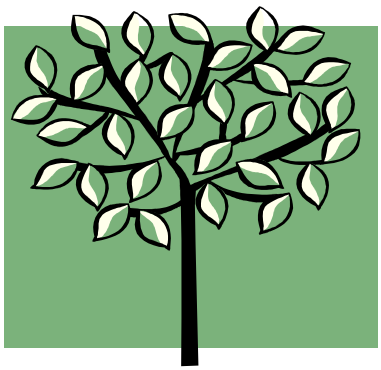
VOLUME 3, ISSUE 2 SPRING ISSUE—JUNE 2008

The Stand Manager

Technical Development, Planning and Utilization Unit Newsletter
NC Division of Forest Resources—DENR



Tech Updates

Ron Myers

What a year this has been for large and damaging fires in North Carolina. Will this add fuel to the fire for support of HR 5541, the "FLAME Act"? In this spring issue we feature technical updates from the FIA Program and a Forest Pest report.

Now that the FDP cost-share program contains a funding component for Timber Stand Improvement (TSI), its important that we understand the effects of thinning on long term growth. We take a look back at a long term hardwood thinning study that NC DFR and USFS installed back in 1971. Brief highlights from a paper are reported on the results from one early thinning 35 years later.

In the years ahead, forestry professionals will need to become more educated on the issues of climate change, biomass, and carbon sequestration. In our Field Notes section, we highlight a cooperative project that NC DFR assisted with on the Pee Dee National Wildlife Refuge.

NC DFR personnel will have an opportunity to attend a workshop this fall on Woody Biomass at the upcoming FM Academy in Kinston on September 18-19th, 2008. The workshop will be focused on What is Woody Biomass Energy & What will it mean to Forestry in North Carolina?

Inside this issue:

FIA Program Notes

Don Roach

North Carolina Forest Inventory and How the FIA Program Benefits Your County

Collection of forest inventory data in NC goes back to the 1930s when the first permanent forest inventory plots were established. The USDA Forest Service historically established and re-measured forest inventory plots in North Carolina on an eight (8) to ten (10) year cycle. Known as the **Forest Inventory Analysis (FIA) program**, this periodic survey was sort of a forest "census" documenting and determining the status, trends, volume, availability, species, and the health of our forests in North Carolina.

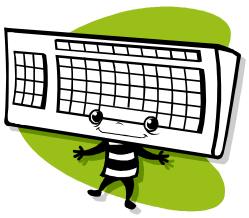
In 1998, with funding from the US Forest Service, the NCFS began assisting the federal government with collecting data for the seventh survey in the state. By 2002, this survey was completed and Forest statistics for North Carolina—2002, was published. The full publication can be found at: http://www.treesearch.fs.fed.us/pubs/6274.

Beginning in 2003, the periodic survey was changed to an annual sample survey. Under this annual format, **15-20% of the forest inventory plots in the state are visited each year**. After 5-7 years, the entire state will be completed. Each year the state will blend in another year's worth of data and "roll" the statistics to produce a running annual update on NC's forest inventory. The most current data will be more readily available through annual summaries and a major publication every five years.

Data is also available in an interactive format on the Internet.

FIA Program Cont.

The **Forest Inventory Mapmaker Version 3.0** is a Web based interactive program that allows users to access this data. Forest Inventory Mapmaker provides users with the ability to generate maps and tables without creating an in depth query of the data. The user provides the following information from an existing list:



- Geographic area of interest (state/county)
- Attribute of interest (timberland area, number of trees, growing-stock volume, etc.)
- Optional filters (restricting query to specific ownership, species, etc.)
- Classification variables to be used for columns and rows

With this input Mapmaker will generate a cross-tabulation report. If the user selects County as the row variable, a shaded counties map will be generated.

Mapmaker can be found at http://srsfia2.fs.fed.us/data/index.shtml.

FIA data is being used in many ways. The US Forest Service in conjunction with the North Carolina Forest Service is using FIA data blended with Satellite Imagery and Soils Maps to create a Southern Pine Beetle Hazard Map. This will allow field personnel to become more efficient by targeting areas with higher risks.

Since Hurricane Katrina hit the Gulf States, Congress has tasked the FIA program to assist states in rapid assessment of forest conditions after natural disasters. In the spring of 2007, the Forest Inventory Analysis group assisted the Georgia Forestry Commission and Florida Forestry Division on a Wildfire Impact Analysis project. The States provided shape files of the perimeter of the fires, used National Land Cover Data, and stratified FIA plot data to calculate forest volume by ownership, forest product categories, and precommercial forest area. Using this information and applying a mortality factor they were able to calculate the economic loss due to the fires.

The FIA program is the only program that conducts a comprehensive study of forest resources on private and public owned land in North Carolina. FIA Data is being used to dictate policies such as increased cost share for longleaf pine restoration to the rising concerns of the decline in shortleaf pine. Without this timely data we would not have the tools to adapt to the evolving forest resources that we manage.

Additional information about the Forest Inventory Program can be found at http://srsfia2.fs.fed.us/.

Forest Pest Update

Laurel Wilt Disease

Ryan Blaedow

A new tree disease is sweeping across portions of South Carolina, Georgia, and Florida. Just like the chestnut blight and Dutch elm disease epidemics that occurred during the 20th century, this disease is caused by a pathogen introduced to the U.S. from Asia, and has the potential to eliminate yet another tree species from our native forests. Since it was first discovered in 2003, the disease has spread across more than 30 counties in the southeast, has killed more than 95% of susceptible trees in infected stands, and has gained the attention of forest pathologists for its ability to kill healthy, mature trees in only a few weeks. **Laurel Wilt is a deadly disease of redbay (*Persea borbonia*),** a tree species common to the maritime forests of the Gulf and Atlantic coastal plains from Delaware to southern Texas.

Frass tubes from redbay ambrosia beetle. Photo taken by James Johnson GAFC.

The disease is caused by a fungus (*Raffaelea sp.*) that is spread by another exotic organism from Asia: **the redbay ambrosia beetle (*Xyleborus glabratus*).** Like many other ambrosia beetle species, the redbay ambrosia beetle does not feed on trees; rather it bores into trees to create tunnels in which it "farms" fungi for food. Unfortunately, the fungus of choice for redbay ambrosia beetles just so happens to be lethal to the beetle's preferred host species.

When beetles carrying the fungus bore into a tree, the fungus quickly spreads into the tree's vascular system, blocking the movement of water in the xylem causing the tree to rapidly wilt and die. For a short while, the dead tree is the perfect home in which beetles can feed and reproduce, but as the tree dries out the beetles must move on and infect other trees.

FEOP Workshop on Invasive Plants Ecology & Management
August 19-20th, 2008—Asheville, NC

The redbay ambrosia beetle was first detected in 2002 near Port Wentworth, Georgia. At the time, three beetles were captured in traps deployed for the **Early Detection Rapid Response (EDRR) program**, a nation-wide project to detect the introduction of exotic organisms as quickly as possible after they arrive so they can be managed more effectively. In 2003, significant redbay mortality was reported on Hilton Head Island, SC; shortly thereafter the redbay ambrosia beetles were discovered on the island and it was determined that an unknown wilt fungus was responsible for the heavy losses. By 2005 dying redbays were being reported in Georgia and Florida, and it quickly became apparent that the extent of the infestation had become too great; it would no longer be possible to eradicate the beetle and thereby prevent additional losses. Currently, it is estimated that the beetles are spreading approximately **20 miles per year** and few living redbays are left behind.

Redbay has been the hardest hit species so far, but all plant species of the Laurel family are susceptible including loblolly bay, sweet bay, swampbay, silkbay, sassafras, pondberry, pondspice, spicebush and avocado. Pondspice is considered to be a threatened or endangered species in many southeastern states, while pondberry is a federally endangered species and is found at only two sites in North Carolina. Sassafras has been shown to be highly susceptible, and is an important wildlife species throughout most of the eastern U.S. The Palamedes swallowtail and the spicebush swallowtail butterflies depend on redbay and pondspice, respectively, for the completion of their lifecycle and are also considered to be threatened by the laurel wilt epidemic.

Redbay mortality. Photo taken by James Johnson, GAFC courtesy of www.forestryimages.com

No practical control methods are currently available for Laurel wilt. Efforts to cut and remove infected trees have slowed the spreading front, but have been unable to eradicate the disease completely. Systemic fungicides that can be injected into susceptible trees are currently being tested, but such treatments are very expensive and must be repeated annually or bi-annually and therefore will be reserved for only the most high-value specimens.

Research efforts are underway to learn more about the beetles, their wilt-causing fungus, and possible management strategies; but for now it is critical that infested wood not be transported to other counties or states. Spread of Laurel wilt can rapidly be accelerated should the beetles be transported to new areas. NC DFR will be participating in the EDRR program and will be monitoring for redbay mortality beginning in 2008, although Laurel wilt is not expected to arrive in North Carolina for several years.

For more information on Laurel wilt, contact the Pest Control Branch or visit http://www.fs.fed.us/r8/foresthealth.

Environmental Review — What is the "FLAME Act"? H.R. 5541

Ron Myers

The FLAME Act is a Bill that was introduced in the House of Representatives on March 6th, 2008. The purpose of the bill is to provide a supplemental funding source for catastrophic emergency wildland fire suppression activities on Department of the Interior and National Forest System lands, to require the Secretary of the Interior and the Secretary of Agriculture to develop a cohesive wildland fire management strategy, and for other purposes. This Act may be cited as the **"Federal Land Assistance, Management and Enhancement Act' or 'FLAME Act'.**

This proposed Bill seeks the establishment and availability of a Flame Fund that would be made available to the Secretaries to pay the costs of catastrophic emergency wildland fire suppression (WFS) activities that are separate from amounts annually appropriated for fire suppression activities. In recent years, both the USFS and the Department of the Interior have had to borrow funds from other agency accounts or program areas to cover the continued escalating costs of wildland fire suppression. In 2007, the USFS spent $741 million more than was budgeted while the Department of the Interior spent $249 million more than was budgeted for WFS. In the case of the USFS, wildland fire suppression activities now account for close to 50% of its budget. The costs of catastrophic, emergency WFS activities account for the majority of these expenditures, as 2 percent of these fires now account for about 80% of costs.

The borrowing of non-fire funds to cover unanticipated fire emergency costs can have a ripple effect on any resource management agency, regardless if they are Federal or State agencies. In addition to the establishment of a Flame Fund, the bill would authorize those agencies to provide grants to certain communities to improve local firefighting capabilities.

Hardwood Silviculture

Ron Myers

Thinning Results from a mixed Upland Hardwood Stand after Thirty-five Years

Ronald J. Myers, Jr., Kenneth R. Roeder, W. Henry McNab

A study of precommercial thinning was originally initiated in the spring of 1971. At the time this study was initiated, very little information on precommercial thinning effects in upland hardwood stands that are predominately oak was available. The primary objective of the study was to compare the short-term results of precommercial thinning treatments in a recently regenerated oak stand on a low quality site. Results after five years were previously reported by Boyette and Brenneman (1978). This report presents a brief portion of the later results of that study, up to 35 years after the precommercial thinning treatment to stand age 41.

Methods

The study site is located in the Bent Creek Experimental Forest, about 10 miles south of Asheville, N.C. This low-quality site (Oak SI_{50} 65-70) is located in the southern Appalachians of western N.C. The study was installed in a six-year-old stand of stump sprouts and advance regeneration that originated from clearcutting a predominantly shortleaf pine stand with a midstory of mixed hardwoods.

The hardwood component consisted mainly of oaks (*Quercus spp*): scarlet, black, white, chestnut, southern red, northern red, and post oak. Other hardwoods included red maple, yellow poplar, and sourwood. Scattered groups of white pine had also been planted before the previous timber stand was harvested.

Initial 400 TPA thinning treatment level in 1971.

Four blocks of two precommercial thinning treatments were installed and compared to a no thinning control in 1971.

Study treatments were: 1) thinning to 400 TPA, (2) thinning to 800 TPA and 5 years later thinning to 200 TPA, and (3) a control plot in which no thinning was done. Treatment plots were 0.25-acre in area with a 0.10-acre center measurement plot.

The initial stem height measurements were made in early spring 1972, immediately following the installation of the precommercial thinning treatments. Repeat measurements of height and d.b.h. of the selected crop trees were made in the spring of 1977, 1982, 1996, and 2007, at **stand ages 11, 16, 30, and 41** respectively.

Results

Five hardwood species comprised the bulk of the crop trees. These species included white oak, black oak, yellow poplar, scarlet oak, and chestnut oak. White pine was also present as a component of the developing stand, especially in the unthinned check plots where they were left. In 1972 oak species comprised between 62 and 77 percent of all treatment stands. At stand age 11, thinning to 800 TPA did not provide a sufficient tree growth response to justify future recommendations in young upland hardwood stands.

Total Basal Area Development from Stand Age 16 to 41 Years

In 1982 the thinning treatments resulted in significantly higher total basal area than the unthinned control treatment **(Table 1)**. The total basal area growth in the 400 TPA thinning treatment was almost double that of the control. During the 11-year period following thinning, trees were able to grow, increase their crown volume, and add d.b.h. growth as reflected in basal area. By stand age 30 and through age 41, no significant differences in total basal area for any of the treatments remained. This is also true when only dominant and codominant crop trees were assessed.

Table 1.-*Total basal area (feet²/acre) by thinning treatment, stand age, and assessment year.*

Thinning Treatment	1982 Stand Age 16	1996 Stand Age 30	2007 Stand Age 41
No Thin Control	18 b	92 a	130 a
200 TPA Thin	24 a	64 a	95 a
400 TPA Thin	34 a	71 a	100 a
R^2	86	88	87

*Values with the same letter are not significantly different at the P <0.05

As these stands developed following thinning treatments, the drier site upland oak species such as white oak, scarlet oak, and black oak were found to contribute more to the basal area totals, especially in the 200 TPA treatment **(Table 2).**

Species such as black cherry, northern red oak, southern red oak, and post oak responded poorly during this stage and were outperformed by the drier site oaks, yellow poplar, and planted white pine. By stand age 30, the northern red oak and post oak had dropped out of all the treatments. By stand age 30, the unthinned control treatments, and the thinned plots where white pine was left as a crop tree were impacted by white pines that were present or seeded in naturally underneath the open hardwood canopies following disturbance **(Table 2).**

On these drier sites in the southern Appalachian mountain region, previous researchers have found that white pine will out-compete most other species regardless of site quality, except yellow poplar on SI^{50} > 95 feet (Doolittle 1958).

Scarlet oak crop tree in 200 TPA treatment

Table 2.-Percent of total basal area (feet²) for drier site oaks, yellow poplar and white pine by assessment year.

Species	1982 Stand Age 16			1996 Stand Age 30			2007 Stand Age 41		
	Control	200	400	Control	200	400	Control	200	400
Drier Site Oaks	59	78	67	32	82	68	33	80	66
Yellow Poplar	26	12	14	16	10	10	17	12	10
White Pine	3	4	9	45	8	16	45	8	17
Total	88	94	90	93	100	94	95	100	93

The 200 TPA thinning treatment did improve the total amount of total basal area of white oak, black oak, and scarlet oak that remained competitive at stand ages 30 and 41. The total basal area growth for these species during this period was larger for the 200 TPA and 400 TPA thinning treatments **(Table 2)**. Both thinning treatments have allowed these species to stay competitive with yellow poplar and white pine. Red maple ingrowth has also increased in the unthinned control and the 400 TPA thinning treatment during this same time period.

Mean d.b.h. Development from Stand Age 16 to 41 Years

At age 16 the mean d.b.h. for the 200 TPA thinning treatment was significantly larger than the 400 TPA thinning treatment and the unthinned control **(Table 3).** The heavier thinning produced the largest mean d.b.h. at 4.5 inches compared to 3.5 inches for the 400 TPA thinning and 2.5 inches for the unthinned control.

The mean d.b.h. for the 200 TPA thinning treatment was significantly larger than both the unthinned control and the mean d.b.h. for the 400 TPA thinning across all measurement periods. There were no differences between the 400 TPA thinning treatment and the unthinned control as the stand matured between age 30 and at age 41.

Table 3.-*Mean d.b.h. (inches) by thinning treatment and assessment year.*

Thinning Treatment	1982 Stand Age 16	1996 Stand Age 30	2007 Stand Age 41
Unthinned Control	2.5 c	7.9 b	8.9 b
200 TPA Thin	4.5 a	8.5 a	10.5 a
400 TPA Thin	3.5 b	7.4 b	8.4 b
R^2	92	95	95

*Values with the same letter are not significantly different at the P <0.05

By age 30 years, approximately 25 years since the original precommercial thinning treatments were applied, no significant differences in mean d.b.h. between the 400 TPA thinning treatment and the unthinned control remain. The mean d.b.h. growth increases were largest for the period between 1982 and 1996. White pine grew to the largest mean diameters across all thinning treatments followed by scarlet oak, yellow poplar, chestnut oak, and white oak. During this period the thinned stands were still understocked and better able to utilize site resources.

Stand Density and Stocking Development from Stand Age 16 to 41 Years

Between 1982 and 1996, the natural mortality in the unthinned control treatment was 42 percent, with stand density decreasing from 417 to 242 TPA **(Table 4).** The mortality in the 400 TPA thinning treatment was similar at 47 percent, decreasing from 415 to 223 TPA. During this same period, natural mortality in the 200 TPA thinning treatment was 14 percent, decreasing from 209 to 179 TPA. Stand conditions were moving into fully stocked conditions with stocking levels of 58, 68, and 85 percent for the 200, 400, and unthinned control treatments respectively at stand age 30.

The 200 TPA thinning treatment was still at the B-line stocking level, considered to be an acceptable stocking level for additional stand growth (Gingrich 1971a). By the 2007 assessment (age 41 years), stand conditions have reached fully stocked to over-stocked conditions with stocking levels of 80, 91, and 110 percent for the 200, 400, and unthinned control treatments respectively **(Table 4).** The unthinned control treatment was now at the overstocked stocking level prior to mid rotation and trees reaching small sawtimber size.

Table 4.-TPA, *stand density, mean d.b.h. and percent stocking levels by thinning treatment, stand age, and assessment year.*

	1982 Stand Age 16			1996 Stand Age 30			2007 Stand Age 41		
	Control	200	400	Control	200	400	Control	200	400
Trees per Acre	417	209	415	242	179	223	233	177	205
Total Basal Area	18	24	34	92	64	71	130	95	100
Mean d.b.h	2.5	4.5	3.5	7.9	8.5	7.4	8.9	10.5	8.4
Percent Stocking Level	<25	<30	45	85	58	68	110	80	91

Discussion

Thinning treatments applied at 6-years old did provide some early growth benefits. This increase in tree growth became less significant with later stand development. **The benefits from this early thinning can be expected to increase growth for only 10 to 15 yrs. Gingrich (1971b) found that a single thinning, unless followed by a series of thinnings at 10 to 15-year intervals, is of doubtful value.** Other researchers have found that growth responses have been inconsistent for released crop trees in young stands less than 10-years after clearcutting (Hilt and Dale 1982, Trimble 1971).

In this study, the initial thinning treatment was applied too early in stand development. Precommercial thinnings on drier sites should be delayed until the stand reaches between 15 to 20-years old. Younger hardwood trees would respond better following more time for crown development. By waiting for the stand to develop further, foresters can better select the highest quality dominant trees of the preferred species that is adapted to the site.

400 TPA treatment 35 years later.

Precommerical thinning did allow more oak species to remain competitive during later stand development. Thinning treatments contained a larger percentage of drier site oaks and yellow poplar. Thinning also prevented white pine and yellow poplar from dominating in the thinned stands.

Where landowners want to produce both timber value and wildlife benefits, white pine is an acceptable species to grow in mixtures on these drier sites. Careful consideration however should be given to how many white pine and yellow poplar trees to leave when grown in mixtures on dry sites naturally regenerating to oak. These species can overwhelm young oak stands at higher stocking levels. Although yellow poplar grew well from stump sprouts, management of this species is generally not recommended on sites of low to intermediate quality (Beck and Della-Bianca 1981).

The full publication and literature citations can be found in: Proceedings 16th Central Hardwood Forest Conference, West Lafayette, IN on April 8-9th, 2008. USFS Northern Research Station, GTR NRS-P-24.

Field Notes: Special Projects & FM Activities submitted by County personnel or Foresters

NC DFR Assists Pee Dee National Wildlife Refuge with Afforestation Project

The Pee Dee National Wildlife Refuge was established in 1963. It contains **8,443 acres** and is located in both **Anson and Richmond** county. The refuge has a seven-person staff and they get about 35,000 visitors annually. The refuge lands are comprised of 3,000 acres of bottomland hardwoods, 1,200 acres of upland pine forest; and 4,300 acres of crop lands, old fields, and mixed pine hardwoods.

Agricultural field adjacent to Pee Dee River

In the fall of 2007, **Anson County Ranger Robbie Perry, Rockingham Assistant District Forester Bill Demay**, and Hdwd. Silviculturist Ron Myers were invited by **Pee Dee Wildlife Refuge Manager J.D. Bricken** to examine several agricultural fields along the Pee Dee River for Afforestation potential. This was a unique opportunity because Refuge Manager J.D. Bricken wanted to bring in local expertise to help provide technical information and recommendations for potential afforestation and conservation funding from the **Go Zero℠ Program.** Following our site visit to examine the agricultural field history, soil series, and drainage class, we developed a detailed forest management plan that included recommendations on site preparation, tree planting, and follow-up maintenance. J.D. Bricken stated that this plan was invaluable to him to provide guidance on the recommended treatments to carry out, the timelines to conduct afforestation activities, and contractor lists to contact for follow-up services and seedlings.

Local contractor Dale Newport was hired to conduct the site preparation and tree planting. Site preparation consisted of ripping the soil in these agricultural fields. The previous cover crop was corn that was established by a no-till method. Following site preparation, a variety of 2-0 hardwood seedlings were hand planted in the furrows created by ripping to allow for better planting depth. Tree species that were planted in the lower bottom along the river included swamp chestnut oak, overcup oak, willow oak, water oak, and persimmon. There were other upland agricultural fields that were planted in white oak, southern red oak, willow oak, water oak, and persimmon.

Approximately **86 acres were established in February 2008** on the refuge. A follow-up herbicide release treatment is planned in May to help control any vines, weeds, or grasses that have begun to colonize the site following tree planting. Funding for all afforestation activities and release treatments was secured by the Pee Dee Wildlife Refuge with the help of a detailed plan developed by NC DFR.

Refuge Manager J.D.Bricken

Funding for this project was granted through the Go Zero℠ program administered by The Conservation Fund. The Go Zero program was created to calculate and offset the annual carbon dioxide emitted by a specific activity, business, organization or individual. Charitable contributions of approximately $5.00/tree helps to support the Fund's Carbon Sequestration program. This program is an effort to plant native trees to address climate change, protect wildlife habitat, and enhance America's public recreation areas.

The Conservation Fund works primarily with state and federal public land agencies, including USFWS on Refuge Lands. On areas where most of the Fund's sequestration efforts have been focused, the Fund and its partners plant approximately **300 TPA, which can sequester approximately 400 tons of carbon dioxide over 100 years.** On a per planted tree basis, this amounts to **each tree absorbing an average of approximately 1 to 1.3 tons of carbon dioxide over its lifetime.**

This cooperative project is a good example of how federal and state agencies can work together to benefit the environment.

For more information about the Go Zero program, go to **www.conservationfund.org**