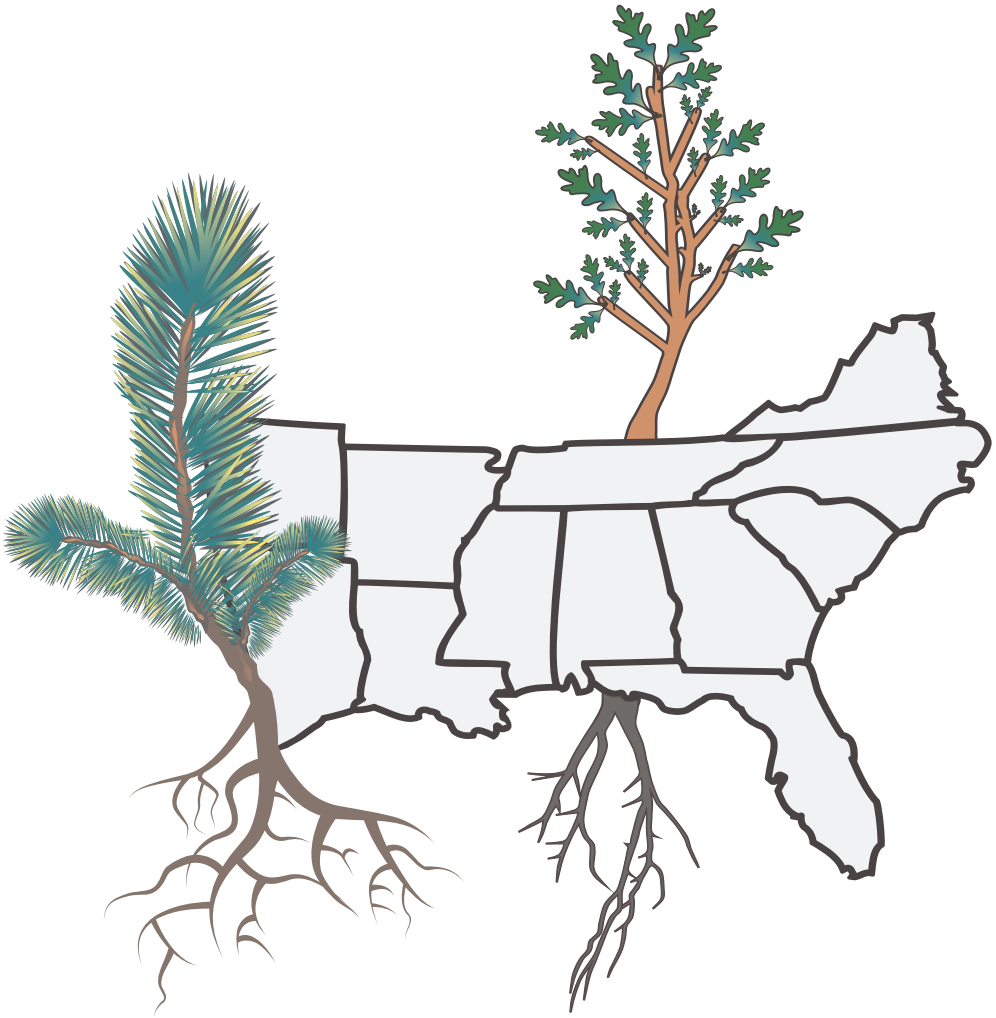
Southern Forest Nursery Management Cooperative



FY 2017 Annual Report

ANNUAL REPORT
FY 2017

(October 1, 2016 - September 30, 2017)

Contents:

AUBURN UNIVERSITY
SOUTHERN FOREST NURSERY MANAGEMENT COOPERATIVE

MEMBERSHIP LIST

(November 2017)

Full Members:

The States of

Arkansas
Georgia
North Carolina
Oklahoma
South Carolina
Tennessee
Virginia

Forest Industry

Rayonier
Weyerhaeuser
K & L Forest Nursery, LLC

Non-Industrial – Private

Westervelt
ArborGen, LLC
International Forest Company
Campbell Global (Crown Pine Timber Nursery)

US Government

USDA Forest Service

Associate Members:

AUBURN UNIVERSITY
SOUTHERN FOREST NURSERY MANAGEMENT COOPERATIVE

EXECUTIVE COMMITTEE

Service Rotation
(November 2017)

FISCAL YEAR†	**Member 1**	**Member 2**	**Member 3**
2012	Tennessee	North Carolina	Arkansas
2013	North Carolina	Arkansas	South Carolina*
2014	Arkansas	South Carolina*	Weyerhaeuser**
2015	South Carolina*	Weyerhaeuser**	Virginia***
2016	Weyerhaeuser**	Virginia***	Forest Service
2017	Virginia***	Forest Service	Georgia
2018	**Forest Service**	**Georgia**	**Rayonier**
2019	Georgia	Rayonier	Oklahoma
2020	Rayonier	Oklahoma	IFCo
2021	Oklahoma	IFCo	Campbell Timberland
2022	IFCo	Campbell Timberland	Westervelt
2023	Campbell Timberland	Westervelt	K&L Forestry
2024	Westervelt	K&L Forestry	ArborGen
2025	K&L Forestry	ArborGen	Tennessee
2026	ArborGen	Tennessee	North Carolina
2027	Tennessee	North Carolina	Arkansas
2028	North Carolina	Arkansas	South Carolina
2029	Arkansas	South Carolina	Weyerhaeuser
2030	South Carolina	Weyerhaeuser	Virginia
2031	Weyerhaeuser	Virginia	Forest Service
2032	Virginia	Forest Service	Georgia

† Member 1 would conduct the Coop business meeting held in that fiscal year. For example, Tennessee conducted the business meeting for FY12, in November of 2011.
* South Carolina could not attend the 2015 meeting. Weyerhaeuser substituted.
** South Carolina filled in for Weyerhaeuser.
***Virginia could not attend the 2016 (FY17) meeting. ArborGen substituted.

AUBURN UNIVERSITY
SOUTHERN FOREST NURSERY MANAGEMENT COOPERATIVE

THE EIGHT FUNDAMENTAL RULES OF ANTI-TRUST COMPLIANCE

1. Competitors may not agree on prices they charge for goods they sell.

2. Competitors may not agree on the prices they charge for services.

3. Competitors may not agree on terms of sale.

4. Companies may not use dominant market position to monopolize a market, control prices, or exclude competitors.

5. Competitors may not agree not to compete by allocating customers, territories, or markets.

6. Competitors may not agree not to compete on bids – i.e. bid-rigging.

7. Competitors may not agree on prices for products or services they buy.

8. Competitors may not join in a boycott of suppliers or customers to accomplish anti-competitive ends.

Rules and Policies for the Auburn University Southern Forest Nursery Management Cooperative

Approved November 1997

MEMBERSHIP

1. Full membership in the Cooperative is open to companies with domestic operations and state and federal agencies that operate a forest tree nursery. Associate membership in the Cooperative is open to domestic companies that do not operate forest tree nurseries but plant forest tree seedlings. Associate membership in the Cooperative is also open to manufacturers and distributors of commercial products used in the production of forest tree seedlings in container or bare-root nurseries.

2. Full members are required to pay annual dues. Associate members are required to pay one-half the dues set each year for full members.

3. Voting rights will be granted to full members only.

4. Membership is for one year. Membership may be terminated by either the member organization or by Auburn University by giving 60 days written notice before October 1.

5. Membership will be contingent on signing a memorandum of agreement with Auburn University.

ORGANIZATION

6. The Dean, School of Forestry, Agricultural Experiment Station of Auburn University in consultation with the Coop Executive Committee, will appoint the Cooperative's Director. The Director will be responsible for:
    A. Directing the activities of the Cooperative;
    B. Employing a competent staff;
    C. Developing the Cooperative's direction in conjunction with the Advisory Council;
    D. Ensuring each member participates to a threshold level; and
    E. Reporting research accomplishments to the Advisory Council

7. An Advisory Council consisting of one representative from each cooperating organization shall be established to:
    A. Act as a liaison between the organization and the Director;
    B. Develop Cooperative policies;
    C. Advise the Director on the Cooperative's direction;
    D. Approve the annual budget and membership fee.

E. The Advisory Council will have an annual meeting in the first quarter of each fiscal year.

8. An Executive Committee consisting of three Advisory Council members and the Director shall have the authority to meet and conduct routine business in the name of the Advisory Council. One Executive Committee member will be appointed annually according to a rotating schedule and will serve for 3 years. The Advisory Council chairman will be the senior member of the Executive Committee and will preside at the Executive Committee and Advisory meetings. Associate members are not eligible to serve on the Executive Committee.

9. Contact representatives will be designated by each cooperating organization. This individual may or may not be the same person serving on the Advisory Council. Contact Representatives will be directly involved in research established with each member organization. A meeting of contact representatives will be held in the 3rd quarter of each fiscal year.

10. All data will be available to all members in the Cooperative.

DUES and BUDGET

11. Membership fees will be set by the Advisory Council at its annual meeting. Recommended fees will be computed annually by the Executive Committee based on the consumer price index (CPI) for the previous year, and will become effective October 1 of the following year.

12. The Cooperative will operate on the fiscal year October 1 to September 30. Invoices for membership fees will be sent to all member organizations on October 1 of each year, or by special arrangement with the individual organization.

13. When a Cooperative member is acquired by another member organization, all, two-thirds, and one-third of the full membership fee will be paid for the lost member the first, second, and third years after acquisition, respectively, by the continuing member.

RULES CHANGES

14. Changes in, deletions from, and additions to the membership rules may be adopted by a two-thirds vote of advisory members in attendance at regularly scheduled or special sessions of the Advisory Council.

DIVISION OF RESPONSIBILITIES BETWEEN AUBURN UNIVERSITY AND MEMBER ORGANIZATIONS IN THE AUBURN UNIVERSITY SOUTHERN FOREST NURSERY MANAGAMENT COOPERATIVE

1. Study plans will be developed by Auburn University in conjunction with the Cooperative's Technical Committee. Responsibilities will be delineated in individual study plans.

2. Auburn will do all date analysis and processing, as well as manuscript preparation, and will insure timely distribution of results to cooperators.

3. Auburn will be responsible for developing a procedure for uniform soil testing and analysis.

4. Auburn will act as a clearinghouse on current nursery management research and will disseminate appropriate information on these practices.

5. Auburn University graduate students will be utilized to work on specific problems.

6. All cooperators will be responsible for adhering to the study plans.

Rules and Policies for the Auburn University Center for Advanced Forestry Systems (CAFS) funded by the Industry/University Cooperative Research Center Program of the National Science Foundation

Approved November 2013

A. The CENTER (Auburn University) will be operated by faculty, staff and students at the UNIVERSITY. For the first five years, the CENTER will be supported jointly by industrial firms, Federal laboratories, the National Science Foundation (NSF), the State, and the UNIVERSITY. It is possible that the UNIVERSITY may receive support from NSF for an additional five years.

B. Any COMPANY, Federal Research and Development organization, or any Government-owned Contractor Operated laboratory may become a sponsor of the CENTER, consistent with applicable state and federal laws and statutes. Federal Research and Development organizations and Government-owned Contractor Operated laboratories may become sponsors of the CENTER on terms and conditions other than those in this agreement upon approval by UNIVERSITY and two-thirds of the Industrial Advisory Board.

C. Any COMPANY that contributes $25,000 annually to University Sponsored Research Cooperatives to support any of the CENTER(s) will thereby become a full member or at least $5,000 to become an associate member.

D. The organization and operation of CENTER will be specified by CENTER bylaws that will be adopted at the Industrial Advisory Board meeting. The bylaws, when adopted, will become part of this Agreement.

E. There will be an Industrial Advisory Board composed of one representative from each member. This board makes recommendations on (a) the research projects to be carried out by CENTER (b) the apportionment of resources to these research projects, and (c) changes in the bylaws. The operation of this board is specified in the bylaws.

F. All patents derived from inventions conceived or first actually reduced to practice in the course of research conducted by the CENTER shall belong to UNIVERSITY. UNIVERSITY, pursuant to chapter 18 of title 35 of the United States Code, commonly called the Bayh-Dole Act, will have ownership of all patents developed from this work, subject to "march-in" rights as set forth in this Act. COMPANIES that wish to exercise rights to a royalty-free license agree to pay for the costs of patent application. UNIVERSITY agrees that all such CENTER sponsors are entitled to a nonexclusive royalty-free license. COMPANY will have the right to sublicense its subsidiaries and affiliates. If only one COMPANY seeks a license, that COMPANY may obtain an exclusive fee-bearing license through one of its agents. COMPANY has the right to sublicense its subsidiaries and affiliates.

G. Copyright registration shall be obtained for software developed by CENTER. COMPANY shall be entitled to a nonexclusive, royalty-free license to all software developed by CENTER.

COMPANY will have the right to enhance and to re-market enhanced or unenhanced software with royalties due to CENTER to be negotiated, based on the worth of the initial software.

H. Any royalties and fees received by UNIVERSITY under this Agreement, over and above expenses incurred, will be distributed in accordance with UNIVERSITY royalty-sharing schedule.

It is further stated that:

1.The UNIVERSITY reserves full right of publication, but the UNIVERSITY will give the COMPANY privilege of reviewing any manuscripts before they are published.

2.That this agreement may be terminated by either party by giving 60 days notice to the other in writing.

The UNIVERSITY, in accepting these funds, has for its purpose the promotion of improved forestry.

AUBURN UNIVERSITY
SOUTHERN FOREST NURSERY MANAGEMENT COOPERATIVE

FY18 ADVISORY MEETING AGENDA

Wednesday, November 8, 2017

TIME	EVENT	SPEAKER
11:00 – 1:00	Registration	SFWS Conference Hall - 1101
1:00 – 1:05	Welcome to Auburn University	Scott Enebak - SFWS
1:05 – 2:00	FY17 Accomplishments	Scott Enebak – SFWS
2:00 – 2:15	New Legislation & Pesticide News	Ryan Nadel – SFWS
2:15 – 2:45	Shortleaf container root production	Ryan Nadel - SFWS
2:45-3:15	Herbicide Trial Updates	Nina Payne - SFWS
3:15 -3:30	Break	
3:30– 4:00	Alternative chemicals for rust control and fumigation trial update	Ryan Nadel – SFWS
4:00 – 4:30	The use of models that use temperature and water availability to predict plant size, and plant carbohydrates	Ryan Nadel - SFWS
4:30	Depart for BBQ Dinner and Social	
5:00 – 8:00	BBQ	Enebak Estate

Thursday, November 9, 2017

TIME	EVENT	SPEAKER
7:00 – 8:00	Breakfast – Danish / Coffee / Juice	SFWS Conference Hall - 1101
8:00 – 8:30	Root health and hydraulic conductivity and its importance to outplanting success	Ryan Nadel - SFWS
8:30– 9:00	2016-17 Seedling Production Survey	Scott Enebak - SFWS
9:00 – 10:00	FY18 Work Plan Discussion & Approval	Scott Enebak & Rayonier
10:00-10:30	Break	
10:30 – 12:00	FY 18 Budget Discussion	Scott Enebak & US Forest Service
12:00 ish	Adjourn	Have a safe trip home!

FY 2018 ADVISORY COMMITTEE MEETING
November 8 & 9, 2017

MINUTES

1) The FY 2018 Advisory Committee Meeting was opened at 1:00 p.m., Wednesday, November 9, 2016 by Scott Enebak, Director.

2) This is to serve as a reminder that all business is conducted according to the guidelines of anti-trust legislation (see page 7).

3) Those in attendance of the FY 2018 Advisory Committee Meeting were as follows:

Mike Coyle, IFCO
Elizabeth Bowersock, AU (Thursday only)
Dave Bowling, Arkansas
Barry Brooks, AU
Ken McQuage, IFCO
John Conn, Tennessee
Brandon Loomis, Westervelt
Mark Davis, Rayonier
Scott Enebak, AU
Gina Bishop, ArborGen
Tim Adams, South Carolina Forestry Commission
Ryan Nadel, AU
Doug Sharp, IFCO
Nina Payne, AU
Brandon Loomis, Westervelt
Tammy Ladd, Weyerhaeuser
Justin Funk, Virginia Dept. of Forestry
James West, North Carolina Forest Service

4) Please see page 15 for the FY 2017 Advisory Committee Meeting Agenda. The following presentations were made on Wednesday afternoon or Thursday morning as noted in the Agenda:

a. New Legislation and Pesticide News – Ryan Nadel
b. Shortleaf Container Root Production – Ryan Nadel
c. Herbicide Trial Updates – Nina Payne
d. Alternative Chemicals for Rust Control & Fumigation Trials Update – Ryan Nadel
e. The Use of Models that Use Temperature and Water Availability to Predict Plant Size, and Plant Carbohydrates – Ryan Nadel
f. Root Health and Hydraulic Conductivity – Ryan Nadel
g. 2016-2017 Seedling Production Survey – Scott Enebak

5) The FY 2018 Business Meeting of the Auburn University Southern Forest Nursery Management Cooperative was called to order at 8:51 a.m. on Thursday, November 9, 2017, by Mark Davis of Rayonier. (USFS nor GFC were able to attend the meeting, so the next rotation was to Rayonier.) Cooperative Members as listed above (page 17) were present. All members present concurred unanimously to begin the meeting. Topics of the FY18 Work Plan were discussed and voted upon, with amendments, as follows:

Goal A.
Objective 1.

a. Methyl Bromide Substitution

Motion to Approve: Dave Bowling
2nd: Doug Sharp
Unanimous Approval

b. Nursery Weed Control
Discussion: Some of these will certainly be demonstrations at Elberta for next year's meeting. It has been requested to test Ronstar Flo on slash. Testing new safeners? - It is possible to get the companies to supply the product so we can test. How to get over the June/July "hump" – in conifers. Do we still need to test PAC? If no one is going to use it in containers, we can stop.

Motion to Approve: Ken McQuage
2nd: Mark Davis
Unanimous Approval

c. Fusiform Rust Control
Discussion: Repeat Compass and 2 other compounds.

Motion to Approve: John Conn
2nd: Mark Davis
Unanimous Approval

d. Nanocellulose/lignin Impregnated with Insecticides to Control Pine Tip Moth
Discussion: This is "phase 1" of the project, to be conducted in the greenhouse. Possible that similar projects have been written before – look for reprints of similar done in Scandinavia.

Motion to Approve: Mark Davis
2nd: Brandon Loomis
Unanimous Approval

Objective 2.

a. Development of a Rapid Screening Test for the Presence of *Fusarium circinatum*

Motion to Approve: John Conn
2nd: James West
Unanimous Approval

b. Modeling Container Seedling Development
Discussion: This will be done in the greenhouse.

Motion to Approve: Dave Bowling
2nd: Brandon Loomis
Unanimous Approval

Objective 3.

a. Hardening Off Practice of Reducing Water Availability
Discussion: This will be done in the greenhouse, in stress boxes. Include optimal nutrient loading to slow growth but not impede – conduct a nutrient analysis as well.

Motion to Approve: Mark Davis
2nd: John Conn
Unanimous Approval

b. Seedling Quantification with Drones
Discussion: New addition to FY18 Work Plan. We can fly the drones, but we need a software engineer to write the code that will allow us to count/data processing. Will contact engineering for guidance.

Unanimous Approval

Objective 4.

a. Chilling Hours and Seedling Storability
Discussion: Cultural practices are changing due to weather patterns; we need to figure out what we need to be doing with the warmer winters.

Motion to Approve: Mark Davis
2nd: Ken McQuage
Unanimous Approval

Goal B.

Objective 1.

a. Methyl Bromide

b. Update Nursery Label Book
c. Revision of Ah Handbook 473, Hardwood Nursery Guide
d. Re-registration of Nursery Pesticides
e. Maintain and Update Nursery Cooperative Website
f. Leveraging of Nursery Cooperative Data

Objective 2.
a. Contact Meeting – July 17-19, 2018 – Pensacola, FL
b. Research Reports
c. Newsletters

Objective 3.
a. Individual and Organization Contacts
b. Seedling Production Survey
c. Nursery Customer Meeting Presentations
d. Short Course – Survey will be sent out in January to assess the need

Goal C.
Objective 1.
a. Advisory Committee Meeting – Oct. 31/Nov. 1, 2018
b. Nursery Cooperative Membership
c. Update Coop Membership and Nursery Directories

Objective 2.
a. Presentations at Meetings
b. Publications
c. Extramural Funding of Nursery Cooperative Projects
d. Interaction with other Research Cooperatives

Motion to Approve Goal B and Goal C: James West
2nd: Dave Bowling
Unanimous Approval

6) BUDGET: $500 dues increase for FY19, re-evaluate based on Barry Brooks' retirement among other things. Continue to look for new members. Create new dues structure potentially based on number of nurseries and to bring into alignment with other cooperatives.

Motion to Approve FY18 Budget Projections with $500 dues increase and re-evaluation of dues during FY18: Mark Davis; 2nd: Doug Sharp; Unanimous Approval

7) The FY 2016 Business Meeting of the Auburn University Southern Forest Nursery Management Cooperative is adjourned.

AUBURN UNIVERSITY
SOUTHERN FOREST NURSERY MANAGEMENT COOPERATIVE

FY 2017 BUDGET – PROJECTED VERSUS ACTUAL

(October 2017)

FISCAL YEAR
(Oct. 1, 2016 - Sept. 30, 2017)

	FY 17 (Projected)	FY 17 (Actual)	Difference
REVENUE			
Carryover from Previous Year	114,173	116,661	2,488
FY 17 Dues	190,050	175,100	(14,950)
FY17 Other Income	20,000	19,660	
Total Revenue	**324,223**	**311,421**	**(12,802)**
EXPENDITURES			
Personnel Costs			
Professional/Non-Faculty - Ryan Nadel	10,162	12,598	(2,436)
Professional/Non-Faculty - Elizabeth Bowersock	26,572	26,854	(282)
Research Assistant - Barry Brooks	44,419	19,279	25,140
Research Assistant - Nina Payne	47,756	38,050	9,706
Graduate Students - PhD/MS	0	0	0
Student Labor	0	0	0
Employee Benefits	39,962	31,032	8,930
Total Personnel Costs	**168,871**	**127,813**	**41,058**
Operating Costs			
Travel	10,000	17,066	(7,066)
Vehicle Mileage	10,000	10,366	(366)
Supplies	6,000	12,218	(6,218)
Equipment	2,000	0	2,000
Total Operating Costs	**28,000**	**39,651**	**(11,651)**
Total Expenditures	**196,871**	**167,464**	**29,407**
CARRYOVER FOR NEXT YEAR	**127,352**	**143,957**	**16,605**

AUBURN UNIVERSITY
SOUTHERN FOREST NURSERY MANAGEMENT COOPERATIVE

THREE YEAR FINANCIAL STATEMENT

(October 2017)

	FISCAL YEAR October 1 - September 30		
	$10,800	$11,300	$11,800
	FY18 (Projected)	**FY19** (Projected)	**FY20** (Projected)
REVENUE			
Carryover from Previous Year	143,957	99,185	37,410
Fiscal Year's Dues	167,867	172,933	177,000
Fiscal Year's Other Income	30,000	10,000	10,000
Total Revenue	**341,824**	**282,118**	**224,410**
EXPENDITURES			
Personnel Costs			
Research Fellow - Ryan Nadel; 61.83%	31,446	31,838	31,838
Research Assistant - Barry Brooks; 100%	46,106	46,124	46,124
Clerical Staff - Elizabeth Bowersock; 50%	27,799	27,966	27,966
Research Assistant - Nina Payne; 100%	50,099	51,101	51,101
Graduate Students - PhD/MS	5,000	5,000	0
Student Labor	2,000	2,000	2,000
Employee Benefits (31%)	48,189	48,679	48,679
Total Personnel Costs	**210,639**	**212,708**	**207,708**
Operating Costs			
Travel	12,000	12,000	12,000
Vehicle Mileage	12,000	12,000	12,000
Supplies	6,000	6,000	6,000
Equipment	2,000	2,000	2,000
Total Operating Costs	**32,000**	**32,000**	**32,000**
Total Expenditures	**242,639**	**244,708**	**239,708**
CARRYOVER FOR NEXT YEAR	**99,185**	**37,410**	**(15,299)**

AUBURN UNIVERSITY
SOUTHERN FOREST NURSERY MANAGEMENT COOPERATIVE

NURSERY COOP
EIGHT YEAR PROJECTED PLANNING BUDGET
(October 2017)

	$10,800 FY18	$11,300 FY19	$11,800 FY20	$12,300 FY21	$12,800 FY22	$13,300 FY23	$13,800 FY24	$14,300 FY25
Revenue (000s)								
Carryover	144.0	99.2	37.4	(15.3)	(48.2)	(73.1)	(90.0)	(98.9)
Income	197.9	182.9	187.0	206.8	214.8	222.8	230.8	238.8
Total	**341.8**	**282.1**	**224.4**	**191.5**	**166.6**	**149.7**	**140.8**	**139.9**
Expenditures								
Personnel/Benefits	203.6	205.7	205.7	205.7	205.7	205.7	205.7	205.7
Student Labor	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Graduate Student	5.0	5.0	0.0	0.0	0.0	0.0	0.0	0.0
Travel	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0
Supplies	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Equipment	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Total	**242.6**	**244.7**	**239.7**	**239.7**	**239.7**	**239.7**	**239.7**	**239.7**
Carry Over Balance	**99.2**	**37.4**	**(15.3)**	**(48.2)**	**(73.1)**	**(90.0)**	**(98.9)**	**(99.8)**

AUBURN UNIVERSITY
SOUTHERN FOREST NURSERY MANAGEMENT COOPERATIVE

FY 2017 ACCOMPLISHMENTS

As Presented to the Southern Forest Nursery Management Cooperative Advisory Committee
November 8-9, 2017

AUBURN UNIVERSITY
SOUTHERN FOREST NURSERY MANAGEMENT COOPERATIVE

FY 2017 ACCOMPLISHMENTS

GOAL A: RESEARCH

Objective 1. Identify, test, evaluate, and promote the registration of cost effective pesticides for use in forest tree nurseries.

Methyl Bromide Substitution

We will establish a replicated Methyl Bromide substitution trial at Rayonier Elberta Nursery, AL. The data collected will include seedling quality, nematodes, weeds and Trichoderma levels prior to and post fumigation. Data will be collected for two growing seasons and treatment plots will be part of the 2018 Southern Forest Nursery Association's annual meeting to be hosted by Rayonier. Products to be tested include Etheyelenedinitril, Dominus, Vapam, Ally 33 and propylene oxide. (Nadel/Enebak)

✓***Accomplishment: Trial was successfully installed. Pre and post Trichoderma and nematode levels were measured. Initial weed counts per treatment were undertaken. Weed data was collected and final seedling characteristics will be taken in November 2017.***

Herbicide Trials

Herbicide trials will be developed and installed to examine the effects of herbicides on seedling quality and on targeted weeds as reflected in our recent problem weed survey. Several of these are further developments of herbicide studies installed in in previous years.

- Pendulum®AquaCap™ on containerized pine: To gain additional seedling tolerance and targeted weed control information, a third-year container trial will be installed to test the tolerance of 4 pine species in container media to applications of PAC and the effectiveness of PAC on black willow and other weeds. Applications will be made weekly during the sowing period to coincide with willow seed dispersal. (Payne/Enebak)

  ✓***Accomplishment: This trial was installed in March and April 2017 in loblolly, longleaf, shortleaf and slash pine at one container nursery. This is the third year of study on loblolly and slash pine, and second year of study on longleaf and shortleaf pine. Newly-sown trays were sprayed over a five-week period in order to coordinate spray***

applications with sowing dates, species availability, and black willow seed dispersal. In addition to the two rates of PAC used in 2015 and 2016 studies, an additional higher rate (highest labelled rate) was added to determine seedling tolerance and its effectiveness in providing longer-term (6 to 8 months) weed control at this rate. The nursery provided 360 trays of seedlings for use in this study. Field counts of seedlings and weeds and collection of sample seedlings are scheduled for late November. Results of this trial will be included in a Research Report.

- Pendulum®AquaCap™ and Marengo® outplanting studies: The four outplanting studies currently in place at Westervelt (AL) and IFCO (LA) nurseries will be continued for one additional growing season to gain additional data. Measurements from these studies will be used to compare survivability and growth of treated to non-treated container loblolly pine seedlings. Outplanting test maintenance is provided by cooperating nursery staff; measurements will be made by either nursery or SFNMC staff. (Payne/Enebak)

  ✓***Accomplishment: Because 2016 measurements of the outplanting studies showed no differences in survival and growth between treated and non-treated container loblolly pine seedlings sprayed with either Pendulum®AquaCap™ or Marengo®, utilization of these outplanting studies is discontinued.***

- Marengo® in bareroot eastern red cedar: A follow-up trial applying Marengo over-the-top of eastern red cedar seedlings will be established at the Georgia Forestry Commission's Flint River Nursery. This trial will be used to confirm results of a 2015 study installed at this nursery in which cedar seedlings treated with Marengo® exhibited increased growth characteristics when compared to untreated seedlings. (Payne/Enebak)

  ✓***Accomplishment: A follow-up trial of Marengo® sprayed at three rates over the top of bareroot eastern red cedar was installed in one nursery in June 2017. The nursery provided 160 feet of bed space for use in this study. Seedling sample collections are scheduled for mid-November 2017, with results of analyses of measurements to be included in a Research Report.***

- Pendulum®AquaCap™ second application timing trial: In response to concerns from multiple bareroot nurseries over reoccurrence of spurge in late summer (after PAC application was made at sowing), a timing trial of PAC will be installed at several nurseries of varying soil types. This study will be used to determine if PAC applications made at sowing and again at 8, 10, or 12 weeks post-sowing will result in herbicide gall formation or have other effects on seedling quality. A similar timing trial with PAC was made in 2013 without an at-sowing PAC application. (Payne/Enebak)

  ✓***Accomplishment: While maintaining the intent of this study, a modification was made to eliminate later-season (at 8, 10 or 12 weeks post-sowing) sprays and substitute a higher rate application of PAC at sowing. Because a later-season application of PAC***

would require weed-free seedling beds for optimal herbicidal effectiveness, hand-weeding of the test beds would be required, defeating the purpose of this study. This rate is the highest allowable labelled rate of PAC, has not been tested by the SFNMC, and is recommended for longer-term (6 to 8 months) weed control. At-sowing applications of PAC at three rates (two previously studied rates and one new high rate) were made in loblolly pine in four bareroot nurseries in April 2017. Each nursery provided between 100 and 150 feet of bed space for this trial. (This higher rate of PAC was also included in the PAC container study listed in the first item.) Field counts of weed populations and collections of sample seedlings are scheduled for October, with results of analyses of measurements included in a Research Report.

- 'New' herbicides screening study: A replicated screening study of multiple (up to 20) pre- and post-emergent herbicides for the control of sedges, grasses, and broadleaf weeds will be installed at member nurseries of various soil types to target specific weed problems. Using our recent problem weed survey, faculty of AU Department of Crop, Soil and Environmental Sciences will identify herbicides to include. These herbicides have not yet been tested by the SFNMC but are presently used in either turf or agricultural settings. Pine seedling tolerance and herbicidal effectiveness will be measured. In addition, second-year trials of any of the 4 herbicides tested in 2016 may be installed after seedling quality data are analyzed to quantify seedling tolerance. One of these 4 new herbicides (sulfentrazone) may be used in an additional trial targeting annual sedge. (Payne/Enebak)

  ✓***Accomplishment: This study was modified to screen only post-emergent herbicides due to logistical limitations of including both pre- and post-emergent products. Nine herbicides, selected for broadleaf weed, grass or sedge control, were applied at 9 weeks post-sowing over the top of loblolly pine in four nurseries and slash pine in one nursery. Each nursery provided from 400 to 650 feet of bed space for this trial. Four of the herbicides used were studied in 2016 trials with no negative effects on seedling characteristics when applied at least 8 weeks after sowing. Field observations over the summer show that at least two of the new herbicides have negative effects on seedling growth and development. Collections of sample seedlings are scheduled for October and results of analyses of measurements will be included in a Research Report.***

- RonstarFlo® (oxadiazon) study targeting annual sedge (*Cyperus compressus*): As a result of increased incidence of annual sedge in both bareroot and container nurseries, a trial of pre-and post-emergent applications of RonstarFlo®, alone and in combination with other preemergent herbicides, will be made. In 2012 and 2013 trials using RonstarFlo®, bareroot pine seedlings exhibited tolerance to the herbicide with good sedge control. (Payne/Enebak)

  ✓***Accomplishment: To continue work begun in 2012, this trial was installed in four bareroot nurseries in loblolly pine. Pre-emergent applications of three rates of RonstarFlo® (two previously studied rates and the highest labelled rate not yet studied) were made at the time of sowing. Conifer nurseries are listed on the RFlo label as***

acceptable use locations but the four major pine species produced by our nurseries are not listed as tolerant in over-the-top applications of the herbicide. Because annual sedge can be a problem weed in container nurseries, this study was expanded to include applications of RFlo at three rates to newly-sown trays of loblolly, longleaf, shortleaf and slash pine in one nursery. Bareroot nurseries each provided 200 feet of bed space, and 360 container seedling trays were provided by one nursery. Field counts of seedlings and weeds and collection of seedling samples are scheduled for October and November, with results of analyses of measurements included in a Research Report.

- A survey of member nurseries will be made to document historical and current use of Goal® (oxyfluorfen) products in weed control regimens. This survey is relevant due to the presence of weeds that appear to be more resistant to Goal® in a limited number of our member nurseries.

  ✓Accomplishment: A request for current and historical use of oxyfluorfen products was emailed to all nurseries in September. Information received will be complied and saved for use should the need arise to investigate herbicide resistance to Goal® products.

Fusiform Rust Control

A seed treatment study on loblolly will be done testing new chemistries in addition to using various rates of Proline® in conjunction with the US Forest Service Rust Testing Laboratory in Asheville, NC. Current label rates for Proline® as a seed treatment on conifer seed were based on the use of tridimefon activity. Label rates for others agronomic seeds are 10-100 x less ai per unit of treated seed. The ability to identify the lowest effective rate for Proline® use on conifer seed will decrease pesticide usage. Any potentially new fungicide seed treatment chemistries will also be assessed in this study. Conifer seed (longleaf, loblolly and slash) will be treated in Auburn and then sown into USFS container systems until germination at which time the seedlings will be challenged with basidiospores of fusiform rust. (April - Nov 2017) (Nadel/Enebak)

✓Accomplishment: Loblolly and slash pine seedlings were treated 5 rates of Proline, standard Bayleton and water check to determine the lowest effective rate to control fusiform rust when used as a seed treatment prior to sowing. Bayleton and non-treated seed were included as a positive and negative control. Treated seed were sown at the USFS Rust Testing Laboratory and 6 weeks post sowing were challenged with 30,000 basidiospores of Cronartium quercuum f.sp fusiforme. Seedlings were then cared for by USFS staff and the amount of infection determined by treatment recorded in October. Effects of reduced seed-treatment rates on infection will be compiled into a Research Report.

Objective 2. Identify and develop economically feasible nursery cultural practices that enhance seedling quality.

Development of a rapid screening test for the presence of *Fusarium circinatum*

We continue testing this new method on conifer seed and seedlings for the presence of the pitch canker fungus and aim to have this new technology adopted and approved by the International Seed Testing Association (ISTA) as a seed screening method that can then be enforced as an alternative to the current blotter paper method used by seed certification companies, disease diagnostic laboratories and plant inspection agencies. SFWS staff will focus on equipment grants that would allow the purchase of a qPCR such that the system could be used to quantify seed infestation. (Nadel/Enebak)

✓***Accomplishment: The molecular protocol developed to rapidly screen for the presence of Fusarium circinatum in pine seed and seedlings has been submitted to the ISTA for review and approval. Pitch canker screening of seedlot and seedling samples is now a service available to members. In collaboration with SFWS staff we have been able to recently acquire a real time PCR machine that will enable us to now work on quantifying the actual seed infestation using molecular method.***

Using Near Infrared (NIR) to Detect Freeze Injury in Loblolly Pine

Near-infrared Spectroscopy (NIR) was originally developed for use in the pharmaceutical industry and is now used in agriculture, and chemical manufacturing. Recently this technique has found a use in identifying different species of Eucalyptus. Initial testing in both bareroot and container loblolly pine that represents a base line for freeze tolerance (e.g. 7-56, Atlantic Coast, Marion County) will be done with a laboratory NIR machine to develop a baseline for non-injured tissue. Two years of funding has been secured from SFWS to bring on a PhD student, who has been identified and is starting on the project in January 2017. Seedlings will then be subjected to various levels of exposure to freezing temperatures to determine if freeze injury can be detected. If successful, we will try to obtain a portable NIR instrument which has been successfully used in forestry. (Jan – Dec 2017) (Enebak/Via)

✓***Accomplishment: A second student was identified and application was approved by AU Graduate School to begin on this project in January 2017. However, the student was not granted a student visa and was denied entry in the US. This, and long duration in locating a student resulted in the matching-SFWS to be rescinded. This project will be tabled until funding and qualified student can be located.***

Controlled Release Fertilizers in Container Seedlings & Nutrient Status

This study will be repeated for a third year using the same protocol as this last year, but focussed on application rates. The use of long-term controlled release fertilizers (CRF) (> 14-18 months) at

different rates will be examined in the production and nutrient status of container seedlings over time. An example of a CRF would be #2 Polyon 16-5-11. Container sets of participating nurseries will be seeded with different numbers of prills by incorporating a sample of the fertilizer, at different rates, in a small portion of their media by hand. Nutrient status will be measured on seedlings treated with various fertilizer rates and examined for foliar nutrients after outplanting. Nurseries interested in participating in the experiment include IFCO, Bellville, River Bend, North Carolina Forestry Commission and Westervelt. (Nadel/Enebak)

✓***Accomplishment: Cooperators for this particular CRF study could not be identified and this trail was not installed in FY17. We continue to monitor the growth and survival of the previous rate trial that was out-planted in December 2016***

Literature search on bareroot seedling nutrient loading

A literature search will be undertaken to determine whether any research has been undertaken on nutrient loading of bareroot seedlings, without the resulting excess foliage flushing. (Nadel/ Enebak)

✓***Accomplishment: No progress was made with this project in 2017.***

Objective 3. Develop methodologies to minimize the environmental impact of nursery cultural practices while maximizing their effectiveness including the development of integrated pest management programs.

The use of drones: Unmanned Aerial Vehicles (UVAs) in seedling production

Working with the Department of Bioscience in the College of Agriculture, UVAs will be flown over the growing season and the data analyzed to examine the effects of nursery practices on seedling productivity in a continuation and confirmation of the 2016 data collection. The ability to count the number of seedlings in a container nursery is imperative. This study will focus on determining the correct software to be used to count individual seedlings from the images obtained from UVAs (McDonald/Enebak/Nadel)

✓***Accomplishment: Imagery of both bareroot and container seedlings were obtained and submitted to AU Biosystems Engineering department to assess the ability of specific software to assist in seedling inventory. Using currently available software, Dr. Tim McDonald was able to "count" seedlings in images provided. Thus, the system is possible, but would need to be tied to individual seedling systems.***

Test alternative fipronil chemistries for use in seedling production

Nursery Cooperative staff will test alternative fipronil chemistries as an alternative to PTM. (Enebak)

✓***Accomplishment: Two a.i. sources of fipronil were identified and a trial installed in March 2017. Growth and survival of the trial will be measured in early 2018.***

Objective 4. Further define the "optimal seedling" so as to maximize the cost effectiveness of artificial regeneration forestry systems.

Chilling Hours and Seedling Storability

Determine the impact of ethylene management on increasing seedling storability and its impact on chilling hours through a one molecule inhibitor of ethylene (1-MCP). Several types of stresses (such as temperature, moisture and nutrient stress) induce ethylene production. Increased Ethylene production has been shown to reduce the growth and survival of several agricultural crops. The AgroFresh Inc. 1-MCP product inhibits the production of ethylene (due to the blocking nature of the molecule) and successfully used in fruit production and storage increasing yields and survivability of such crops. There are potential opportunities for the forestry industry to use such a product (during lifting and storage of seedlings) to increase survivability. This study we aim to determine what impact the 1-MCP molecule will have of ethylene production of seedlings and whether such a product could aid in increasing seedling storability and out planting success. (Nadel/ Enebak)

✓***Accomplishment: Study was undertaken using a single seedlot of slash pine. Seedling were pulled from the nursery for each treatment and placed in a cooler. At two week intervals seedlings were removed from the stored seedlings for measurement and outplanting. Outplanted seedlings growth and survival continues to be measured. Provisional results indicate an impact of 1-MCP on seedling survival. Further studies on the use of 1-MCP are required to determine the reproducibility of the results over a "normal" lifting period***

A meta-data analysis (statistical analysis of data across multiple studies) will be attempted to determine if there is a link to the number of chilling hours seedlings are exposed to and their ability to survive storage after outplanting. (Enebak/Loewenstein)

✓***Accomplishment: No progress was made with this project this growing season.***

GOAL B: TECHNOLOGY TRANSFER

Objective 1. Serve as a clearinghouse of information related to nursery production and tree planting.

Methyl Bromide

In collaboration with MBr manufacturers, the Methyl Bromide Industry Panel (MBIP), the Chloropicrin Manufactures Task Force (CMTF) and applicators, the Nursery Cooperative staff will continue to keep abreast of EPA actions and/or possible legislative initiatives that may affect the future availability of soil fumigants. We will continue to inform the membership through the Advisory Committee to keep the membership knowledgeable of these activities

The Nursery Cooperative staff will continue to keep abreast of activities related to the Quarantine pre-shipment (QPS) process. We will inform the membership of any EPA initiatives and continue to work with the AF&PA, the Crop Protection Council, USDA and APHIS to provide input and influence the QPS process if necessary.

The Nursery Cooperative staff will continue to work with the AF&PA, and USDA to inform and influence the EPA deliberations regarding pesticide regulation as it pertains to the soil fumigation re-registration decisions that were released in spring 2013. (Nadel/Enebak)

✓Accomplishment: Accomplishments: Nursery Cooperative staff participated in 1 conference calls with the MBIP and the CMTF on soil fumigation rules. Nursery Cooperative staff continue to survey members each fall and spring as to their soil fumigation operations. Soil fumigation use, rates, compounds and issues are being compiled for inclusion on the soil fumigation REDs including Telone, which appears to have a lower toxicity ranking than previously reported. These, and other changes, will be part of the new labels, scheduled to appear in 2020.

Update of Nursery Label Book

The Nursery Pesticide Label Book on the Nursery Cooperative's website will be updated to include recent additions of herbicide, insecticide and fungicide labels. (Brooks/Enebak)

✓Accomplishment: The collection and listing of herbicides, insecticides and fungicide labels continues. Labels for herbicides, Insecticides and Fungicides were linked to an Excel Spreadsheet that is available on the Nursery Cooperative Web Page.

Revision of Ag Handbook 473, Hardwood Nursery Guide (Hardwood Manual)

In collaboration with the US Forest Service and with input from Nursery Cooperative membership, Dr. McNabb and Nursery Cooperative staff and Carolyn Pike, of the USFS, Purdue will complete the missing chapters of the Hardwood Manual. (McNabb/Starkey/Bowersock)

✓***Accomplishment: Ken McNabb has completed the missing chapters of the Hardwood Nursery Guide and is in the final editing process for submission to printers with a deadline of October 31, 2017. Plans are to have the guide printed in and distributed to membership in 2018.***

Re-registration of Nursery Pesticides

The Nursery Cooperative staff will continue to follow the re-registration process for pesticides currently under review under the Food Quality and Protection Act (FQPA) used in seedling production and will provide information to the necessary regulatory agencies (USDA, APHIS, EPA, etc) when necessary. (Enebak/Nadel)

✓***Accomplishment: In early July 2017, a request came from EPA/USDA ARS on the use of phosmet, an insecticide labeled for use in nurseries and seed orchards on conifers. I queried the southern seedling producers about their usage, if any of phosmet, and received no comments from the 18 or so state, federal or private nurseries. I also could find no record in the Nursery Practices Survey Reports or data sheets conducted in 2012 of any organization using any of these materials.***

Maintain and Update Nursery Cooperative Web Site

The Nursery Cooperative staff will continue to update the Nursery Cooperative website for use by Nursery Cooperative Members and increase the "searchable" status of the Cooperative's data and reports. (Bowersock)

✓***Accomplishment: A compilation of herbicide Research Reports based on active ingredient from 1979 to 2017 was developed and distributed to nursery members in paper format at the 2017 Contact Meeting, and also made available as a searchable Excel spreadsheet to interested nursery personnel. This list allows for searches by herbicide common and trade name, weed type, and species tested. (Payne)***

Leveraging Nursery Cooperative Data

The Nursery Cooperative staff will continue to stress the importance of Cooperative membership and when possible, leverage Cooperative information for grant proposals and data cite license for the seedling production survey. (Staff)

✓***Accomplishment: Accomplishments: The Nursery Cooperative had an additional year added to the 5-yr agreement to share seedling production data under a Cite License. For an annual fee of $10,000, seedling production data will be given to USFS Washington Office for them to use in their planning and reporting programs. Funds are used towards Elizabeth Bowersock's salary to compensate for her time.***

✓***Accomplishment: A proposal that used Nursery Cooperative funds as a match/leverage for Center for Advanced Forestry Systems (CAFS) was approved in July 2017. The Nursery Cooperative will share $60,000 annually with the Forest Health Cooperative in FY 18 that will go towards Dr. Ryan Nadel's salary. This is the last year of this grant proposal.***

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

Contact Meeting

The Nursery Cooperative Contact meeting will be conducted as a 2-3 day program will be held in in South Carolina. ArborGen's SuperTree Nursery in Blenheim, SC will serve as the host and conduct the nursery tour. Working with Gary Nelson, cooperative trials will be install as part of the outreach component of Nursery Cooperative research. The agenda will cover presentations by Nursery Cooperative staff on current research activities and results during the week of July 10, 2017. Details will be worked out with Gary Nelson with meeting information outlined in the Spring 2017 Newsletter. (Enebak/Bowersock)

✓***Accomplishment: The 2017 Nursery Cooperative Contact meeting was held on July10-13, 2017 in Myrtle Beach with ArborGen's SuperTree Nursery in Blenheim, SC serving as the host and conducting the nursery tour. The meeting was attended by 38 Nursery Cooperative members. Nursery Cooperative staff presented information to the entire group on soil fumigant usage rates over time, weed control, new technologies and mobile apps and a rapid pitch canker identification tool that is ready for members to participate. In addition, guest speakers included Tim McDonald, Biosystems Engineering from Auburn discussing the possibility of seedling inventory and camera systems, Lisa Samuelson from SFWS reporting on seedling physiology and Barbara Crane, US Forest Service on the status shortleaf and longleaf pine seed orchards. The field trip at this meeting included a tour of the Blenheim Nursery and SFNMC herbicide trials. Special thanks to Gary Nelson, his staff and ArborGen for their efforts to host the group.***

Research Reports (Staff)

We plan on producing Research Reports and Technical Notes in FY17.

✓***Accomplishment: Nursery Cooperative staff produced 3 Research Reports, 1 Technical Note and 1 Management Alert that covered the following topics.***

- ***RR 2017-01. Effect of Rate of Over-the-Top applications of Marengo (indaziflam) on seedling tolerance and control of black willow and other weeds in container-grown pine seedlings. Payne, Enebak and Brooks.***

- ***RR 2017-02. Herbicide trials with florasulum, penoxsulam, trifloxysulfuron and sulfentrazone in loblolly and slash pine seedlings. Payne and Enebak.***

- ***RR 2017-03. Pendaulum Aquacap (pendimethalin) applications on tolerance of container-grown loblolly, longleaf, shortleaf and slash pine and on black willow and weed populations in containerized growing systems. Payne and Enebak.***

- ***MA 2017-01. Record heat and drought impact on seedling outplanting growth and survival. Nadel.***

- ***TN 2017-01. Forest tree seedling production in the southern United States for the 2016-2017 planting season. Enebak.***

Newsletters

Newsletter distribution will be planned for March and September 2017. Members are encouraged to submit articles and organizational updates. (Staff)

✓***Accomplishment: Newsletters were produced and mailed to 90 contacts within the Nursery Cooperative membership in March and September 2017. Topics within those Newsletters included:***

2017 Contact Meeting
2018 Advisory Meeting
Nursery Production Survey
Pesticide News and QPS Updates
Herbicide Trial Updates
International Forest Research
Chilling Hours
Status of the World's Forests
Know Weeds – Green Kyllinga

Objective 3. Provide a limited consultancy function to the membership in the area of nursery seedling production and outplanting.

Individual and Organization Contacts

An on-going activity and is handled as individual situations within each organization within the Nursery Cooperative as cases arise during the growing and planting season. (Payne/Nadel/Enebak)

✓***Accomplishment: Staff participated in the following contacts***

	Payne	Enebak	Nadel
Phone calls	**53**	**34**	**10**
Letters	**0**	**2**	**0**
Emails	**231**	**43**	**33**
Site Visits	**43**	**1**	**1**
Diagnosis	**6**	**8**	**23**

Seedling Production Survey

The Nursery Cooperative staff will continue the seedling production survey initiated in FY 03. The same questionnaire will be used to obtain production figures for the 2016 to 2017 planting season. The survey will be sent out in June 2017. (Enebak/Bowersock)

✓***Accomplishment: A mailing list that 56 nurseries was mailed in May 2017 throughout the southern US to gauge seedling production for the 2015-2016 planting season. Data was compiled and put into Technical Note 17-01 which will be mailed to all participating nurseries.***

Nursery Customer Meeting Presentations

Over the past several years as schedules and travel permits, Nursery Cooperative personnel have participated customer (internal and external) meetings at nurseries in an effort to encourage and improve customer relations and educate nursery customers on seedling planting and successful plantation establishment. 30-minute presentations such as "*Why Did My Seedlings Die*?" and "*The Ten Commandments of Seedling Survival*" are presentation the staff have made.

✓***Accomplishment: There were no requests for special one-on-one meetings or presentations with member organizations in FY17.***

Short Course

With the Nursery Cooperative's short course in Auburn in September 2015, we will hold off for a year or two and revisit the course again in January 2017. The Short course would be in September 2017. (Staff)

✓***Accomplishment: In early February 2017, 6 people had expressed an interest in a Short Course. However, once the dust settled on the Plum Creek/Weyerhaeuser/IFCO nursery transfers in June, it became apparent that 25+ members could use a Short Course. AU staff was simply not ready to pull Short Course together in that time frame. We will begin planning and organizing in early 2018 for a Short Course in September 2018.***

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 on November 8-9, 2017. A 2, half-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. (Enebak/Bowersock)

✓***Accomplishment: Nursery Cooperative Advisory Meeting was conducted in Auburn on November 8-9, 2017, Workplan, Accomplishments and Budget was shared with membership.***

Nursery Cooperative Membership

The Nursery Cooperative staff will make an effort to recruit new members among those nurseries that will benefit from activities of the Nursery Cooperative. (Staff)

✓***Accomplishment: We have made a couple of contacts with PRT located in Atmore, AL. They have indicated that they would join the Cooperative after their first crop is complete in FY18. No new members joined the Nursery Cooperative in FY17.***

Update the Coop Membership and Nursery Directories

An on-going activity with an updated directory distributed annually to each member. (Bowersock)

✓***Accomplishment: Nursery Cooperative Membership Directories were updated and sent to Cooperative Members in November 2016 and again in June 2017.***

Objective 2. Increase the visibility and effectiveness of the Cooperative as a source of information on issues related to seedling production and plantation establishment.

Presentations at Meetings

Nursery Cooperative staff will continue to be encouraged to participate as a speaker or attendee in regional and national meetings related to artificial regeneration. (Staff)

✓ ***Accomplishment: Nursery Cooperative staff at Auburn University presented 3 talks on nursery related topics to regional and local groups. Topics and Titles are listed below:***

- ✓ ***Tri-State Forest Herbicide Workshop (Payne), Association of Consulting Foresters State Chapter Meetings (Payne),***
- ✓ ***Nadel, RL. The ten commandments for better seedling survival. Alabama Division, Society of American Foresters, Montgomery, Alabama. 29 August 2017.***
- ✓ ***Nadel, RL. and Enebak S. Root development and morphological comparisons of container-grown pine and subsequent productivity after establishment. Centre for Advanced Forestry Systems 2017 Industrial Advisory Board Meeting, Portland, Oregon. 2 – 4 May 2017.***

Publications

Nursery Cooperative staff is encouraged to publish research results in scientific journals. (Staff)

✓***Accomplishment: Nursery Cooperative staff at Auburn University published 4 manuscripts on nursery related topics in national and international journals. Titles and journals are listed below:***

- ✓ ***South D.B., Nadel R.L., Enebak S.A. and Bickerstaff G. (submitted) The nutrition of loblolly pine seedlings exhibits both positive (soil) and negative (foliage) correlations with seedling mass. Tree Planters Notes XXX (submitted), pg. 1 – 17***
- ✓ ***South D.B., Nadel R.L., Enebak S.A. and Bickerstaff G. (submitted) Effect of sulfur and lime on soil pH and nutrients in a sandy Pinus taeda nursery. New Forests XXX (submitted), pg. 1 – 17***
- ✓ ***Devkota P., Nadel R.L. and Eckhardt L.G. (submitted) Intra-species variation of mature Pinus taeda L. in response to root-infecting Ophiostomatoid fungi. Forest Pathology XXX (submitted), pg. 1 – 35***
- ✓ ***Zhao X., Hui B., Hu L., Cheng Q., Via B.K., Nadel R., Starkey T. and Enebak S. (2017)***

Potential of near infrared spectroscopy to monitor variations insoluble sugars in Loblolly pine seedlings after cold acclimation. Agricultural and Forest Meteorology 232 (2017), pg. 536 – 542 DOI 10.1016/j.agrformet.2016.10.0120168-1923/

Extramural Funding of Nursery Cooperative Projects

Nursery Cooperative staff will continue to be encouraged to locate and generate extramural funding opportunities directly related to artificial regeneration. (Staff)

✓ ***Accomplishment: The Southern Forest Nursery Cooperative and the Forest Health Cooperative jointly was awarded a 4th year of a 5-yr proposal period of which $60,000/year that will be used to direct Nursery Cooperative and Forest Health Cooperative research.***

Interaction with other Research Cooperatives

The Nursery Cooperative staff will make efforts to interact, attend, work with other regional and national forest research Cooperatives in an attempt to broaden and strengthen research ties that can benefit seedling production. (Staff)

✓ ***Accomplishment: Attended and presented Nursery Cooperative information at the 2017 Annual CAFS meeting in Portland, Oregon, May 2-4, 2017***

AUBURN UNIVERSITY
SOUTHERN FOREST NURSERY MANAGEMENT COOPERATIVE

FY 2018 WORK PLAN

As Approved by the Southern Forest Nursery Management Cooperative Advisory Committee
November 8-9, 2017

AUBURN UNIVERSITY
SOUTHERN FOREST NURSERY MANAGEMENT COOPERATIVE

FY 2018 WORK PLAN

GOAL A: RESEARCH

Objective 1. Identify, test, evaluate, and promote the registration of cost effective pesticides for use in forest tree nurseries.

Methyl Bromide Substitution

We will continue to monitor the replicated Methyl Bromide substitution trial at Rayonier Elberta Nursery, AL. The data collected will include seedling quality, nematodes, weeds and Trichoderma levels prior to and 1-yr post fumigation. Data will be collected for the second growing season and treatment plots will be part of the 2018 Southern Forest Nursery Association's annual meeting to be hosted by Rayonier. Products tested included Etheyelenedinitril, Dominus, Vapam, Ally 33 and propylene oxide. (Nadel/Enebak)

Nursery Weed Control

Information will be gathered and appropriate trials developed and installed to examine methods of weed control by herbicide application, crop seed protection, and weed seed source containment. Several of these herbicide trials are continuations or expansions of trials currently in progress.

- *Weed seed source scouting for each nursery*: Participating nurseries will be scouted, using field visits, online maps or drones, to examine areas where weed seeds may be accumulating, in addition to identifying mechanical or cultural practices that may introduce or transport weed seeds. Any SFNMC member nursery may participate (Payne).

- *Herbicide safeners in hardwood*: The feasibility of using herbicide safeners as potential hardwood seed treatments will be explored. These safeners are chemical agents applied to seed or into herbicide tank mixes to reduce herbicide injury to desired plants without diminishing the herbicidal effectiveness in control of targeted weeds. Commercial safeners are currently used in corn, grain sorghum, rice, and wheat. If practicable, a trial using herbicide safeners on spring-sown hardwood species will be installed to determine tolerance of multiple hardwood species as well as effectiveness of weed control with safeners (Payne/Brooks).

- *Pendulum®AquaCap™ High Rate in bareroot and container pine*: In response to concerns from nurseries about late summer weed problems, a follow-up study using the highest allowable labelled rate of PAC will be installed at sowing to measure seedling tolerance (herbicide gall formation) and longer-term (6 to 8 months) weed control. Bareroot loblolly and slash pine and container loblolly, longleaf, slash and shortleaf will be included. INSTALLATION OF THIS TRIAL IN EACH SPECIES IS DEPENDENT ON RESULTS OF 2017 TRIAL. (Payne/Enebak)

- *Marengo® in bareroot eastern red cedar*: A third-year study applying Marengo over-the-top of eastern red cedar seedlings will be installed at the Georgia Forestry Commission's Flint River Nursery. This trial will be used to confirm results of a 2015 study installed at this nursery in which cedar seedlings treated with Marengo® exhibited increased growth characteristics when compared to untreated seedlings. INSTALLATION OF THIS TRIAL IS DEPENDENT ON RESULTS OF 2017 TRIAL. (Payne/Enebak)

- *'New' Postemergent Herbicide Screening in bareroot pine*: A replicated screening study of several post-emergent herbicides for the control of sedges, grasses, and broadleaf weeds will be installed at member bareroot nurseries. Along with recommendations from AU College of Agriculture faculty, results of 2016 and 2017 trials will be used to determine inclusion of herbicides in the study. (Payne/Enebak)

- *Low rate glyphosate applications over the top of hardwood*: In an effort to identify safe herbicides for emerged weed control in hardwood nurseries, reviews of research of low rate applications of glyphosate in agricultural crops will be made. Sufficient positive results may lead to the design and installation of a study using low rate, over the top applications in multiple hardwood species in Coop member nurseries. (Payne/Brooks)

- *RonstarFlo® (oxadiazon)* in *bareroot and container pine*: As a result of increased incidence of annual sedge in member nurseries, a trial of pre-emergent applications of RonstarFlo® will be made in bareroot and container nurseries. Previous bareroot nursery trials in 1999, 2012, and 2013 showed no negative effect on loblolly pine seedling characteristics. Bareroot loblolly and slash pine and container loblolly, longleaf, slash and shortleaf will be included. INSTALLATION OF THIS TRIAL IS DEPENDENT ON RESULTS OF 2017 TRIAL. (Payne/Enebak)

- *RonstarFlo® (oxadiazon) over hardwood*: Interest in the use of RonstarG in postemergent applications in hardwood has been expressed following its past use. A trial using granular and liquid formulations of oxadiazon in applications after hand-weeding will be installed in one nursery. (Payne)

Fusiform Rust Control

A seed treatment study on loblolly will be done testing new chemistries in conjunction with the US Forest Service Rust Testing Laboratory in Asheville, NC. Two new fungicide treatment chemistries will be assessed in this study. Conifer seed (loblolly and slash) will be sown at Auburn

into USFS container systems until germination at which time the seedlings will be treated prior to being challenged with basidiospores of fusiform rust. (April - Nov 2018) (Nadel/Enebak)

Nanocellulose/lignin impregnated with insecticides to control pine tip moth

Nanocellulose particles will be created and impregnated with imidacloprid, fipronil and/or emamectin benzoate. Particles will be dispersed over seedlings in a greenhouse (25 per treatment) with a sifter/spray. Seedlings (needles, stems, roots) will be sampled at various time points (weekly for 10 weeks). Tissues will be ground and analyzed to determine movement of pesticide through seedling tissues. (Persin/Eckhardt/Nadel)

Objective 2. Identify and develop economically feasible nursery cultural practices that enhance seedling quality.

Development of a rapid screening test for the presence of *Fusarium circinatum*

We will continue to obtain approval by the International Seed Testing Association (ISTA) as a seed screening method that can then be enforced as an alternative to the current blotter paper method used by seed certification companies, disease diagnostic laboratories and plant inspection agencies. (Nadel/Enebak)

Modeling container seedling development

This will be a collaborative project with the Plantation Management Research Cooperative, University of Georgia. We aim to model growth and carbohydrates in container grown pine seedlings over time. The model uses temperature and water availability to predict plant size, and plant carbohydrates levels (Nadel/ Montes).

Soil stabilizer trials

Three soil stabilizers (H.B Fuller, Tailored Chemical Systems, Soil Tech) will be tested at both Jessup and Elberta Nurseries. The application rates to be tested are 4:1, 7:1, 10:1. (Nadel/Payne)

Seedling growth/root vigor trials.

Two products reported to increase seedling growth and vigor will be examined for their reported efficacy. These include Radiate and Megafol and will be tested at Jessup nursery. (Nadel/Payne)

Objective 3. Develop methodologies to minimize the environmental impact of nursery cultural practices while maximizing their effectiveness including the development of integrated pest management programs.

Hardening off practice of reducing water availability and its impact on root heath

Root heath and root hydraulic conductivity is of importance to outplanting success. With this study we aim to determine whether the hardening off practice of reducing water availability, prior to the lifting of seedlings, may inadvertently (in warmer winters) increase the vulnerability of seedlings to develop embolisms. As roots play a significant role on whole plant water transport, embolized roots will increase drought vulnerability for outplanted seedlings. Some southern pine species have moderate embolism resistance, however, the majority of studies were undertaken on mature trees. Little is thus known about root vulnerability to cavitation for loblolly seedlings undergoing water stress. As there is no direct comparisons at the seedling stage at a particular site we aim to determine whether there is any potential genetic variation to embolism resistance within loblolly. Nutrient levels of the seedlings will also be monitored overtime. (Nadel/ Samuelson).

Objective 4. Further define the “optimal seedling” so as to maximize the cost effectiveness of artificial regeneration forestry systems.

Chilling Hours and Seedling Storability

Determine the impact of ethylene management on increasing seedling storability and its impact on chilling hours through a one molecule inhibitor of ethylene (1-MCP). Increased Ethylene production has been shown to reduce the growth and survival of several agricultural crops. The AgroFresh Inc. 1-MCP product inhibits the production of ethylene (due to the blocking nature of the molecule) and successfully used in fruit production and storage increasing yields and survivability of such crops. There are potential opportunities for the forestry industry to use such a product to increase survivability. This study we aim to determine what impact the 1-MCP molecule will have of ethylene production of seedlings and whether such a product could aid in increasing seedling storability and out planting success. (Nadel/ Enebak)

GOAL B: TECHNOLOGY TRANSFER

Objective 1. Serve as a clearinghouse of information related to nursery production and tree planting.

Methyl Bromide

In collaboration with MBr manufacturers, the Methyl Bromide Industry Panel (MBIP), the Chloropicrin Manufactures Task Force (CMTF) and applicators, the Nursery Cooperative staff will continue to keep abreast of EPA actions and/or possible legislative initiatives that may affect the future availability of soil fumigants. We will continue to inform the membership through the Advisory Committee to keep the membership knowledgeable of these activities

The Nursery Cooperative staff will continue to keep abreast of activities related to the Quarantine pre-shipment (QPS) process. We will inform the membership of any EPA initiatives and continue to work with the AF&PA, the Crop Protection Council, USDA and APHIS to provide input and influence the QPS process if necessary.

The Nursery Cooperative staff will continue to work with the AF&PA, and USDA to inform and influence the EPA deliberations regarding pesticide regulation as it pertains to the soil fumigation re-registration decisions that were released in spring 2013. (Nadel/Enebak)

Drone use for seedling quantification

There is a need to develop software that will be capable of counting the number of seedlings in a nursery once images have successfully been captured by a drone that has flown the nursery.

Update of Nursery Label Book

The Nursery Pesticide Label Book on the Nursery Cooperative's website will be updated to include recent additions of herbicide, insecticide and fungicide labels. (Brooks/Enebak)

Revision of Ag Handbook 473, Hardwood Nursery Guide (Hardwood Manual)

In collaboration with the US Forest Service and with input from Nursery Cooperative membership, Dr. McNabb and Nursery Cooperative staff and Carolyn Pike, of the USFS, Purdue will complete the Hardwood Manual in FY18. (McNabb/Starkey/Bowersock)

Re-registration of Nursery Pesticides

The Nursery Cooperative staff will continue to follow the re-registration process for pesticides currently under review under the Food Quality and Protection Act (FQPA) used in seedling production and will provide information to the necessary regulatory agencies (USDA, APHIS, EPA) when necessary. (Enebak/Nadel)

Maintain and Update Nursery Cooperative Web Site

The Nursery Cooperative staff will continue to update the Nursery Cooperative website for use by Nursery Cooperative Members and increase the "searchable" status of the Cooperative's data and reports. (Bowersock)

Leveraging Nursery Cooperative Data

The Nursery Cooperative staff will continue to stress the importance of Cooperative membership and when possible, leverage Cooperative information for grant proposals and data cite license for the seedling production survey. (Staff)

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

Contact Meeting

The Nursery Cooperative Contact meeting will be conducted as a ½ day program will be held in conjunction with the Southern Forest Nursery Association's biennial meeting in Pensacola, FL on Monday July 16, 2018. The SFNA meeting will kick off on Monday evening, and run through Thursday July 19, 2018. Rayonier's Nursery in Elberta, AL will serve as the host and conduct the nursery tour as part of the SNFA meeting. Working with Mark Davis, cooperative trials will be install as part of the outreach component of Nursery Cooperative research. The agenda will cover presentations by Nursery Cooperative staff on current research activities and results. Details will be worked out with Mark Davis and the SFNA Planning Committee with meeting information outlined in the Spring 2018 Newsletter. (Enebak/Bowersock)

Research Reports (Staff)

We plan on producing Research Reports and Technical Notes in FY18.

Newsletters

Newsletter distribution are planned for March and September 2018. Members are encouraged to submit articles and organizational updates. (Staff)

Objective 3. Provide a limited consultancy function to the membership in the area of nursery seedling production and outplanting.

Individual and Organization Contacts

An on-going activity and is handled as individual situations within each organization within the Nursery Cooperative as cases arise during the growing and planting season. (Nadel/Enebak)

Seedling Production Survey

The Nursery Cooperative staff will continue the seedling production survey initiated in FY 03. The same questionnaire will be used to obtain production figures for the 2017 to 2018 planting season. The survey will be sent out in June 2018. (Enebak/Bowersock)

Nursery Customer Meeting Presentations

Over the past several years as schedules and travel permits, Nursery Cooperative personnel have participated customer (internal and external) meetings at nurseries in an effort to encourage and improve customer relations and educate nursery customers on seedling planting and successful plantation establishment. 30-minute presentations such as "*Why Did My Seedlings Die*?" and "*The Ten Commandments of Seedling Survival*" are presentation the staff have made.

Short Course

With the Nursery Cooperative's short course in Auburn in September 2015, and a large demand that could not be conducted in September 2017, we will begin organizing a Short Course to be offered in September 2018. (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 FY19 Advisory Committee Meeting will be held on 30 October – 1 November 2018. A 2, half-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. (Enebak/Bowersock)

Nursery Cooperative Membership

The Nursery Cooperative staff will make an effort to recruit new members among those nurseries that will benefit from activities of the Nursery Cooperative. (Staff)

Update the Coop Membership and Nursery Directories

An on-going activity with an updated directory distributed annually to each member. (Bowersock)

Objective 2. Increase the visibility and effectiveness of the Cooperative as a source of information on issues related to seedling production and plantation establishment.

Presentations at Meetings

Nursery Cooperative staff will continue to be encouraged to participate as a speaker or attendee in regional and national meetings related to artificial regeneration. (Staff)

Publications

Nursery Cooperative staff is encouraged to publish research results in scientific journals. (Staff)

Extramural Funding of Nursery Cooperative Projects

Nursery Cooperative staff will continue to be encouraged to locate and generate extramural funding opportunities directly related to artificial regeneration. (Staff)

Interaction with other Research Cooperatives

The Nursery Cooperative staff will make efforts to interact, attend, work with other regional and national forest research Cooperatives in an attempt to broaden and strengthen research ties that can benefit seedling production. (Staff)