



FOREST HEALTH REVIEW

November 2008



Severe gypsy moth defoliation blankets much of the landscape of the George Washington National Forest in western Augusta County.

IN THIS ISSUE...

THE "GREEN MENACE" IS BACK AND
THIS TIME, IT'S HERE TO STAY

UPDATES:

Weather
Gypsy Moth
Bark Beetles
Southern Pine Beetle
Hemlock Woolly Adelgid

Sudden Oak Death
Early Detection Rapid Response Program
(EDRR)

Tulip Tree Scale

Sirex Noctilio

New Tree of Heaven Publication
Coming Soon

CURIOSITIES

USING LANDSAT IMAGERY TO
DETECT GYPSY MOTH DEFOLIATION

GREETINGS

What a busy summer. Right in the middle of our gypsy moth aerial survey season, the emerald ash borer showed up again with a vengeance just after the July 4th weekend. In fact, the emerald ash borer has made alarming progress throughout the country this year and can now be found in 10 U.S. states and two Canadian provinces. Its known range stretches from southeast Missouri to Montreal, Quebec, southeast Wisconsin to northern Virginia. Firewood movement appears to be acting as the major dispersal agent. I will have a lot more to say about gypsy moth and emerald ash borer in this issue. Meanwhile, relative drought conditions continue across much of the Commonwealth, adding to the stress on trees from past years of drought. The good news is that southern pine beetle activity has generally been quite low once again, and this is the case across the Southern Region all the way to Texas. Nobody can really explain why this is, but nobody is complaining either. I hope you find this issue to be useful and informative.

Chris Asaro, forest health specialist



THE “GREEN MENACE” IS BACK AND THIS TIME, IT’S HERE TO STAY

During the July 4th holiday weekend, VDOF’s Halifax County Forester, Andrew Brown, was spending time at home with his family in Herndon, Virginia. He was walking his dog through the Fairfax County neighborhood where he grew up when he noticed some severely declining ash trees by the roadside. Upon inspection, Andrew noticed what looked like wood borer emergence holes that were D-shaped. Peeling off some loose bark also revealed numerous zig-zagging gallery patterns. Suspicious that this damage might be from the emerald ash borer (EAB), Andrew took some photos of this damage and forwarded them to me the following week. After seeing the photos, I was pretty certain this was EAB. I forwarded the pictures to Frank Finch with the Fairfax County Forest Pest Program along with directions to the trees in

question. Frank and his colleagues were involved with the original EAB eradication near Wolf Trap Park in 2004 (see FHR May 2007) and was, therefore, one of the more qualified individuals in Virginia to investigate this. Frank promptly visited the site July 7th and was able to find a few dead EAB adults. The Virginia Department of Agriculture (VDACS) was promptly notified and specimens were sent to a specialist with the Animal and Plant Health Inspection Service (APHIS) in Michigan to confirm the diagnosis. This confirmation occurred July 9th. Within one month of that find, EAB also was discovered for the first time in Wisconsin and Missouri, expanding the range of this pest to 10 states.

Andrew Brown’s alertness was not a complete accident since, prior to his employment as a forester with VDOF, he worked for me during the summer and fall of 2006. One of his primary jobs was to conduct visual surveys

“Every instant of time is a pinprick of eternity. All things are petty, easily changed, vanishing away.”

Marcus Aurelius, 121-180 AD

THE “GREEN MENACE” IS BACK, CONTINUED

for EAB throughout the state. Ironically, the trees that he examined in his neighborhood in Herndon were included in his 2006 survey efforts. It is very possible, if not likely, that these trees were infested as far back as 2006, but unfortunately it is almost impossible to tell whether an infestation is present in its early stages. This demonstrates the real limitations of performing a visual survey for EAB.

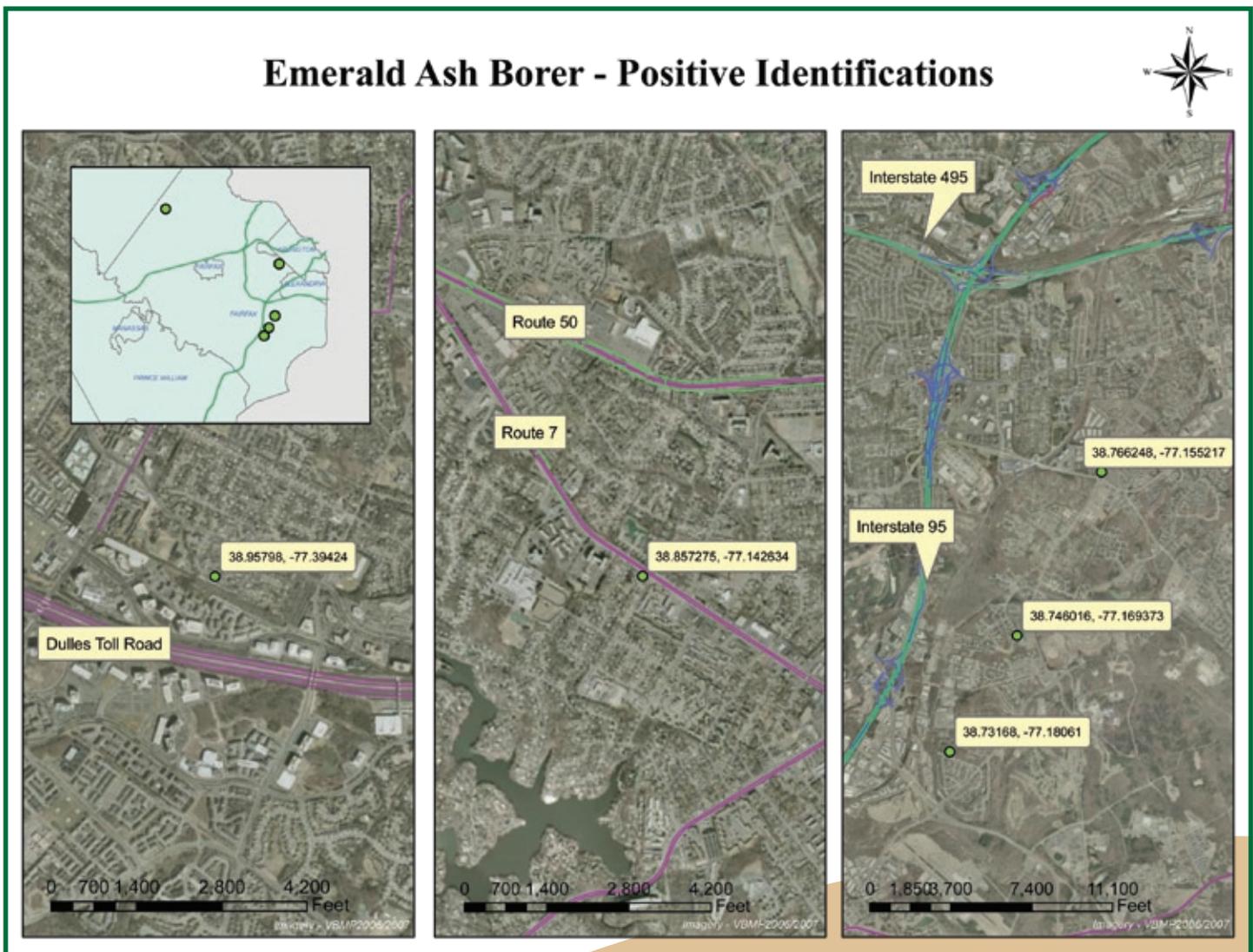
Since that first detection, EAB has appeared in three other areas throughout Fairfax County (Figure 1). Knowing that its arrival into a new area often precedes detection by at least a year or more, VDACs

took the proactive step of not only quarantining Fairfax County, but also the four adjacent counties of Arlington, Loudoun, Fauquier and Prince William and the cities of Alexandria, Fairfax City, Falls Church, Manassas and Manassas Park. This should significantly limit movement of firewood and any infested product made from ash to other parts of Virginia. While the expectation is that EAB will eventually spread across the Commonwealth, there is great value in slowing it down in terms of deferred costs.

Firewood movement via commerce and private citizens is considered to be the primary means of

continued on page 4

Figure 1.



“At twenty years of age, the will reigns; at thirty, the wit; at forty, the judgment.”

Benjamin Franklin, 1741

THE “GREEN MENACE” IS BACK, CONTINUED

long-distance dispersal of EAB. The circumstantial evidence is quite strong in that most new infestations are found near major interstate corridors or around campgrounds where firewood may be brought in by the public from hundreds of miles away. It is imperative that we begin to enforce restrictions on unprocessed



Emerald ash borer galleries from an ash tree in the Newington area of Fairfax County.

firewood entering Virginia, not only to slow the spread of EAB but to prevent other pests, such as the Asian longhorned beetle, from entering the Commonwealth. These two pests alone, if established here, could result in billions of dollars in losses to Virginia’s economy.

Eradication is no longer a feasible option for this pest in Virginia. Indeed, no state has successfully eradicated EAB despite some considerable monetary investment in those few states that have tried. It is still thought that the original eradication efforts in Virginia in 2004 (described in FHR May 2007) were successful. However, the circumstances were considerably different than now; a shipment of infested ash trees was planted in Fairfax County in the vicinity of a public school near Wolf Trap Park. The infested trees were discovered quickly, and all were accounted for and removed before the insect had a chance to complete its life cycle, emerge and spread. Therefore, it is believed that the latest infestation in Fairfax County likely had another source. The proximity of the new infestation to I-95 and the Dulles Toll Road suggest is that they could have come from virtually anywhere. Even if one county or state were successful in EAB eradication, the threat of re-infestation remains extremely high due to the spread of unchecked populations in adjacent states. VDACS and/or county governments will only officially remove and destroy infested trees on county property. On private property, it will be up to the individual owners to dispose of EAB infested trees and materials. Likewise, infestations on land owned by state and federal agencies will be handled by the respective owner.

Instead of eradication, efforts will be focused on slowing the spread of EAB by enforcing the quarantine restrictions on movement of all firewood and ash wood products to other areas outside the quarantine zone. Such products must be certified by a VDACS inspector before they can be legally shipped. Some form of acceptable heat treatment and/or fumigation must be applied to the product to meet inspection standards. Through the Virginia Invasive Species Working Group, we are also making an effort towards legislation that will require all hardwood firewood entering the state be treated, whether sold

“The love of liberty is the love of others; the love of power is the love of ourselves.”

William Hazlitt, 1819

THE “GREEN MENACE” IS BACK, CONTINUED

commercially or brought in by private citizens for personal use at campsites or other venues.

While enforcement of regulations is important, no level of enforcement will be enough without the willing cooperation of the public. Therefore, educating the public about EAB, invasive species and firewood movement is essential. Agencies at all levels of government as well as non-profits, including APHIS, the USDA Forest Service, Shenandoah National Park, VDOF, VDACS, Virginia Department of Conservation and Recreation (DCR), Virginia Tech, Virginia Cooperative Extension, The Nature Conservancy, Fairfax County, Master Naturalist and Master Gardener associations and many other entities are involved with engaging and educating the public. Recently, I participated in an EAB training session in Fairfax organized by Terry Lasher, assistant regional forester for northern Virginia, and Jim McGlone, VDOF urban forest conservation specialist in Fairfax County. Presenters included myself; VDOF Fauquier County Forester Joe Rosetti; Debra Martin with VDACS Office of Plant and Pest Services, and Troy Shaw of the Fairfax County Forest Pest Program. The audience was an assortment of folks from DCR, master naturalists, master gardeners and other concerned citizens. In the afternoon, we visited a number of sites throughout Fairfax County to observe active infestations.

What can we expect from EAB over time?

The urban forest resource will be the most immediately and visibly impacted. While about 1.6 percent of Virginia’s forested volume is ash (mostly green and white) according to Forest Inventory and Analysis (FIA) plot data, the prevalence of ash in our urban forests is not well documented. Since the FIA plot system does not include urban forest landscapes, it’s up to individual municipalities to keep street tree inventories. While some municipalities in Virginia do have good, up-to-date inventories, a majority do not, including some of our major cities. Without this information, it will be hard to determine the full impact of EAB on Virginia’s urban landscape. Our agency is working with Virginia Tech to try to remedy this situation. With funding provided by the USDA Forest Service, Forest Health Protection branch, Professor Eric Wiseman and I are



Troy Shaw with the Fairfax County Forest Pest Program demonstrates how to use a bark scraper to expose emerald ash borer larvae and galleries.

trying to obtain a 5-10 percent street tree sample of all major municipalities across the Commonwealth. Pre-existing inventory data will be collected and new survey data generated where they are needed until we have enough of a sample to represent the whole state. All sample data will be entered into the USDA Forest Service statistical software package known as STRATUM for analysis. It will take a number of years before we have a good data set, but this will provide Virginia and her municipal areas with a valuable planning tool – answering such questions as:

- 1) How many ash street trees are out there?
- 2) How large/old are they?
- 3) How much will it cost to remove and replace trees killed by EAB?
- 4) What other common street tree species besides ash are there, and what is their abundance?

continued on page 6

“No race can prosper till it learns that there is as much dignity in tilling a field as in writing a poem.”

Booker T. Washington, 1901

UPDATES

THE “GREEN MENACE” IS BACK, CONTINUED

The latter question is most significant for future invasive species, such as the Asian longhorned beetle, that may plague us. This pest attacks maples as well as trees in other genera and could be even more devastating than EAB, since red maple alone makes up seven percent of our forest volume and probably a much higher percentage of our urban forest (including red, Norway, sugar, silver and other varieties of maple) compared to ash species. The combined impact of both of these pests, if established across Virginia, could total billions of dollars. The key question for EAB right now is: over what time period will these costs incur?

If EAB has taught us anything, it is that we must begin to focus more of our efforts on interrupting pathways for invasive species, rather than focusing all our attention and resources on battling individual pests on a case by case basis. While the latter is important, the list of threats is only going to keep getting longer while our time and resources get stretched thinner and thinner if we do nothing to shut down, or at least slow down, this constant influx of untreated, infested material.

“Science is built up of facts, as a house is built of stones; but an accumulation of facts is no more a science than a heap of stones is a house.”

Henri Poincaré, 1905

WEATHER

After a winter that was warmer and drier than normal along with a horrible start to the fire season in February, a relatively wet spring settled over most of the Commonwealth. In April, a majority of the state saw average monthly precipitation levels that were more than 130 percent of normal, with most areas in the coastal plain more than 200 percent. Only extreme southwestern Virginia from Lee County to the Grayson Highlands was on the dry side, about 70-90 percent of normal. Temperatures during the month remained 1-2 degrees above average in most areas, with a few pockets in the north and western mountains 3-4 degrees above average.

In May, unusually cool weather prevailed almost everywhere, down to two degrees below normal most places and 3-5 degrees below the monthly average in the northwest mountains and northern Shenandoah Valley. Precipitation during May was extremely variable, with the northern third of Virginia and much of the Piedmont experiencing 150-300 percent above average monthly rainfall. Southeastern and southwestern Virginia, on the other hand, were mostly between 50-90 percent of normal, with some pockets in the extreme southwest were under 50 percent of normal monthly precipitation.

During June, an increasing gradient of above average temperatures occurred from west to east: average to 2 degrees above in the West; 2-4 degrees above in most of the Piedmont, and 4-6 degrees above in most of the Coastal Plain. Wet weather continued in the northern part of the state (110-130 percent above normal), but dry weather prevailed everywhere else. Much of southeastern Virginia saw less than 50 percent of normal monthly rainfall, while many other areas were between 50-90 percent of normal.

July was relatively cool, with most areas 1-3 degrees below average. Only an area from DC south to Richmond and west to Charlottesville was about average or slightly above average in temperature. Precipitation was extremely valuable: very dry pockets under 50 percent occurred along the Chesapeake



Damage to a young pine stand and some ornamental trees in Green County caused by a June hailstorm.



Aerial view of damage to a large pine stand in Green/Orange counties caused by a June hailstorm.

Bay, while most other areas were between 50-90 percent of normal precipitation. Most of the mountainous areas from the far north to the extreme southwest were 110-300 percent above normal, except for Bath, Highland, Tazewell and Smyth counties, which were dry.

The unusually cool summer continued into August, with just about every part of the Commonwealth averaging 2-4 degrees below normal. Precipitation remained variable: 125-200 percent above normal from the Grayson Highlands north and east to Charlottesville, Farmville and Mecklenburg, and 25-75 percent of normal everywhere else. Southeastern Virginia was the driest part of the state during August, with most areas between 25-50 percent of normal monthly precipitation.

September saw just about average to slightly above average temperatures everywhere. Precipitation was, once again, extremely variable: most of the eastern half of the state from north to south saw 110-200 percent of normal monthly precipitation, while the western half and mountainous regions were between 25-75 percent of normal in most places.

Over the summer, much of the variability in precipitation from one area to the next was due to the fact that some places benefited from a passing tropical depression or two while others did not.

October continued to be dry but quite cool. The southwest and a few isolated areas of the south central piedmont saw rainfall totals that were 50-90 percent of normal, while most other locations were 25-50 percent of normal. Temperatures were about average to two degrees below average for the month, which seemed exceptionally cool given the well above average temperatures we've seen during the fall in recent years.

“Editor: a person employed by a newspaper, whose business it is to separate the wheat from the chaff, and to see that the chaff is printed.”

Elbert Hubbard, 1914

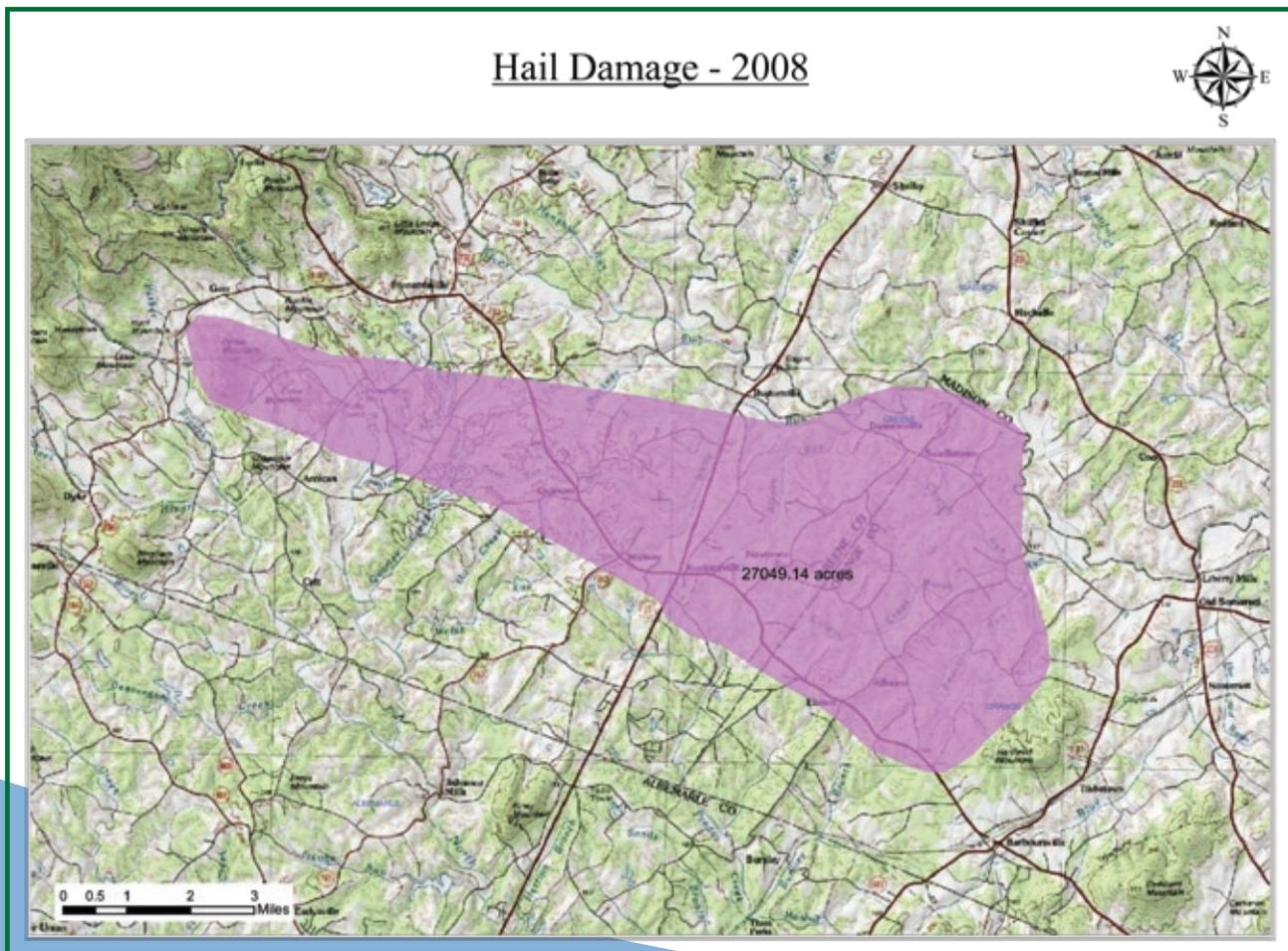
UPDATES

HAIL STORM

On the afternoon of June 16th, a freak hail storm hit Green and Orange counties. The storm brought soaking rains, lightning, strong winds and several inches of hail to many areas between Stanardsville and Gordonsville. The many witnesses to the storm said the hail was coming down nearly sideways at times. So much hail accumulated so quickly

that snowplows had to be brought out to clear the roads. Hundreds of thousands of dollars in damaged property was reported. The worst impacts seemed to be centered in and around Ruckersville, following the Route 33 corridor on either side of Route 29. A number of smaller roads were closed temporarily due to flooding or downed power lines. Damage to trees was widespread and very spotty. In some areas, moderate to severe defoliation was apparent. This damage was quite visible from an aerial survey of the impacted area, which encompassed at least 27,000 acres (Figure 2). Most trees will recover from this, but some that were in a weakened condition to start with may decline further.

Figure 2.



“Several excuses are always less convincing than one.”

Aldous Huxley, 1928

GYPSY MOTH

Defoliation by the gypsy moth increased significantly this year to 112,343 acres from 73,408 acres last season. Although there were a few new areas of defoliation this year, most areas affected were a continuation of last year's hot spots, albeit expanded considerably in most instances. The worst hit area was in Augusta and Rockingham counties, which saw a combined defoliation estimate of more than 42,000 acres. Much of this area included remote National Forest land with very few major roads. Defoliated areas also expanded in Giles, Craig, Montgomery, Roanoke, Allegheny and Loudoun counties as well as within Shenandoah National Park (Figure 3). Frederick and Shenandoah counties were the only areas that saw less defoliation than last year, presumably due to highly effective aerial spray applications and an even greater preponderance of cool, wet weather during spring. Approximately $\frac{3}{4}$ of the defoliated area (more than 82,000 acres) occurred on Federal lands.

This year's total was the highest since 2001, when more than 400,000 acres of defoliation occurred across Virginia. Except for 2001, this was the highest

total defoliation in the Commonwealth since 1995. The emergence of the gypsy moth fungus, *Entomophaga maimaiga*, in 1996, along with wet weather, provoked a major crash in gypsy moth populations. This occurred after six successive years of state-wide defoliation levels that were between 450,000-850,000 acres annually.

There is no question that *E. maimaiga* has continued to play a very significant role in moderating gypsy moth populations ever since its arrival in the U.S. However, successive years of dry, spring weather limit the effectiveness of this fungus and can facilitate the resurgence of gypsy moth populations. This occurred leading up to the outbreak in 2001, and dry spring weather predominated during the 2005-07 seasons, leading up to current outbreak levels.

Gypsy moth caterpillars hatch from eggs during late April into May and feed throughout most of May and early June. The best time for cool wet weather and the gypsy fungus to have a maximum effect is during early to mid-May when early-instar caterpillars are feeding. This year, unusually cool, wet weather persisted over a three-week period during May, just at the right time. Unfortunately, the gypsy moth fungus does not typically kill infected caterpillars until they have almost completely matured and completed most of their feeding. While many of these caterpillars



Pockets of gypsy moth defoliation straddle the Blue Ridge Parkway near Wintergreen.



“The test of a vocation is the love of the drudgery it involves.”

Logan Pearsall Smith, 1931

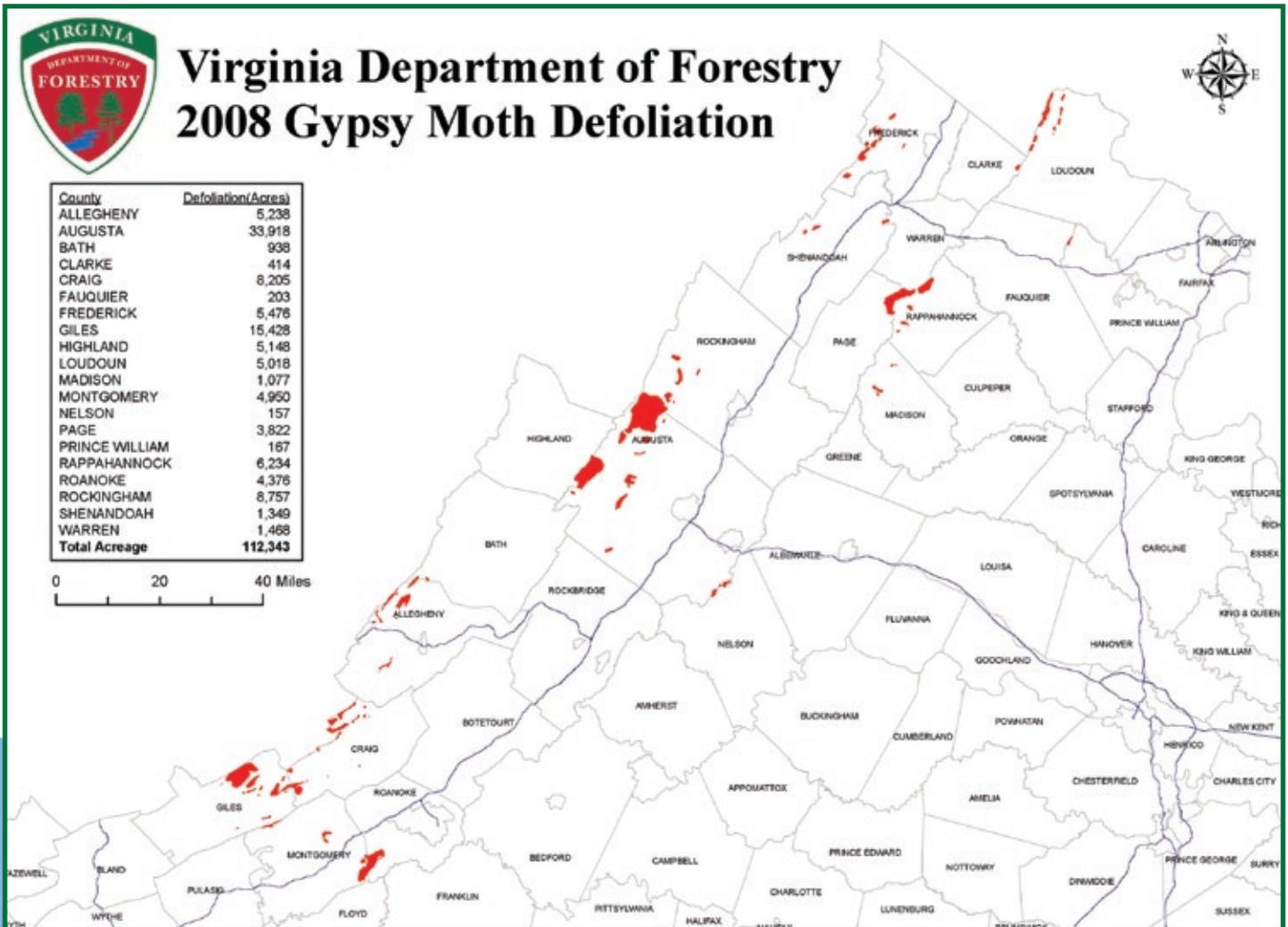
UPDATES

will ultimately succumb and die due to the fungus, this typically won't affect defoliation levels until the following year. In a number of areas, evidence of diseased caterpillars was everywhere. In other areas, there was little apparent disease and loads of new egg masses, portending additional problems with defoliation next year. Another wet May in 2009 may push overall gypsy moth populations into a decline.



A chestnut oak in Augusta County covered with recently laid gypsy moth egg masses.

Figure 3.



“In planning for battle I have always found that plans are useless, but planning is indispensable.”

Dwight D. Eisenhower, 1962

BARK BEETLES

Reports of southern pine beetle, *Ips*, and turpentine beetle activity have been almost non-existent this season. While spring trapping for SPB suggested generally low activity in most locations, *Ips* and turpentine beetle activity have been slightly more common over the past few years. While the accumulated effect of drought may be to exacerbate bark beetle impacts, it clearly does not play a huge role in causing them – at least not in Virginia.



A loblolly pine stand ready to be thinned on Appomattox-Buckingham State Forest.

SOUTHERN PINE BEETLE

We have now added first commercial thinnings to the suite of services offered to landowners under the SPBPP grant. In addition to a 60 percent cost-share



A loblolly pine stand planted at 400 trees per acre.

payment for pre-commercial thinnings and longleaf restoration, flat rate payments of \$50 per acre for first commercial thinnings on tracts of 50 acres or less are being offered as well. Our goal is to include mostly smaller parcels in the 10-30 acre range for which first thinnings are usually not profitable enough to provide a strong incentive for many landowners to undertake. While pre-commercial thinnings will still be the emphasis of the program, we hope the addition of these first thinning payments will further expand areas of well-managed pine forests throughout Virginia and reduce the impacts of future SPB outbreaks.



Pine stand thinning on Appomattox-Buckingham State Forest using shears mounted on a Bobcat.



These shears can cut through 12-inch diameter pine in less than two seconds.

“I don’t want to achieve immortality through my work; I want to achieve it by not dying.”

Woody Allen, 1975

UPDATES

HEMLOCK WOOLLY ADELGID

Most remaining areas within the native range of eastern hemlock have the adelgid, but a few uninfested pockets remain. In general, hemlock decline seems to have stabilized in that mortality rates of infested or previously infested trees have not increased much over the last five years. Many hemlocks begin to decline after a few years of infestation, at which point the adelgids leave the tree in search of healthier trees that are putting out new growth. This allows the previously attacked tree a chance to recover, or at least not deteriorate further. Unfortunately, trees that do start to recover after an initial attack are often attacked a second time, which generally does them in.

SUDDEN OAK DEATH

Stream sampling to monitor for the sudden oak death pathogen, *Phytophthora ramorum*, continues to provide no evidence of the pathogen in our forests. Todd Edgerton has sampled 10 watersheds across six counties where oak is prevalent (Allegheny, Bath, Highland, Rockbridge, Augusta and Rockingham) covering more than 62,000 watershed acres. Likewise, staff from Shenandoah National Park chose to participate in the survey starting this year. Within the Park, they also surveyed 10 watersheds totaling 91,000 watershed acres and including seven counties (Augusta, Albemarle, Greene, Rockingham, Madison, Page and Rappahannock). While we remain very concerned about the potential impacts of

To say, for example, that a man is made up of certain chemical elements is a satisfactory description only for those who intend to use him as a fertilizer.

H.J. Miller, 1943

this pathogen on Virginia's forests, it seems that we have avoided spreading it from California via infested nursery stock thus far.

EARLY DETECTION RAPID RESPONSE (EDRR) SURVEY

This year, Virginia participated in the USDA Forest Service National EDRR Survey for early detection of new exotic bark and ambrosia beetle pests. This survey is staggered so that a dozen or so states participate annually over a five-year period. We would have been hard pressed to do the survey without the assistance of VDACS, whose inspectors did all the trapping and sample collecting every two weeks from April through August. We deployed 24 Lindgren funnel traps (the same traps used to monitor SPB, but using different baits) throughout the Commonwealth. Traps were placed in forested environments adjacent to urban areas and were focused around Radford, Blacksburg, Harrisonburg, Dulles Airport, Richmond, Petersburg, Newport News and Portsmouth. All collected samples were sent to a USDA Forest Service Lab in Louisiana for identification by a taxonomic specialist. This process takes time, but so far our samples have revealed no new exotic beetles in Virginia this year.

TULIP TREE SCALE

Last fall, I reported a significant area of tulip poplar that was being heavily impacted by the tulip tree scale in Nelson County. Much of the damage was scattered along the eastern slopes of the Blue Ridge from Massie's Mill north to Wintergreen. This outbreak has continued this year and appears to be worse in some locations. One large landowner has already clearcut some acres to salvage some of the very large poplar before it is killed. The tulip tree scale is known to occasionally exhibit eruptive outbreaks that can affect large areas of natural forest, although this is not a common occurrence. In most cases, scale populations crash on their own due to killing off or weakening their hosts or

because insect natural enemy populations begin to take effect.



Dead and declining tulip poplar exhibiting epicormic sprouting following a clearcut to salvage the larger diameter trees due to a severe outbreak of tulip tree scale.

SIREX NOCTILIO

Surveys for *Sirex noctilio*, the European woodwasp, were performed by VDACS this year, and none of the exotic wasps were detected in Virginia. *Sirex noctilio* remains widespread in New York state and northern Pennsylvania. Since pine logs are not used as firewood, the rate of artificial spread of this pest is not nearly as dramatic as with the emerald ash borer. However, the threat remains that this pest could spread southward naturally or arrive to Virginia as a separate introduction via entry through one of her ports. We remained concerned

about the potential impact of this pest on the loblolly pine resource in Virginia.

NEW TREE-OF-HEAVEN PUBLICATION COMING SOON

Tree-of-Heaven (*Ailanthus altissima*) is probably the most significant forest weed in Virginia and is the bane of many a landowner. Department of Forestry personnel are often asked what the most efficient means of control is for this prevalent weed. We will soon release a new publication on *Ailanthus*, which emphasizes optimal control strategies and means of utilization. The idea is to find possible uses for all size and age classes of *Ailanthus*, which could serve to balance control costs. Reducing net costs would increase the incentive for some landowners to control and or eliminate it from their property. This publication will be based on recent work by myself; Jerre Creighton; Charlie Becker, and Virginia Tech's Wood Products and Pallet Testing labs. Other future uses are also being considered, including small-diameter harvests of *Ailanthus* for pulpwood or biomass production.



Basic research is what I am doing when I don't know what I am doing.

Werner von Braun, 1973

CURIOSITIES

In June, VDOF Fauquier County Forester Joe Rosetti sent me some interesting pictures of red insects covering the bole of a large hickory from a landowner's yard. He also sent me pictures of leaf galls on the same tree, which I suspected were a separate issue. Not being sure what we were dealing with, I asked for samples. He collected some of the insects off the bark of the tree, as well as a bunch of leaves with the galls on them. When I was able to examine the red insects close up, I realized they were thrips.

What are thrips? This is an Order (Thysanoptera) of sapsucking insects (containing many Families, Genera, and species therein). They're usually very tiny and are most often associated with flowers. In introductory entomology classes where an insect collection is required, you are usually taught to look for thrips by grabbing the inflorescence of a small plant like a goldenrod and slapping it into your palm. This will often shake out very tiny thrips into your hand. Thrips can be pests on a variety of horticultural and food crops, but otherwise most folks are unaware of them.

Getting back to my story – I sliced open some of the galls. Low and behold, I found the very same thrips

inside (one in each leaf gall) that Joe had collected from the bole of the tree. Not being familiar with gall-making thrips, I did a little research. While common in the tropics, thrips species that induce plants to form galls that they then live inside of are relatively uncommon in the temperate zone. All the thrips removed from the galls were in the nymphal stage, meaning they did not have fully formed wings yet. What surprised me was that all of the thrips that Joe had collected off the bark were nymphs as well. My entomological common sense would have told me that these tiny, soft-bodied insects would have waited until they were fully formed, winged adults before emerging from their protective galls. Otherwise, they would be "sitting ducks" while exposed on the bark of a tree. Being immature, they probably also were incapable of mating – also puzzling. Why would they otherwise aggregate in such large numbers on the thick bark of a tree where they cannot feed, mate, or fly away? I really had no answers as I knew so little about the biology of this species, or for that matter, what species it was. Thrips are not generally significant forest pests so I've paid little attention to them over my career.

To try to get some answers, I sent some specimens down to a thrips taxonomist (not many of those around) at the Florida Department of Agriculture in Gainesville, Florida. It was identified as a member of the Family Phlaeothripidae, Genus *Liothrips*. The species was unknown because without an adult specimen, they lack the adequate number of characteristics (i.e. wings) with which to take the identification to the species level. Furthermore, the thrips expert was unable to tell much more about the biology of this insect than I already knew. He was, however, impressed by the pictures. Presumably, this is not a common sight and probably not too important in a practical sense or from a forest health standpoint. Nonetheless, I hope to have time next June to visit that same hickory tree and see if they show up again.



*He that would thrive must rise at five;
He that hath thriven may lie till seven.*

John Clarke, 1639

USING LANDSAT IMAGERY TO DETECT GYPSY MOTH DEFOLIATION

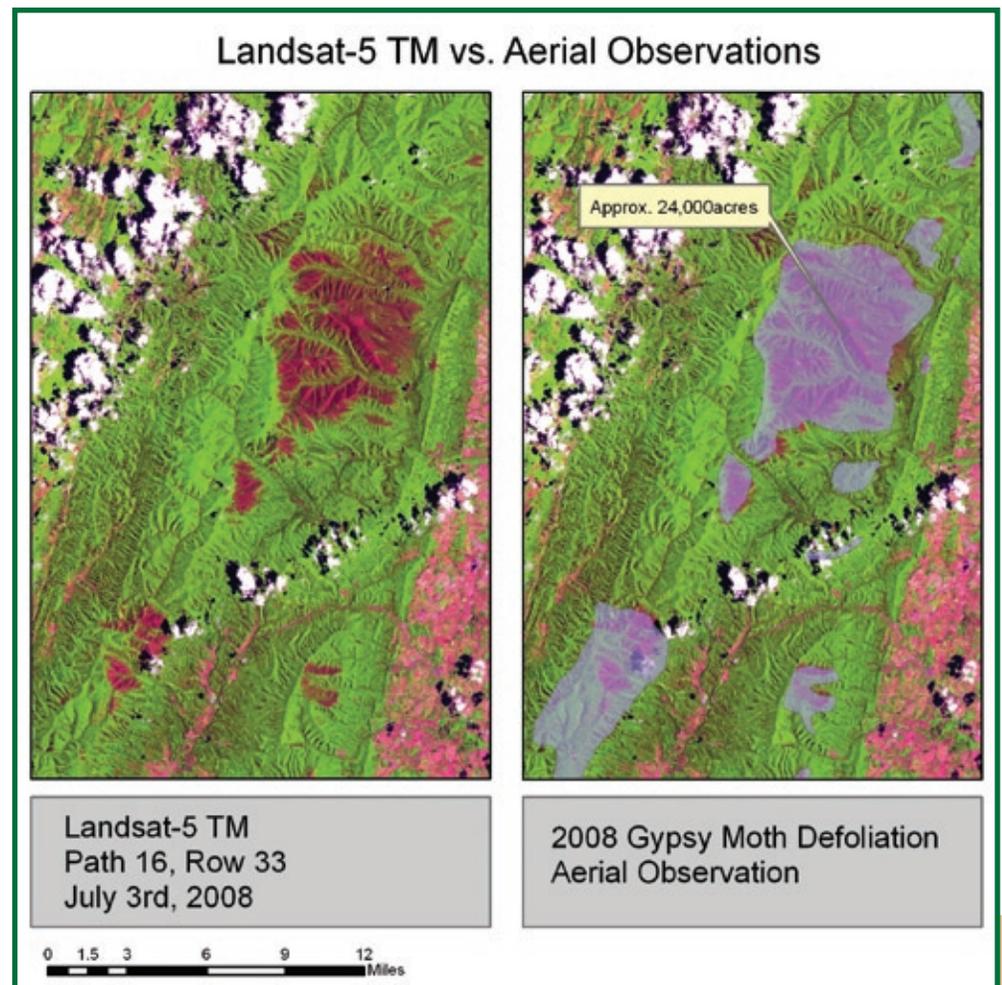
Aerial sketch mapping is the primary means by which annual gypsy moth defoliation is surveyed and quantified. Will this always be the case? It's conceivable that some day we may rely more heavily on remote sensing. The advantages of remote sensing include an enormous savings in time and the potential for extremely high accuracy under the right circumstances. Aerial sketch mapping requires a great deal of experience and expertise, and, over time, fuel costs may greatly exceed the cost of imagery. In fact, LandSat 5 satellite imagery, which passes over an area every two weeks or so, will soon be available free of charge. In addition, scheduling flights around bad weather, maintaining experienced pilots and sketch mappers, the existence of no-fly zones, plane maintenance and repairs, and liability issues are some of the many challenges to contend with in maintaining a robust aerial survey program.

The major limitations of using satellite imagery are that if a satellite pass is made on days with significant cloud cover or heavy haze, the imagery is worthless. Such conditions occur more often than not in Virginia during late spring and early summer, which is the optimal time period to survey for gypsy moth defoliation. While such conditions can also prohibit a survey flight, we have the option of picking which days to fly and can simply wait for the weather to clear. With satellite imagery, you get what you get depending on the conditions on the particular day in which the satellite passes over the area of concern.

Another difficulty with imagery is accurately interpreting what you see. Ultimately, you will still need to ground-truth an area to be sure of what you are looking at on the imagery. In a nutshell, there is no discrete 'gypsy moth signature' or 'southern pine beetle signature.'

For the past two years, I have collected what LandSat 5 imagery I could find during the summer. With technical assistance from Todd Edgerton and Jim Pugh, we have been analyzing this imagery and comparing it with the results of my aerial survey maps to determine

Figure 4.



One crowded hour of glorious life is worth an age without a name.

Thomas Osbert Mordaunt, 1791

USING LAND SAT IMAGERY TO DETECT GYPSY MOTH DEFOLIATION, CONTINUED

whether it accurately detects gypsy moth defoliation. One of our key findings so far is that the imagery doesn't seem to do very well for light defoliation or new defoliation, whether heavy or light (we are not yet sure why this is, but we have some ideas that we need to explore further). On the other hand, in areas that are experiencing a second year or more of defoliation, the accuracy has been fantastic.

Figure 4 is an example from Augusta County, one of our worst hit areas in 2008. The purple areas on the left denote gypsy moth defoliation (actually, they denote areas reflecting less water from vegetation, which we happen to know in this case is due to gypsy moth

defoliation). On the right, we overlaid the polygons (light blue) from my aerial survey flight onto the satellite imagery, and the congruence was excellent (you'll have to take my word for it that the polygons from my flight were drawn prior to obtaining the imagery!). While aerial sketch mapping will continue to be an essential tool for some time to come, we should probably expect to some day transition to a greater reliance on satellite imagery as it becomes cheaper and the technology becomes better. Perhaps one day we will be able to see right through clouds and haze.



Virginia Department of Forestry

Central Office
900 Natural Resources Drive, Suite 800
Charlottesville, Virginia 22903
www.dof.virginia.gov
Phone: (434) 977-6555
Fax: (434) 296-2369

VDOF; 11/2008

This institution is an equal opportunity provider.

Virginia Department of Forestry
900 Natural Resources Drive, Suite 800
Charlottesville, VA 22903