ICE STORM DAMAGE TO TREES NEAR LAKE ONTARIO

by
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Environmental Science 102
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Introduction

When I heard that a devastating ice storm had paralyzed Monroe County, New York, I first thought of the safety of my family, my sister and her father who live on the shores of Lake Ontario and my own father who lives further inland south of the city of Rochester. However, it was not long before my mind was filled with grand ideas of elegant experiments measuring the macro-litter volume of debris from the ice storm in the eery peace of a red pine cathedral in Webster Park through which I had skiied during the winters of my childhood.

Spring vacation arrived. I found myself in Webster, New York, a suburb of Rochester, designing a method for assessing the extent and forms of damage to different species of trees in Webster Park, realizing in the process how fortunate I was to conduct my study with a heated house to return to after hours in the cold, wet forest, a lamp to read by at night, and a functioning telephone to pursue my aggressive search for complete and accurate information relavent to my project.

During the course of this report, I will analyze how various tree species in Webster Park reacted to the climatic stress of the ice storm. At the same time, I would like to convey a feeling for the broad-reaching impact of the storm. As a result of the incredible number of casualties among all tree species living in the rural, urban, and suburban areas of Monroe County, the entire infrastructure of the greater Rochester metropolitan area was dislocated. Trees took with them telephone and electrical wires debilitating the city for more than a week, leaving some people without electricity, heat, or telephone for an entire fortnight. The face of downtown Rochester, famous for the summer shade of its tree-lined avenues, is irrevocably altered.

dropped from 52° F to 27° F; a cold air mass had slipped underneath the warm air mass forming a layer of warm air on top of cold. By early morning Monday, March 4, the surface temperature was below freezing and the ground still slightly warm, defrosted by the preceding warm spell. When the precipitation began at 12:55 AM Monday morning, it entered the cold air mass as rain and froze at 30° F on the tree limbs and all other available surfaces. The temperature did not rise above 32° F during the time of precipitation and dropped down to 30° F at the end of precipitation at 11:50 AM only to drop further to a low of 27° F later that night.

During these significant temperature changes, fluctuations in the barometric pressure also indicate the movement of low pressure and high pressure air masses. As the temperature rose to its highest pinnacle, mid-afternoon March 2, the barometric pressure dropped to a low point of 28.845 at 12:50 PM (Appendix C). As the cold air, high pressure system moved into place, with the drop in temperature the barometric pressure rose to 29.245 at 9:50 AM Sunday morning. During the peak of precipitation, the barometric pressure reached its lowest point and then shot up from 28.685 at 6:51 AM, Monday, March 4, to 29.235 at 17:50 PM, Tuesday, March 5.

The fluctuations in wind speed over this span of time are also significant because the periodic gusts of 25 knot winds during the course of the storm may be partially responsible for the extent of damage to trees (Appendix D). It appears there were periodic gusts of wind between 9 and 12 knots on Tuesday morning; and from articles in the local newspapers, high winds following the ice storm by a few days seem to be partially responsible for exagerrating the extent of the damage.

The impact of this meteorological event on the tree population in Monroe County severely disrupted the day-to-day, rush-hour routine of the Rochester

COMPARISON OF ICE STORM DAMAGE AMONG DIFFERENT TREE SPECIES IN WEBSTER PARK

The first half of my study involved walking the trails of Webster Park taking photographs of different tree species damaged by the ice storm. My primary goal was to determine the frequency of damage among different species of trees and then to observe any trends in the way this damage was manifested among certain species types. In other words, why did certain trees tend to split down the trunk, why did some lose their crowns, why were others uprooted? My conclusions are drawn from the photographs and field notes taken while hiking through Webster Park, from the rather limited statistical information given to me by the Monroe County Park Service, and from my research on the structure of trees conducted since my return to Williams College.

I will compare the effects of the ice storm on ten different species of trees found in abundance in Webster Park: the Eastern white pine, red pine, red spruce, American larch, and red cedar [gymnosperms] and the silver maple, paper birch, sycamore, quaking aspen, and weeping willow [angiosperms]. Among the individuals I have used to represent each species type range various crown shapes, branching patterns, wood structures, ages, states of health, and locations of habitat (i.e. slope, soil type, microclimate, natural or plantation growth pattern). I will compare the typical geometric shape of each tree species--crown and branching pattern--aswell as its wood structure to determine how the weight of the ice, distributed in different ways over the surface of each tree, resulted in the varying forms of destruction observed during my field work. I am assuming for the purposes of this study that these factors are the most measureable and significant differences between each of the studied species.

However, it is important to note that the varying age, health, and habitat location of each species type contributed significantly to the numbers lost

Comprehensive numbers for damage to all trees in the park were not available. The above numbers combine exact figures of damage to planted trees in the "landscaped" area of the park and speculative estimates of damage to trees such as the Eastern white pine in the "wilder", natural growth and campsite areas.

I spoke with Bob Hoepfl, forester at Highland Park, downtown Rochester, on May 9, 1991. According to Monroe County Park headquarters he has the updated figures on the number of trees lost by each of the county parks. However, he was only able to list by name the species in Webster Park that were damaged by the ice storm and the total number of trees lost or requiring a pruning. Hoepfl said that the most affected species were maple, willow, ash, birch, aspen, hackberry, and locust followed by various other individuals--some oak, linden, Katsura, red bud, dogwood, Douglass fir, Eastern white pine, red pine, spruce, red cedar, and juniper. These numbers indicate that the most noticeable damage occured among softwood and rapidly growing species aswell as among those species not native to upstate New York. According to Hoepfl, 85 of the park's planted trees were killed and 185 will need professional pruning. Because of the storm's severity and the pressing need to clean up the debris as quickly as possible, numbers for the frequency of damaged trees among certain species are not being carefully tabulated.

Several articles in the Democrat and Chronicle have made observations stating which tree species were most affected by the storm. A March 13 article said that the "street trees that were most significantly affected in the storm were green ash, Norway maple, London plane, hackberry and honey locust..." A March 18 article in the Times-Union stated that rapidly growing softwoods such as silver maples, willows, and poplars were most severely damaged. In the article, Dave Reville, a tree expert with the Cornell Cooperative Extension in Wayne Country "recommended replacing [softwoods] with slow-growing hardwoods,

The Eastern white pine is the only 5-needled pine. It is tall and extends few branches horizontally from its trunk forming a rounded, dome-shaped crown. The wood of the white pine is described as "light, soft, straight-grained," and not as resinous as other pines with a specific gravity of 0.38. It is known for rapid growth. (and strength)

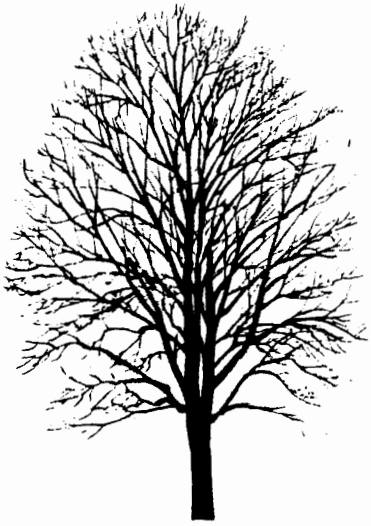
The red pine, like the Eastern white pine, grows in plantation rows in great profusion in the forested areas of the park. In an area near Camp Cattaraugus, a considerable stand of red pines was decimated. Uprooted in some areas and, in other areas, crowns snapped off a third to halfway down the trunk of the trees. (not native to this part of NY)

cone-shaped crown. Four-sided linear needles cover all areas of the branches and extend out in all directions. The wood is "soft, weak, close-grained, not durable," and pale reddish yellow in color. It is resinous with a specific gravity of 0.45 and grows slowly.

West of the pathway leading to the pine and spruce stands, on an upland slope bordering a wetland area lies a natural growth stand of American larch, also known as tamarack. This stand of trees appeared to survive the storm unscathed.

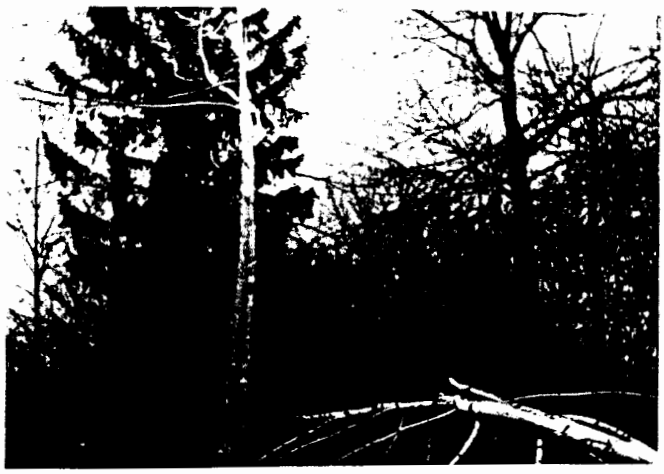
AMERICAN LARCH

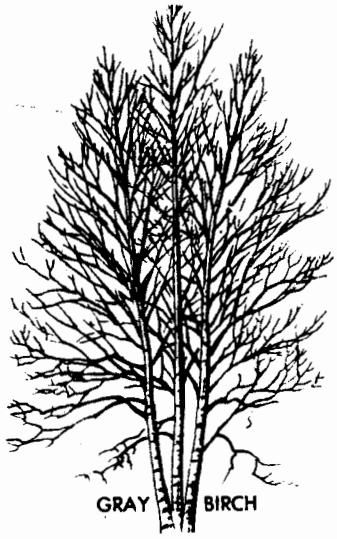
In mid-March, the American larch is still a skeleton of twig-covered branches without its spring leaves. The branches spread out horizontally with a slight upward slope from the trunk, growing progressively shorter towards the crown of the tree, thus forming a slender, conic tree. This tree grows rapidly and



The silver maple has a silhouette similar to that of the red maple. It is one of the most rapidly growing trees, frequently used in city landscaping to line streets. The wood is "hard, brittle, [and] light brown" with a specific gravity of 0.53. The brittleness of the wood makes the silver maple extremely vulnerable to storm damage; "violent summer gales will sometimes strew the ground with its branches."

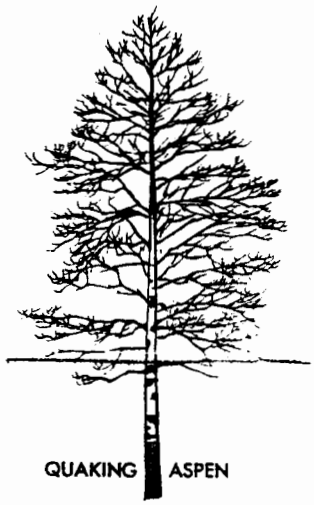
Clusters of white paper birch trees are scattered all over the park. Most of the birch that I saw were killed by the ice storm, many of them split down the center of the trunk.





split down the trunk by the disproportionate weight on some of the branches.

shallow root plate



QUAKING ASPEN

The branches of a quaking aspen do not extend out from the trunk in a very regular pattern; the tips of the branches often droop at the ends. Large populations of aspen frequently indicate the first stage of a successional forest. They grow rapidly in poor soils; their seeds are spread by the wind. The wood is "soft, weak, and soon decays" with a specific gravity of 0.40.

The last tree species of this study is the weeping willow. Mature populations of this tree border East Creek and Mill Creek.

WEEPING WILLOW

close-grained, weak" though durable nature of the wood by the fact that no split red cedar trunks were observed.

The last two gymnosperm groups were less successful in avoiding ice storm damage. The Eastern white pine and red pine both lack a defined conic crown; this may be the reason for the higher frequency of snapped crowns among both species. Two inches of ice would have had a greater surface area on which to collect. With the occasional gusts of high winds that followed the storm, a weakenned or cracked crown would have blown off more easily.

It seems strange that I should have observed more damage to red pine considering it has the harder wood of the two species. According to Horn, there is a cost benefit trade-off in tree species between a hardwood chemistry and a softwood chemistry. He writes,

> The woods of different trees vary greatly in caloric content and strength. Hardwood has heavily lignified cell walls, or extensive deposits of pitch and resin in the compression wood of conifers (Jane 1956). Hardwood is heavy even when dried; it is very strong and rigid, but somewhat brittle. Softwood has a much lower caloric content per unit of volume; it is much lighter than hardwood when dried, but when it is green there is less difference in weight (Section 14 in Forbes 1955). Softwood is flexible and elastic, but of course its thin-walled cells are easily ruptured when a branch is flexed beyond its elastic limit (Jane 1956)...A given volume of hardwood has a higher caloric cost to the tree than softwood. In return for its higher cost, hardwood is better able to support the tree and its leaves against the constant compression and torque of gravity. Variable winds (or the extra weight of ice accumulation) call for compromises between the rigid strength of hardwood and the elastic flexibility of softwood, but these compromising strategies have not been adequately studied. (p. 107-108: see Appendix G for reference to Jane, <u>The Structure of Wood</u>)

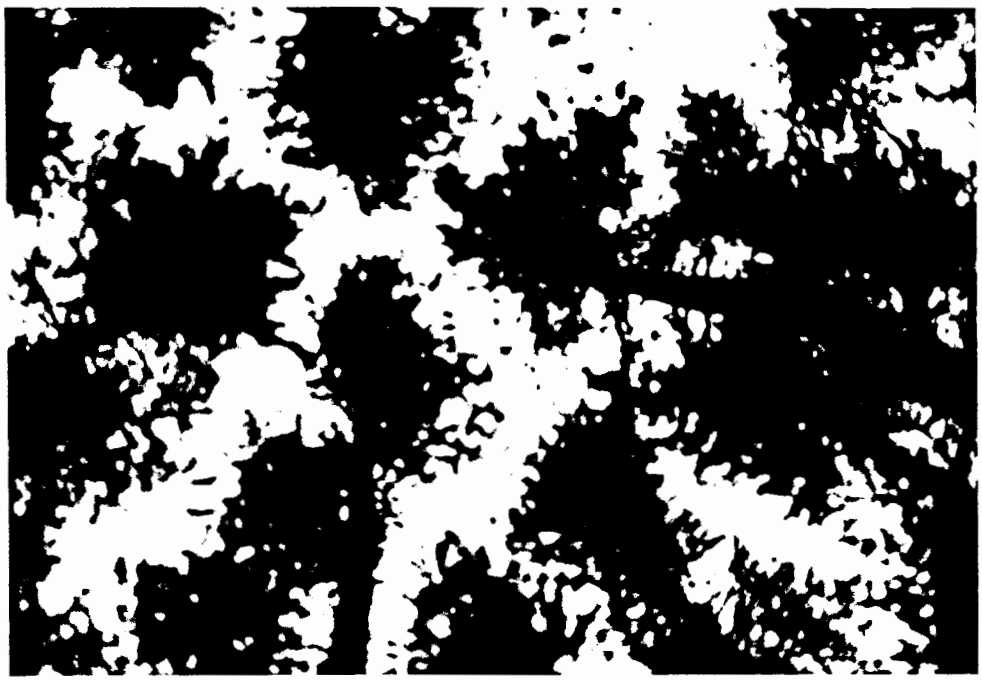
The second group of trees in this study are the angiosperms. The paper birch and quaking aspen angiosperm species share the conical shape of the spruce and larch families yet they did not survive the ice storm. They suffered the most out of all the angiosperm species that I studied. Horn writes, "...the conical shape alone is not enough to adapt trees to snow. Aspens and birches

area or stronger wood, both of which increase the weight of the branch. " (p. 108)

These are only a few of the forces at work within the wood structure and geometrical shape of a tree. Other forces include wood texture and grain, the number of rings in the trunk of a tree per unit measure, the number of vessels, and the wood lignite content, percentage air, and water holding capacity--many forces which need to be studied at the cellular level. In addition, the complicating factors of age, health, and location of habitat for each tree, strongly influenced the outcome of this project in many unmeasureable ways.

The gridded map (Appendix I) of the area indicates the relative position of each individual tree and a descripition of the type of damage suffered by each tree. The lines have been drawn to indicate the position of each row of trees. The red pine trees are planted approximately three to four paces from one another. Certain areas of the map reveal patterns of damage that may have been amplified by the artificial growth pattern of the trees. For example, in quadrant BIV the tree furthest north leaning south seems to have caused a group of four trees to lean. In rows 4, 7, and 9, uprooted trees are followed by trees that have lost more than 50% of their crown and stem.

without a mixture of other tree species overlapping and changing the surface of the canopy, may also be responsible for the extent of damage to this plantation stand of trees.



The eastern half of the grid contains greater species diversity which may have shielded the more vulnerable red pine crown from ice storm damage. Therefore, the stand of red pine trees may have been more vulnerable to ice storm damage because of the single species, row-planted pattern.

will remain much longer than the damage to wooded areas of Webster park.

SOURCES:

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Democrat & Chronicle

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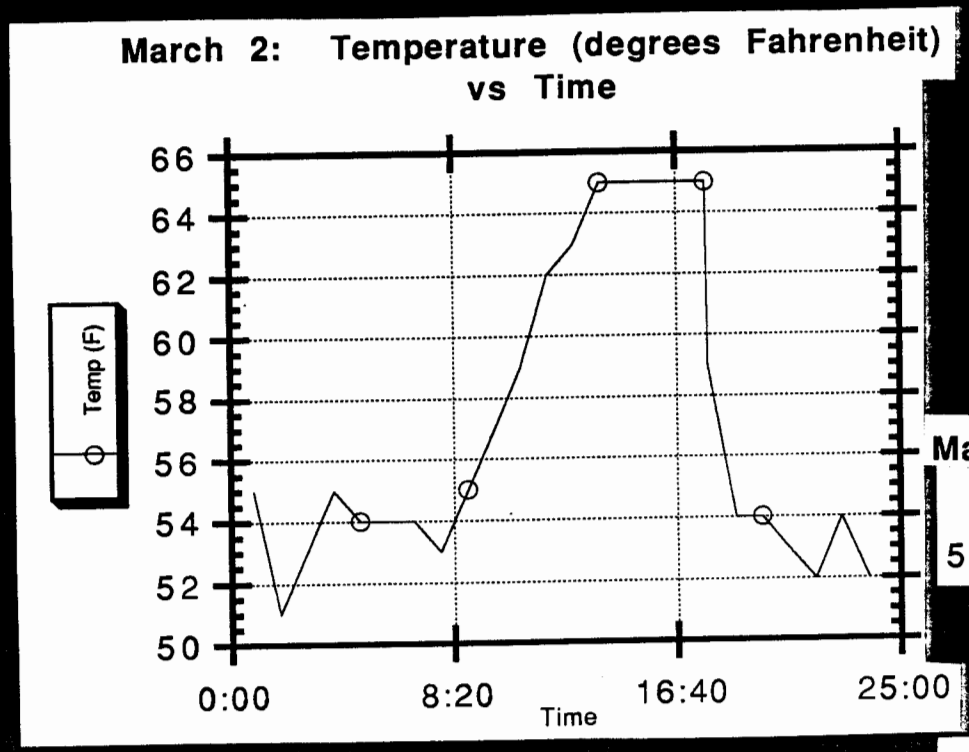
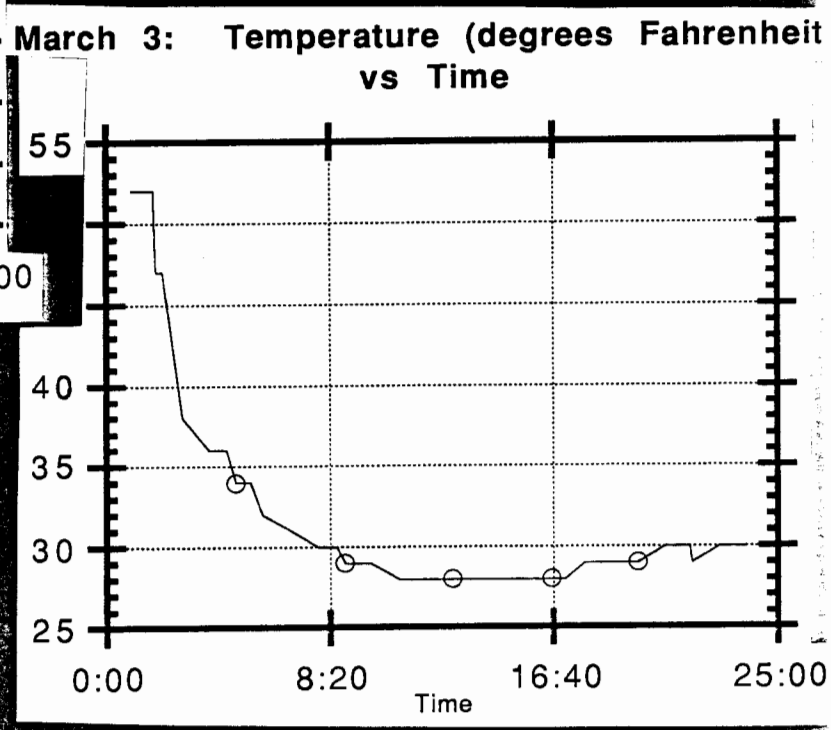
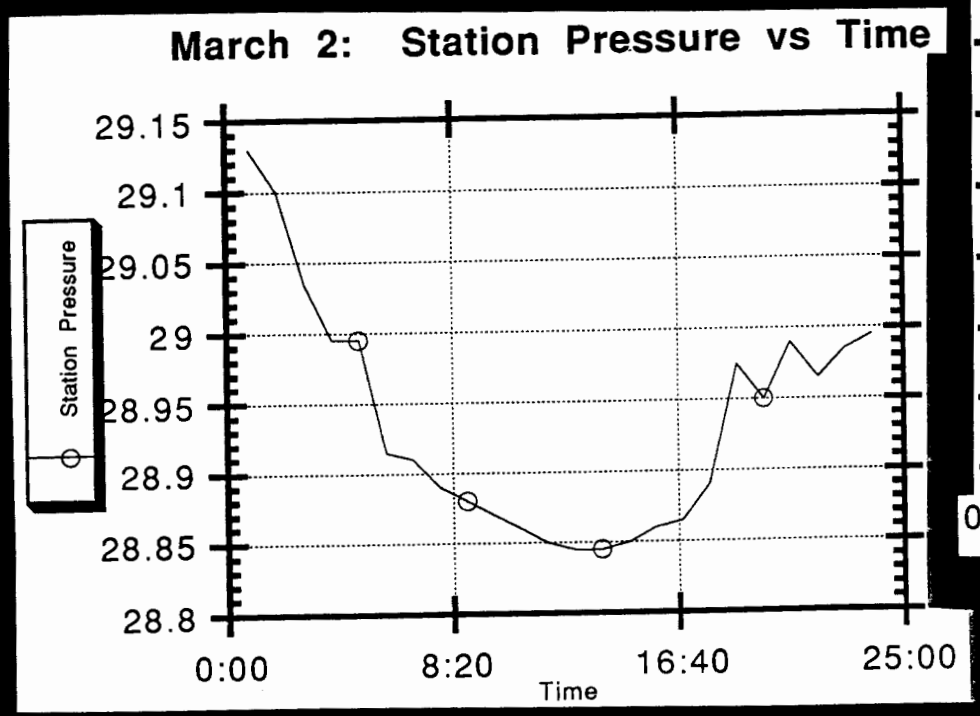
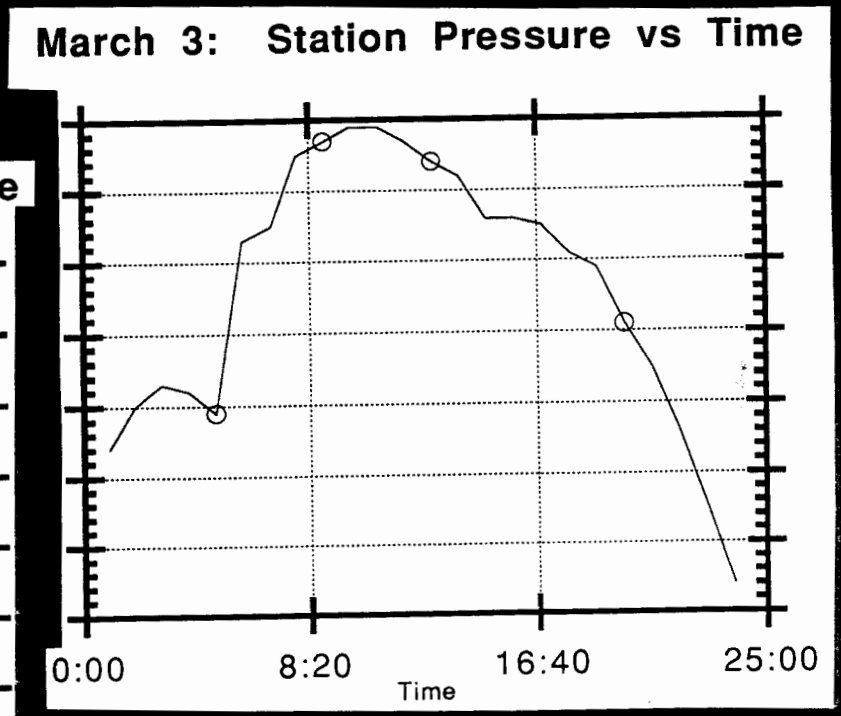
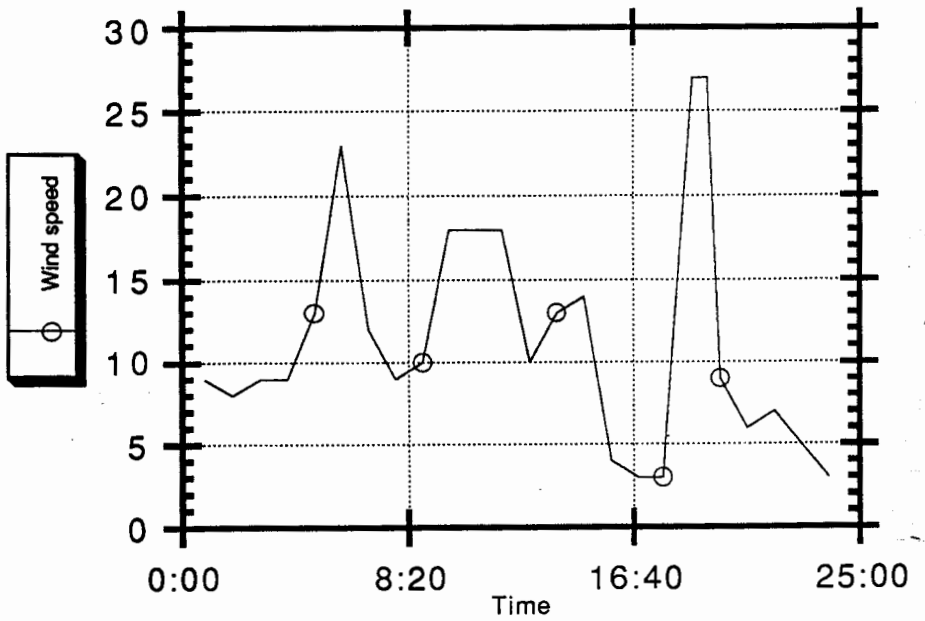

March 2: Temperature (degrees Fahrenheit) vs Time
66
64
62
60
58
56
54
52
50
Temp (F)
0:00
8:20
16:40
25:00
Time


March 3: Temperature (degrees Fahrenheit vs Time
55
40
35
30
25
0:00
8:20
16:40
25:00
Time

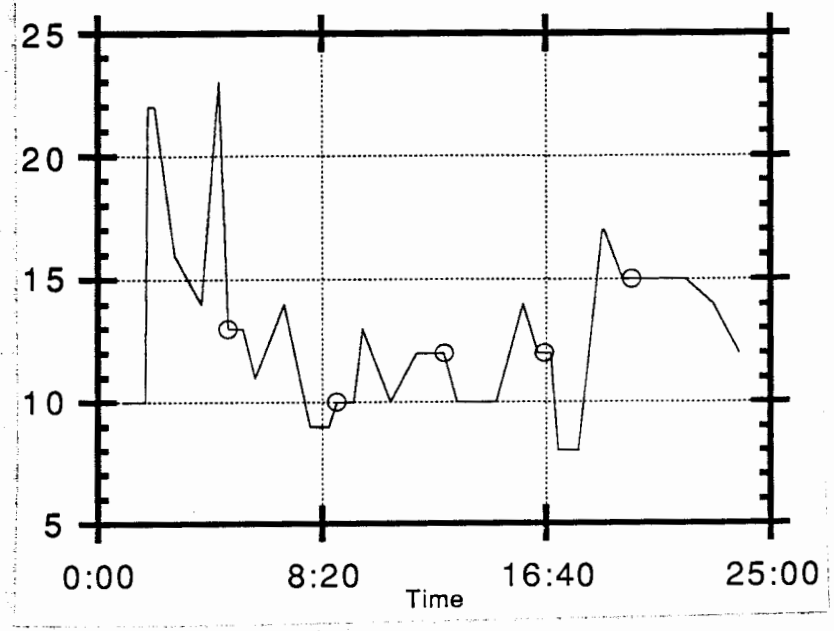

March 2: Station Pressure vs Time
29.15
29.1
29.05
29
28.95
28.9
28.85
28.8
Station Pressure
0:00
8:20
16:40
25:00
Time


March 3: Station Pressure vs Time
0:00
8:20
16:40
25:00
Time

March 2: Wind speed (knots) vs Time

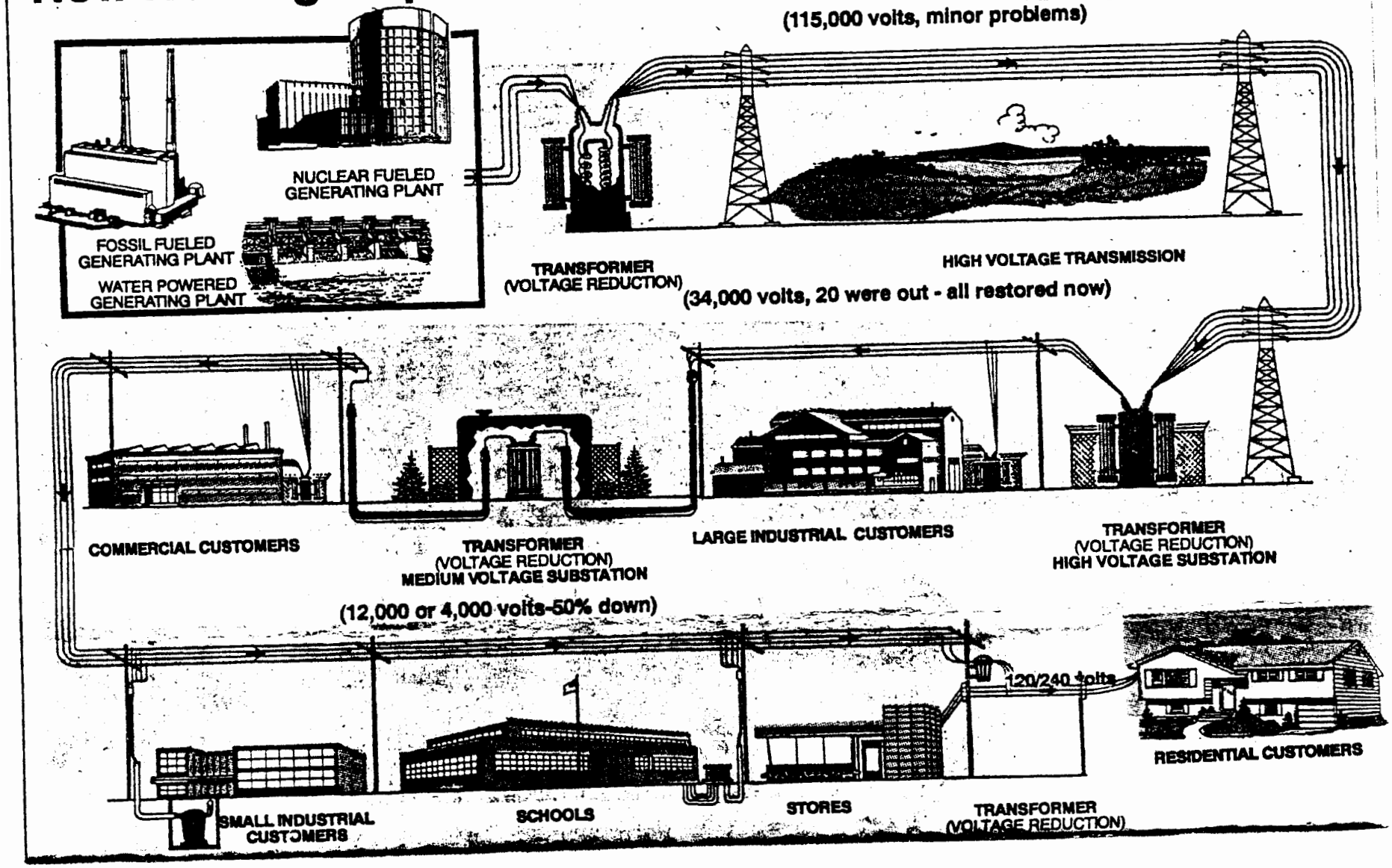


March 3: Wind speed (knots) vs Time



APPENDIX D:

How RG&E gets power to you



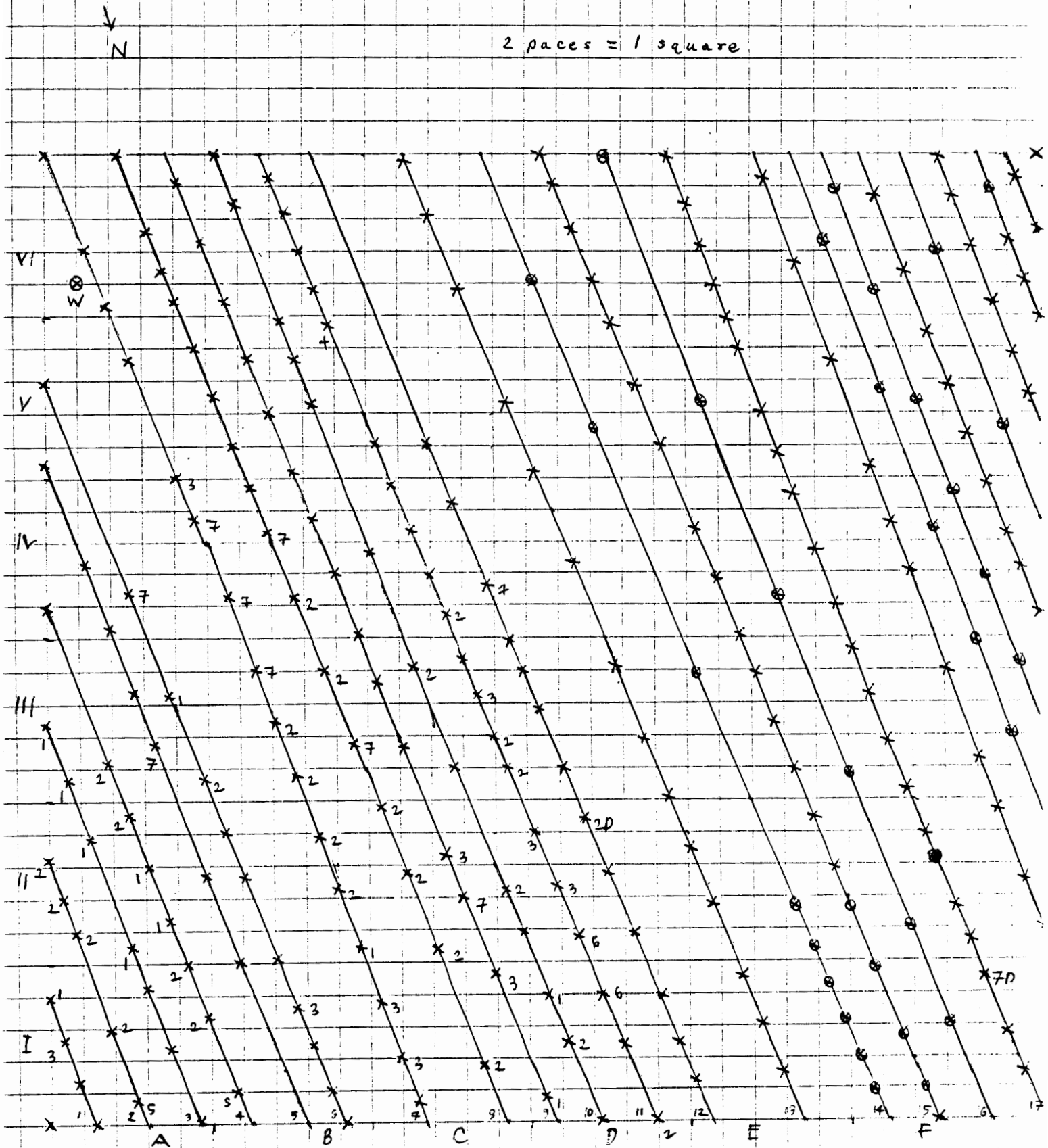
Appendix G: Density, Proportions, and Specific Gravity of Wood (p. 265, The Structure of Wood)

Density (*lbs. per cu. ft.*)	*Proportions* *Wood*	*Air*	*Relative Density* (*Specific Gravity*)
1	0·011	0·989	0·016
10	0·105	0·895	0·160
20	0·210	0·790	0·320
30	0·316	0·684	0·481
40	0·421	0·579	0·640
50	0·526	0·474	0·801
60	0·631	0·369	0·962
62·4 (*Water*)	—	—	1·000
70	0·737	0·263	1·121
80	0·842	0·158	1·282
90	0·945	0·055	1·444
95·35	1·000	0·000	1·528

Since the density of wood is an indication of the amount of wood substance contained in unit volume, it might appear that density should be a guide to the general strength of a timber, and it is well-established that this is so. It has been stated, indeed, that where the average density and strength values for a species are known, the density of a given clear specimen may be a better indication of its strength properties than strength tests. Some strength properties, like stiffness, vary almost directly with density, while for others the relation is less direct; toughness, for example, varies almost as the square of the density. Dadswell and Nicholls (1959) found that in Pinus elliottii var. elliottiii specific gravity (i.e. relative density) was a good index of average cell wall thickness, this latter being related, in its turn, to the proportion of late wood present in the rings. It was found that specific gravity increased in successive rings from the pith, becoming fairly constant from about the 15th ring outwards, although the specific gravity of the early wood tended to decrease from the pith outwards and that of the late wood to remain more or less constant...We have seen (p.200) that juvenile wood has less dense late wood than does mature wood, and that this late wood forms a smaller proportion of the growth ring, so that these results are what might be expected. (p. 265)

APPENDIX I

MAP OF RED PINE AND EASTERN WHITE PINE STAND IN WEBSTER PARK



KEY: DAMAGE TYPE

Species
× red pine
⊗ Eastern white pine
• paper birch

1 uprooted
2 > 50% crown off
3 < 50% crown off
4 split trunk
5 broken off branches
6 twigs fresh needles (surrounding)
7 leaning

Nature, and pruning, can work wonders

By STEPHEN LOWE
Times-Union

Don't despair.

While the ice storm damaged untold thousands of trees in the Rochester area, experts say many can be salvaged.

"Damaged trees can thrive," said Daniel Marion, a Canandaigua tree pathologist. "If properly cared for, you're on the road to rebuilding health."

Proper pruning can help prevent the onset of deadly diseases. And with time, many trees will rebound with new growth.

"Nature is a funny thing and anything can happen," said Chuck Crandall, a certified arborist with Crandall Tree & Landscaping Service Inc. "Let the tree take its course and see what happens."

As spring and summer come, dormant buds will start growing.

"They'll pop out all over," said Robert Morrison, a regional forester with the Department of Environmental Conservation. "The trees will fill out again."

Still, trees that lost a large portion of their limbs may struggle to survive. Along with the roots, the crown of leaves feeds a tree and provides energy to heal wounds.

"When a tree loses its crown, you're taking away its source of energy," said Andy Pleninger, a city forestry assistant.

As a rule, arborists say a tree that has lost much more than 50 percent of its crown will be malnourished and may die.

Pleninger estimates that up to 50 percent of city-owned trees between sidewalks and streets may die.

But pruning can help many battered trees recover.

Experts stress that people need to be careful when pruning dangling limbs.

"Our concern is people who don't know what they're doing," said Terry Gifford, executive director of the Cornell Cooperative Extension-Monroe County. "It really can be a dangerous situation."

Improper pruning can damage a tree.

"You don't want to cut too close and you don't want to leave a stub," said Mark Keister, a regional DEC forester.

After pruning, callouses eventually will grow over the wounds, protecting the tree.

Open wounds from snapped off limbs provide an easy entrance route for disease.

"Trees that had the tops snapped off almost are certainly to get heart-rot decay," Keister said.

Diseases can take from a few years to 20 or more before a tree finally dies or weakened limbs break off.

Wounds also provide openings for voracious insects. "There are many types of wood borers that will jump at the opportunity," Keister said.

Trees already stressed by disease or poor growing conditions will be less likely to survive. And a late frost or hot, dry summer will knock out more trees.

Growing conditions, such as soil and nutrition, play the most important role in recovery, much more than species type, said Nina Bassuk, director of the Urban Horticulture Institute at Cornell University.

"The major thing is how well it's growing and how well the environment is," she said.

Many trees will survive by drawing on their energy reserves. "They may be able to live on carbohydrates for several years," said Terry Ettinger, a Cornell University cooperative extension agent. "Before you eliminate a tree, have a professional arborist look at it."

TIPS ON CARING FOR DAMAGED TREES

☐ **The uncrowned:** Trees that lost much more than 50 percent of their crown of leaves could die and may have to be removed.

☐ **Pruning:** Prune damaged trees to help prevent disease. A tree limb should be cut just above the "collar," a swelling where the limb joins the trunk. While some trees normally are best to prune in the spring and others in the summer, experts said severely damaged trees should be pruned soon regardless.

When cutting off a damaged limb, make a cut first on the bottom side of the limb so that when it gives way it won't peel bark down the trunk and make the tree even more susceptible to infection.

☐ **Consider a pro:** Experts advise that people consider hiring professional arborists because pruning can be difficult, even dangerous. Professionals also offer another advantage: They can appraise tree damage, which may be tax deductible.

☐ **Bad goo:** Arborists strongly advise against applying asphalt-based dressings to open wounds because they may inhibit healing.

☐ **Good shellac:** Some arborists recommend applying "orange shellac" to wounds to prevent the spread of disease.

Shellac kills fungi and will break down over the summer, said Chuck Crandall, an arborist.

☐ **Watch the sap:** People should closely examine their trees for sap flows that give away hairline cracks. Cracked limbs should be cut off. People also should look for swelling around the base, a sign that roots may have broken. If roots are broken, the tree will probably die.

☐ **Fertilize, carefully:** Many arborists suggest applying liquid fertilizer in the spring to help generate new growth. But people should be careful not to apply too much fertilizer, which could cause rapid growth and weaken a tree. The amount of fertilizer depends on the tree and growing conditions.

☐ **Water:** Damaged trees will need plenty, especially if summer is dry.

County rejects plan to compost storm debris

By BLAIR CLAFLIN
Times-Union

THE ICE STORM OF '91

How much wood would Monroe County have to compost if the county would compost wood?

Too much, according to administration officials, who are dismissing a Republican call to leave all of the debris from last week's storm in piles across the county so it could decompose naturally.

"Nobody wants to burn it," said County Solid Waste Administrator Paul Wendelgass, who said composting the wood could take two or three years. "But we just don't have a place to compost it all."

Armed with a plan they say is endorsed by gardening experts and radio garden personalities Doc and Katie Abraham, Legislators Peter N. McCann, R-Parma, and Dale E. Rath, R-Sweden, yesterday said composting would be better for the environment.

"What's a couple of years?" asked McCann, who figures a system of piles would allow the debris to break down naturally into a soil product that could be placed on fields or gardens.

The two legislators said they were moved to action by Jim McGowen, a landscaper and owner and developer of Buttonwood Golf Course, who has successfully composted large quantities of tree limbs in recent years at his golf course.

The problem, according to Wendelgass, is the amount of wood debris the storm left.

By now you may have heard the analogies made by officials: the estimated 5 to 6 million cubic yards of wood debris generated by the storm could fill the War Memorial 50 times or is equal to five times what county residents typically send to a landfill in a year.

Wendelgass said that's too much for composting. He said the county would be left with massive piles of wood that would take two to three years to break down.

He said the county processing centers are already overwhelmed trying to turn as much wood as possible into chips that will eventually be used as mulch in county, city and town parks, and perhaps private landscaping.

But McCann insists there is enough public property in the county to absorb all of the wood after it's picked through by residents who want larger pieces for firewood.

Wendelgass said it can be costly to handle the composted piles, which must be turned regularly.

Rath said maintenance would be minimal, because the waste is all wood. It wouldn't take the constant turning that mixed waste composting requires.

Some burning has already started.

Wendelgass said Gates is burning some of the wood debris it collected and, because the debris is wet, the burning is causing a lot of smoke.

He said county officials are looking at some way to inject oxygen into the burning process to produce more heat and less smoke.

In addition, county officials have had preliminary discussions with Eastman Kodak Co. about using its incinerator for the wastes, which would allow burning at an even higher temperature.

Residents want dialogue on composting proposal

By James Gertner
Publisher

3/13/91
Webster Herald

Opponents to the plans for a village composting project are not satisfied that latest efforts by the municipality alleviate their concerns.

They want the town board to help.

Gary Linn, 1258 Stafford Crescent, spokesperson for what he called a large group of neighbors of the village wastewater treatment plant, made a plea to the town board last Thursday to work with them in asking the village to pursue alternatives to the static pile composting planned at the plant.

Linn said the group's concerns continue despite the village board action two weeks ago moving the site of the pile out of the floodplain and away from Mill Creek.

"We are concerned for the potential of odors, environmental risks to Mill Creek, noise and traffic," Linn told the board. "We are not opposed to the concept of composting, but we are opposed to the location."

Linn asked the board to suggest a workshop between officials in the town and the village and neighbors to "search for alternatives."

He said the group considers location of the composting facility at the town's Phillips Road wasterwater treatment plant "reasonable and logical."

Board members told Linn and another 10 neighbors in attendence their argument was misdirected.

"We have met with the village several times," Supervisor Adrian Stanton said. "The town was offered an opportunity to have a joint composting facility but declined to participate. I do not see the town renting, leasing or selling land to another municipality for an operation we are not interested in being involved in," he said.

Stanton said responsibility for review of the environmental concerns rest with the state Department of Conservation.

"The DEC will look at the village's application in excruciating detail," he

(continued on page 2)

Compost

(continued from page 1)

said.

Linn said the group was planning a rebuttal of the village's application and Environmental Assessment Form to DEC, but still pressed the board to open up a dialogue between the municipalities and the neighbors, who are town residents.

"They believe they are responding to concerned residents, but they are not," Linn said of the village's alternate plan. "We want some pressure placed on them to be really good neighbors."

"We've already told them it's a poor place to put it," board member Robert Hanloff said.

"If this was my project, I wouldn't do it," Stanton said. "We don't have the power to tell them thay can't do that on their property. We will make sure all the (approval) processes are followed," he said.

The village's plan is to resume the mixing of processed residue from the treatment plant with leaves. A similar