Report to the Maryland Public Service Commission on the Progress of the Maryland Electric Reliability Tree Trimming Council (MERTT) in Addressing Commission Order # 79159 Regarding Recommendation for Specific Actions that Utilities Can Take to Best Manage Privately Owned Trees Adjacent to and within Utility Rights-of-Way.

Prepared by

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Executive Summary

Maryland's electric transmission utilities responded to several major outages during 1999. A severe ice storm impacted central Maryland during January; followed by heat-related outages on Maryland's Eastern Shore in July, and capped off by Hurricane's Dennis in August and Floyd in September, 1999. On October 1, 1999 the Public Service Commission of Maryland docketed Case # 8826 Investigation Into the Preparedness of Maryland Utilities for Responding to Major Outages. (Details on all Public Service Commission documents can be found on the Maryland Public Service Commission web page (http://webapp.psc.state.md.us/Intranet/home.cfm) under the order or case number.) On December 9, 1999 the Commission issued Order # 75823 creating a tree trimming working group consisting of Commission Staff, Maryland Department of Natural Resources, Maryland Office of People's Council, electric utilities, telephone companies, and other interested parties to "develop recommended modifications to the State's policies and regulations to improve tree trimming within utility rights-of-way…...". The Commission further ordered the group "to evaluate the need for appropriate legislation or regulations with regard to tree trimming on private property". Maryland was again struck by severe weather during 2003. Severe thunderstorms impacted the state during August, and Hurricane/Tropical Storm Isabel disrupted power during September, 2003. In the aftermath of Isabel, the Commission docketed Case # 8977 In the Matter of the Electric Service Interruptions due to Hurricane/Tropical Storm Isabel and the Thunderstorms of August 26-28, 2003. Case # 8977 sought to "review the preparedness and performance of utilities in responding to major electric distribution outages" which resulted from the August and September, 2003 severe weather events. As a result of the findings in Case # 8977, the Commission issued Order # 79159 directing the "Commission's Engineering Division Staff and the electric utilities" to "work through the MERTT to develop a detailed recommendation for specific actions that utilities can take to best manage privately owned trees near utility rights-of-way." This report provides an analysis and discussion of the tree related outage data collected from program inception in 2006 through March, 2010 by the six participating transmission/distribution utilities operating in Maryland (Baltimore Gas and Electric (BGE), Potomac Electric Power Company (PEPCO), Southern Maryland Electric Coop (SMECO), Allegheny Power (AP), Delmarva Power (DP), and Choptank Electric Coop (CE)). The utility forester investigates power outages reported as occurring due to vegetation interference, and collects detailed information about each outage. This information documents the electric line characteristics (e.g. line voltage, construction phase, sectionalizing device, etc.) and tree-related characteristics (e.g. species, planted vs. volunteer, on/off right-of-way, health, etc.) of the outage. While outages were reported from across the state, there was a predominance of outages reported within the central urban/suburban dominated counties. This anomaly appears to be an artifact of population distribution/density. The dispersed nature of ratepayers in rural areas of eastern and western Maryland makes meeting the minimum reporting threshold of a 100 household outage a rarer event than in the more populated urban and suburban central counties. The higher percentage of planted tree caused outages in the central suburban/urban counties was also very evident and points up the need for continuing education and outreach. The majority of the trees investigated as being the cause of an outage originate off of the utility rights-of-way and these trees have generally shown no indications of problems that would trigger current utility vegetation management actions. The information about limb or whole tree failure by species and tree age (size) also provides a solid basis for establishing species and age specific best management practices (BMPs), such as trimming red maple and removing black locust even when there are no external indicators of potential failure. The MERTT Program data will inform a utility forester's best professional judgment when specifying vegetative management actions. The continuation of this program will enable Maryland transmission and distribution utilities to establish science based BMPs for inclusion in their vegetative management plans for areas within and adjacent to rights of way. The program results may also provide the basis for formalizing enforcement of what are currently suggested voluntary planting restrictions near utilities.

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Introduction

Maryland's electric transmission utilities responded to several major outages during 1999. A severe ice storm impacted central Maryland during January; followed by heat-related outages on Maryland's Eastern Shore in July, and capped off by Hurricane's Dennis in August and Floyd in September, 1999. On October 1, 1999 the Public Service Commission of Maryland docketed Case # 8826 Investigation Into the Preparedness of Maryland Utilities for Responding to Major Outages. (Details on all Public Service Commission documents can be found on the Maryland Public Service Commission web page (http://webapp.psc.state.md.us/Intranet/home.cfm) under the order or case number.)

On December 9, 1999 the Commission issued Order # 75823 creating a tree trimming working group consisting of Commission Staff, Maryland Department of Natural Resources, Maryland Office of People's Council, electric utilities, telephone companies, and other interested parties to "develop recommended modifications to the State's policies and regulations to improve tree trimming within utility rights-of-way…...". The Commission further ordered the group "to evaluate the need for appropriate legislation or regulations with regard to tree trimming on private property".[1]

The tree trimming working group recognized the need for a continuing forum to discuss issues and concerns relating to utility tree trimming issues. To this end, the Maryland Electric Reliability Tree Trimming Council (MERTT) was established, and met for the first time on May 9, 2000. MERTT membership remains open to all parties interested in vegetation management associated with overhead electric facilities.

Maryland was again struck by severe weather during 2003. Severe thunderstorms impacted the state during August, and Hurricane/Tropical Storm Isabel disrupted power during September, 2003. In the aftermath of Isabel, the Commission docketed Case # 8977 In the Matter of the Electric Service Interruptions due to Hurricane/Tropical Storm Isabel and the Thunderstorms of August 26-28, 2003. Case # 8977 sought to "review the preparedness and performance of utilities in responding to major electric distribution outages" which resulted from the August and September, 2003 severe weather events. The findings of the review were that "tree trimming and vegetation maintenance programs had relatively little negative impact on storm-related outages during Hurricane Isabel in comparison with tree-related damage outside of utility control." The utilities had reported during the review that "most outages were caused by whole trees falling onto electric lines from outside the utility-trimmed rights-of-way" and that the trees were "often trees on private property." The Commission agreed with the utilities report and stated that "even the most aggressive trimming methods can not avoid damage caused by the collapse of an entire tree." The Commission went on to say that the "primary concern for the Commission in

[1] Order No. 75823, p. 8.

this area is finding an acceptable policy for addressing privately owned trees near utility rights-of-way;" and "opportunities for system storm-resistant hardening."

As a result of the findings in Case # 8977, the Commission issued Order # 79159 directing the "Commission's Engineering Division Staff and the electric utilities" to "work through the MERTT to develop a detailed recommendation for specific actions that utilities can take to best manage privately owned trees near utility rights-of-way." The Commission further ordered "that the utilities shall commence public education efforts" in order to "increase awareness of the potential risk to their power supply that property owners incur in planting trees too close to power lines." MERTT's response to Order # 79159 stated that "the Council has identified the need to better understand the scope and the degree of impact that privately owned trees have on electric service reliability in Maryland before making any policy change recommendations. In order to develop proper and defensible policy/strategy initiatives, the Council recommends a research project to study the impact of outages caused by trees." On November 8, 2005 the Commission approved the recommendations made by the MERTT council. MERTT member utilities were asked to collect data for tree related outages impacting more than 100 customers during normal system operating conditions; and for tree outages impacting more than 1000 customers following major or severe weather events. The Maryland Department of Natural Resources, Power Plant Research Program (PPRP) accepted the responsibility of project coordinator for the Council. PPRP tasked their Biological Integrator (Versar Inc.) with developing a procedure for data collection, being the data repository and manager, and producing quarterly and annual data summaries.

This report provides an analysis and discussion of the tree related outage data collected from program inception in 2006 through March, 2010 by the six participating transmission/distribution utilities operating in Maryland (Baltimore Gas and Electric (BGE), Potomac Electric Power Company (PEPCO), Southern Maryland Electric Coop (SMECO), Allegheny Power (AP), Delmarva Power (DP), and Choptank Electric Coop (CE)). Public outreach and education efforts undertaken to date are noted, and a basis for promulgating more precise vegetation best management practices is established as a result of this work.

Tree-Related Outage Data Collection Methods

There is no universally applicable, precise definition of electric utility "right-of-way" as related to vegetation management near overhead lines. Physical dimensions as well as the legal rights of utilities to manage vegetation within and adjacent to the rights-of way vary considerably. As a result, electric utilities have, over time, continued efforts to establish corridors or envelopes for vegetation management near overhead lines by balancing issues of easements, private property rights, politics, public policy, community impacts and financial concerns for the purpose of maintaining reliability associated with electrical facilities. For the purposes of this data collection effort, to establish whether a tree or branch causing an outage was on or off the right-of-way, the definition of the Vegetation Right-of-Way agreed upon by the MERTT council is a "Corridor or envelope surrounding the electric facilities that is defined by previously maintained vegetation or scope of work as otherwise established by the utility."

The transmission/distribution utilities employ utility foresters who are responsible for managing vegetation within and adjacent to electric power line rights–of-ways (ROWs) to minimize the

risk of vegetation caused outages. The utility forester investigates power outages reported as occurring due to vegetation interference, and collects detailed information about each outage. This information documents the electric line characteristics (e.g. line voltage, construction phase, sectionalizing device, etc.) and tree-related characteristics (e.g. species, planted vs. volunteer, on/off right-of-way, health, etc.) of the outage.

To facilitate and standardize the information collected on tree-caused power outages, each utility forester has been supplied with a tree-data collection system composed of a Personal Digital Assistant (hp iPAQ PocketPC) with ArcPad 6.0 software linked to a Global Positioning System (Garmin GPS Map 76C) (Figure 1). Maryland DNR Forestry developed a data collection template with the ArcPad software to be used for the MERTT Tree-data program.

Figure 1. Pocket PC (left) showing ArcPad display screen with satellite window; positional data is received from GPS (right).

The data collection begins with the forester on site and after confirmation that the outage resulted from vegetation (usually trees) interference with the electric line. Upon initialization, the data collection system records the latitude and longitude of the location and initiates opening of a series of 14 menu driven data entry pages in ArcPad. Figure 2 shows examples of these data entry pages. The first page to open, records the utility, service district, county, and date of inspection. Other data pages in turn provide fields for recording information on the tree species, height, indicators of tree health, volunteer or planted, weather conditions, whether the outage

was caused by limb failure, tree growth, whole tree failure, vines, or other, and whether the tree was on or off a right-of-way. The list of data entry fields is provided below.

- **General Data**
  - Company
  - County
  - Date of Inspection
  - Inspected By
  - Date of Outage
  - Outage Investigation Number
  - Longitude/Latitude
  - Year of Last Maintenance
- **Facility Information**
  - Feeder/Circuit Name
  - # customers interrupted
  - Voltage
  - Construction Phases & Type
  - Trouble & Sectionalizing Pole #'s
  - Tree Contact Evidence
  - Wire Broken

- **Tree Information**
  - Genus, Species & Common Name
  - DBH
  - Height
  - Tree Origin
  - Reported Tree Cause
  - Field Verified Tree Cause
  - Tree from On R/W or Off R/W
  - Tree Growth – Top, Side, Overhang
  - Limb Failure – Overhang or beside the line, size of limb
  - Whole Tree Failure
    - Trunk Failure – height & diameter
    - Root Failure – roots broken, cut/severed, restricted, root plate lifted
  - Contributing Factors – dead, diseased, decay, canker, multiple trunk/co-dominant stems, etc.
  - External Indicator of Failure
  - Trim Analysis – does/does not meet utility trim specifications

On a quarterly schedule, the data collected by utility foresters is sent electronically to a centralized database maintained by Versar, Inc. The data received from utility foresters is compiled into an Access database for archiving and management. Following quarterly reporting, a summary data report is prepared, which also includes a summary table of outage incidents sorted by reporting utility. To generate the summary report, the MERTT database is queried for a subset of the fields collected as noted below.

Utility
County
Circuit/Feeder
Voltage
Outage Weather
Tree from Off Right-of-Way (R/W)
If Tree on, R/W Type?
External Indicator of Failure
Tree Health, Defects, Structure
Field Verified Cause
Tree Common Name

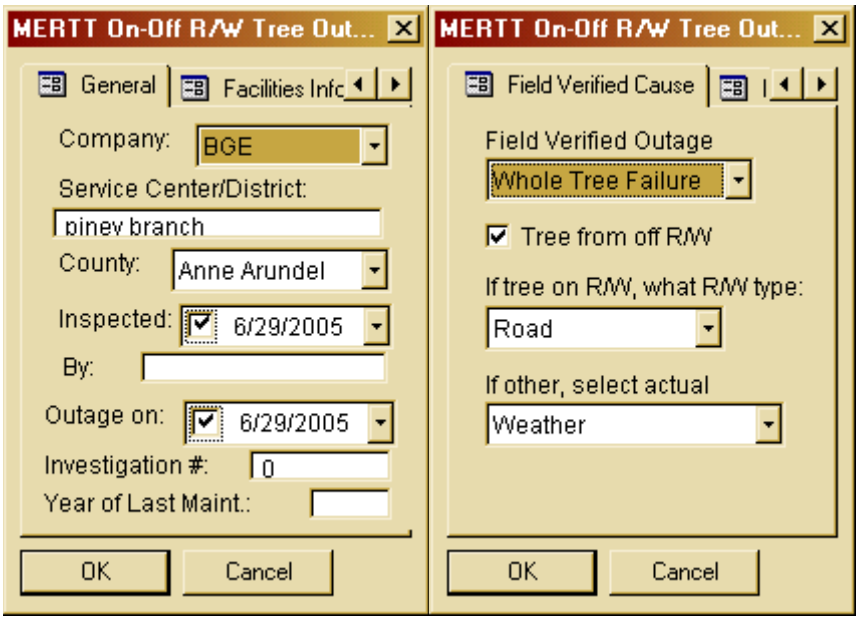

Figure 2. Typical screens of the MERTT Tree-data collection application.

Results

The results presented below represent all utility collected data submitted to Versar from the start of data collection during the 4th quarter of 2007 through the 1st quarter of 2010. The four DNR service regions (Eastern, Central, Southern and Western) were used to facilitate mapping because of their approximate congruence with the utility service territories. For reporting purposes, the thresholds for a qualifying outage are based on number of customers impacted and type of weather event. A major storm is defined as "…a weather-related event during which: (a) more than 10 percent or 100,000, whichever is less, of the electric utility's Maryland customers experience a sustained interruption of electric service and; (b) restoration of electric service to these customers takes more than 24 hours" (COMAR 20.50.01.03B). All other outages impacting 100 or more customers are considered reportable incidents.

A map of all tree caused outages meeting the reporting threshold as reported by utility foresters from program inception in 2007 through March, 2010 is shown in Figure 3. Table 1 provides a list of the various tree species implicated in these outage investigations. The tree species implicated in the majority of the outages are represented by four groups or species; maples

(sugar, red and silver), oaks (red and white), tulip poplar, and black locust (Figure 4). Figures 5 through 8 illustrate how the predominant problem group/species changes by region, with a predominance of black locust and maple species out west, oak species and poplar in the Central region, a predominance of maple and oak species in the east, and pine, maple and oak species predominating in the south. While maple species were not the most problematic species overall, they were more likely to be within the right of way across all regions. Oak species also had relatively high incidents of being within the rights of way in the Southern region, as did tulip poplar within the Central region. Consistent with the testimony from Case #8977, the outage investigations are showing that a large majority of the outage causing trees originate from outside of the utility rights-of-way (Figure 9). Figures 10 through 13 break out the most numerous outage causing trees by origin within each region. The legend for figures 10 through 13 answers the question – Did the tree originate from off of the right of way? While a majority of the trees involved in outages where volunteers (i.e. seeded naturally, not planted by people), there were a limited number of species common to all regions that comprised the majority of the planted trees causing problems (Figures 14 through 17). Red and silver maples and white pines dominate this category. These species also dominated the outage causing species found within the rights of way. Regardless of species involved, limb failure and whole tree failure where the major causes of reported outages (Figures 18 through 21). Within the limb failure category, maples are the dominant outage causing species. Eighty-four percent of the trees investigated for this study had no external indicator of failure, thus would not have triggered utility maintenance action (Figure 22). Of those trees investigated that showed no external indicators of failure, approximately 45% had hidden defects that where only able to be noted after failure (Figure 23).

A significant effort in public education and outreach resulted in the production of the “Right Tree – Right Place” flyer (Figure 24). This flyer was distributed in electric bills, with tree purchase coupons distributed by DNR, and at public venues where utilities and/or DNR had displays. Poster size versions of this flyer are displayed at Earth Day events that the utilities participate in , and at some retail tree nurseries and home improvement stores such as Lowes and Home Depot. Radio spots about “Right Tree – Right Place” are also sponsored by several utilities.

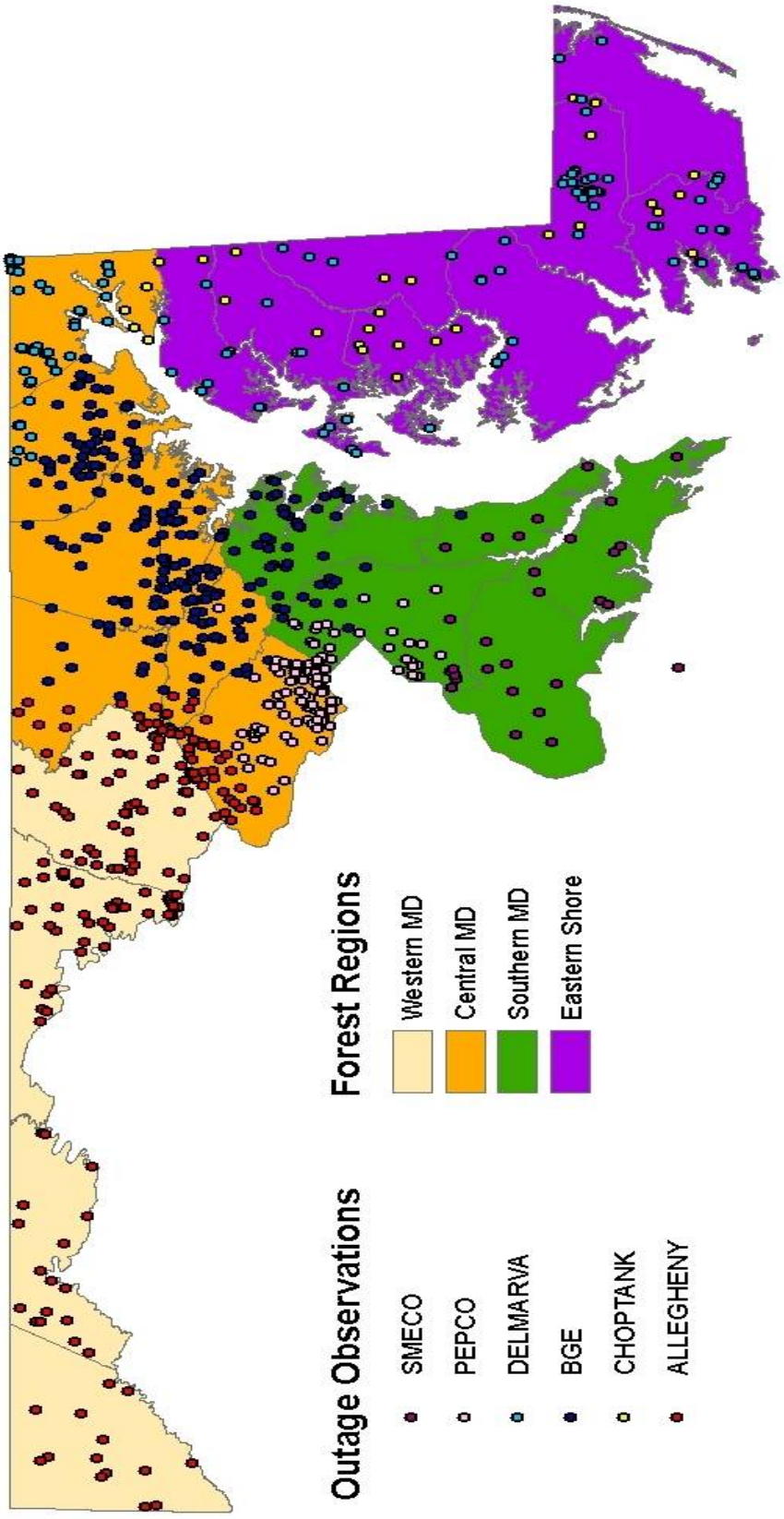

Figure 3. Tree-caused outages in the MERTT database recorded by utility foresters since 2007.

Table 1. Tree and other species reported as causing outages.

COMMON_NAME	W*	C	E	S
SILVER FIR	X			
FIR SPECIES			X	
BOXELDER	X	X		
NORWAY MAPLE	X	X		
RED MAPLE	X	X	X	X
SILVER MAPLE	X	X	X	X
SUGAR MAPLE	X	X	X	X
MAPLE SPECIES		X	X	
TREE OF HEAVEN	X	X	X	X
BITTERNUT HICKORY		X		
PIGNUT HICKORY			X	
SHAGBARK HICKORY	X			
BLACK HICKORY		X		
MOCKERNUT HICKORY		X		
HICKORY SPECIES		X		
PECAN			X	
CHESTNUT SPECIES			X	
NORTHERN CATALPA		X		
NORTHERN HACKBERRY	X			
LEYLAND CYPRESS			X	
AMERICAN BEECH	X	X		
WHITE ASH	X	X		X
GREEN ASH	X	X		
ASH SPECIES		X	X	
HOLLY SPECIES			X	
LITTLE WALNUT	X			
BLACK WALNUT	X			X
EASTERN RED CEDAR	X	X		
SWEETGUM		X	X	X
TULIP TREE	X	X		X
OSAGE ORANGE		X		
MAGNOLIA SPECIES			X	
CRABAPPLE SPECIES		X		
WHITE MULBERRY		X		
BLACK MULBERRY		X		
RED MULBERRY		X		X
MULBERRY SPECIES				X

COMMON_NAME	W	C	E	S
BLACK TUPELO	X	X		
NORWAY SPRUCE	X	X		
BLUE SPRUCE	X	X		
RED PINE				X
EASTERN WHITE PINE	X	X	X	X
LOBLOLLY PINE		X	X	
VIRGINIA PINE	X	X	X	X
PINE SPECIES		X	X	
AMERICAN SYCAMORE	X	X	X	X
EASTERN COTTONWOOD		X	X	
BLACK POPLAR	X	X		
ASPEN SPECIES		X	X	
SWEET CHERRY	X		X	
PIN CHERRY		X		
BLACK CHERRY	X	X	X	X
COMMON CHOKECHERRY	X			X
CHERRY SPECIES		X		
SAWTOOTH OAK		X		
WHITE OAK	X	X	X	X
SWAMP WHITE OAK			X	
SCARLET OAK		X		
SOUTHERN RED OAK		X		X
BUR OAK				X
WATER OAK			X	
PIN OAK	X	X	X	X
WILLOW OAK	X			X
CHESTNUT OAK	X	X		X
NORTHERN RED OAK	X	X	X	X
BLACK OAK	X	X	X	X
OAK SPECIES		X	X	X
BLACK LOCUST	X	X	X	X
LOCUST SPECIES		X		
WEEPING WILLOW	X	X		
BLACK WILLOW	X	X		
SASSAFRAS		X		
AMERICAN ELM	X	X	X	
CHINESE ELM		X	X	
SLIPPERY ELM		X		X
ELM SPECIES		X		
BAMBOO		X		

* W = Western DNR region
  C = Central DNR region
  E = eastern DNR region
  S = Southern DNR region

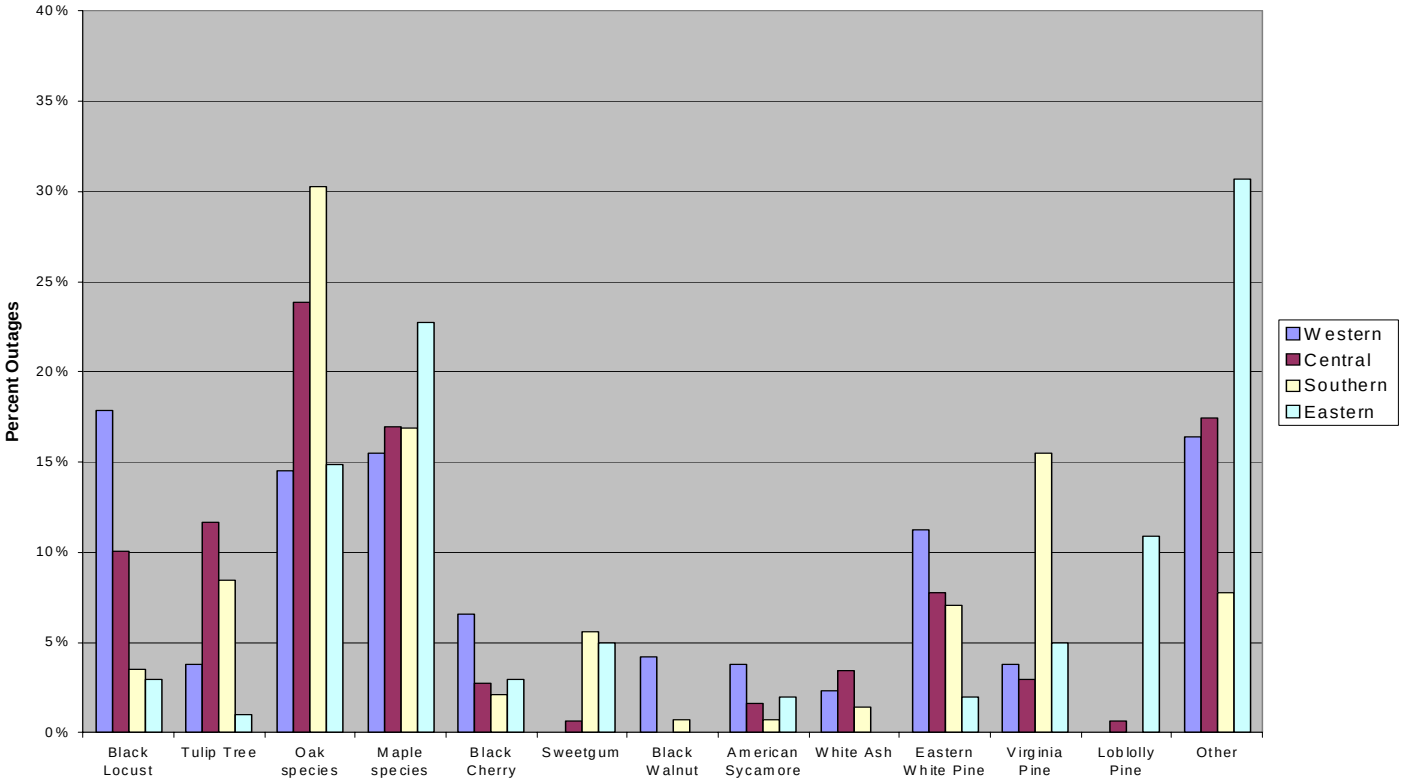

Figure 4. Percent of Qualifying Outages by Tree Species, all DNR Regions

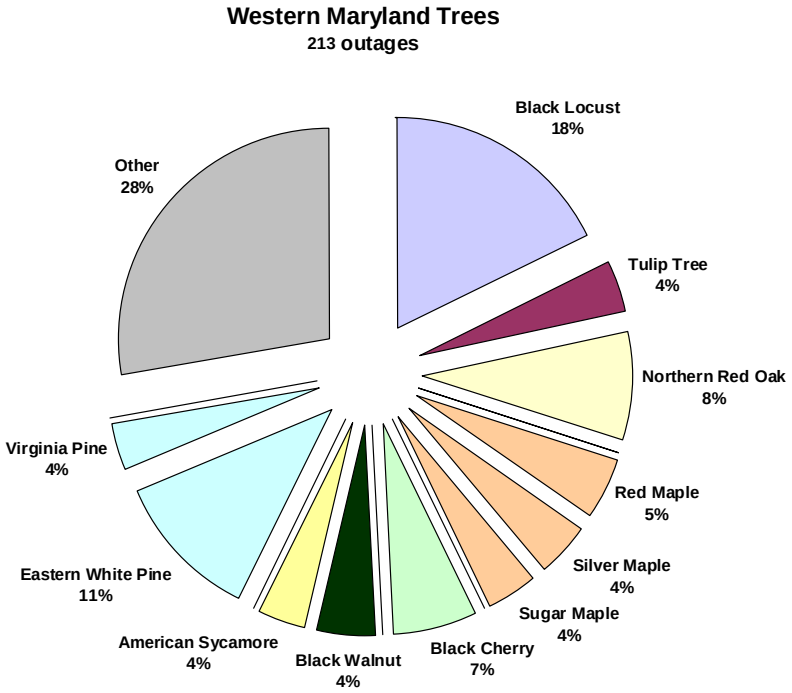

Figure 5. Percent of Qualifying Outages by Tree Species, DNR Western Region

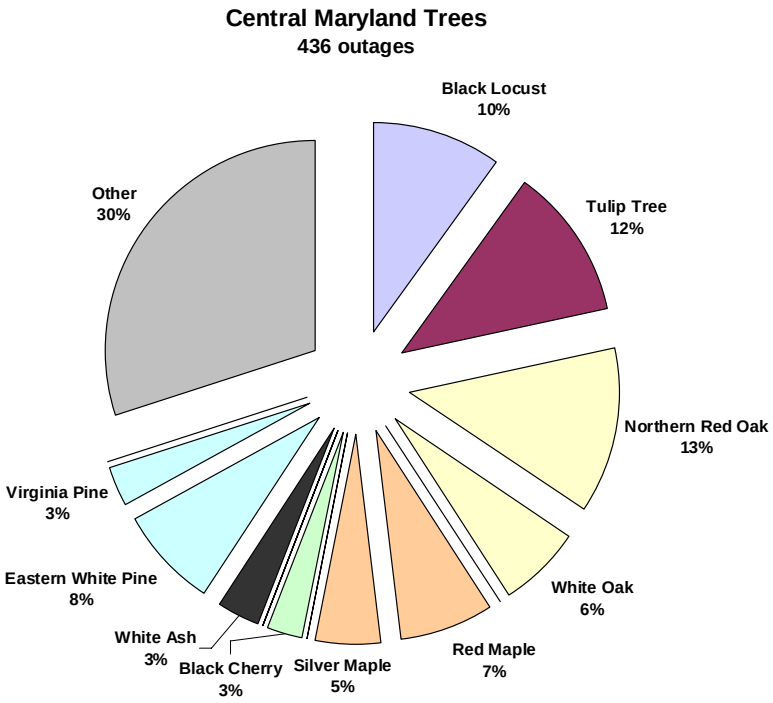

Figure 6. Percent of Qualifying Outages by Tree Species, DNR Central Region

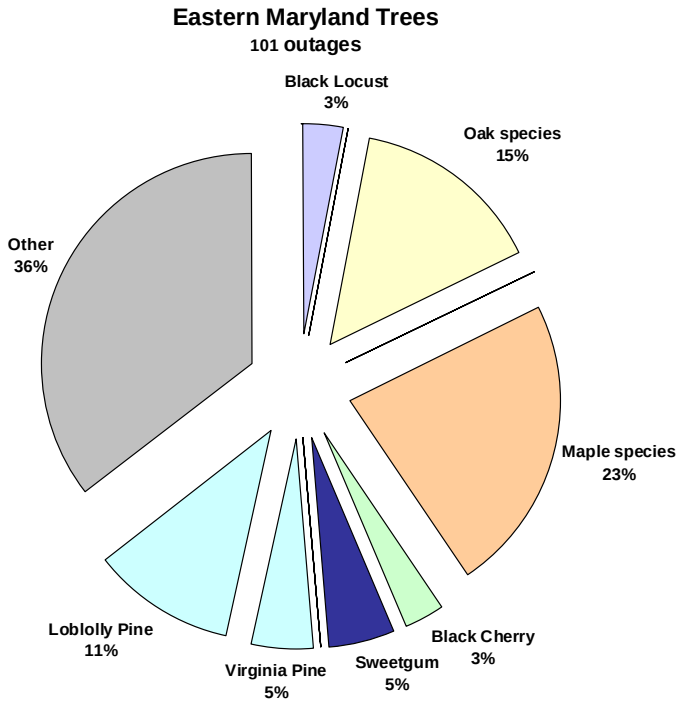

Figure 7. Percent of Qualifying Outages by Tree Species, DNR Eastern Region

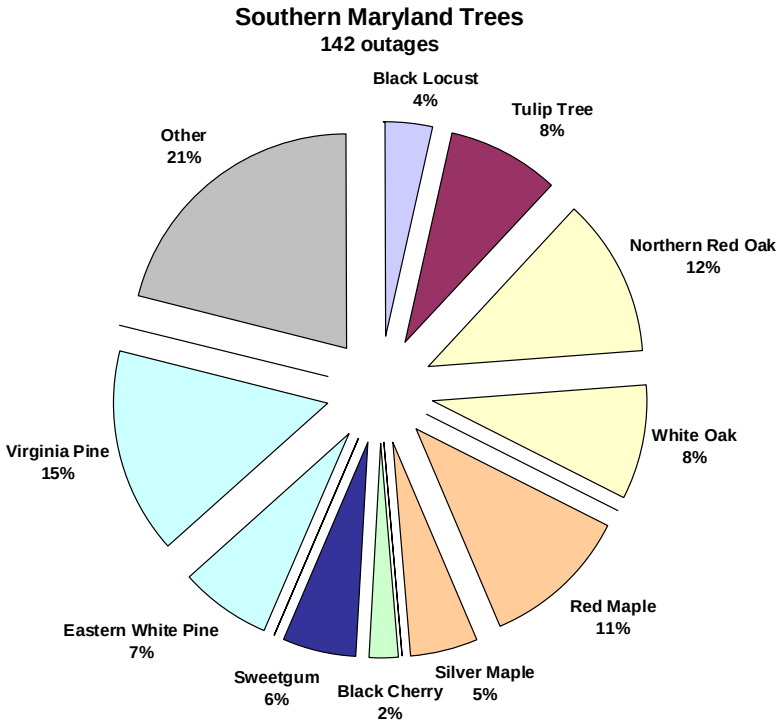

Figure 8. Percent of Qualifying Outages by Tree Species, DNR Southern Region

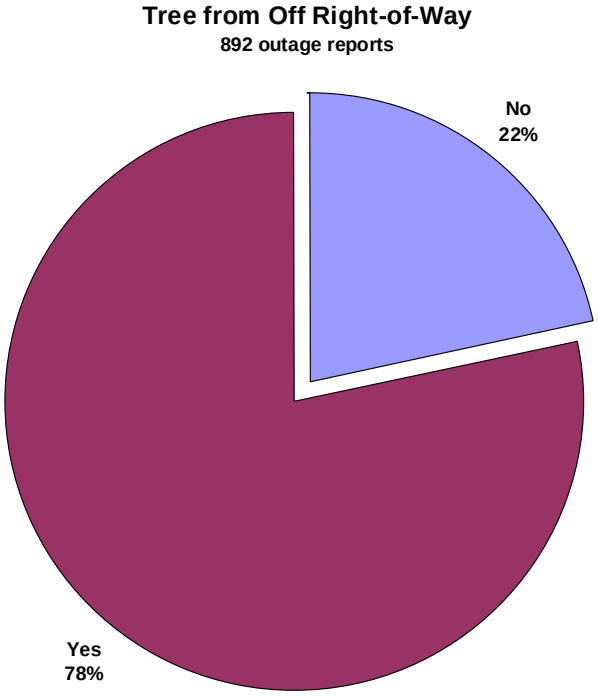

Figure 9. Percentage of trees on and off right of way causing outages, all regions combined.

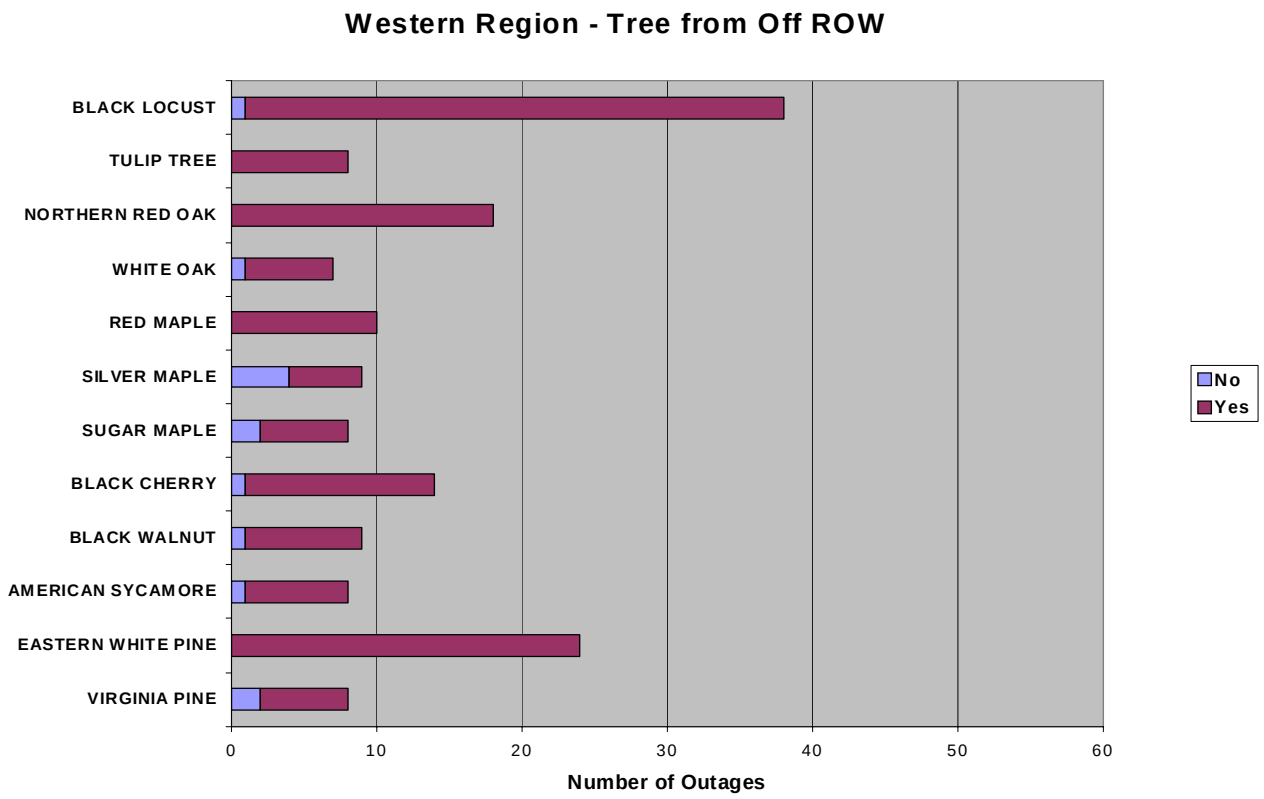

Figure 10. Outage Causing Trees - Off vs On Right of Way, Western DNR Region

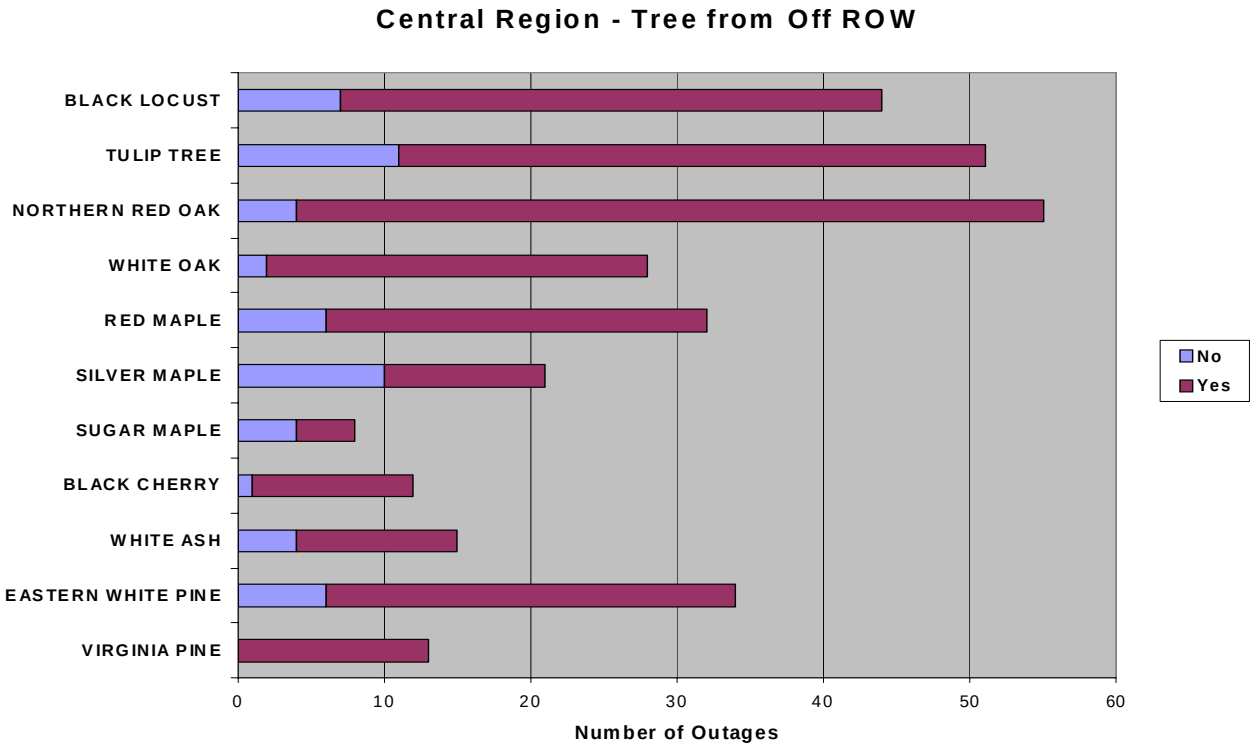

Figure 11. Outage Causing Trees – Off vs On Right of Way, Central DNR Region

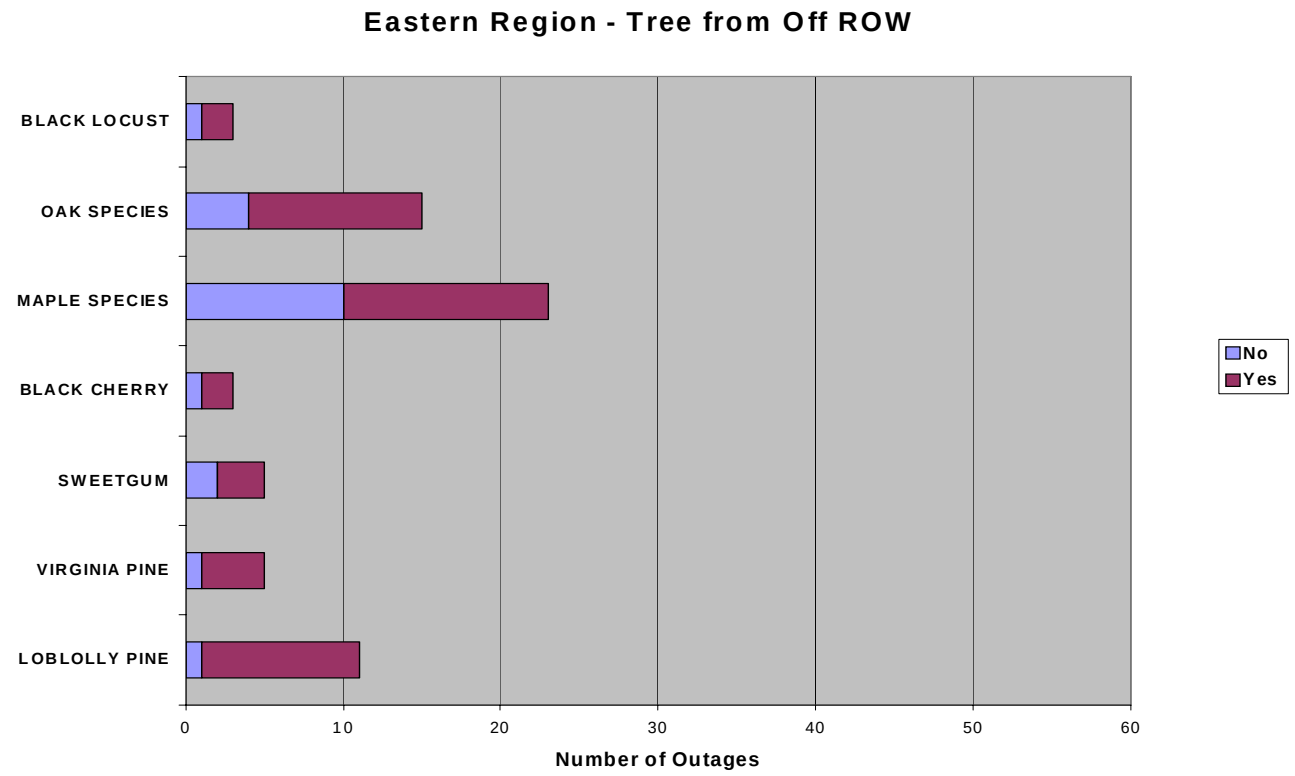

Figure 12. Outage Causing Trees – Off vs On Right of Way, Eastern DNR Region

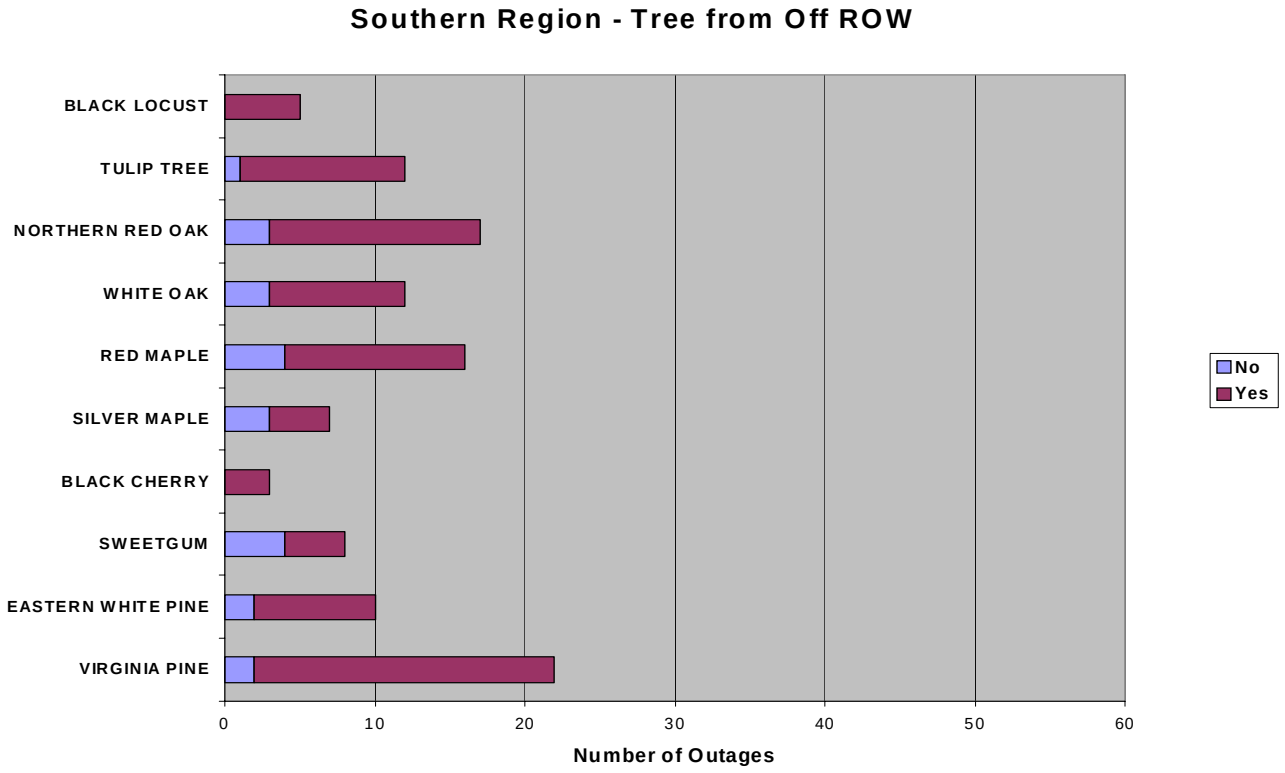

Figure 13. Outage Causing Trees - Off vs On Right of Way, Southern DNR Region

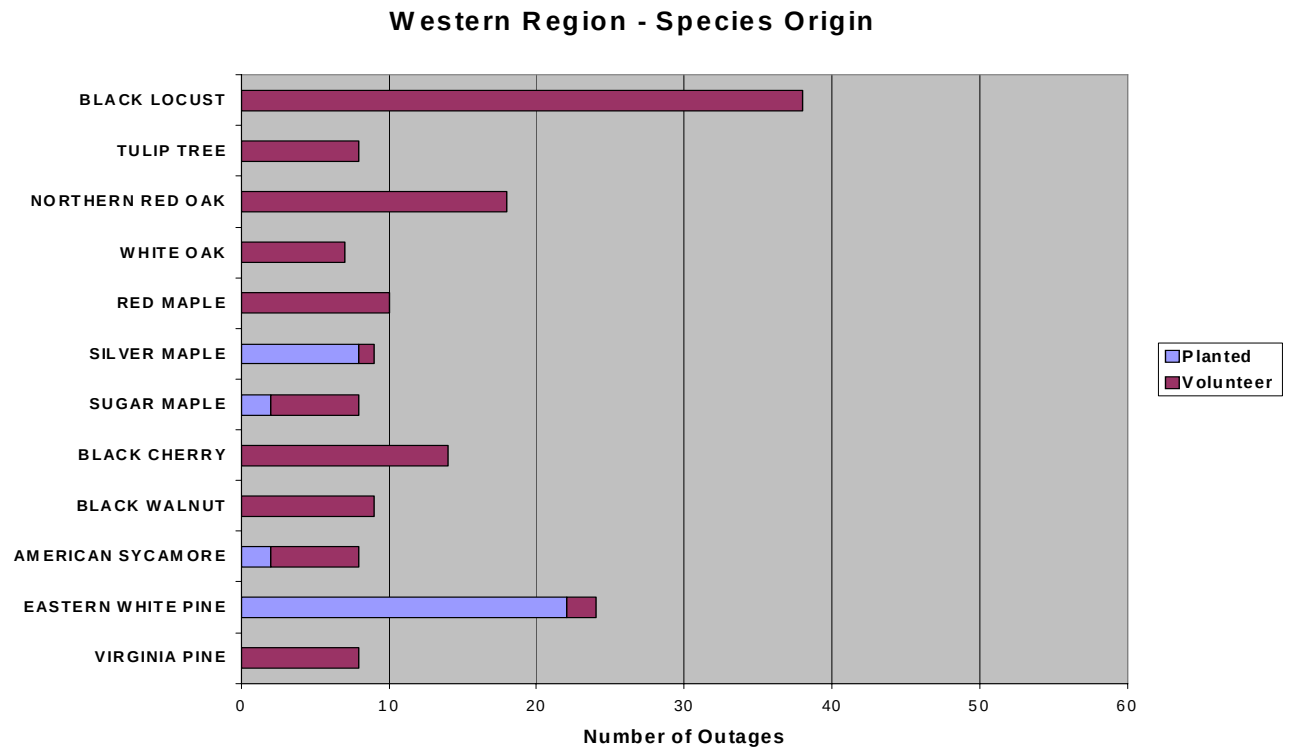

Figure 14. Outage Causing Trees - Planted vs Volunteer, Western DNR Region

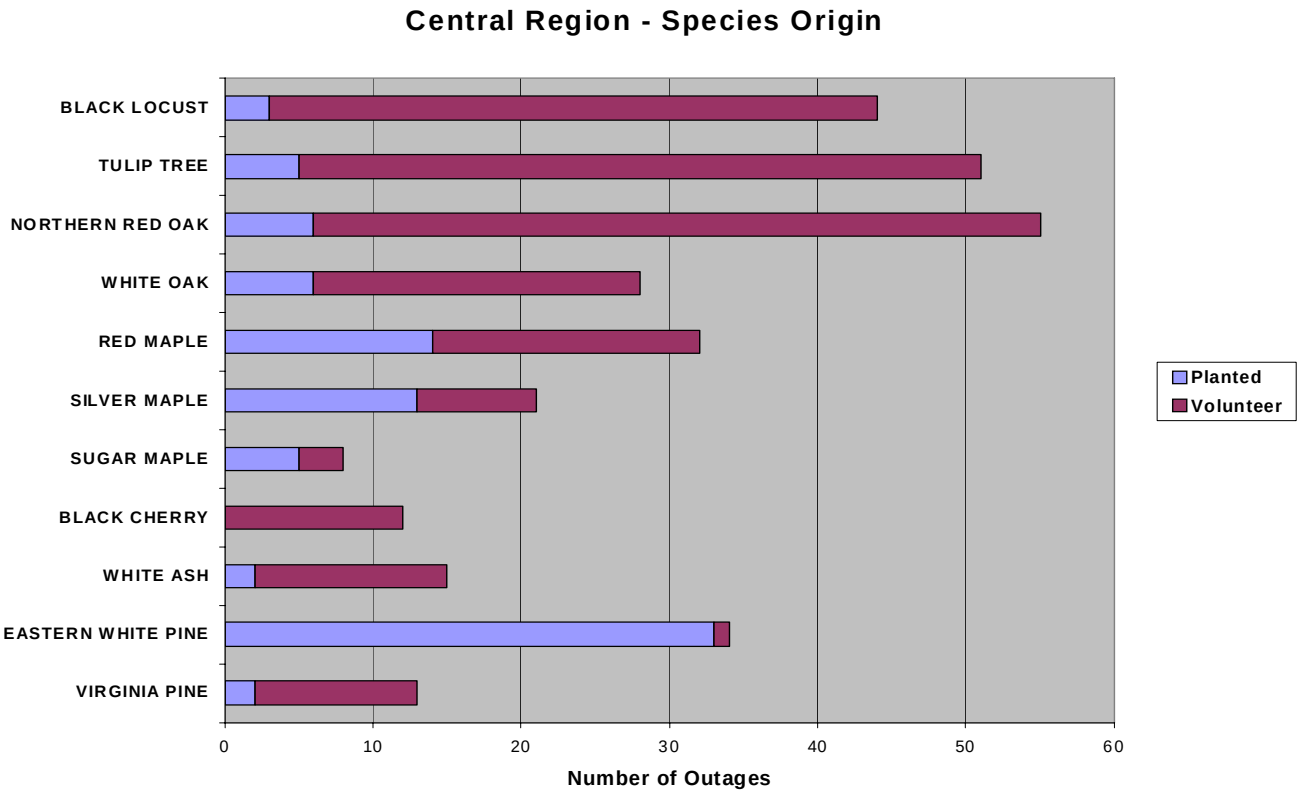

Figure 15. Outage Causing Trees - Planted vs Volunteer, Central DNR Region

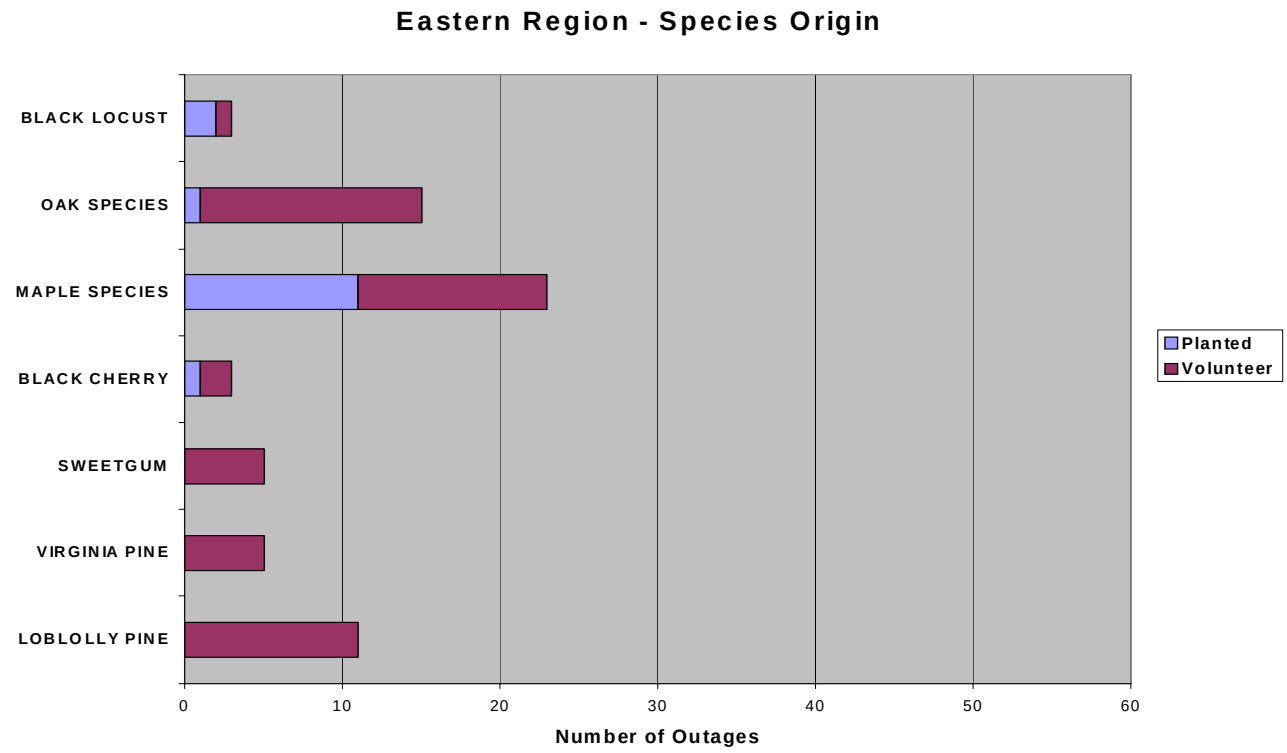

Figure 16. Outage Causing Trees - Planted vs Volunteer, Eastern DNR Region

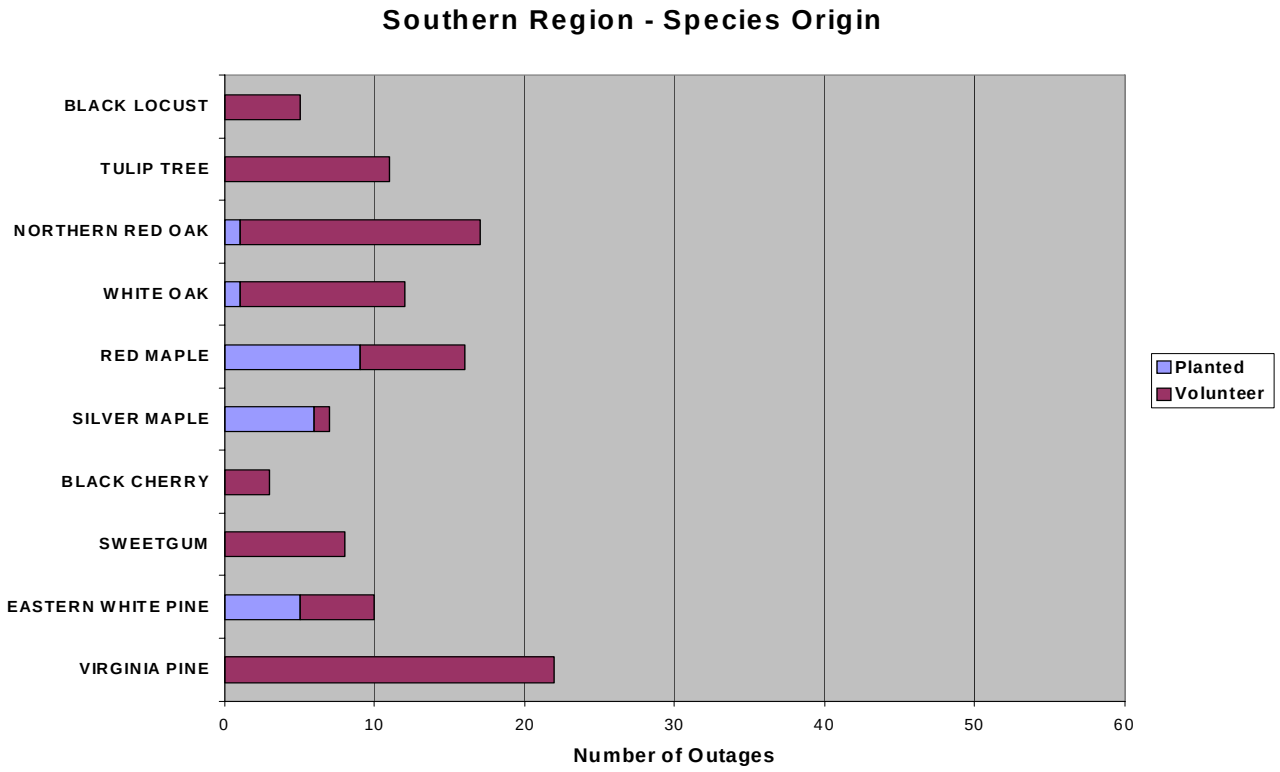

Figure 17. Outage Causing Trees - Planted vs Volunteer, Southern DNR Region

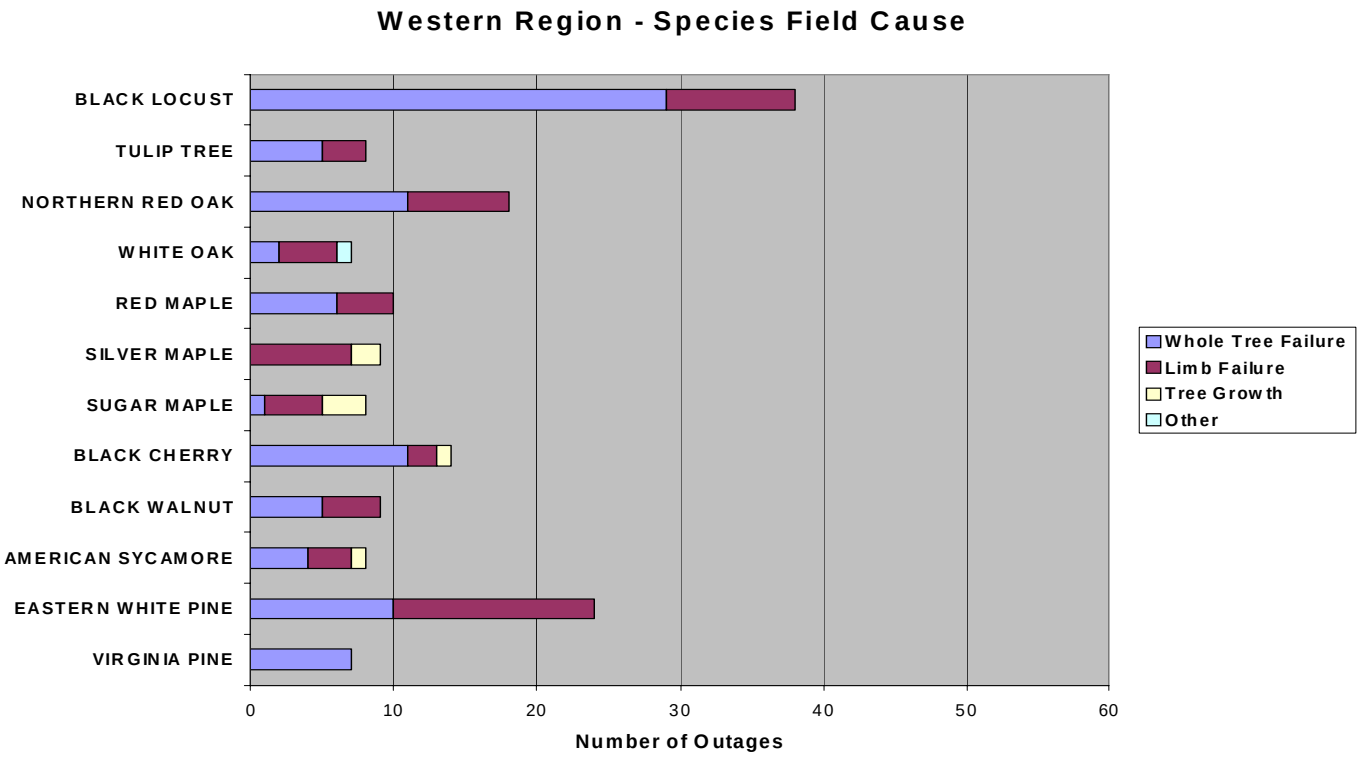

Figure 18. Type of tree failure by species, Western DNR Region

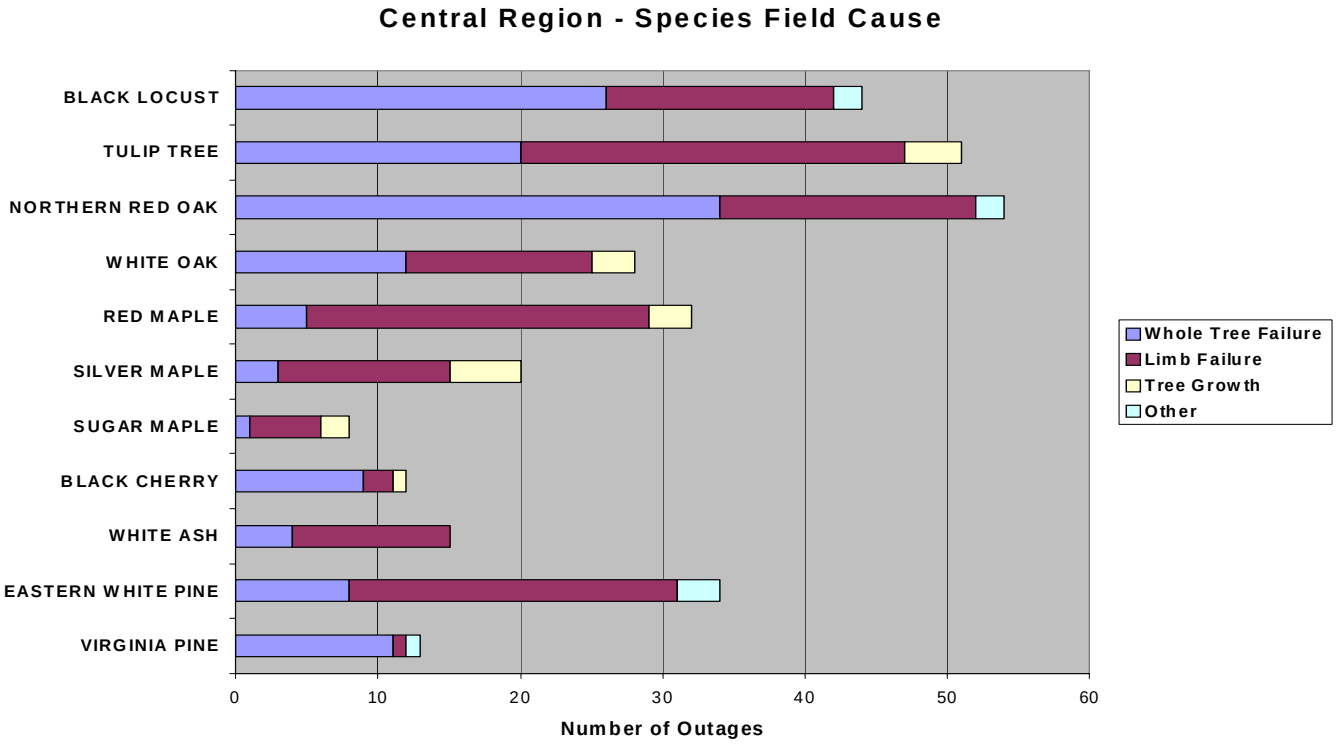

Figure 19. Type of tree failure by species, Central DNR Region

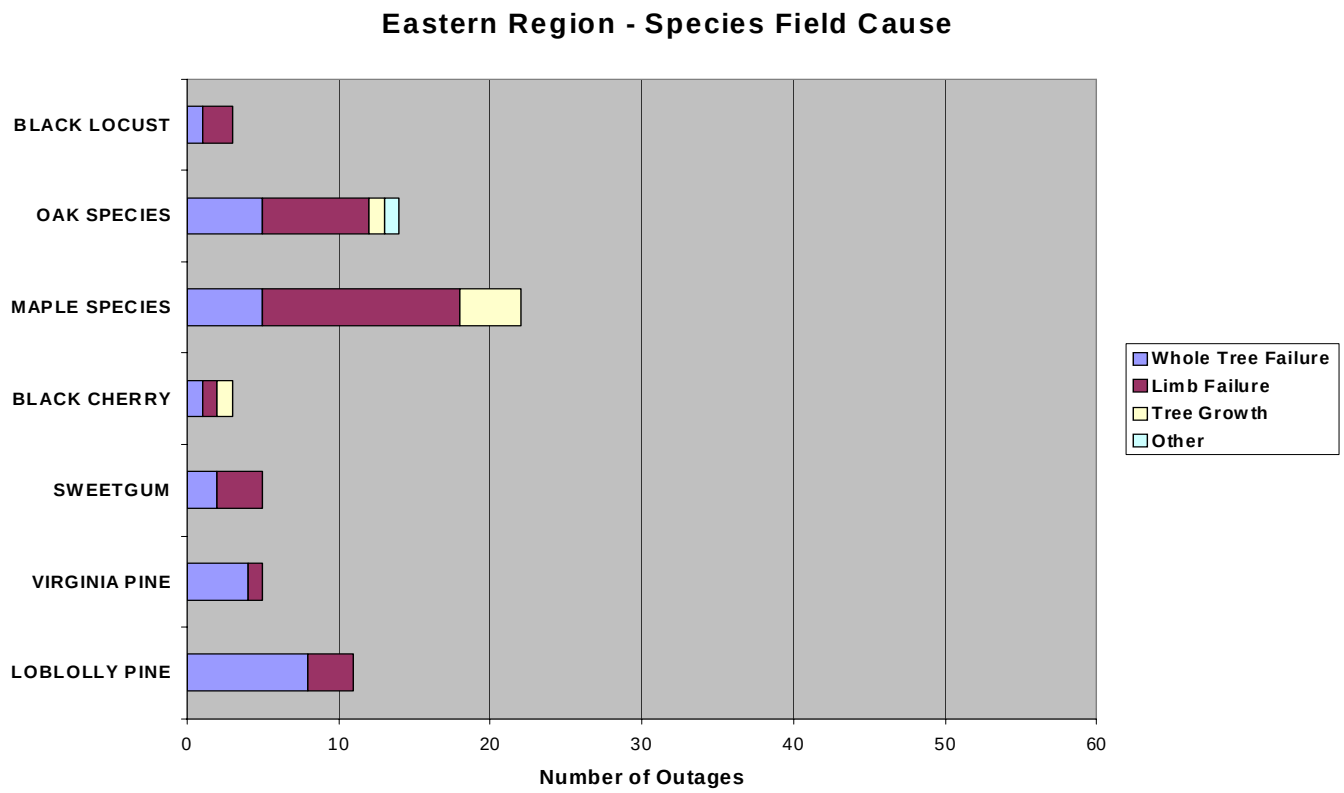

Figure 20. Type of tree failure by species, Eastern DNR Region

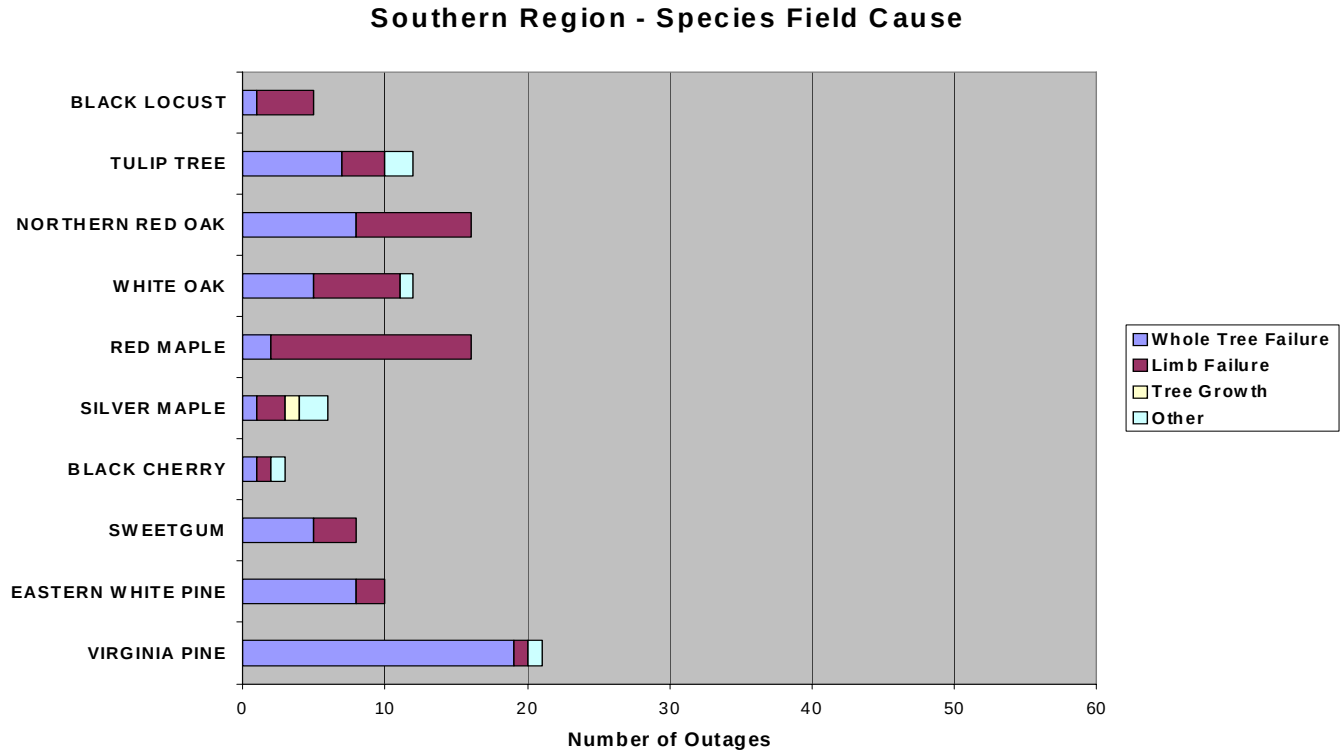

Figure 21. Type of tree failure by species, Southern DNR Region

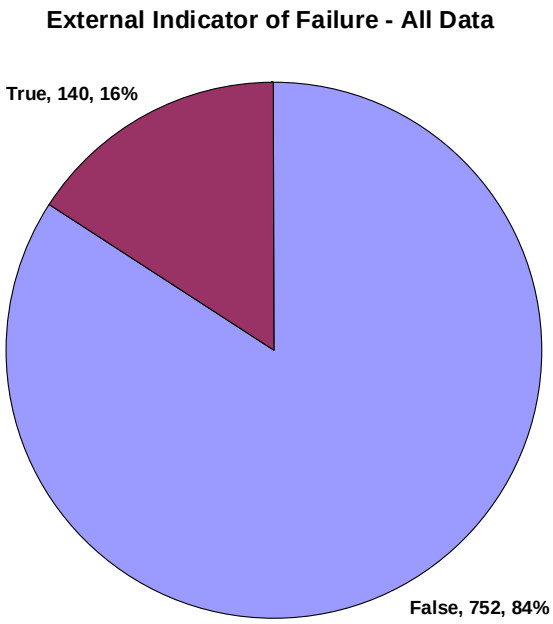

Figure 22. Percentage of outages from trees with and without maintenance triggering visible defects, all regions.

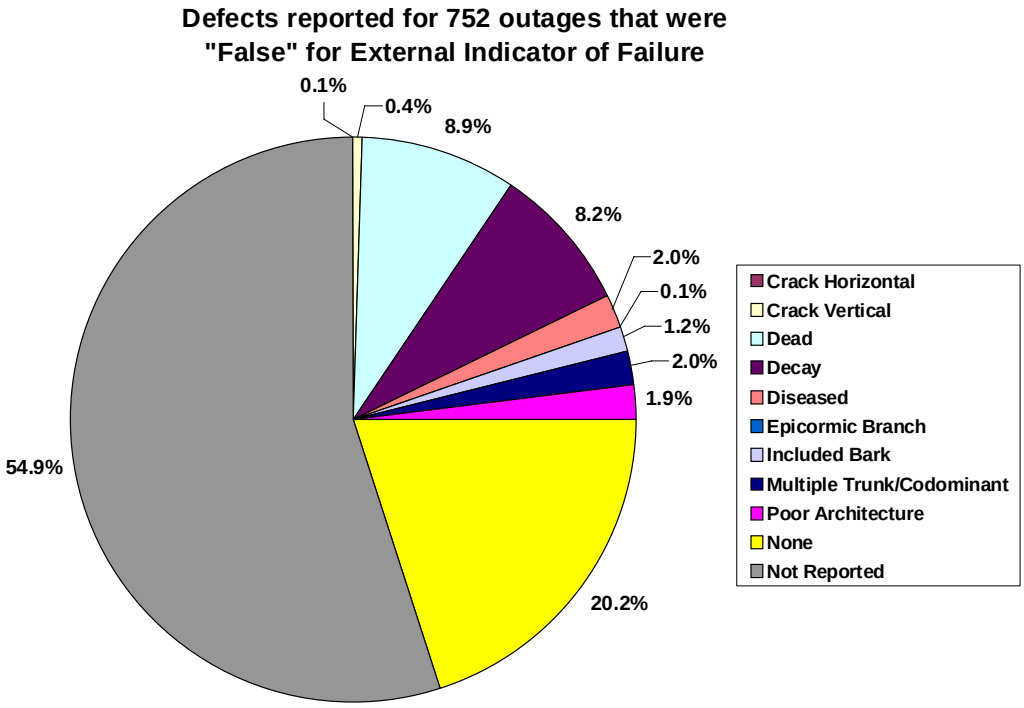

Figure 23. Percentage of hidden defects for trees with no external indicators of failure, all regions.

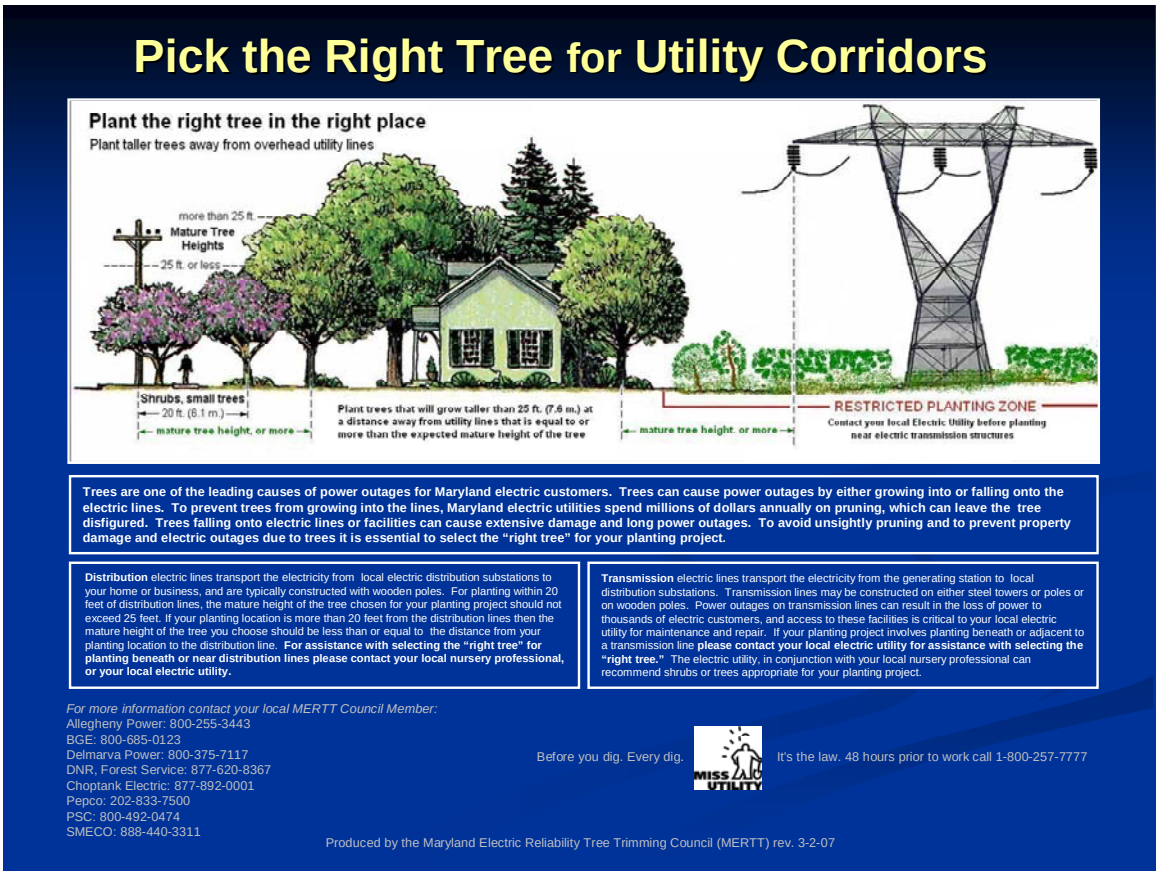

Figure 24. Right Tree – Right Place Public Information/Education Flyer

Discussion

While outages were reported from across the state, there was a predominance of outages reported within the central urban/suburban dominated counties. This anomaly appears to be an artifact of population distribution/density. The dispersed nature of ratepayers in rural areas of eastern and western Maryland makes meeting the minimum reporting threshold of a 100 household outage a rarer event than in the more populated urban and suburban central counties. The higher percentage of planted tree caused outages in the central suburban/urban counties was also very evident and points up the need for continuing education and outreach. The predominant planted species, maples and white pines, are fast growing and often used for vegetative screens. It should be noted that planted trees causing current problems would have been planted more than 20 years ago, and are now becoming susceptible to the failure problems causing outages. These planted trees would also have been planted well before any concerted effort to educate the public on the implications of planting inappropriate trees near power lines. This information may provide justification for enactment of local ordinances or statewide policy to address planting known problem causing trees near utilities. MD DNR, PPRP has been and continues to fund research through the National Arboretum developing a variety of tree cultivars with growth habits appropriate for planting in the vicinity of overhead power lines.

As noted, the majority of the trees investigated as being the cause of an outage originate off of the utility rights-of-way and these trees have generally shown no indications of problems that would trigger current utility vegetation management actions. The utilities typically use external

indicators to predict an increased risk of causing a power outage when identifying tree trimming or removal candidates. The presence of hidden defects only becomes apparent after tree failure. While this will be an ongoing problem, the MERTT program's ability to assist in identifying species prone to hidden defects and species that are prone to failure in general, such as black locust out west and maples and tulip poplar elsewhere, provides a well founded basis for targeting specific species for management activities that would otherwise be overlooked with current vegetative management programs. The information about limb or whole tree failure by species and tree age (size) also provides a solid basis for establishing species and age specific best management practices (BMPs), such as trimming red maple and removing black locust even when there are no external indicators of potential failure. The MERTT Program data will inform a utility forester's best professional judgment when specifying vegetative management actions.

This program continues to benefit the electricity ratepayers of Maryland by providing utilities a clearer picture of what trees species and tree origins are problematic in various types of weather events (rain, wind, snow, etc.). This information will enable the utilities to refine maintenance practices within and adjacent to the ROW. The use of quantified empirical evidence as a core of education and outreach efforts should enhance the utility's ability to negotiate proposed vegetation management options with property owners adjacent to rights of way. In the face of continuing skepticism after education and outreach, using the species specific data in a cost/benefit study should help a utility choose the most cost effective management plan to determine if the potential reliability benefits justify the additional cost and potential customer ill will resulting from the proposed near right-of-way vegetation management.

The continuation of this program will enable Maryland transmission and distribution utilities to establish science based BMPs for inclusion in their vegetative management plans for areas within and adjacent to rights of way. The program results may also provide the basis for formalizing enforcement of what are currently suggested voluntary planting restrictions near utilities.