

FPC Strategic Planning Meeting Topic Descriptions

December 2020

Monday, Day 1: Nutrition and Site-Specific Resource Supply (2 hr)

Overview of Current Research: Soil mapping, P-carryover, Indicators (biotic/abiotic) of potential supply, Nutrient carryover (P carryover, ¹⁵N seedling carryover), RW20 Resource allocation/Nutrient use efficiency, Single tree plots w/Cu on Organic soils

- **Soil mapping for potential response and productivity to fertilization**
 - Incorporating past RW fertilizer response information into the new FPC soil map
 - Modeling what soils properties drive response across the Southeast
 - Mapping observed expressed & potential site index values across FPC soils
- **Refining which/how much fertilizer to use on different soils**
 - Through compiling past RW studies, defining knowledge gaps of which soils still need information response for N, P, and/or K rate trials (target gaps)
- **LAI-based rate applications**
 - What is the stand or sub-stand level response to fertilization based on LAI across different soils?
 - When during the rotation is the best time to assess leaf area for fertilization response?
- **Micronutrients application (how, when, which ones)**
 - Which micronutrients are most important to growth response on which soils?
 - When is the best time to apply? (establishment? One year after?)
 - What is the best method for application? (mixed with other fertilizers? Applied with HWC?)
- **Long-term nutrient availability within a rotation (magnitude and duration of response by soils)**
 - What is the magnitude and duration of responses on different soils and geologies within a rotation (either from establishment or during the rotation)
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Long-term nutrient cycling across rotations (^{15}N availability studies, litter, decomposition)

- How much nutrient supply carries over to the following rotations?
- How is decomposition (supply and release) affected?
- **Mid-rotation fertilization: Crown recession & potential response (interactions with genetics)**
 - What is the relationship between crown recession and ability or timing of response to fertilization?
 - What is the critical live crown length that is past the point of recovery?
 - Is that critical value influenced by genetics?

Tuesday, Day 2 Part 1: Vegetation Management (2 hr)

Current research: ^{15}N Timing of Fertilization vs Herbicide with different levels of understory competition at Appomattox, VA

- **Vegetation Control vs Fertilization: Midrotation release response (Soil specific response)**
 - Where should we fertilize, control vegetation, or both?
- **Vegetation Control vs Fertilization: Timing during rotation (pre vs post thin)**
 - When should the vegetation be controlled prior to a thinning and mid-rotation fertilization?
- **Type of competition & intensity (Competing vegetation succession)**
 - How do we standardize competition intensity quantification? BA? QMD? LAI? Stems/acre? Proximity to crop trees (intra- vs interbed)?
 - How do we best categorize the competition? Species, origin (seed or stump), growth form (grasses, arborescent, ericaceous, conifer, deciduous, etc.)?
 - How does competing vegetation succession change with control? Does control enable the establishment of a more or less problematic species?

Effect of duration of competition presence (i.e. how much is there and how long has it been there?)

- Does competition-related crown recession reduce a stand's capacity to respond to vegetation control?
- Can Landsat-derived estimates of competing vegetation LAI over time inform which stands are likely to respond?
- Is a static estimate of the amount of competition today and reliable predictor of post-vegetation-control response or does duration of presence need to be considered?
- **Volunteer pine: extent of the problem (position paper), edge effects, control in SMZs & edges**
 - What is the competitive effect of volunteer pine on crop tree pine?
 - How do we reduce edge and seed source presence among stands?
 - Can we identify the variables associated with stands which are highly susceptible to volunteer pine inundation post-harvest?
- **Volunteer pine: how best to control (chemical vs pct)**
 - Quantify tradeoffs associated with both methods
- **Volunteer pine: do site-prep burns create additional need for fertilization?**
 - Nutrient losses from fire could warrant post-burn-specific fertilization regimes
- **Site preparation: Herbicide Sensitivity (imazapyr damage)**
 - Is there a negative effect of residual imazapyr on planted pine?
- **HWC fall vs spring**
 - Should Oust be applied with fall site prep or separately in the spring?
 - When/why is fall application sufficient?
- **Banded vs broadcast**
 - At site preparation or HWC, is there an additional long-term benefit to broadcast vs banded application?
- **Duration of control (i.e. how long do we need to keep it out?)**
 - What intensity of weed control is warranted from a productivity standpoint?

Tuesday, Day 2 Part 2: Density Management & Other Silviculture Questions (1 hr)

Current research: Genetics x Silviculture x Spacing (RW20), Thinning x Fertilization & Second thinning (RW19)

- **Genetic improvement and initial stocking**
 - Growth rates have increased due to improved growing stock and are requiring thinning earlier. Should planting densities be reduced to account for increased growth rates?
- **Lower initial densities & veg control**
 - If initial planting densities are reduced (as in the above bullet-point), will vegetation control become a higher priority?
- **Growth & resilience (Heat tolerance & drought stress)**
 - Are some genotypes or provenances more resistant/resilient to drought/variable weather?
 - Can survival rates and productivity be improved with more informed site-specific deployment?
 - Does early silviculture improve resilience of seedling survival and growth?
- **Tip moth control (long term growth & variability; in collaboration with forest health coops)**
 - Quantify growth gains and reduction in variability from tip moth control
 - Is the initial cost of tip moth control justified by greater economic gains through higher saw timber potential?
 - Does banding vs broadcast vegetation control affect tip moth severity? (by breaking up flight paths)
- **Timing of early silviculture/early stand inventories**
 - Beyond survival surveys, early stand inventories are rare. Juvenile fertilization and expanded vegetation control windows would require these data to inform management. Can remote sensing provide this information and improve management?

Wednesday Day 3 Remote Sensing (3 hr)

Current research: Variable Rate Fertilizer application (Cohrs), Sentinel-2 vs LiDAR LAI estimation (Trlica), Understory estimation with LiDAR (Sumnall), UAV LiDAR biomass/understory estimation (Sumnall), Scan angle optimization (improving utilization of LiDAR; Sumnall)

Randy Wynne, Val Thomas, and Josh Gray should be on hand for additional questions on remote sensing.

- **Precision applications (Stand selection vs sub-stand level)**
 - On a sub-stand level, what are the best rates of fertilization to apply based on LAI measurements from satellite or LiDAR? And in conjunction with soils?
 - On a stand level, how can stands best be prioritized based on percent cover of LAI below a critical limit or understory above a critical limit?

LiDAR

- **Competing veg quantification (LAI, biomass, other indices for predicting response)**
 - How accurate are each of the ways to quantify understory or competing vegetation indices? At different stages of stand development?
 - What is our measurement error with different competing species?
 - Where and when do we have the most confidence?
- **Crop tree LAI**
 - Further validation and refinement of LiDAR-derived Crop tree LAI
 - Individual tree LAI quantification
- **Ground truthing**
 - Broadening the scope of understory, stand development, spacing, etc that is validated to define our confidence level in understory and crop tree measurements
- **Stand inventory (Ht & BA), young and post thin stands with LiDAR (Juvenile fert or veg control)**
 - How, where, and when can LiDAR replace traditional timber cruising?
 - Can higher resolution LiDAR (such as from helicopter and/or skidder) provide enough resolution for Ht and BA? for a total stand inventory?
 - Can juvenile inventories also provide information for fertilization and/or veg control?
- **Genotype structure (in collaboration with TIP)**

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- Can we use ground-based and/or UAV LiDAR to measure stem form characteristics important for higher value products?
- **How to operationalize**
 - What are the greatest barriers to implementation and how do we resolve them? Economic analysis? Data management? Link between data output and silvicultural decisions?
- **Slash pine**
 - Cross validate work in loblolly pine with slash

Satellite

- **LAI (crop tree)**
 - Further refine Sentinel-2 (10 meter resolution) LAI algorithm across a broad variety of stands across the Southeast
- **Competing veg LAI estimates (current and past)**
 - Develop Sentinel-2 (10 meter resolution) for LAI of competing vegetation index
 - Develop a time-series approach to assess duration and intensity of that deciduous competing vegetation
- **Slash pine**
 - Cross validate work in loblolly pine with slash
- **Explore: NAIP, Sky sat, Planet, SAR**
 - Many other remote sensing opportunities exist. Planet and Sky sat produce high resolution imagery but are not free. Synthetic Aperture Radar has the potential to characterize biomass and change detection. NAIP has potential for inventory.

Thursday Day 4: Tech Transfer & Decision Support Tools (1hr)

- **Soil mapping (average vs potential site index; fertilizer response)**
 - Continuing to test and develop the FPC Soil Classification system
 - Deploy new soil management recommendations into system
 - Create potential productivity maps based on real expressed site index data
 - Create fertilizer response potential maps

- **Lidar Support Center**
 - Not a service center but a research oriented, hypothesis driven, LiDAR processing center to test silvicultural recommendations
 - Could work in conjunction with LiDAR data acquisition and processing contractors to develop and test silvicultural questions
- **Modeling - LobDSS update**
 - RW19 data to update thinning response w/FastLob/FMRC
 - Integrate with new FPC soil system and more recent RW18 soil fertilizer response information
- **Economic decision calculator**
 - This would be a simple field calculator delivered as an app. Inputs would include: discount rate, fiber prices, treatment growth responses and treatment costs. Output would be NPV. The calculator could generate values for a target NPV or generate NPV based on selected inputs.