburn University Southern Forest Nursery Management & Forest Health Cooperatives 2015 Contact Meeting. St, Simons, GA
- Nadel, R.L., Matusick, G., and Eckhardt, L.G. 2015. Quantifying the impact of pine decline in the southeastern United States. Joint Auburn University Southern Forest Nursery Management & Forest Health Cooperatives 2015 Contact Meeting. St, Simons, GA
- *Trautwig, A., Eckhardt, L., Hoeksema, J., and Carter, E. 2015. Mycorrhizal communities in *Imperata cylindrical* invaded and non-invated commercial *Pinus taeda* stands. Joint Auburn University Southern Forest Nursery Management & Forest Health Cooperatives 2015 Contact Meeting. St, Simons, GA
- *Chieppa, J.J., Chappelka, A.H., and Eckhardt, L.G. 2015. Effects of elevated tropospheric ozone and altered irrigation regimes on loblolly pine seedlings inoculated with ophiostomatoid fungi. Joint Auburn University Southern Forest Nursery Management & Forest Health Cooperatives 2015 Contact Meeting. St, Simons, GA
- *Devkota, P. and Eckhardt, L.G. 2015. Variation In Tolerance of *Pinus taeda* Families to Root Infesting Fungi *Grosmannia huntii* and *Leptographium terebrantis*. Joint Auburn University Southern Forest Nursery Management & Forest Health Cooperatives 2015 Contact Meeting. St, Simons, GA
- *Cole, A., Eckhardt, L., Liebold, A., and Slippers, B. 2015. A survey for *Sirex noctilio* and native woodwasps in Alabama. Joint Auburn University Southern Forest Nursery Management & Forest Health Cooperatives 2015 Contact Meeting. St, Simons, GA

- Via, B.K. and Eckhardt, L.G. 2015. Near infrared reflectance (NIR) spectroscopy: dialing stem chemistry for optimal root disease resistance and forest products. Center for Advanced Forestry Systems 2015 Industrial Advisory Board Meeting, Asheville, NC
- Nadel, R.L., Matusick, G., and Eckhardt, L.G. 2015. Quantifying the impact of pine decline in the southeastern United States. Center for Advanced Forestry Systems 2015 Industrial Advisory Board Meeting, Asheville, NC
- *Acquah, G., Via, B.K., and Eckhardt, L.G. 2015. Nondestructive estimation of the chemical and thermal properties of forest biomass using vibrational spectroscopy and thermogravimetric analysis. This is Research: Student Symposium 2015. Auburn University, Auburn, AL
- *Chieppa, J.J., Chappelka, A.H., and Eckhardt, L.G. 2015. Effects of elevated tropospheric ozone and altered irrigation regimes on loblolly pine seedlings inoculated with ophiostomatoid fungi. This is Research: Student Symposium 2015. Auburn University, Auburn, AL
- *Trautwig, A., Eckhardt, L., Hoeksema, J., and Carter, E. 2015. Mycorrhizal communities in *Imperata cylindrical* invaded and non-invated commercial *Pinus taeda* stands. This is Research: Student Symposium 2015. Auburn University, Auburn, AL
- *Devkota, P. and Eckhardt, L.G. 2015. Variation In Tolerance of *Pinus taeda* Families to Root Infesting Fungi *Grosmannia huntii* and *Leptographium terebrantis*. This is Research: Student Symposium 2015. Auburn University, Auburn, AL
- *Trautwig, A., Eckhardt, L., Hoeksema, J., and Carter, E. 2015. Mycorrhizal communities in *Imperata cylindrical* invaded and non-invated commercial *Pinus taeda* stands. Southeastern Ecology and Evolution Conference, Athens, GA
- *Acquah, G., Via, B.K., and Eckhardt, L.G. 2015. Nondestructive estimation of the chemical and thermal properties of forest biomass using vibrational spectroscopy and thermogravimetric analysis. 18th Annual Biennial Southern Silvicultural Research Conference, Knoxville, TN
- Eckhardt, L.G., Ditchkoff, S.S., Duong, T.A., DeBeer, Z.W, and Wingfield, M.J. 2015. Two new ophiostomatoid species isolated from soil on snouts of wild pigs damaging pine roots in Georgia. 18th Annual Biennial Southern Silvicultural Research Conference, Knoxville, TN
- *Chieppa, J.J., Chappelka, A.H., and Eckhardt, L.G. 2015. Effects of elevated tropospheric ozone and altered irrigation regimes on loblolly pine seedlings inoculated with ophiostomatoid fungi. 18th Annual Biennial Southern Silvicultural Research Conference, Knoxville, TN
- *Trautwig, A., Eckhardt, L., Hoeksema, J., and Carter, E. 2015. Mycorrhizal communities in *Imperata cylindrical* invaded and non-invated commercial *Pinus taeda* stands. 18th Annual Biennial Southern Silvicultural Research Conference, Knoxville, TN

- Carter, E.A., Brunson, B.A., and Eckhardt, L.G. 2015. Soil properties associated with cogongrass infested and non-infested loblolly pine stands in Mississippi. 18th Annual Biennial Southern Silvicultural Research Conference, Knoxville, TN
- Nadel, R.L., Eckhardt, L.G., and Enebak, S.A. 2015. A rapid PCR screening test for the presence of *Fusarium circinatum* on pine seed and planting material. Society of American Foresters National Convention, Baton Rouge, LA
- *Acquah G. E., Via B.K., Eckhardt L.G., Fasina O. O. and Billor N. 2015. Rapid assessment of disease tolerant *Pinus taeda* families for strength, chemical and bioenergy applications using near infrared spectroscopy. Sigma Xi's Annual Meeting and Student Research Conference, Kansas City, MO
- *Cole, A.B., and Eckhardt, L.G. 2015. Effect of Growth Rate on *Amylostereum* spp. Fungus by Terpenes. Society of American Foresters National Convention, Baton Rouge, LA
- *Essien, C., Via, B.K., Eckhardt, L., Cheng, Q., Gallagher, T., McDonald, T., and Wang, X. 2015. Acouto-mechanical response of fourteen year old suppressed loblolly pine (*Pinus taeda*) to variation in cellulose, hemicelluloses, lignin, microfibril angel and density. Society of American Foresters National Convention, Baton Rouge, LA
- *Cole, A.B., Eckhardt, L.G., Liebhold, A., Slippers, B. 2015. Prevalence of *Sirex noctilio* F. in Alabama Forests. Society of American Foresters National Convention, Baton Rouge, LA
- *Acquah G.E., Via B.K., Eckhardt L.G., Fasina O. and Billor N. 2015. Application of NIRS in the screening of disease tolerant *Pinus taeda* families for chemistry, strength and bioenergy. Society of American Foresters National Convention, Baton Rouge, LA
- *Trautwig, A., Eckhardt, L., Loewenstein, N.J., Hoeksema, J., and Carter, E. 2015. *Imperata cylindrica* reduces colonization by mycorrhizal fungi on *Pinus taeda* in commercial stands. Society of American Foresters National Convention, Baton Rouge, LA
- *Devkota, P., Eckhardt, L., Liu, K. and Kloepper, J. 2015. Biological control of blue stain fungi by plant root growth promoting rhizobacteria (PGPR). Society of American Foresters National Convention, Baton Rouge, LA
- *Devkota, P., Eckhardt, L., and Singh, A. 2015. Relative susceptibility of several loblolly pine (*Pinus taeda* L.) families to ophiostomatoid fungi. Society of American Foresters National Convention, Baton Rouge, LA
- *Devkota, P. and Eckhardt, L 2015. Susceptibility of various mature loblolly pine (*Pinus taeda* L.) families to root infecting fungi. Society of American Foresters National Convention, Baton Rouge, LA
- *Acquah G. E., Via B.K., Fasina O. O. and Eckhardt L.G. 2015.Non-destructive prediction of the chemical and thermal reactivity properties of forest biomass using vibrational spectroscopy and thermogravimetric analysis. 19th International Nondestructive Testing and Evaluation of Wood Symposium, Rio de Janeiro, Brazil.

- *Acquah G.E., Via B.K., Eckhardt L.G., Fasina O. and Billor N. 2015. Application of NIRS in the screening of disease tolerant *Pinus taeda* families for chemistry, strength and bioenergy. Sigma Xi's Student Research Conference, Kansas City, MO
- *Cole, A., Eckhardt, L., Liebold, A., and Slippers, B. 2015. A survey for *Sirex noctilio* and native woodwasps in Alabama. This is Research: Student Symposium 2015. Auburn University, Auburn, AL
- *Trautwig, A., Eckhardt, L., Hoeksema, J., and Carter, E. 2015. Mycorrhizal communities in *Imperata cylindrical* invaded and non-invaded commercial *Pinus taeda* stands. SFWS Annual Advisory Meeting Student Poster Session, Auburn University, Auburn, AL
- *Devkota, P., Singh, A., Nadel, R. and Eckhardt, L 2015. Variance and tolerance of several loblolly pin (*Pinus taeda*) families to *Leptographium terebrantis* and *Grosmannia huntii* root fungi. SFWS Annual Advisory Meeting Student Poster Session, Auburn University, Auburn, AL
- *Cole, A. and Eckhardt, L., Liebold, A., and Slippers, B. 2015. Prevalence of *Sirex noctilio* F. in the southeastern United States. SFWS Annual Advisory Meeting Student Poster Session, Auburn University, Auburn, AL
- *Chieppa, J.J., Chappelka, A.H., and Eckhardt, L.G. 2015. Effects of tropospheric ozone on loblolly pine seedlings inoculated with ophiostomatoid fungi. SFWS Annual Advisory Meeting Student Poster Session, Auburn University, Auburn, AL
- *Acquah, G., Via, B.K., and Eckhardt, L.G. 2015. Nondestructive estimation of the chemical and thermal properties of forest biomass using vibrational spectroscopy and thermogravimetric analysis. SFWS Annual Advisory Meeting Student Poster Session, Auburn University, Auburn, AL
- Sayer, M.A.S., Tyree, M.C. Blazier, M.A., Sung, S.S., and Eckhardt, L.G. 2015. Is natural defense capacity correlated to the allocation of dry mass to the stem in loblolly pine? 18th Annual Biennial Southern Silvicultural Research Conference, Knoxville, TN
- *Cole, A. and Eckhardt, L., Liebold, A., and Slippers, B. 2015. A survey for *Sirex noctilio* and native woodwasps in Alabama. 18th Annual Biennial Southern Silvicultural Research Conference, Knoxville, TN
- *Devkota, P. and Eckhardt, L. 2015. Variance and tolerance of several loblolly pine (*Pinus taeda*) families to *Leptographium terebranctis* and *Grosmannia huntii* root fungi. 18th Annual Biennial Southern Silvicultural Research Conference, Knoxville, TN
- *Trautwig, A., Eckhardt, L., Hoeksema, J., and Carter, E. 2015. Mycorrhizal communities in *Imperata cylindrical* invaded and non-invaded commercial *Pinus taeda* stands. Southeastern Society of American Foresters Annual Meeting, St Simons Island, GA
- *Devkota, P., Singh, A., Nadel, R. and Eckhardt, L 2015. Variance and tolerance of several loblolly pin (*Pinus taeda*) families to *Leptographium terebrantis* and *Grosmannia*

huntii root fungi. Southeastern Society of American Foresters Annual Meeting, St Simons Island, GA

- *Chieppa, J.J., Chappelka, A.H., and Eckhardt, L.G. 2015. Effects of tropospheric ozone on loblolly pine seedlings inoculated with ophiostomatoid fungi. Southeastern Society of American Foresters Annual Meeting, St Simons Island, GA
- *Cole, A. and Eckhardt, L., Liebold, A., and Slippers, B. 2015. A survey of *Sirex noctilio* F. and native wood wasps in Alabama. Southeastern Society of American Foresters Annual Meeting, St Simons Island, GA

Publications

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

- *Chieppa, J.J., Chappelka, A.H., and Eckhardt, L.G. 2015. Effects of tropospheric ozone on loblolly pine seedlings inoculated with root infecting ophiostomatoid fungi. Environ. Poll. 207: 130-137.
- Beach, J., Uertz, J., and Eckhardt, L. 2015. Hyperspectral interferometry: sizing micro-scale surface features in the pine bark beetle. Microscopy Research and Techniques Published online first: DOI: 10.1002/jemt22550.
- *Acquah, G.E., Via, B.K., Fasina, O. and Eckhardt, L.G. 2015. Nondestructive estimation of forest biomass properties for bioenergy, fuels and chemical applications using near infrared spectroscopy (NIRS). J. Near Infr. Spec. Published online first: doi: 10.1255/jnirs.1153.
- *Sells, S.M., Held, D., Enloe, S., Loewenstein, N., and Eckhardt, L. 2015. Impact of cogongrass management strategies on generalist predators in longleaf pine stands. Pest Mgmt. Sci. 71:478-484.

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, Nadel, Matusick, Sword, Cater. 2015. Quantifying loblolly pine decline – FHC and SFWS – SFWS portion $60,000
- Eckhardt and Enebak. 2015. Sudden Oak Death – *Phytophpora ramorum* surveys - $36,000.

- 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).
- Hoeksema and Eckhardt. 2015. Identification of climate effects on microbial symbionts of longleaf pine - ERDC-SERL - $50,000.
- 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 Enebak. 2014. Sudden Oak Death – *Phytophpora ramorum* surveys - $36,000.
- 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. 2014. Rapid assessment tools for the genetic improvement of forest products and bioenergy – HATCH - $50,000.