

Southern Pine Health Research Cooperative (SPHRC)

26th September 2019 - Meeting Notes

Attendees:

University of Georgia: Rebecca Abney, Chuck Bargeron, Brittany Barnes, Lea Clark, Kamal Gandhi, Dale Greene, Elizabeth McCarty, Cristian Montes, Larry Morris, Lori Sutter, Caterina Villari

ArborGen: Jason Watson

Hancock Forest Management: David Wilkinson

International Forest Company: Chris Johnston

Rayonier: Alan Wilson

Resource Management Services: Ryan Saunders

USDA Forest Service: Chris Asaro, John Nowak

Synopsis of the Meeting:

Dean Greene welcomed the cooperative members to the annual meeting. Kamal reiterated that the Southern Pine Health Research Cooperative (SPHRC) will always have a strong emphasis on applied research and outreach. SPHRC is focused on native insects and diseases by the decision of our members, but that we still need to be aware of non-native insect and disease threats. For example, Kamal is involved with another comprehensive research group working on predicting new invasive species on conifers, and research has now started on hardwoods. *The paper is attached to this email for consideration.*

Kamal provided a synopsis of the progress in Year 1 of the cooperative with activities from the strategic plan as follows:

1. Provide and vote on 1-2 research projects with inclusion of results from our current ongoing projects. **COMPLETED.**
2. Recruit 1-2 students, and initiate first year of sampling and/or technology development. **COMPLETED.**
3. Create fact-sheet(s) for chosen pine pests and/or pathogens for research projects. **COMPLETED.**
4. Establish and process agreements and dues for first year. Recruit new cooperative members. **COMPLETED.**
5. Build research and outreach liaisons with other scientists, forestry cooperatives in the country, and other agencies. **ONGOING.**
6. Build a website for the cooperative to advertise our efforts and facilitate scientific collaborations. **NEARLY COMPLETED.**

Kamal revisited the strategic plan and pointed out how the objectives for Year 1 were to conduct a literature review and identify potential projects, but instead actual research projects were voted on and the two funded research projects were successfully established. Hence, SPHRC is about a year ahead, which means that we will need to seriously consider the next set of projects in another year. The current meeting was focused on the two research projects, the fact-sheets, and the cooperative website, while the strategic plan will be revisited in Year 2020.

She also discussed “reasons for failure/mitigation” of the cooperative. Our goal is to make the cooperative sustainable long-term, which means being flexible, changing, and transforming as the industry changes. Revisiting these line items at annual meeting will keep these measures of failure and mitigation in place.

1. Membership:

Current seven members of SPHRC are: ArborGen, Hancock, IFCO, Jones Center, Rayonier, RMS, and USDA-FS-FHP. Other companies including Weyerhaeuser and Superior Pines, have expressed an interest in joining the cooperative. We discussed the optimal number of members for this cooperative. More members allow us to bring additional funds, but it comes with the risk of losing focus and perspective (as it has happened to previous forest health cooperatives). We agreed that 8-10 members would be optimal.

2. Dues and Budgets for Cooperative:

Dues will stay at \$10,000 for the first two years (2018-2020), but the cooperative will reach an agreement on the dues structure for the following years. This will be one of the topics of discussion during the next semi-annual meeting in 2020. If we increase the dues, then we become eligible to be funded by NSF Center for Excellence with additional \$120,000/year. Kamal specified that the budget year for each member started when their agreement was processed, and that 5-year agreements will be preferable to allow the funds and projects to keep rolling. She reminded that SPHRC agreements have a 0% indirect cost, which is uncommon for university agreements.

We discussed the dues for new members, and that they will pay the same rate current members are paying in the year they join. In some cooperatives, new members either pay an extra fee or provide something extra such as using their forests for research. Cristian suggested that new members pay up front for a few years (rather than yearly), so they are more vested in the cooperative.

UGA shows a high level of support for SPHRC by matching 2-3 times as much incoming membership funds. The cooperative’s contribution is \$70,000 per year. UGA contributes >\$245,000 per year. This contribution is underestimated, as it does not include external grant money. Kamal estimates that 59% of coop funds is spent on salaries and benefits, 13% on travel, and 28% on supplies. We will re-budget items as needed when the agreements come up for renewal.

Kamal will be sending invoices for Year 2 of the cooperative in the next few weeks, realizing that it is important for companies to get them in the same budget quarter every year. Alan mentioned that Rayonier is at the end of budget planning for 2020, so it may be too late to plan for field work for next year. The cooperative’s goal is for field work to be planned by July/August to get it in the following year’s budget. Caterina suggested we plan the next meetings in April and October 2020 to coincide with company’s budgets.

3. Field and Lab Consulting:

There were no consulting requests from the members during the first year. Email and phone consultation with members are free. Starting in 2020, Kamal will contact each company, and

would like to spend time in the field learning about their concerns and needs. Members are welcome to email us whenever they notice things, as we are always looking for research sites, can send people to collect samples, and provide diagnostic work. Elizabeth also appreciates the information, as it increases her knowledge and boosts her outreach material.

Questions were asked where to send diseased samples for diagnosis, and the answer is to contact Elizabeth even if samples are from another state. She may inform the county agent in that state as a courtesy, depending on her working relationship with them. Caterina specified that she does not routinely perform diagnostic work, unless the disease is relevant to her research program. SPHRC does not currently have a fee structure for diagnoses, and is not planning on setting one up. Elizabeth mentioned that pictures are always useful, and that she would prefer to receive pictures for a preliminary evaluation, before receiving the actual samples. She also mentioned that her Facebook profile is work-related, and that she posts useful forest health news.

Ryan suggested posting a standard set of questions on a form for pest and pathogen diagnosis. Alan said other cooperatives have this for basic information such as slope, location, where and how to send information, how to sample properly, etc. For now, send questions to Elizabeth, who will call you and talk through the issue with you. Elizabeth will post information in the Members section of the SPHRC website for sample diagnosis.

Caterina has an upcoming project on needle cast disease with Jason Smith at UFL (the specific sites have not yet been decided), and she hopes members will provide samples. She needs 10+ different locations for samples. Alan said he might have a site for this project. Results of this research will be made available to members. In the next two years, Caterina will train members in two workshops on how to use these novel pathogen diagnostic techniques.

4. Website:

The Center for Invasive Species and Ecosystem Health assisted with building the SPHRC website - <https://southernpinehealth.org>. Kamal sought input on how much information to include about the two major projects funded by the cooperative. Results of the research will not be posted publicly, and there will be delay in posting information. There is a members-only tab for confidential information. The password for the Members-only section is: **sphmember2019**. When new files are posted (e.g., presentations on two projects), Kamal will send an email to the members. Finalized website will be passed to Elizabeth's lab where it will be maintained and archived. Alan spoke on how the purpose of a cooperative's website is usually to draw in new members. Hence, the website will continue to be refined and updated with time (e.g., the Members only page is being updated right now). Kamal will also attend and present at other forestry cooperative's annual meetings to widely advertise SPHRC.

Our website does not have any public information about membership for now. Information on how to join (with dues and structure) is hidden in the Members-only section, and companies can contact Kamal directly. Caterina suggested we can discuss this in six months when we have agreed on the next five-years' structure.

5. Release of Information:

The group discussed how much to reveal about the projects in presentations. The members approved the immediate release of two fact-sheets and are comfortable with students and faculty presenting their research at conferences, as long as technical details (such as information about genetic families, or specific silvicultural treatment recommendations) are not revealed. We also agreed that papers from the cooperative will be submitted only after the project is completed or after the final report is given to cooperative members.

Cristian, however, said that if something is going to be an issue of national health or security, we should release it immediately because insects and pathogens do not know boundaries, and a rapid intervention might be crucial and beneficial to everyone. Chris Asaro agreed and spoke about the needle cast information not being released in the past because of the genetic information it would have revealed. It is important to think about both issues of cooperative benefit and public knowledge.

6. Fact-sheets:

Kamal discussed two fact sheets (pine tip moth, and bark and woodboring beetles in response to hurricanes) that were drafts and in peer review. The second fact-sheet was written because we are getting reports of damage with some indication that *Ips* beetles are increasing in numbers on wind disturbed areas. We have two research projects, one at the Jones center and one in Florida working with private funding in 90% damage areas.

The two fact-sheets are now posted at:

https://www.warnell.uga.edu/sites/default/files/publications/WSFNR-19-38_McCarty.pdf
https://www.warnell.uga.edu/sites/default/files/publications/WSFNR-19-34_McCarty.pdf

7. Other Items:

Chuck Bargeron, the co-director of the Center for Invasive Species and Ecosystem Health, presented information on bugwood.org, with whom we could potentially liaison in the future. Bugwood has over 300,000 images available, and invasive.org is the portal to information for chemical and biological control. Bugwood has added maps and aggregated data showing distributions of invasive species for early detection, and they have >30 phone apps. If the cooperative wants to have a members-only app, that is possible. Chuck said it makes sense to collaborate with SPHRC to provide time-sensitive information about pest and pathogen infestations. Chuck also mentioned that four regional IPM centers are funded at \$1 million per year and provide grant money to others and to universities. The Southern IPM center provides technical support, and resources and statistics are shared with them.

Alan inquired about the use of LIDAR as a detection tool, and Kamal mentioned that she is working with modelers for the use of LIDAR and satellite data, and advocated for the use of more advanced technology and tools in all forest health research.

Cristian suggested we collaborate closely with the PMRC to obtain detailed information about any tree dieback and growth loss in their plots. More regional-level information about forest health issues and economic impacts is needed.

On 29th August 2019, the first national meeting of forest health cooperatives was virtually held, and they will meet again in December. One of the topics of discussion was that cooperatives have common challenges and can share resources and personnel, but we need to have a better dialogue.

8. Plans for Next Meetings:

Members decided to have an in-person meeting in Tifton in April 2020, and then a meeting in Athens in October 2020.

Pine Tip Moth Project Update

Elizabeth presented the status of the research on pine tip moth (PTM) susceptibility of loblolly genetic lines. This cooperative funded project is looking at open pollinated (OP) versus mass control pollinated (MCP) pines – to assess whether MCP has higher PTM occurrence and damage on these two genetic lines? These research sites can be developed into longer-term projects.

In 2019, she planted GFC and cooperative study seedlings in similar site conditions with three sites on Hancock Forest Management land. Three thousand seedlings were planted in January, with 48 seedlings per plot. Infestations will be assessed 4-5 times per year by recording percent infestation of the top whorl. Elizabeth is working with David Dickens (UGA) to mark forking and ramicorn branches.

ArborGen, GFC, and IFCO bare root seedlings were used to determine differences among genetic lines. She selected genetic entries with the most market appeal in market. GFC Giant has the lowest infestation rate at under 10%. Arborgen AGM25MCP was 22%. The lowest mortality was of Arborgen AG6. Pine mortality was caused by poor weather conditions, not PTM. These results are limited geographically and would be different in the Piedmont region. We will repeat the study with other genetic lines in the future. Elizabeth cautions that it is too early to take anything home yet, but solid progress is being made. The study will continue for two years, and can be extended as based on the results.

In addition, Elizabeth is working with the GFC to study insecticides and generation timing of PTM. In the generation timing study, county agents are doing state-wide trapping using pheromone traps and assessing generation timing in relation to warming temperatures. The GFC's Survey 123 app is used to enter data. In the PTM insecticide study, four insecticides are being assessed – fipronil, imidacloprid, dinotefuran, and chlorantraniliprole (systemic, much better environmental profile but not currently operational financially).

In January 2019, cow syringes were used to apply insecticide. In the future, she will use a small injection gun with filter, and Chris Johnson offered to get her something to use. These chemicals will bind more tightly in organic soil and leach in sandy soil. Overall, PTM infestation was the lowest with chlorantraniliprole and dinotefuran followed by imidacloprid, fipronil, and control (untreated seedlings). Very low PTM infestation rates were found in April. In June, there were no differences in infestation rates among treatments, but overall infestation was lower than in August. Elizabeth expects more of a difference in September and later. Chris Asaro commented that those are low infestation rates which won't affect pine growth. Elizabeth said the rates were higher a few weeks ago, timing is critical, and one week makes a difference. Early generations are in synchrony, but later in the season they are off. PTM life cycle is in synchrony with growth of loblolly pines. Genetic strains that come out earlier or later affect the timing issue. Because of the high seedling mortality, these seedlings will be replanted and improvements will be made with dosing and product choice. However, the study is initially promising for all the tested insecticides.

David indicated there are data for the Louisiana PTM research, and he is trying to figure out if it can be released. There are cooperative gene data available, so we can look at the difference between genotype and geographic area to look at different families using chemical profiling of the chemotypes of different trees.

Manganese and Bark Beetle Project Update

Manganese (Mn) is a micronutrient in the photosystem II molecule and a component of many other important stress-defensive enzymes (e.g., during drought). Mn is involved in stabilization of enzymes in the main defense-related metabolic pathways such as the phenylpropanoid pathway, which produces phenolics and lignin. Two previous studies have clearly indicated that about half as amount of Mn was present in soils in pine stands with dieback as compared to healthy stands. The objectives of the project are to determine the influence of Mn availability on resistance to fungal inoculations, production of defense compounds in pine trees, and effects of Mn fertilization on bark beetle outbreak development (in the future).

A total of 180 Georgia Giant GFC seedlings were planted into nutrient deficient sand ($Mn = 0.15 \text{ g/L}$) in January 2019. The seedlings are watered daily or as needed, and water has $< 0.05 \text{ ppm}$ of Mn. Twice per week, three different Mn levels in a Hoagland's solution of 500 ml of fertilizer are applied: 1.8 g/L (sufficient Mn level), 0.9 g/L (low Mn level), and 0 Mn 0g/L (Mn deficient level). We waited for Mn from nursery and sand to be depleted through new growth. The study is in a randomized block design with six blocks of 30 trees each, and 10 trees per block of each Mn level. Height and stem diameter are being monitored once per month, and no differences across Mn treatments have been observed so far. Every two months, a subset of 90 trees is being monitored for fluorescence, which measures light re-emitted and gives a general gauge of plant health. There's a slight decrease in fluorescence due to Mn deficiency but it's not significant; all are still in the range of healthy plants. Nutrient status in needles of 36 seedlings subset were analyzed, and this clearly revealed Mn deficiency. Hence, this is an optimal time to challenge the trees with fungal inoculations, as trees are experiencing a suboptimal level of Mn which is low enough to potentially alter resistance mechanisms, but not low enough to induce deficiency symptoms or other physiological stress. This is consistent with field observations where pine trees looked healthy before starting to show dieback symptoms fairly quickly.

The non-control seedlings will be inoculated in mid-October 2019 (light and temperature conditions will be extended) with a pitch canker fungus and an *Ips*-associated fungus. Three inoculation methods including spore suspension injection, spore suspension spray, and agar plug (commonly used for blue stain fungi) were tested on trees. Inoculation was successful in all cases, but the agar plug method induced the longest fungal lesions, was the easiest method, and had the lowest variability, hence will be the method adopted for the full-scale experiment. Three weeks after inoculations (in November), we will measure physiological parameters e.g., fluorescence, growth, water conductance and foliar nutrient content and defense parameters e.g., lesion length, terpenoids, phenolics, lignin (also in roots), and enzymatic activity.

We hypothesize that Mn deficiency likely becomes important in water deficit years similar to Boron deficiency (both may be genetically controlled). Chris Asaro mentioned that Mn fertilization may not be applicable in the field, and Larry said that it will be similar to boron

application as an investment strategy, is quite cheap to apply as Mn is a micronutrient and needed in small amounts, and is totally field operational. Alan suggested to contact the Forest Biology Cooperative at UFL for their studies on the interactions between soil, genetics and nutrients, where variable nutrients and micronutrients were used. Foliage and soil samples have been taken every other year in those plots, and so they may be showing some trends that could assist our study.