RUTGERS COOPERATIVE EXTENSION AT THE NEW JERSEY AGRICULTURAL EXPERIMENT STATION

PLANT & PEST ADVISORY

VEGETABLE CROPS EDITION $1.50 OCTOBER 1, 2003

INSIDE

Improve Your Soil Through Leaf Mulching This Fall

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Leaf mulching is the application and incorporation of collected municipal shade tree leaves on agricultural land. Research conducted by Rutgers University shows that leaf mulching can improve soil quality. In our study, leaves were applied to research plots each fall for three years. The applications rates were no leaves, 3 inch depth = 10 dry tons/acre or 6 inch depth = 20 dry tons/acre. Soil measurements were taken one year after the end of a three year period of annual leaf applications.

Leaves have relatively low concentrations of most plant nutrients (1% N, 0.1% P and 0.4% K) and an average carbon to nitrogen (C:N) ratio of 50 to 1. A valuable attribute of leaves is that they can be applied at high rates that rapidly build soil organic matter without causing a rapid release and buildup for available N and P. Soil organic matter levels increased from 2.4% in our unamended soil to 2.9% in plots that received 3 inches/year and to 3.1% where leaves were applied at 6 inches/year. Calculations indicate that about 17% of the organic carbon that was added to the soil remained in the soil one year after the end of the three-year period of annual applications. – a sign that organic matter levels were building.

The application of plant or animal residues with a C:N ratio of greater than 30:1 does not rapidly release mineral N in the soil. The addition of these high C:N ratio leaves did cause some initial 'tie-up' (immobilization) of N as they decomposed in the soil, reducing the amount of available N for the crop. However, in our study, crops grown (field corn, soybean) on soils amended with leaves the previous fall generally exhibited only mild to no symptoms of N deficiency. Plant tissue analysis performed on the corn and soybean during the reproductive growth stage revealed that applying N fertilizer to counteract the soil N immobilization was not necessary. One year after the end of the three-year period of annual applications, soil organic nitrogen levels rose from 0.10% in unamended soil to 0.14% for the 3 inches/year rate and to 0.20% for the 6 inches/year rate. The increased soil organic matter content provides slow release N for long term soil fertility.

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LEAF MULCHING FROM PAGE 1

An application of leaves at 6 inches would add an estimated 45 lbs. P/acre, 171 lbs. K/acre, 108 lbs. Mg/acre and 738 lbs Ca/acre. Annual applications of leaves over the three year study period did not significantly increase the soil test (Mehlich-3) levels of P or Mg. The K soil test level and especially the Ca level were significantly increased with applications of leaves. Base saturation percentages of soil cation exchange capacity (CEC) changed with the application of leaves; the Mg percentage decreased from 23% saturation on unamended soils to 20% on amended soil and the Ca percentage increased from 54% to 60% respectively. For micronutrients, applications of leaves did not change the soil test levels of copper (Cu), manganese (Mn), or zinc (Zn) but it increased boron (B) from 0.4 ppm on unamended soil to 0.6 ppm on amended soil.

The application of leaves tended to cause a slight increase in soil pH. We observed a soil pH of 6.2 on unamended soil and a pH of 6.4 on amended soil (both leaf application rates). Although leaves do not appear to significantly influence the agricultural limestone requirement, the selection of the type of limestone for future maintenance of a balance between Ca and Mg in the soil may be a consideration for crops that are more susceptible to Mg deficiency.

Therefore leaves can provide a desirable source of organic material for soil improvement, add organic matter and some nutrients. However, careful planning and specific crop management must be followed. If you are interested in starting an on-farm leaf mulching operation, these ten steps should be followed to ensure success:

✔ **Get the facts:** Contact your county solid waste or recycling office to determine what permitting or approval process is required, as the process varies from county to county. In most cases approvals are simple, but it may also require some reporting and information sharing, so plan accordingly.

✔ **Follow the rules:** Leaf mulching is state regulated. Leaves can be accepted and spread on farm fields at a depth of 6 inches annually, cannot be stockpiled at the farm for more than seven days, and must be incorporated into the soil by spring.

✔ **Push the pencil:** Determine the fields to which leaves are to be applied and determine the total acreage. The six-inch application rate is equivalent to approximately 800 cubic yards of leaves per acre. Calculate the total amount of leaves you would need. Initially, consider accepting small quantities of leaves or operating on a limited acreage.

✔ **Plan, plan, and plan:** Have an all-weather road for truck traffic and a site for unloading. Remember that leaf deliveries will quickly "add up," especially if wet or freezing weather delays spreading.

✔ **Find a leaf source:** Ask county solid waste/recycling officials about municipalities who are looking for farmers to accept leaves, or contact potential leaf sources directly.

✔ **Form an agreement:** Ask any supplier if an agreement or contract stating the specific terms of the agreement can be made. Consider the following factors:

- length of agreement
- time period when leaves will be delivered
- amount of leaves to be delivered
- tipping fee (dollars per cubic yard or ton of leaves) to be received
- location(s) leaves are to be unloaded
- delivery schedule
- acceptable quality standards/conditions upon which loads can be rejected
- responsibility for removal of non-biodegradables and other trash
- responsibility for damage to fields from delivery trucks
- methods for dispute arbitration

✔ **Educate:** Make it clear to the leaf supplier why farm fields should not be driven on, or how bottles or trash can break equipment or injure animals. Explain that the leaves must be collected, handled and delivered properly to insure quality.

✔ **Experiment:** Test different spreading and incorporation equipment. Consider a manure spreader and chisel plow which have been shown to work well. Try different application rates. Research has determined that leaf mulching can increase soil moisture retention, increase surface residue, and may extend lower soil temperatures in early spring. This may affect planting or crop establishment. Leaf application may temporarily tie up soil nitrogen. Experiment with different crops, seeding rates, or combinations of nitrogen supplying materials such as manure. Consider legumes or low nitrogen use crops immediately after incorporating leaves, or transplants versus direct seeding.

✔ **Plan for problems:** Have written contingency plans should problems arise. For example, if odors become a problem with stockpiled leaves, will you apply limestone to neutralize odors? Move the material off site? Spread it immediately? What will happen if your spreading equipment breaks down and you cannot spread the material in a timely manner? Will you spread it by a different method? Be able to stop deliveries until the equipment is repaired? Plan ahead and have a response ready for any problems that may occur.

✔ **Keep good records:** Record leaf deliveries, application rates, spreading and incorporation methods, cropping practices, crop vigor and yields. These records will help you to determine the effects of the practice. In addition, they can be used to illustrate your successful use of the practice should problems arise, such as local opposition to or inspection of your operation.

These guidelines should help you prepare to start on-farm leaf mulching. Obviously, the success of such an operation depends on a good plan and proper execution, but the benefits to your soil can outweigh the investment in time spent planning. ❑

IPM Update

Kristian Holmstrom, Program Associate in Vegetable IPM

Sweet Corn

European corn borer (**ECB**) adult activity is largely over except in parts of the southernmost counties (see ECB map). This area of activity is likely part of a limited third flight. At this time all remaining sweet corn plantings are probably silking. Regular insecticide applications on silks as dictated by the local **corn earworm (CEW)** catches should control any ECB as well. The highest average nightly ECB blacklight trap catches are:

Mannington	3	East Vineland	2	Pole Tavern	2
Bayside	2	Elmer	2	Woodstown	2
Cedarville	2	Jones Island	2	Hopewell	1
Cohansey	2	Pedricktown	2	Shirley	1

Corn earworm (CEW) adult activity rises and falls with changes in prevailing weather patterns. When New Jersey experiences significant southerly breezes, trap catches increase somewhat. Cooler evening temperatures result in lower trap catches and lower activity overall. CEW activity is moderate throughout the state, with higher catches along the Delaware Bay shore (see CEW map). For this reason, strict silking spray schedules should be observed on remaining sweet corn until local catches indicate otherwise. Black areas on the map (red on the web) represent populations requiring a 2-3 day silk spray schedule. Cross-hatched areas on the map (green on the web) represent a population requiring a 3-4 day silk spray schedule. Night temperatures in the 50's or lower will allow spray schedules to be relaxed by 1-2 days. The highest average nightly CEW blacklight trap catches are:

Bayside	19	Belvidere	7	Little York	6
Jones Island	19	Mannington	7	Croton	5
Elmer	9	Woodstown	7	Elm	5
Seeley Lake	8	Cohansey	6	Hackettstown	5

General Sweet Corn Spray Schedule

Silking Corn:	North	3-4 days
	Central	3-4 days
	South	3 days

Pumpkins

Maintain fungicide programs on pumpkins and winter squash as long as vines are viable and further fruit ripening is required. If the crop is largely mature, fungicides may be discontinued, but prompt removal of fruit from the field is advisable. The recommended fungicide program for **powdery mildew** (**PM**) control is chlorothalonil +Nova to be alternated with a strobilurin type fungicide at 7-10 day intervals. It is important to remember that Quadris (a strobilurin type) is effective on PM, but is highly phytotoxic to some apple types. For this reason, Flint is a good substitute if apples are to be sprayed with the same apparatus used for spraying pumpkins and winter squash.

Downy mildew (DM) is favored by moist conditions, and infects all cucurbit crops. Heavy sporulation when leaves are wet leads to rapidly spreading infections. Protectant fungicides are necessary to stop spore penetration on uninfected foliage. Fungicides with eradicant properties like Ridomil or Acrobat can help combat existing infections. Check fields weekly for the presence of yellow blotches becoming necrotic on

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Strawberry Update

Peter Probasco, Salem County Agricultural Agent

A new variety trial is going in this month in Pedricktown. Last year's trial showed that Chandler is still the best variety for New Jersey, but the new USDA variety "ovation" looks good for a late season variety. Plants are hard to find of ovation, but hopefully more will be available next year.

Diseases have been a problem on plugs this year as **Phytophthora cactorum** has already showed up on plugs. Ridomil is our best chemical control, but growers need to improve their plug mix drainage with 50% vermiculite or perlite before sticking the tips. Growing the plugs outside without a shade cover or plastic cover can be risky when you have the amount of rainfall we had this summer.

Another disease we are seeing this year is **anthracnose** in some of the renovated fields. These need to be destroyed before this disease spreads to your new field. Anthracnose has been reported in Virginia and North Carolina on their plugs so we are concerned that it may appear in New Jersey. Quadris is a good choice for anthracnose control. The last disease to manage is **leaf spot**. Leaf spot disease came down with the tips this year and can be controlled by spraying recommended fungicides in the field on a 3-week schedule. ❑

Editor's Note: This is the last issue of the Vegetable Crops edition of the Plant & Pest Advisory for the 2003 season. Thanks for subscribing.

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the upper surface of leaves with dark, felt-like sporulation on the lower surface. The sporulation frequently occurs along the leaf veins. This disease is present in many New Jersey cucurbit fields at this time. For this reason, it is advisable to maintain a 7 - day protectant program as long as healthy vines are required. It is important to note that DM does not directly infect fruit, so after ripening, fungicides are not necessary to protect fruit from this pathogen. Consult the *2003 Commercial Vegetable Production Recommendations* for spray materials.

As pumpkin fruit begin to mature, it is important to check fields periodically for the presence of **cucumber beetles**. Early in the season, these insects are a threat to transmit **bacterial wilt**. At this time of the season they sometimes begin to feed on the rinds of mature fruit, causing direct damage and allowing rot organisms to establish. Cucumber beetles are often not distributed evenly throughout the field, so it is important to visit several areas to evaluate the situation. If cucumber beetles are found feeding on fruit, consider treating to prevent further injury.

As fruit mature, consider removing them from the field as soon as possible. As long as fruit are in the field, they are susceptible to insect and animal damage, **phytophthora**, and **bacterial soft rot**.

Tomatoes

Maintain regular fungicide applications for **alternaria, anthracnose, and septoria** control on tomatoes. Good disease management to preserve foliar cover for fruit is critical for good fruit quality.

Tomato fruitworm (corn earworm) adult activity is generally below the level considered damaging to tomatoes. An exception to this continues to be along the Delaware Bay shore (see CEW map), where catches are higher. In these areas, consider weekly treatments to prevent fruit injury until the population subsides. Fruitworm larvae often bore into the shoulders of tomatoes near the outer canopy of the plants. Consult the *2003 Commercial Vegetable Production Recommendations* for spray materials.

Snap and lima beans

CEW continues to threaten snap and lima bean plantings in the southwestern counties. Areas shaded black on the map (red on the web version) indicate CEW adult populations that are potentially damaging to these crops. Consider treating snap beans at 5-7 day intervals if local CEW activity is heavy in your area. Check lima beans for the presence of larvae, and consider treating if averages of more than 2 larvae are found per 6 feet of row up to 4 weeks before harvest. After this, the threshold is 3 larvae per 6 row feet. It is important to choose an appropriate control material, as acephate is not effective against CEW. See *2003 Commercial Vegetable Production Recommendations* for spray materials.

Cole crops

Imported cabbageworm (ICW), diamondback moth larvae (DBM), and **cabbage looper (CL)** are all active now on cole crops. In addition, **flea beetle** continues to be a problem on young plantings when days are warm. Check plantings at least once a week for the presence of the above pests. Consider treating if greater than 20% of plants are infested prior to head formation or if greater than 5% are infested when heads are present. For collards, kale, mustard and other leafy cole crops, consider treating when 10% or more plants are infested with any larvae. When fields are harvested, disk and cover the residue as soon as possible to prevent old fields from becoming a source of DBM. Flea beetle infestations should be treated when the pest is present on more than half the plants in the sample and damage is occurring.

Alternaria is a threat to maturing cole crops now, and will remain so for the rest of the season. Look for necrotic lesions on older tissue. The lesions often have concentric rings within the borders. In Brussels sprouts, entire sprouts turn black as the infection advances. At the first sign of disease, begin a 7-10 day fungicide program. Consult the *2003 Commercial Vegetable Production Recommendations* for effective spray materials.

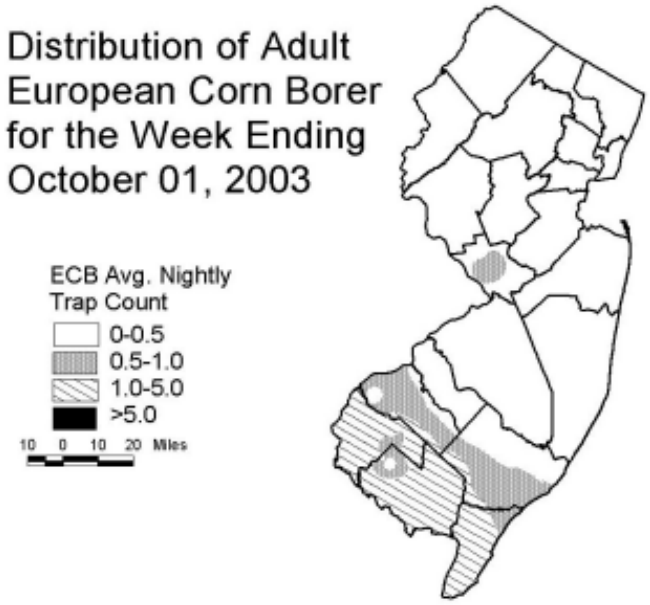
Peppers

In the southern Cumberland and Salem Counties, consider a weekly protectant insecticide schedule to prevent fruit injury. On the **CEW** map, dark portions (shaded red on the web version) represent areas where CEW activity is a threat to pepper fruit. As eggs hatch, larvae will tunnel into the fruit around the cap like ECB does. As the larvae feed in the fruit, bacteria enter and can result in a high incidence of **soft rot**. When scouting, look at two fruit on five consecutive plants in ten random locations throughout the planting. Consider treating for CEW if fruit injury is increasing in the field. Consult the *2003 Commercial Vegetable Production Recommendations* for spray materials.

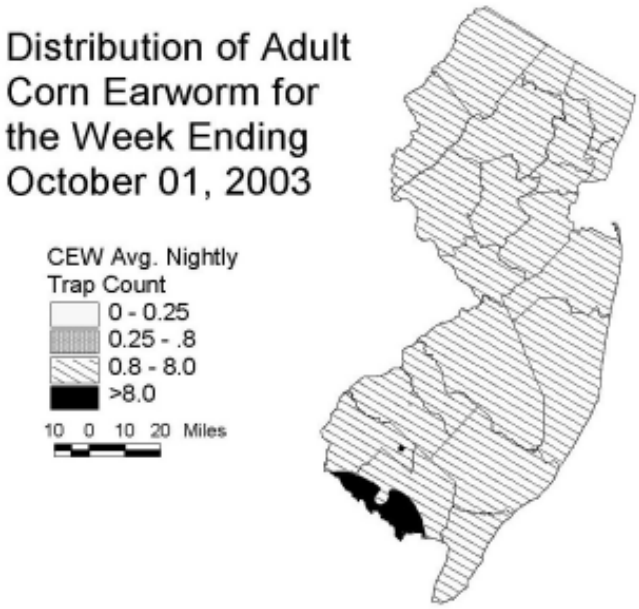
End of Season Disease Management

Proper disposal of infected plant material is critical to managing certain diseases for the following growing season. Bacterial pathogens such as **bacterial speck**, **spot**, and **canker** of tomato; **bacterial leaf spot** of pepper; and **black rot** of cole crops are all capable of overwintering on undecomposed host plant material. Fungal pathogens like **gummy stem blight** of cucurbits and **alternaria** (multiple species and hosts) survive the winter in this manner as well. For this reason, it is critical that these sources of inoculum be eliminated. Remove all crop residue from the field or incorporate it fully into the soil this fall to ensure decomposition prior to planting in the spring. Waiting until next spring to incorporate crop residue may not permit complete decomposition of the material. Improper handling of diseased crop residue can foil the best efforts to avoid diseases next year.

See ECB and CEW Distribution Maps on page 5



Data collected and processed by: Kris Holmstrom, Marilyn Hughes
Rutgers Cooperative Extension & Center for Remote Sensing



Data collected and processed by: Kris Holmstrom, Marilyn Hughes
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Weekly Weather Summary

Keith Arnesen, Ph.D., Agricultural Meteorologist

Temperatures averaged much above normal. Extremes were 83 degrees at Hammonton on the 28th, and 46 degrees at Newton on the 24th. Weekly rainfall averaged 2.66 inches north, 1.73 inches central, and 1.13 inches south. The heaviest 24 hour total reported was 1.89 inches at Belvidere on the 23rd to 24th. Estimated soil moisture, in percent of field capacity, this past week averaged 98 percent north, 93 percent central and 84 percent south. Four inch soil temperatures averaged 65 degrees north, 67 degrees central and 69 degrees south.

Weather Summary for the Week Ending 8 am Monday 9/29/ 3

	RAINFALL			TEMPERATURE				GDD BASE50		MON
WEATHER STATIONS	WEEK	TOTAL	DEP	MX	MN	AVG	DEP	TOT	DEP	%FC
BELVIDERE BRIDGE	2.81	42.30	13.98	80	48	64.	5	2860	263	95
CANOE BROOK	MISSING									
CHARLOTTEBURG	MISSING									
FLEMINGTON	2.08	38.82	10.41	81	47	65.	6	2805	128	99
LONG VALLEY	2.89	39.93	9.21	76	48	63.	6	2251	-38	98
NEWTON	2.86	39.76	12.10	80	46	62.	6	2583	260	98
FREEHOLD	1.61	30.73	3.16	82	49	67.	6	3036	183	100
LONG BRANCH	1.92	33.29	5.39	77	52	66.	4	2859	62	100
NEW BRUNSWICK	1.85	36.08	8.02	82	47	66.	5	3000	18	100
TOMS RIVER	1.83	35.16	6.63	80	50	67.	6	3050	250	100
TRENTON	1.44	30.35	3.81	80	49	66.	4	2971	-134	99
BRIDGETON	.00	.00	.00	0	99	0.	0	0	0	0
CAPE MAY COURT HOUSE	.98	27.41	2.64	79	50	68.	3	2962	110	76
DOWNSTOWN	1.19	31.45	5.51	82	50	67.	4	3104	-20	83
GLASSBORO	1.44	32.77	5.45	82	54	69.	7	3293	206	89
HAMMONTON	.92	27.07	-.22	83	49	68.	6	3246	152	84
POMONA	1.06	25.26	.67	80	50	67.	6	3087	214	88
SEABROOK	1.18	32.98	7.95	80	53	69.	6	3360	215	77
ATLANTIC CITY MARINA	missing									
SOUTH HARRISON	1.37	30.00	3.38	81	53	68	NA	3252	NA	NA

WES KLINE — GDD BASE 40 PINEY HOLLOW Last Week 206 (Ending 9/22/03) This Week 192 (Ending 9/29/03)

The Climate of New Jersey

Reprinted from Office of the New Jersey State Climatologist, Rutgers, The State University of New Jersey: http://climate.rutgers.edu/stateclim.

New Jersey is located about halfway between the Equator and the North Pole, on the eastern coast of the United States. Its geographic location results in the State being influenced by wet, dry, hot, and cold airstreams, making for daily weather that is highly variable.

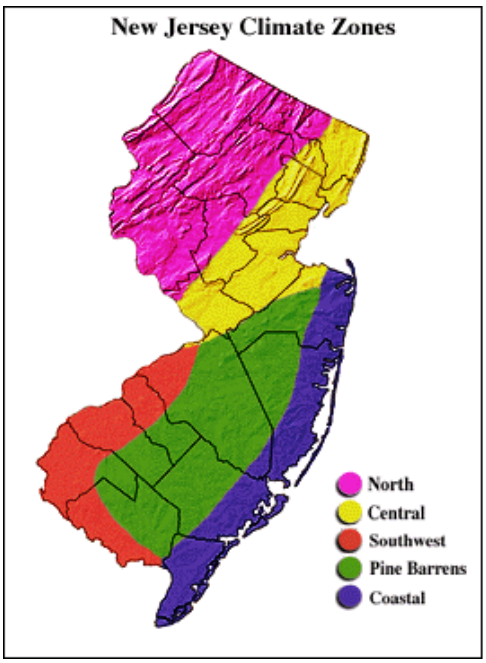
The Garden State is 166 miles long from north to south, and its greatest width is about 65 miles. While this may not seem too large, there is a marked difference in climate between Cape May in the south and the Kittatinny Mountains of northwestern New Jersey.

The dominant feature of the atmospheric circulation over North America, including New Jersey, is the broad, undulating flow from west to east across the middle latitudes of the continent. These "prevailing westerlies" shift north and south and vary in strength during the course of the year, exerting a major influence on the weather throughout the State.

Some general observations about the temperature and precipitation in New Jersey include:

1) Temperature differences between the northern and southern parts of the state are greatest in the winter and least in summer. All stations have registered readings of 100 degrees F or higher and have records of 0 degrees F or below.
2) Average number of freeze free days in the northern highlands is 163, 179 in the central and southern interior, and 217 along the seacoast.
3) Average annual precipitation ranges from about 40 inches along the southeast coast to 51 inches in north-central parts of the state. Many areas average between 43 and 47 inches.
4) Snow may fall from about October 15 to April 30 in the highlands and from about November 15 to April 15 in southern counties.
5) Most areas receive 25 to 30 thunderstorms per year, with fewer storms near the coast than farther inland. Approximately five tornadoes occur each year, and in general, they tend to be weak.
6) Measurable precipitation falls on approximately 120 days. Fall months are usually the driest with an average of eight days with measurable precipitation. Other seasons average between 9 and 12 days per month with measurable precipitation.

Although New Jersey is one of the smallest states in the Union, with a land area of 7,836 square miles, it has five distinct climate regions. The geology, distance from the Atlantic Ocean, and prevailing atmospheric flow patterns produce distinct variations in the daily weather between each of the regions. The five regions, Northern, Central, Pine Barrens, Southwest, and Coastal, are described below and shown in the accompanying figure.



Northern Zone

The Northern climate zone covers about one-quarter of New Jersey and consists mainly of elevated highlands and valleys which are part of the Appalachian Uplands. Surrounded by land, this region can be characterized as having a continental type of climate with minimal influence from the Atlantic Ocean, except when the winds contain an easterly component. Prevailing winds are from the southwest in summer and from the northwest in winter.

Being in the northernmost portion of the state, and with small mountains up to 1800 feet in elevation, the Northern Zone normally exhibits a colder temperature regime than other climate regions of the State. This difference is most dramatic in winter when average temperatures in the Northern Zone can be more than ten degrees Fahrenheit cooler than in the Coastal Zone. Annual snowfall averages 40 to 50 inches in the northern zone as compared with an average of 10-15 inches in the extreme south.

A storm track extending from the heart of the Mississippi Valley, over the Great Lakes, and along the St. Lawrence Valley is a major source of precipitation for this region. Coastal storms, with precipitation shields that reach well enough inland add to the precipitation totals.

The highlands and mountains in this area play a role in making the climate of the Northern Zone different from the rest of the state. Clouds and precipitation are enhanced by orographic effects. For instance, following a cold frontal passage, air forced to rise over the mountains, produces clouds, and even precipitation, while the rest of the state observes clear skies. The latter is due in part to subsiding air flowing off the highlands.

During the warm season, thunderstorms are responsible for most of the rainfall. Cyclones and frontal passages are less frequent during this time. Thunderstorms spawned in Pennsylvania and New York State

See NJ Climate on page 7

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often move into Northern New Jersey, where they often reach maximum development in the evening. This region has about twice as many thunderstorms as the coastal zone, where the nearby ocean helps stabilize the atmosphere.

The Northern Climate Zone usually has the shortest growing season, about 155 days. The average date for the last killing Spring frost is May 4. The first frost in Fall is around October 7. The exact dates vary significantly within the region as well as from year to year. Some valley locations have observed killing frost in mid-September and as late as mid-June.

Central Zone

The Central Zone has a northeast to southwest orientation, running from New York Harbor and the Lower Hudson River to the great bend of the Delaware River in the vicinity of Trenton. This region has many urban locations with large amounts of pollutants produced by the high volume of automobile traffic and industrial processes. The concentration of buildings and paved surfaces serve to retain more heat, thereby affecting the local temperatures. Because of the asphalt, brick, and concrete, the observed nighttime temperatures in heavily developed parts of the zone are regularly warmer than surrounding suburban and rural areas. This phenomenon is often referred to as a "heat island".

The northern edge of the Central Zone is often the boundary between freezing and non-freezing precipitation during wintertime. In summer, the northern reaches often mark the boundary between comfortable and uncomfortable sleeping conditions. Areas to the south of the Central Zone tend to have nearly twice as many days with temperatures above 90 degrees F than the 15-20 commonly observed in the central portion of the state.

Pine Barrens Zone

Scrub pine and oak forests dominate the interior southern portion of New Jersey, hence the name, Pine Barrens. Sandy soils, which are porous and not very fertile, have a major effect on the climate of this region. On clear nights, solar radiation absorbed during the day is quickly radiated back into space, resulting in surprisingly low minimum temperatures. Atlantic City Airport, which is surrounded by sandy soil, can be 15-20 degrees cooler than the Atlantic City Marina on the bay, which is only about thirteen miles away.

The porous soil permits any precipitation to rapidly infiltrate and leave surfaces quite dry. Drier conditions allow for a wider range between the daily maximum and minimum temperatures, and makes the area vulnerable to forest fires.

Southwest Zone

The Southwest Zone lies between sea level and approximately 100 feet above sea level. The close proximity to Delaware Bay adds a maritime influence to the climate of this region. The Southwest has the highest average daily temperatures in the state and without sandy soils, tends to have higher nighttime minimum temperatures than in the neighboring Pine Barrens.

This region receives less precipitation than the Northern and Central regions of the state as there are no orographic features and, it is farther away from the Great Lakes-St. Lawrence storm track. It is also far enough inland to be away from the heavier rains from some coastal storms, thus it receives less precipitation than the Coastal Zone.

Prevailing winds are from the southwest, except in winter when west to northwest winds dominate. High humidity and moderate temperatures prevail when winds flow from the south or east. The moderating effect of the water also allows for a longer growing season. Autumn frosts usually occur about four weeks later here than in the North and the last spring frosts are about four weeks earlier, giving this region the longest growing season in New Jersey.

Coastal Zone

In the Coastal Zone, continental and oceanic influences battle for dominance on daily to weekly bases. In autumn and early winter, when the ocean is warmer than the land surface, the Coastal Zone will experience warmer temperatures than interior regions of the state. In the spring months, ocean breezes keep temperatures along the coast cooler. Being adjacent to the Atlantic Ocean, with its high heat capacity (compared to land), seasonal temperature fluctuations tend to be more gradual and less prone to extremes.

Sea breezes play a major role in the coastal climate. When the land is warmed by the sun, heated air rises, allowing cooler air at the ocean surface to spread inland. Sea breezes often penetrate 5-10 miles inland, but under more favorable conditions, can affect locations 25-40 miles inland. They are most common in spring and summer.

Coastal storms, often characterized as nor'easters, are most frequent between October and April. These storms track over the coastal plain or up to several hundred miles offshore, bringing strong winds and heavy rains. Rarely does a winter go by without at least one significant coastal storm and some years see upwards of five to ten. Tropical storms and hurricanes are also a special concern along the coast. In some years, they contribute a significant amount to the precipitation totals of the region. Damage during times of high tide can be severe when tropical storms or nor'easters affect the region.

Acknowledgments: This narrative borrows liberally from David Ludlum's New Jersey Weather Book, Rutgers University Press, New Brunswick, New Jersey, 1983, and also includes information from Climate of New Jersey, by the National Climatic Center, Asheville, North Carolina, June 1982. ❑

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