Soil Deposition of Road Salt on City Trees in Highland Park, IL

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Abstract/Summary

The focus of this study was to determine the impact of road salt (NaCl) deposition in soils on tree health with respect to distance from the street. It was hypothesized that higher amounts of salt would be found in soils closer to the street, with decreasing concentrations at increasing distances from the roadway. The study streets were of similar layout and length, all located in the city of Highland Park, IL. Rice Street, Ivy Lane and Delta Avenue were chosen for their similarities, and data including health and location was collected from the City of Highland Park Forestry Department for roadside trees within the city's right-of-way. Soil samples were then collected along a gradient for each street, and tested for salinity. These results showed the spatial distribution of salt along the roadsides, and were used for comparison with relative tree health. Analysis of overall trends showed that while salt concentrations were higher at the curb that at 25' from the curb, the highest average concentrations were observed at 12.5' from the curb. Because sidewalks on each street were located roughly 12' from the curb, the increased amounts are likely due to private application. Increased levels were also observed where samples were collected along or near private driveways, again pointing to private applications. While excessive levels (above 400 ppm) were only occasionally observed, no point-source of deposition can be determined, although it is clear that private land-owners and city officials are each partly responsible. Furthermore, it is important to educate the public about the effects of NaCl and other deicers. Encouraging home and business owners to manually remove snow and use road salt in moderation may also prevent excessive accumulation and damage to vegetation.

Background Information / Literature Review

Application of deicers

Each year, cities around the world apply deicers to roadways in an effort to minimize ice and snow buildup. Individual counties and townships strive to provide the maximum amount of road clearance as possible with the funds they have available. Cities with higher taxes, and thus more funds available to public services, have the most salt available of use during winter months. These cities, such as Highland Park, IL, plow and salt every public street after each significant snowstorm. The Streets Department of Highland Park is responsible for snow removal, and according to the City of Highland Park, "Under normal conditions all streets are plowed at least once within the first 6 hours of a 3-inch snowfall" (www.cityhpil.com).

While deicers can be helpful to mitigate snow, they also have the potential to negatively impact roadside vegetation. Understanding both how road salt enters soil and how roadside vegetation is affected is essential for protecting our natural systems. Carefully managing their use is important in order to minimize the impact on plants in roadside environments. The aim of this project is to determine the effects of soil salt concentrations on trees in the upper-class neighborhoods of Highland Park, IL.

As soon as snow begins to accumulate on the frozen ground, public service employees and property owners start to clear it away. Shovels and plows are the primary mechanism used to remove snow from paved or cemented surfaces, but are almost always followed by an application of road salt or sand. Sand is used as an alternative to salt, as it has fewer negative effects and provides a longer-lasting traction. SAE Airline Company has set snow-control standards for their runways, and says that "…sand has been used typically to improve the frictional properties of runway, taxiway and ramp surfaces for aircraft braking purposes, but usage is not limited to such applications."

The amount of road salt applied by a city depends on amount of snowfall, and the cost and availability of NaCl. The Illinois Department of Transportation uses on average 140,000 tons of road salt each winter. It is estimated that up to 280,000 tons are applied in addition to this by county and municipal use (Lake County Health Department, 2008). If more road salt is needed than has been purchased in preparation, the city council must meet to decide how much more is needed, as well as logistics as to price and availability.

Salt is used in response to snow storm events, and more is applied when temperatures fluctuate above and below freezing. Because Highland Park is located along the shore of Lake Michigan, it is subject to lake effect snows. The Department of Commerce and Economic Opportunity reports an average annual winter temperature of 28 degrees Fahrenheit (-2.2 degrees Celsius), and an average annual snowfall of 36 inches (91.44cm) (DCEO, 2007). Temperatures are variable from day to day, and the amount of salt applied by individual landowners and city workers can vary from year to year. De-icers work by lowering the freezing point of water to a point dependent on the concentration. For example, a concentration of 23.3% NaCl freezes at -60ºF while a solution with 29.8% CaCl freezes at -67ºF (Anderson et al. 1996).

Individual preference and relative cost dictate how much a homeowner will apply to their driveway or sidewalk, and many apply it as a precaution before an expected snowstorm. A study conducted by the Wisconsin Department of Natural Resources reported that "salt concentrations in Wisconsin's surface and groundwater have increased since the early 1060's," but no signs of an effect has been noted on aquatic wildlife. Drinking water is also monitored by the WDNR, and has been found to be within safe limits, with the exception of instances in which storage facilities have seeped due to poor management and/or construction. Wisconsin state law requires highway agencies to keep road salt supply in a "covered, waterproof structure," (Road Management Journal, 2008).

Methods and concentrations used for application vary between locations depending on factors such as climate, winter precipitation, surface temperature, time, and chemicals used (Anderson et al. 1996). While each storm is unique, applying a single standard for application in all conditions is inappropriate. Thus, depending on conditions, between 100 and 300 pounds of sodium chloride is applied per single lane mile (WDNR, 2008). If ground surface temperatures are above freezing, little or no accumulation will take place and less salt will be necessary. However, lower temperatures require more deicer, and will take much longer to remove ice or snow.

Chemicals commonly used and their origins

Many chemicals exist for the purpose of preventing or removing ice, and these chemicals are often mixed and used together. Chemicals used as deicers are usually harvested from mines and treated before they are made available for use. Sodium Chloride usually comes from "mined rock salt that has been crushed, screened, and treated with an anti-caking agent." Calcium chloride is derived from natural brines, and resembles dry flakes or pellets compared to sodium chloride's crystal-granule shape (Road Management Journal, 2008). Although the primary source of sodium in roadside environments is of anthropogenic decent, it is important to note that it is naturally present in trace amounts.

Table 1: Advantages and Disadvantages of Common Chemical De-icers

Common chemicals for de-icing	**Lowest effective temperature**	**Damage to plants**	**Soil damage**	**Water pollutant**	**Damage to concrete/metals**
Sodium Chloride	+15˚	High	High	Yes	Yes
Calcium chloride	-20˚F	Medium	Medium	Yes	Yes
Calcium magnesium acetate	+15˚F	Low	Low	No	No
Urea	+15˚F	Medium	Low	Yes	No

(Derived from the 2008 Journal of Horticulture)

The most common de-icer used is sodium chloride, or common road salt. Some alternatives include calcium chloride, calcium magnesium acetate, and urea. As can be seen in Table 1, each chemical deicer has positive and negative factors associated with it. For example, calcium chloride's lowest effective temperature makes it much more effective during severe storms or in locations with very cold winter climates. When temperatures drop below 0˚ Fahrenheit, calcium chloride is used as it decreases the freezing point of water more than sodium chloride (Table 1). This chemical is also less damaging to plants and soils, which is important in heavily vegetated or sensitive communities. However, CaCl is also much more expensive and requires careful handling. The MSDS Material Safety Data Sheet advises: "Keep in a cool, tightly closed container, stored in a cool, dry, ventilated area. Protect against physical damage. Moist Calcium chloride and concentrated solutions can corrode steel. When exposed to the atmosphere, Calcium chloride will absorb water and form a solution" (MSDS, 1999). The handling requirements of this de-icer make it less appealing for both public and private use.

Sodium chloride is relatively inexpensive, and is very effective at temperatures above 15˚F (Table 1). Because of its granular shape, NaCl provides traction as it dissolves into a brine solution. Sodium chloride is known to become airborne and "burn" roadside vegetation. The accumulation of this chemical may have detrimental effects on nearby soil, much more so than other commonly used deicers. However, because of its low cost, availability, and applicability to most environments, NaCl remains the most commonly used deicer. Common road salt is easier to store and manage than other chemicals, as it does not clump when exposed to moisture.

Calcium chloride costs on average $130/ton, compared to $50/ton for sodium chloride. While it is more costly, much less is required to be effective at very low temperatures, and has fewer detrimental effects on the environment. CaCl gives off an intense heat when dissolved into a brine solution, drawing in atmospheric moisture to provide water for the process to initiate, accounting for its ability to melt ice quickly without much moisture. Unfortunately, these characteristics that make the chemical useful also require it to be stored in waterproof bags and kept away from moisture until its use. Storage problems often occur when moisture is present, causing the chemical to harden into large chunks. To balance the costs and benefits of this chemical, it is commonly mixed with sodium chloride, allowing it to initiate the melting process (Road Management Journal, 2008).

Calcium magnesium acetate (CMA) is a mixture of dolomic lime and acetic acid. In its solid form, this chemical resembles common road salt, but is also available in liquid form. CMA may also be made from cheese whey; it has even been suggested that this derivative may be better at penetrating ice. While calcium magnesium acetate is expensive, the chart indicates that it has low corrosion rates on metal and concrete structures. CMA also has a very low toxicity, and is biodegradable. Because this chemical adheres to surfaces for longer than others, fewer applications are needed for the same results. The versatility of the chemical allows it to be used alone as a solid or liquid, or mixed with sand or another chemical (Lake County Health Department, 2008).

Urea is a deicing chemical that is very useful for temperatures above 15˚F, but has potentially detrimental effects on the environment. A product of the degradation of Urea is ammonia, which is highly toxic to aquatic organisms. Urea is approximately 46% nitrogen, and is commonly used in household fertilizers (Chemical Solutions, Inc., 2005). As a source for nitrogen, urea can also lead to anthropogenic eutrophication in water systems as it accelerates the formation of algal blooms. These blooms can cut off the oxygen supply available to aquatic animals, causing them further stress. Because deicing chemicals become dissolved in runoff water and carried to waterways, Urea use is kept to a minimum (Pro-Act, 1995).

How sodium enters soils

Salt enters soils in a variety of ways, some of which are caused by natural processes, while others are of anthropogenic decent. Even when carefully applied, salt enters soil through salt spray, plowed salt/slush mixtures over curbs or into piles, over-application, or as runoff from roads. Salt spray results from dry salt on a street becoming crushed and airborne due to traffic. Sodium naturally enters soils through precipitation, as water droplets capture airborne particulates as they pass through the atmosphere. Some studies in the Great Lakes Region of the U.S. have shown that rainfall naturally delivers on average 20 lbs/acre of sodium chloride each year (Button, 1964).

In suburban cities, such as those near Chicago, residents generally use lawn-care services and sprinkler irrigation systems. Water is pumped from Lake Michigan, is treated at the local water treatment facility, then travels through a network of pipes and eventually soaks the lawns of thousands of single-family homes. However, even treated tap water contains small amounts of salts. Over time, poorly managed irrigation may lead to salt accumulation in the soil and have an effect on soil quality and the health of vegetation (Koç, 2008).

While irrigation can lead to salt accumulation over a period of several years or even decades, direct application of NaCl as a deicer requires much less time to build up, and usually does so in much larger quantities. Previous research indicates that damage to vegetation and roadside structures occurs within 60 feet of the road and is greatest close to the pavement (Anderson et al. 1996). Analyzing salt concentrations in soil offers an indication of how much is leaving the road surfaces and entering our environmental systems.

Salt spray largely affects the aboveground portion of trees; the effect can resemble “burning” on leaves and leaf buds, as well as a white powder on the leaf surface. Deposition of sodium from traffic “splash” accounts for the majority of damage below ground. In a study by Pedersen (2000), salt concentrations in planted median strips were 20 to 100 times as higher than sodium chloride in natural forest conditions. It was also noted “though the concentrations peaked in the salt application period during winter dormancy, the concentrations remained high during the period of growth.” These findings indicate that winter salt application has a lasting effect on soil conditions and tree health.

Salts build up over time on the soil surface, and may remain there until temperatures rise above the freezing point. Upon snowmelt, the saltwater can infiltrate the soil and becomes deposited in the upper layer. This process continues throughout the dormant period of winter, hence the increased levels of salt recorded during the summer in other studies.

Sodium and plant growth

Numerous studies have been conducted worldwide regarding the effect of salt use on roadside vegetation. Some plants exhibit a tolerance to salt, while others are extremely susceptible. Because many invasive species are more tolerant to stresses such as salt, it is important to understand variability in plant tolerance to salt in order to best manage roadside vegetation.

Research has indicated that some plants grow better with low amounts of sodium available; usually in these cases the sodium seems to carry out some of the functions usually taken on by potassium (Button, 1964). Potassium is a vital nutrient for plants, aiding in drought resistance, root and stalk growth, and regulating the opening and closing of stomata. It is also the "seventh most abundant element in the Earth's crust," and commonly added to fertilizers, unlike NaCl (CFAITC, 2008).

An early study was conducted in 1985 which found that yield response to sodium was only obtained while potassium levels were low. Similarly, in 1908, it was discovered that if potassium supply was optimal, then sodium decreased the absorption of potassium and resulted no increase in plant growth (Button, 1964). Thus in trace amounts, and depending on the availability of other nutrients, sodium chloride certainly is capable of having a positive effect on some plants. However, the accumulation of salts in any soil may be more harmful than helpful.

Salt accumulation in plants is primarily due to the absorption of a saltwater solution in soils. In the soil, sodium depresses nutrient absorption of potassium, calcium and magnesium by displacing them. Excessive sodium concentration in soil causes aggregates to break apart. The result is poorly aerated soil with low water permeability (Clatterbuck, 2003). The product is a soil in which drainage and aeration is poor, which affects the ability of roots to absorb moisture. In fact if soil salt content is high enough, water can actually be pulled osmotically from plant cells into the soil. This level is variable among plants depending on their salt tolerance.

Flowering trees are the most vulnerable to salt stress, as the delicate buds are sensitive and injured buds are slow to open or do not do so at all (Clatterbuck, 2003). Other symptoms may include a reduced green coloration in leaves, commonly associated and often mistaken for chlorosis. Reduced coloration indicates an influence on net photosynthesis. In Cornelius' 1980 study, *Acer pseudoplatanus*, *Tilia cordata* and *Pinus sylvestris* were contaminated with 159g of NaCl/m² during winter dormancy. While the influence on the amount of reduced photosynthesis varied between species, all were affected. Reduced rates of photosynthesis were indicated by varying degrees of discoloration, and were most apparent in *A. pseudoplatanus*.

Evergreens are not typically planted in the right-of-way in urban areas as they are much more susceptible to salt damage than deciduous trees. Part of the reason lies in the fact that evergreens do not drop their leaves annually. Damage to needles is thus more long lasting. Many coniferous trees spread out shallow roots where soil moisture is more readily available. Unfortunately, salt deposits will collect in the topsoil horizon, potentially damaging these roots.

In a study conducted by the University of Tennessee Agricultural Extension Service in 2003, trees exhibiting salt stress had "smaller leaves with scorched margins, thin crowns with dying twigs and branches, early fall coloration and leaf fall, tufting and clumping of foliage and sparseness of leaves, and small growth rings. The irregularity of foliage thickness from year to year reflects both the growth conditions and differences in the amount of injury each year.

Table 2 indicates the relative salt tolerance of trees and shrubs often observed within the right-of-way in Highland Park, IL. Other susceptible species include Red and Sugar maple, Serviceberry, American hornbeam, Hawthorn, Beech, and Yellow poplar (University of Tennessee Agricultural Extension Service, 2003). Individual tree tolerance to salt varies depending on size, health, and environmental conditions such as soil quality.

Table 2: Salt Tolerance of Trees and Shrubs

Salt Tolerance (ppm)	Trees & Shrubs
Very High (12,800)	
High (10,240)	Siberian salt tree, Sea buckthorn, Silver buffaloberry
Moderate/High (5,120)	Hawthorn, Russian olive, American elm, Siberian elm, Villosa lilac, Laurel leaf willow
Moderate (3,840)	Ponderosa pine, apple, Mountain ash
Moderate/Low (2,560)	Common lilac, Siberian crabapple, Manitoba maple, Viburnum
Low (1,280)	Colorado blue spruce, Rose, Douglasfir, Balsam fir
Trace (640)	Cottonwood, Aspen, Birch, Raspberry
None (0)	Black walnut, Dogwood, Little-leaved linden, Winged euonymus, Spirea, Larch

(Chart derived from Department of Agriculture and Rural Development)

Purpose of the study

This study aims to determining the effect of sodium chloride soil concentrations on tree health in Highland Park, IL. The city of Highland Park is located north of Chicago along the shores of Lake Michigan. The topography of this area is unique due to the influence of the glaciers which formed the lake and shaped the land around it. Ravines dominate this community, and runoff from roadways becomes a major contributor to water pollution. Because Highland Park is both densely forested and heavily salted, it is an ideal location to study the effects of road salt on vegetation.

The Highland Park Forestry Department plants a variety of tree species and varieties, all of which have different degrees of susceptibility to salt damage. The city was recently dubbed “crabapple city, USA,” commemorating the plethora of *Malus* species bordering neighborhood streets. Because these trees are not very tolerant to the accumulation of salt, understanding how we are impacting these trees in particular will aid in selecting appropriate varieties and road salt management processes.

Understanding how tree health is affected by road salt with relation to distance from the street will aid in the management of salt use in the city. Patterns found can be used to establish appropriate methods and concentrations for de-icing roadways in various locations.

It is predicted that, where road salt concentrations are high in soils, trees will exhibit symptoms of stress and increased susceptibility to invasive insects and disease. Therefore, is it expected that if sodium chloride concentrations are highest near the street, then more of the trees which are dead, removed, or in poor condition will also be observed closer to the street, while fewer will be impacted at increasing distances.

Experimental Design (Materials & Methods)

This study searches for patterns in tree health and salt concentrations in soil with relation to planting distance from the street in Highland Park, IL. Data was collected for the Right-of-Way of three streets (city-owned property bordering streets, usually 33' from the centerline. Data collected includes specie and condition of trees (based on the system used by the Highland Park Forestry Department. Information was also collected on salt use in Highland Park.

Similar streets were chosen in Highland Park, IL based on factors such as location, speed limit, and recentness of inventory. Only streets that were inventoried in the same year of the study were included, assuring that all retrieved information was equally up-to-date. Secondly, roads were chosen which were of similar length and shared similar features, such as spacing of houses, road width, and dead ends. Each of these factors may have an influence on the distribution of road salt; limiting any large differences between sites minimizes the margin of error such factors may cause. A total of 3 streets were chosen in Highland Park: Delta Road, Ivy Lane and Rice Street.

Information pertaining to salt use in Highland Park was collected including amounts and types of de-icers used and any regulations that may relate to the experiment. Records were gathered from the Highland Park Forestry Dept for chosen city streets regarding trees removed and their locations, tree species, size, and most recently recorded condition.

Tree data was collected during the summer of 2008, and was therefore the most current information available. Tree health reflects the current condition of each tree, and is recorded as a percent. Any standing tree, dead or alive, receives 10%. A condition of 100% represents a "perfect" tree with no lean, broken or dead branches, leaf discoloration, lawnmower blight, disease or infestation. Most healthy trees receive a rating between 80 and 90%.

Figure 1: Study Street Gradient

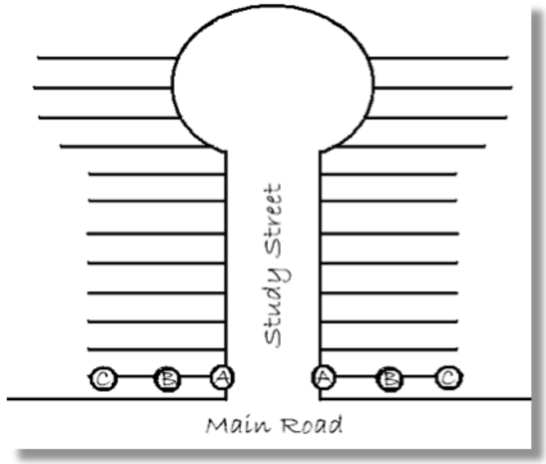


Figure 1 indicates how samples of soil were collected in every 30 feet, in 12.5 feet increments from the curb, for 25 feet. This was completed by first measuring a string to a length of 30’, and then securing flagged stakes at appropriate increments from the curb. The string was used to measure both distance between points and distance to each sample location from the street. Adjustments were made for increments between points for longer streets, increasing to 60’ between each point. If a sample could not be taken within 1.5’ of target point (due to a large paved area or other impervious surface), the results were omitted.

Salinity for each soil sample was determined using a Kelway SST electrical conductivity tester according to provided instructions. Results were compared to respective tree health and observed for correlation with distance from street. Data collected pertaining to trees removed from each street was also compared for correlation with soil salinity.

Results

Figure 2:

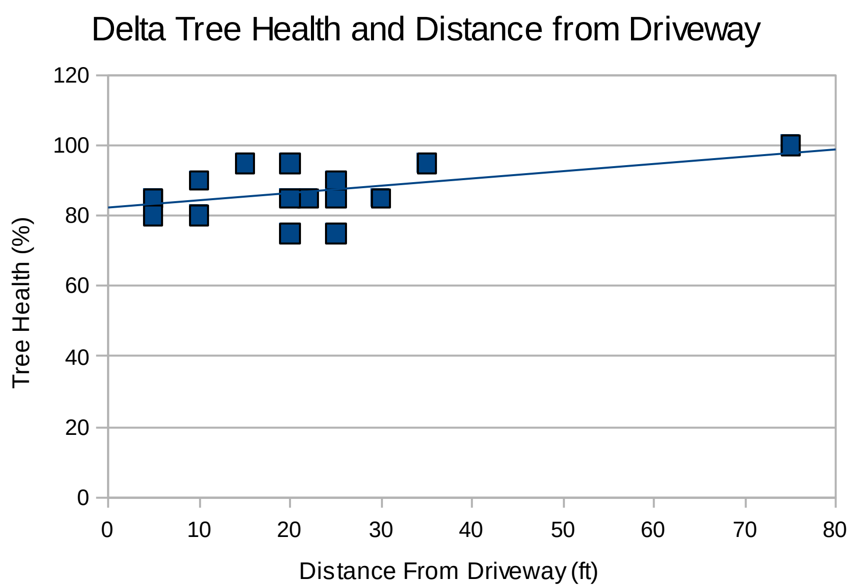


Figure 3:

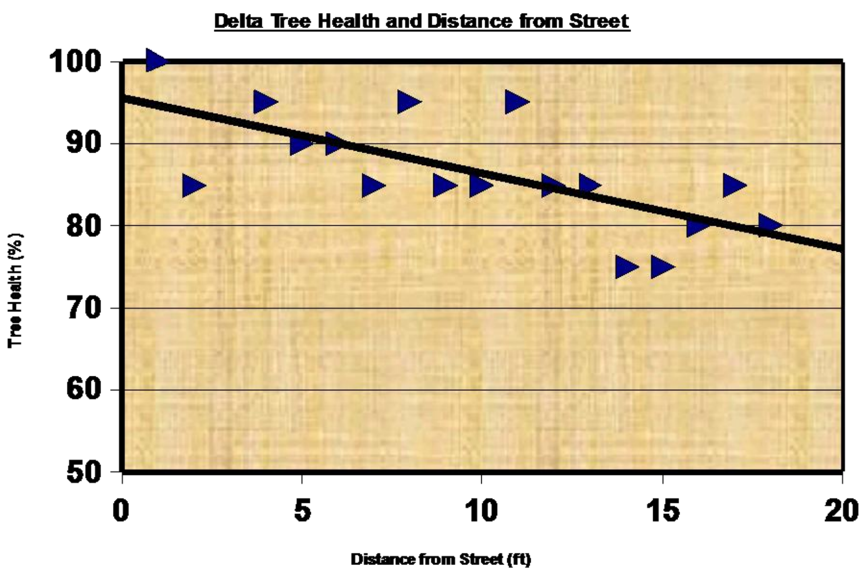


Figure 4:

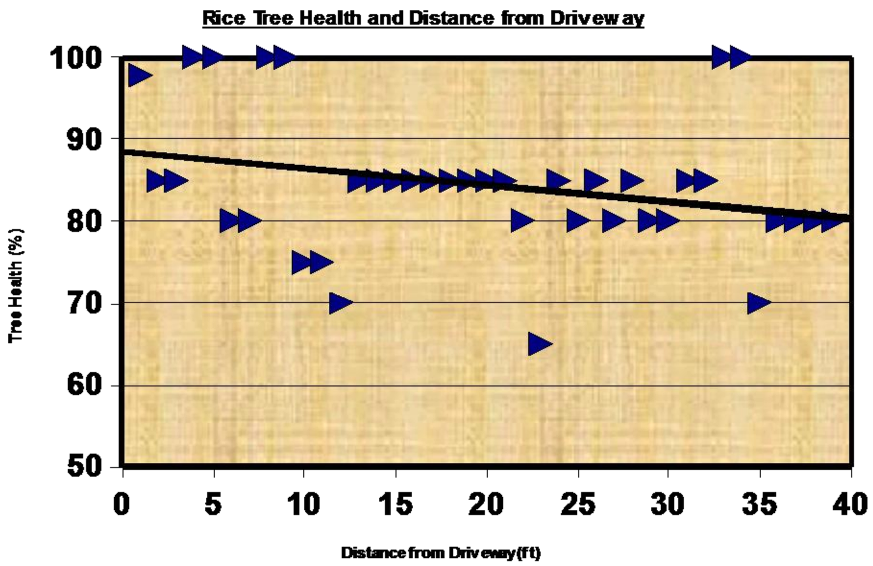


Figure5:

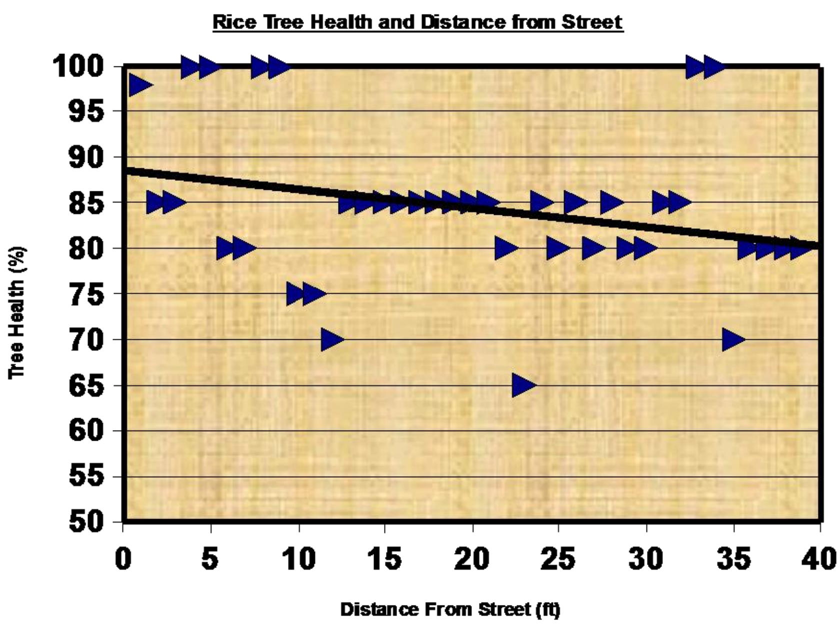


Figure 6:

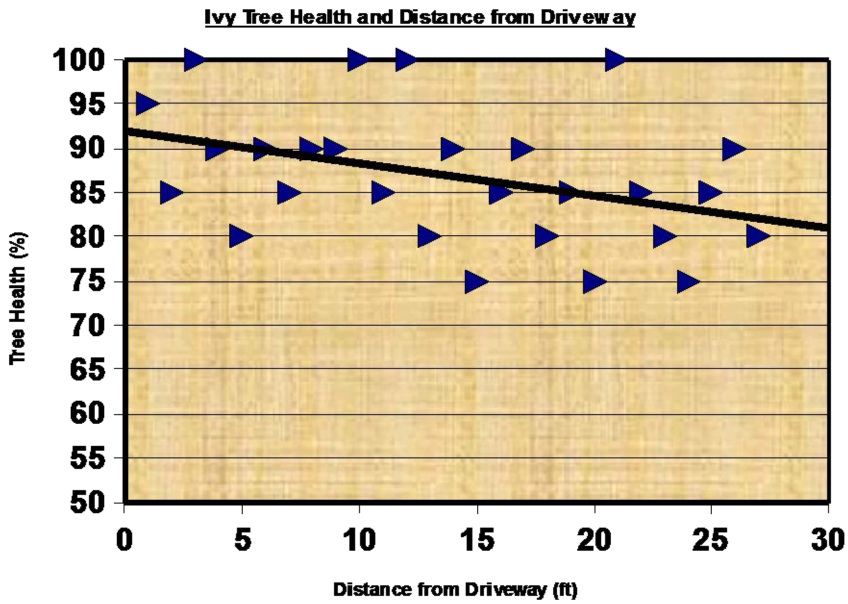
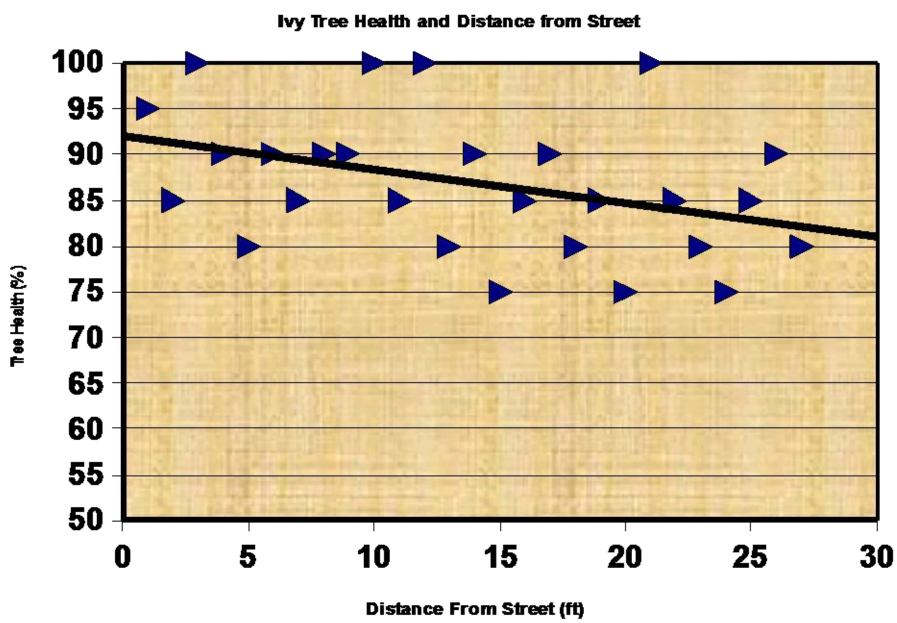


Figure 7:



The overall trend of salt concentrations shows that, as distance from the street increases, tree health does not improve (Tables 3-7). Comparing the average salt concentrations with average health of trees allows for analysis of the impact of NaCl on these values. High concentrations of salt were found mostly along the street and near private driveways. However, when directly comparing tree health with distance from the street or driveways, it appears that trees are generally in better condition along the roadway. The only exception seen is in comparing tree health with distance from driveways on Delta Ave. However, this may be due to one outlier and therefore is not considered heavily in the results. While this visualization of results does not support my hypothesis, the trend seen is likely contributed to roadside tree maintenance and the replanting of trees ranked less than 50% in health. In other words, the farther back that the tree lies from the public right-of-way, the less of a hazard it is to pedestrians and motor vehicles. These trees may be allowed to lean more than roadside trees or have more broken branches, etc., resulting in a lower health rank. Therefore, considerations must be made for trees removed in the past in order to make more accurate comparisons.

Figure 8:

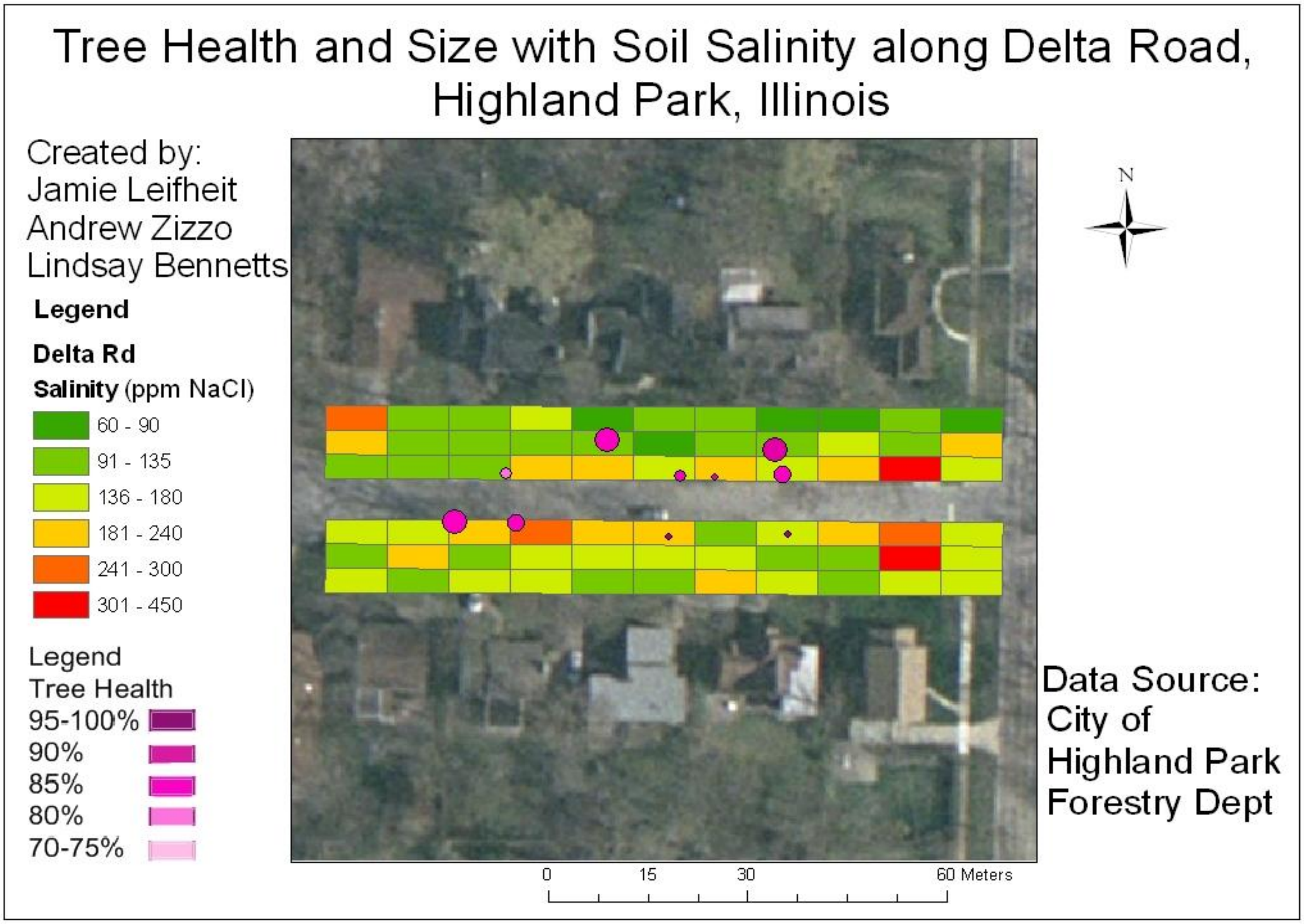

Tree Health and Size with Soil Salinity along Delta Road, Highland Park, Illinois
Created by:
Jamie Leifheit
Andrew Zizzo
Lindsay Bennetts
Legend
Delta Rd
Salinity (ppm NaCl)
60 - 90
91 - 135
136 - 180
181 - 240
241 - 300
301 - 450
Legend
Tree Health
95-100%
90%
85%
80%
70-75%
N
Data Source:
City of
Highland Park
Forestry Dept
0
15
30
60 Meters

Figure 9:

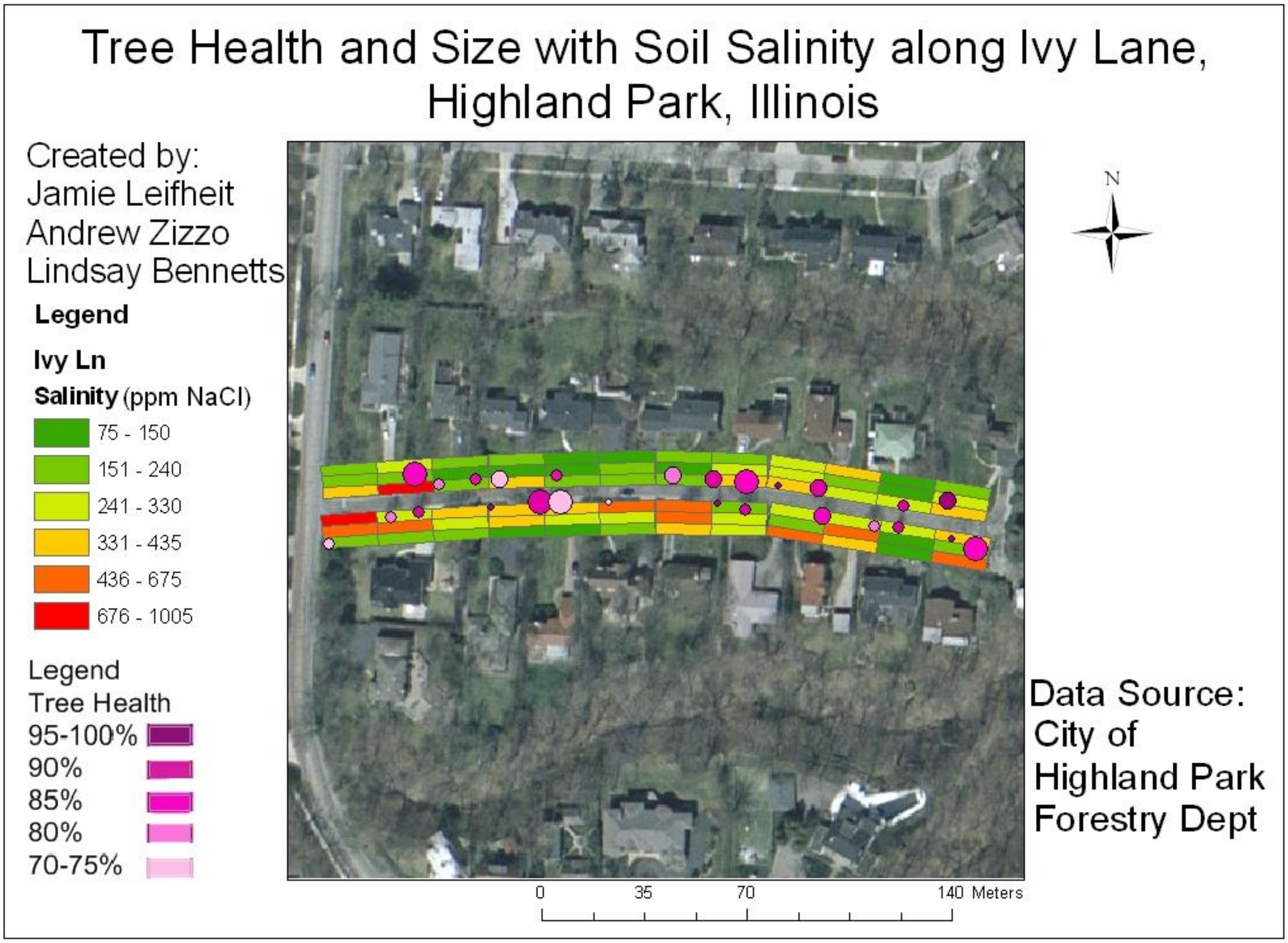
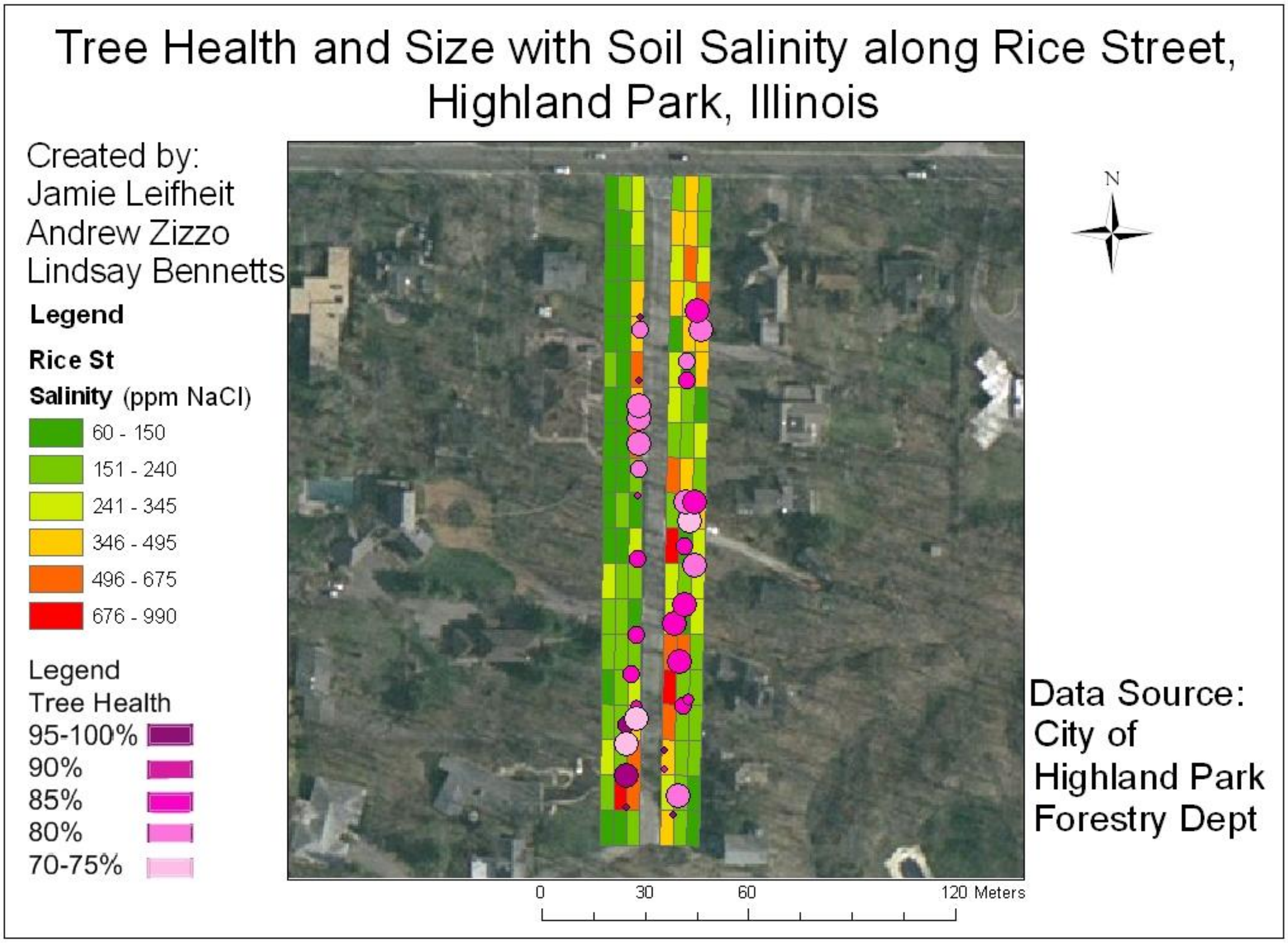

Tree Health and Size with Soil Salinity along Ivy Lane, Highland Park, Illinois
Created by:
Jamie Leifheit
Andrew Zizzo
Lindsay Bennetts
Legend
Ivy Ln
Salinity (ppm NaCl)
75 - 150
151 - 240
241 - 330
331 - 435
436 - 675
676 - 1005
Legend
Tree Health
95-100%
90%
85%
80%
70-75%
N
Data Source: City of Highland Park Forestry Dept
0
35
70
140 Meters

Figure 10:



The included maps showed that, overall, salinity concentrations were highest along the curb of each street. However, values also increased where circular driveways and sidewalks were present. While the tree health values did not clearly exhibit an inverse relationship with salinity levels, it was clear that more small trees were found closer to the street. This signifies recent replacement of a dead, dying or diseased tree, which may be due at least partially to salt stress. Larger trees were observed more in areas with low salinity values, and those seen in areas with high concentrations most likely signify salt-tolerant species

Table 3:

Average Soil Salinity at Increasing Distances From Streets

Street	Avg. Salinity Curb (ppm)	Avg. Salinity 12.5' (ppm)	Avg. Salinity 25' (ppm)
Delta	196	158	141
Rice	381	300	204
Ivy	379	280	241
Total Average	319	246	195

Table 3 shows salinity in parts per million at each distance from the street. It was expected that concentrations would increase close to the curb, and be present in decreasing amounts as distance increases, and the results fit with this hypothesis. This trend indicates that salt from the previous winter is still present in the soil just before the next year's snowfall, and that significant leaching is not occurring. Accumulation of NaCl results from poor drainage, which explains the “cemented” condition of many samples collected along the roadside. As seen in Table 3, salinity decreased with increasing distance from the street, although individual streets varied somewhat in overall NaCl accumulation. Delta's highest average salinity was seen at point A, or the curb, yet was still nearly 200 ppm less than Rice and Ivy at the same locations. This trend is repeated with points B and C, with Delta always having the lowest amount. Ivy and Rice were the most similar in length; they were both longer than Delta and thus more traveled. This explains why somewhat higher concentrations were seen on these streets.

Discussion:

Highland Park Compared to Other Cities

Virtually every urban and suburban (and most rural) cities have winter snow removal programs. However, the amount of financial input depends on taxes paid by home and business owners in the area. Highland Park focuses on the safety and comfort of its residents, and every street is plowed within six hours of a snow storm. The result is clear streets and sidewalks, and happy citizens. But what are the implications for roadside vegetation? De-icers are routinely applied after snow removal, and often in high amounts, as previously discussed. These chemicals can accumulate in the soil, and often have detrimental effects on vegetation.

Highland Park is not alone in this potential problem; many municipalities routinely use several tons of NaCl each winter. More urban cities usually take extra steps to clear the streets, and the salty runoff has fewer places to go. In rural areas, open fields create drift, and streets are more widely distributed, leading to less salt application.

This study is applicable to any other city that receives annual snowfall and uses chemical de-icers to control snow and ice buildup. Repeating this study within Highland Park would allow for a more thorough understanding of the accumulation of salt over time and space. Repeating the study in other cities and regions would allow for comparisons to be made between locations, chemicals and techniques used, and methods resulting in less accumulation.

Importance of Roadside Trees

Perhaps the most common roadside vegetation, aside from grass, are trees. Cities benefit from the aesthetic and functional value of healthy trees. A healthy canopy can lower heating costs, make summer heat more bearable, provide food and shelter for a plethora of organisms, and enhance the beauty and value of properties.

Unhealthy, damaged, or diseased trees can be a financial burden and a potential hazard to persons utilizing the city’s right-of-way adjacent to the street. These trees must be trimmed, treated, or removed, costing the city thousands of dollars each year. For example, the City of Highland Park Forestry Department values a healthy (80%) oak tree with a diameter of 24.5” and an estimated height of 60' at $7299.49. Conversely, an oak with only 60% health, a smaller diameter of 18”, and an shorter height of 45' is valued at just $618.05. The cost to remove a tree varies depending on species, location and size. A large tree may cost more than $1,000 to be carefully removed due to wires, slopes, and other obstacles.

If high amounts of road salt are found in soils bordering private property, it is possible that the City is in fact impacting the health of both public and private vegetation. Steps may be taken, such as lowering winter speed limits or setting restrictions on overall winter salt use.

Minimizing Salt Damage

Salt stress can be minimized in roadside trees in a variety of ways. The simplest way to do so consists of educating private home and business owners, as well as city officials, about the impact of chemical de-icers. Encouraging less use of these chemicals in exchange for manual removal will help to slow NaCl accumulation.

Simply choosing to plant trees that exhibit salt-tolerance is another common approach to the problem of soil salinity. According to a University of Tennessee Agricultural Extension Service, "trees that are relatively tolerant to salt should be planted in locations where salt accumulates in the soil or is sprayed through vehicular traffic near roads." As long as these plant species have proven not to be invasive, planting them can help to stabilize and beautify areas with persistently poor soils due to salinity.

Trees that have been previously injured or affected by salt are also more susceptible to infestations. In fact, "weakened or stressed plants are often attacked by insects and disease" (Clatterbuck, 2003). Retaining soil moisture may be vital for plant recovery, yet may be difficult to do under conditions of high salt content. Maintaining trees near roadways can make recovery from salt stress more likely.

Reducing salt spray is important for protecting trees with thin bark, such as the beech, and with delicate leaf and flower buds. Setting an appropriate winter speed limit is essential for both vehicle safety and minimizing the effects of salt spray. Lower speed limits are safer on winter roads (which allows for less salt usage), and decrease the slush "splash" effect.

Applying gypsum to soils affected by high sodium levels has proven effective in Clatterbuck's 2003 study; "The addition of calcium displaces the soil sodium and lessens the dispersion of soil particles and the loss of soil aggregates, improving soil aeration and drainage." However, the balance between the amount of gypsum applied and levels of salt in the soils is important to consider and may require a professional for application.