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PLANT & PEST ADVISORY

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Left tree is infested with pinewood nematode and is dying from pine wilt. Source: University of Illinois Extension.

INSIDE

Pine Wilt Disease

Ann B. Gould, Ph.D., Specialist in Plant Pathology

Since the early 1900s, the pine wood nematode, which causes **pine wilt disease**, has been responsible for the widespread loss of pines in Japan. This nematode, *Bursaphelenchus xylophilus*, was first reported in the United States in Missouri in 1979. It is now found in nearly all the states east of the Rocky Mountains and in California and southern Canada. The wide distribution of *B. xylophilus* in North America suggests that this nematode is a native species that had been previously overlooked as a pathogen.

Host Range

The pine wood nematode has a wide host range that includes more than 28 species of pine. Highly susceptible species include Austrian, cluster, Japanese black, Japanese red, loblolly, mugo, Scots, and Virginia pines. The nematode has also been found in eastern-white, jack, longleaf, pitch, shortleaf, slash, and table-mountain pine. Although pine wilt disease has been reported in hosts such as atlas and deodar cedar, balsam fir, blue and white spruce, European larch, and hemlock, its occurrence is rare.

Symptoms

Trees affected by the pine wood nematode appear wilted soon after infection. The needles rapidly turn yellow, then brown, and may remain attached to the tree. Death of highly susceptible trees may occur by the end of the growing season. Branches cut from infected trees appear "dry" with visibly reduced resin flow.

Causal Agent

Bursaphelenchus is eel-shaped, very small (0.8 mm long), and difficult to see without magnification. This nematode can utilize both fungi and living plant material as a food source. Within the tree, the nematode feeds upon on the epithelial cells that line the resin canals in woody tissue. Each adult female nematode can lay about 80 eggs that develop into reproductive adults after four molts. These adults may disperse rapidly throughout the tree. Upon the fourth molt, the nematode may also develop into dauerlarvae, which are resistant to drying and are important in nematode dispersal. The pine wood nematode is dispersed by long-horned beetles in the family Cerambycidae (*Monochamus* spp.) Other wood boring insects, however, may also be potential carriers of pine wilt disease.

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Disease Cycle

The disease cycle begins in the spring when adult beetles emerge from dead wood carrying thousands of dauerlarvae within their tracheae and on their bodies. The beetles feed on the tender tissue of healthy pines, creating wounds through which the nematode larvae enter the tree. Beetles can transmit nematodes the entire growing season.

Once in the tree, the nematodes molt and migrate to the resin canals, where they feed upon and destroy the epithelial cells that line the canals. Throughout the growing season, the nematode reproduces and spreads quickly throughout the tree. The subsequent reduction in transpiration and water flow causes the tree to rapidly wilt and die. Heat and drought stress contribute to disease progression and to high levels of tree mortality.

Toward the end of the growing season, adult cerambycid beetles are attracted to freshly cut, weakened, or dying pines for mating and egg laying. These trees are also attractive to bark beetles in the family Scolytidae. Scolytid beetles carry secondary fungal invaders called the "blue stain fungi" (*Ceratocystis* spp.). Pine wood nematodes can utilize these fungi as a food source. Beetle eggs are laid singly under the bark and hatch in a few days. The beetle larvae form feeding galleries in the woody tissue. Nematode juveniles collect in these galleries and molt into dauerlarvae. After the insect overwinters, pupates, and becomes an adult, the dauerlarvae invade the newly emerging beetles and are carried to a new host, thus completing the disease cycle. *Bursaphelenchus* may also be present on woody tissue that has been killed by environmental factors, other diseases, or insects. Under these circumstances, the nematode can build to high populations and become an inoculum source for healthy trees.

Diagnosis and Management

Trees with pine wilt disease rapidly wilt and die, frequently within a single growing season. Needles on affected pines will turn brown and may hang on the tree. Other diagnostic characteristics of this disease include the presence of beetle exit holes, lack of resin production in fresh cuts, and the presence of a blue stain in the wood. Positive confirmation of pine wilt disease, which consists of the extraction of nematodes from woody plant material, must be performed by a plant diagnostic laboratory or nematode detection service.

Since pine wilt disease is more prevalent in trees (especially older ones) suffering from abiotic stresses, the maintenance of plant vigor through proper pruning, irrigation, and fertility is of primary importance. Healthy trees are also less susceptible to invasion by beetles. Routine, prompt removal of dead and dying plant material will reduce populations of both the nematode and its beetle vector. ❑

Waterlogged NJ: August and Summer 2011 Summary

David A. Robinson, Ph.D., New Jersey State Climatologist

Excerpted from http://climate.rutgers.edu/stateclim

August Overview

August 2011 will go down in New Jersey's weather annals as one of the most remarkable months on record. For most residents, the most memorable event of the month was Hurricane Irene. The first land-falling hurricane in NJ since 1903, Irene necessitated the largest coastal evacuation in state history, record flooding on a number of rivers, power outages for almost one million customers, and tragically the loss of life of at least a dozen NJ residents. Others will remember severe local flash flooding associated with several massive rainstorms earlier in the month. In fact, prior to a drop of rain from Irene, enough precipitation had fallen to rank this as the state's 6th wettest August since 1895. With the addition of Irene's rainfall, the previous record for any calendar month back to 1895 was shattered by almost 5".

Before discussing the month's storms, let's take a look at August's temperatures. The monthly average of 74.1° ties with 1918 and 2007 as the 28th warmest of the past 117 years. This is 0.7° above the 1981-2010 average. On four afternoons the high temperature equaled or exceeded 90° at one of the approximately 60 stations the Office of the New Jersey State Climatologist monitors across the state.

The preliminary estimate of statewide August precipitation is 16.64". This staggering figure is 12.43" above the 1981-2010 average and is by a wide margin the wettest August on record. Or any calendar month for that matter, as it far surpasses the previous record of 11.98" in October 2005. Table 1 shows the ten wettest Augusts, with the 1955 record associated with hurricanes Connie and Diane now sitting at #2 for August and #3 for any month.

Rank	Year	Aug. Prcp
1	**2011**	**16.64"**
2	1955	11.44"
3	1933	10.71"
4	1971	10.36"
5	1967	9.11"
6	1901	9.01"
7	1911	8.52"
8	1990	8.24"
9	1927	8.17"
10	1942	7.76"

Table 1. The ten wettest Augusts across NJ since 1895.

County maximums were at least 15.43" (Cape May) and the top stations in Cumberland, Gloucester, Middlesex, and Monmouth counties were over 20.00". Six other counties had maximums between 19.00-19.99" and only Ocean and Cape May counties had a station minimum under 10". The 7.80" in Little Egg Harbor Town-

See Storm Summary on page 3

Storm Summary from page 2

ship (Ocean) was the lowest monthly total in NJ.

In most months the storms that pounded the state on the 13th-14th would highlight any summary. While later upstaged by Irene, prodigious rains brought flash flooding and flooding of several moderate size rivers in southwest to central locations. The situation was especially devastating in eastern Salem, western Cumberland, eastern Gloucester, eastern Camden, and western Atlantic counties, where roads and several dams were overtopped or destroyed. In this area, 10.82″ was measured in Upper Deerfield Township, 8.53″ in Franklin Township (Gloucester), 8.04″ in Winslow Township (Camden), and 7.51″ at Hammonton (Atlantic).

The weekend visit of Irene on the 27th-28th was preceded by an unprecedented evacuation of at least one million visitors and residents from coastal counties from Cape May to Monmouth. The morning of the 27th saw rain showers dotting the state, some in the north associated with the remnants of the front that brought the rain on the 25th. To the south, a shield of moderate to heavy rain began slowly moving northward. By evening, the entire state was receiving squalls with heavy rain, excessive wind and occasional lightning. At times, rainfall rates exceeded well over an inch per hour, with flash flooding quickly becoming a dangerous hazard. Trees began to topple, many uprooted due to the already saturated soils. Subsequently, wires came down and the bright greenish hue of exploding transformers illuminated the sky. By dawn on the 28th the heaviest rain had departed the south as Irene made landfall at Little Egg Harbor, just north of Atlantic City. By the time it exited into eastern Raritan Bay a few hours later Irene had been downgraded to a tropical storm. By mid morning the heavy rain made a full exit from NJ. Winds continued to gust strongly as the storm moved over New York City and into western Connecticut, the wind now from the northwest as opposed to earlier east to northeast gales, and some light showers passed through the state during the afternoon. By this time the secondary and major rivers within NJ were in flood stage. The smaller ones crested on the 28th, while the Raritan River did so on the 29th and the Passaic not until the 30th.

Irene was the first hurricane to make landfall in New Jersey since 1903 and only the third since colonists settled the region (September 1821 was the other one). While fortunately arriving as only a weak category 1 storm, as the preceding paragraph began to explain, Irene impacted the state significantly through a combination of coastal flooding, strong wind, and heavy rain. Coastal areas suffered beach erosion and some structural damage, however escaped what would have been far more significant consequences had the storm arrived stronger.

Tropical storm force winds throughout NJ brought down numerous trees onto homes and power lines resulting in structural damage and the loss of power to almost one million customers. Along the coast, winds gusted to near hurricane force, reaching 69 mph at Harvey Cedars (Ocean), 66 mph at the Atlantic City Marina (Atlantic), 65 mph at Point Pleasant Beach, with similar gusts from Cape May to Sandy Hook. Inland, gusts were in the 40-60 mph range. The minimum pressure in the eastern third of the state was 28.45″-28.65″, with the western third between 28.75″-28.85″.

Rainfall was generally in the 5-10″ range and amounted to NJ's largest rainstorm in over a century. The statewide rainfall averaged approximately 7″. This surpassd Tropical Storm Doria on August 27-28, 1971, and is only behind tropical rains from an October 8-10, 1903 storm that occurred several weeks after the hurricane.

Irene was a storm for the record books. For that matter so was the entire month of August. However mere numbers do not tell the story of the loss of so many lives, nor the enormous hardships endured by so many who coped with this storm's wrath and with flooding earlier in the month.

Summer 2011 Overview

The 2011 summer (June-August) proved to be New Jersey's 3rd warmest since statewide records commenced in 1895 (Table 7). The average temperature of 75.1° is 2.3° above the 1981-2010 average (2.9° above the 1971-2000 average). The heat peaked in July, which with the late receipt of some data moved it from what was previously reported to be the second warmest on record to a tie with 1955 for warmest. This included July 22, one of the hottest days ever experienced by NJ residents. The NWS station at Newark Airport reached 108°, only 2° below the record state maximum. At least one location in every county reached triple digits on the 22nd. Seven of the ten hottest summers in the past 117 years have occurred in the past 13 years.

Rank	Year	Summer Temp.
1	2010	76.1°
2	2005	75.6°
3	**2011**	**75.1°**
4	1949	74.6°
5	1999	74.5°
6	2002	74.4°
7	2006	74.3°
8	1955	74.1°
9	2008	74.0°
10	1900	73.9°

Table 7. The ten warmest summers across New Jersey since 1895.

While statewide average rainfall was slightly below average in June and July, the ultra-wet August was enough to push the summer 2011 rainfall well above the previous record maximum. The 23.90″ that fell is 11.15″ above the 1981-2010 average. This exceeds the previous wettest summer (1928) by 4.23″ (Table 8). This summer was also the wettest of any season on record, surpassing fall 1983 for top honors. Nine different decades are represented in the top ten.

Rank	Year	Summer Prcp
1	**2011**	**23.90″**
2	1928	19.67″
3	1938	19.64″
4	1903	19.50″
5	1975	19.29″
6	2009	19.07″
7	1897	18.55″
8	1945	17.98″
9	1967	17.94″
10	1942	17.82″

Table 8. The ten wettest summers (June-August) across New Jersey since 1895.

For the full text of this article, go to: http://climate.rutgers.edu/stateclim. ❑

NJ Deploys Fish and Native Crustaceans in the Battle against Mosquitoes

Salvatore Mangiafico, Environmental and Resource Management Agent, Rutgers Cooperative Extension of Salem and Cumberland Counties

The New Jersey Department of Environmental Protection announced in May the deployment of the state's newest weapon in the battle against mosquitoes: a tiny crustacean that eats mosquito larvae: a copepod named *Macrocyclops albidus*. These creatures are native to New Jersey, and it is hoped that they will be effective in reducing the number of mosquitoes— including the Asian tiger mosquito—in small pools, ditches, and other small wet areas. The State Department of Agriculture is rearing large numbers of the crustacean for release.

It is hoped that using these copepods—along with *Gambusia* mosquitofish, fathead minnows, killifish, and sunfish—can reduce the reliance on pesticides for mosquito control. One advantage of these biological control agents is that they can build up their populations relatively quickly after release so that they can effectively control mosquito larvae populations. A second advantage is that, once established, population of beneficial predators can maintain themselves over time. This is in contrast with some pesticides that may require multiple applications in a season.

References:

NJDEP. 2011. News Release: New Jersey Marks Milstone in Battling Mosquitoes, Employs Unique Fish for the Task. May 9. http://www.nj.gov/dep/newsrel/2011/11_0065.htm.

NJDEP. 2011. News Release: Tiny Creature Battles Jersey Mosquitoes. May 26. http://www.nj.gov/dep/newsrel/2011/11_0068.htm.

Appelbaum, A. and D. Goldberg. 2011 N.J. to release shrimp-like crustaceans to combat mosquito problem. The Star-Ledger. June 09. http://www.nj.com/news/index.ssf/2011/06/state_to_release_native_nj_cru.html. ❑

NJ Rain Garden Manual

Rain gardens are specifically designed to manage stormwater runoff, mainly from rooftops, but also from driveways, lawns, roads, and parking lots. Rain gardens look like regular perennial gardens, but they are much more. During a storm, a rain garden fills with water, and the water slowly filters into the ground rather than running into storm sewers. Compared to a patch of lawn, a rain garden allows about 30% more water to soak into the ground. Therefore, by capturing stormwater, rain gardens help to reduce nonpoint source pollution (i.e., road sediment/salt, fertilizers, pesticides, bacteria from pet waste, eroded soil, grass clippings, litter, etc.) and help to protect local waterways. Rain gardens also add beauty to neighborhoods and provide wildlife habitat.

The Rain Garden Manual of New Jersey is available as a free download from the Rutgers Water Resources Rain Garden Information Center. Find all the resources you need on building Rain Gardens in New Jersey at: http://water.rutgers.edu/Rain_Gardens/RGWebsite/rginfo.html. ❑

Rain Garden at Rutgers Cooperative Extension of Middlesex County EARTH Center.

Weekly Weather Summary

Keith Arnesen, Ph.D., Agricultural Meteorologist

Note: Some data continues missing as a combined result of Hurricane Irene and the recent Verizon strike.

Temperatures averaged near normal, averaging 62 degrees north, 66 degrees central, and 67 degrees south. Extremes were 88 degrees at several locations on the 15th and 38 degrees at Belvidere on the 19th. Weekly rainfall averaged 0.45 inches north, 0.09 inches central, and 0.23 inches south. The heaviest 24 hour total reported was 0.70 inches at Newton on the 12th to 13th. Estimated soil moisture, in percent of field capacity, this past week averaged 89 percent north, 73 percent central and 69 percent south. Four inch soil temperatures averaged 65 degrees north, 68 degrees central and 70 degrees south.

Weather Summary for the Week Ending 8 am Monday 9/19/11

	RAINFALL			TEMPERATURE				GDD BASE50		MON
WEATHER STATIONS	**WEEK**	**TOTAL**	**DEP**	**MX**	**MN**	**AVG**	**DEP**	**TOT**	**DEP**	**%FC**
BELVIDERE BRIDGE	.28	45.14	18.17	81	38	60.	-2	2483	-10	80
CANOE BROOK	MISSING									
CHARLOTTEBURG	MISSING									
FLEMINGTON	.09	41.91	14.81	85	44	62.	-1	2958	392	83
NEWTON	.97	51.84	25.49	81	45	62.	2	2836	594	94
FREEHOLD	.05	43.65	17.31	88	43	65.	0	3281	560	72
LONG BRANCH	.00	45.96	19.28	84	44	66.	1	3059	394	57
NEW BRUNSWICK	.08	43.66	16.91	88	42	65.	1	3292	435	82
TOMS RIVER	.18	28.23	.96	87	45	67.	2	3134	464	60
TRENTON	.14	40.14	14.82	86	45	65.	-1	3578	612	62
CAPE MAY COURT HOUSE	MISSING									
DOWNSTOWN	.40	28.94	4.10	88	44	66.	0	2983	5	71
HAMMONTON	MISSING									
POMONA	.23	29.58	5.86	88	46	67.	2	3614	857	59
SEABROOK	.06	47.32	23.43	88	47	68.	1	3691	694	62

*Belvidere appears to be having extreme thermometer problems. Temperatures are way too low. Problem fixed as of July 14th, but earlier bad numbers have affected cumulative values for temperature.

** SOUTH HARRISON RAIN GAUGE HAS BEEN DOWN FOR NUMEROUS WEEKS.

*** CAPE MAY COURTHOUSE IS BACK WITH DATA AFTER SEVERAL MONTHS, BUT CUMLATIVE VALUES WILL BE WAY OFF.

WES KLINE -- GDD BASE 40 PINEY HOLLOW

LAST WEEK 213 (ENDING 9/5/11)

THIS WEEK 240 (Ending 9/15/11)

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