Winter 2019

TreeIQ

The Minnesota Tree Inspector Quarterly Newsletter

DEPARTMENT OF NATURAL RESOURCES

Department of FOREST RESOURCES
UNIVERSITY OF MINNESOTA

Table of Contents

Cover photo by Nick Greatens of rust fungi infecting glossy buckthorn, Frangula alnus

Submit photos to treesins@umn.edu

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Tree Inspector Program Survey

University of Minnesota Department of Forest Resources

Every few years, the Tree Inspector education team at the University of Minnesota reaches out to the Tree Inspector community with a program survey. The purpose of the survey is to help keep the training workshops and certification program current and pertinent to the issues that each and every community in Minnesota is addressing.

Although our last survey was conducted in 2016, a lot has impacted urban trees in Minnesota: the further spread of emerald ash borer, bur oak blight, the decline in the health of maples, and the continuing issues with spruce and some of the pines. So it seems like a good time to get your opinions and observations again.

Thanks for helping.

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TreeIQ Featured Tree Inspector, Winter 2019

John Elward

Minneapolis Park and Recreation Board

Interview by Gary Johnson, University of Minnesota, Department of Forest Resources

Our featured Tree Inspector for this cold, snowy, winter issue of the TreeIQ newsletter is John Elward, an arborist and crew leader for the Minneapolis Park and Recreation Board (MPRB), Forestry Department. For almost 20 years (that 20 year anniversary comes up at the 2020 Shade Tree Short Course), John has been a Certified Tree Inspector, first inspired by Rich Hauer and the Tree Inspector training course at that Shade Tree Short Course 20 years ago. A lot has happened since then.

Other than the Tree Inspector Certification, John has accumulated a few other urban forestry "merit badges," including the International Society of Arboriculture Certified Arborist, the Minnesota Pesticide Applicator certification, and the annual ACRT line clearance training. On top of that, John has been a long time member of the Arbor Day Foundation and their associated hazelnut program.

TreeIQ: What first got you interested in trees?

J.E: "Growing up in Chicago, I began my tree climbing career with my brothers and other neighborhood fri-

ends, cutting our teeth on a crabapple tree in the back of my folk's yard. We hiked up and down that tree so much that the bark was literally polished smooth. That's when I decided that being a forester was the life for me." It took some twists and turns before it finally happened, but (spoiler alert), it happened.

Fast forward to 1994 and having decided to move on from a profession in the computer field, John began working as an arborist with Tom Dunlap, a long time professional arborist in the Twin Cities (who ironically finished up his career as an arborist for MPRB). John then worked with Dave Norgaard at Top Notch Tree Care, and finally with Bratt Tree Company where he was mentored by Jon, Stan, Wally, and Carola. That's a pretty intensive training program with some of the finest arborists in Minnesota.

Tree IQ: Why did you leave the private tree care industry for municipal urban forestry?

J.E: "Despite the fact that the work was challenging, engaging, and rewarding, the lure of regular working hours and spending more time with my family brought me to MPRB Forestry in May of 1999." In another irony, John started working the Monday after he volunteered for a MPRB Arbor Day event on the previous Saturday. Since 2006, John has been a crew leader and a self-described "chief agitator" with the Forestry Department.

Tree IQ: After 20+ years, what do you find most rewarding about being a Tree Inspector and an arborist for MPRB?

J.E: "I like talking with people about trees and listening to what they have to say. It's rare when I don't learn something from a client. Another rewarding part is finding a tree in the early stages of Dutch elm disease, cutting out the infected limb, and seeing the tree thrive for many more years."

TreeIQ: I'm thinking that you probably have an opinion or two on the role/s of Tree Inspectors in managing urban forests around Minnesota. How about just one?

J.E: "I have many opinions. One would be that if you actively practice the sanitation program as prescribed by Dr. French (50 years ago), you can effectively control Dutch elm disease. If you give it just lip service and don't follow up on your words, you will lose the resource, and that would be a shame."

TreeIQ: Don't you ever do anything but work on and with trees? There must be another side to John.

J.E: During the rare waking hours when I am not doing tree work I like to hang out with friends and family, and if can get them to go canoeing with me down a river or take a hike, it's even better.

Tree IQ: Since you've been a Tree Inspector for almost 20 years, you must have a story or two that is either funny, scary, or a serious lesson learned. Can you share a good one?

J.E: "There was one time in south Minneapolis when I knocked on a citizen's front door after opening the screen door. The interior door opened with the pressure of my knocking (ruh-roh). Some deep guttural sounds came to my ears as I heard claws looking for "purchase" on the floor inside. I realized there was nothing between me and a very large bull

dog-type creature that was accelerating in my direction. I was on a high porch and as I back-pedaled I found myself with my back to a low wall and the hound was barking ferociously (which my co-workers found humorous). I thought I would have to jump off this porch or become shredded, but...just then a firm command came from someone inside the apartment and the creature miraculously stopped just as it was forcing the screen door open. A few deep breaths later and with more chuckles from the guys in the truck (it was not their flesh on the line) I thanked the hound's owner for having such a well-trained animal and apologized for knocking so hard. She said not to worry! Oh yeah, and then I let her know about the tree issues."

TreeIQ: We all wish we would have done a thing or two (or more) differently, at least career-wise. Anything come to mind?

J.E: If I had a chance to do it over I might go for some more formal forestry education and start in the industry sooner (and stretch more regularly).

TreeIQ: Seems to me you got in the industry at the perfect time…for Minnesota. Everything seems to come in pairs. If you had to name the biggest threat to Minnesota's urban forest and then flip it over and name the greatest strength, what would they be?

J.E: The greatest threat to urban forestry is people not understanding how important trees and green infrastructure is to our well-being on all levels: physically, emotionally and spiritually.

The greatest strength might be the diverse, talented and dedicated people who work with trees.

Peace, John Elward.

TreeIQ: Nice way to end, John.

Nicholas Greatens Talks Emerging Biocontrol For Warding Off Invasive Plant Species in Minnesota

Interview by Ryan Murphy, University of Minnesota, Department of Forest Resources

Generally speaking, us plant folks don't like to hear about rust fungi infecting our beloved photosynthetic cousins… until now. TreeIQ sat down with Nicholas Greatens, a graduate student in the Department of Plant Pathology at the University of Minnesota, to discuss his research exploring whether a newly discovered strain of rust fungus could be used for safe and effective biocontrol of glossy buckthorn and reed canary grass.

Figure 1. Rust fungus on reed canary grass. Photo credit to Nicholas Greatens.

TreeIQ: So I've heard about a rust fungus which infects common buckthorn, maybe you could start by explaining a bit about that, and then how that relates to your current research?

N.G.: That is oat crown rust. Oat crown rust has two different hosts. It lives on oats throughout much of the summer, and once the oat plant starts to senesce, the rust fungus will start to produce overwintering spores called teliospores, which then germinate in the spring to cause infection on common buckthorn (*Rhamnus cathartica*). The rust life cycle is pretty complicated - with five different spore stages. This is a very devastating disease for oats in Minnesota, sometimes causing up to 50% crop loss.

We are working on a related rust also in the crown rust complex. It's called crown rust because the overwintering teliospores look like they're wearing a little crown. For a while, it has been considered one or two species, but in the past 20 years or so, a few new forms have been identified. It's all a bit of mess right now. They're all fairly difficult to differentiate just based on morphology. There are a couple of differences such as size of the teliospores, but without looking at DNA sequences or inoculating the rust onto its host plants, it's difficult to identify.

TreeIQ: So the species of rust you are working with is more recently discovered?

NG: Yeah, about two years ago, my advisor and some other people started to see it widely on glossy buckthorn (*Frangula alnus*).

There are a couple of species of buckthorn. There's common buckthorn, *Rhamnus cathartica*, which is the awful one that you see everywhere in the cities and our forests, and there's also glossy buckthorn, which is actually rated as a worse invasive by the Minnesota Invasive Terrestrial Plants and Pests Center (MITPPC) here at the University of Minnesota. Glossy buckthorn is frequently found in the Great Lakes region and New England. It's a really awful invasive that tends to invade wetlands more than common buckthorn does.

We knew that there were some rust species associated with glossy buckthorn previously, but this one seems to be totally different. It causes much greater infection, to the point where almost all the flowers are infected and can cause pretty severe defoliation—especially in areas where both hosts are abundant.

TreeIQ: Do you think this was some sort of mutation or an introduction of a new rust species?

N.G.: A key region of the rust's DNA suggest it is likely an introduction of a European form of crown rust. A couple of papers out of England also describe a rust with a very similar host range. But we can't yet say definitively.

TreeIQ: So it only severely infects glossy buckthorn, not common buckthorn?

N.G.: It doesn't seem to infect common buckthorn as far as we can tell. We've tried to infect it and it doesn't work. We do have a native buckthorn here in Minnesota, *Rhamnus alnifolia*, but we're not sure if it infects that yet. It does infect a US native buckthorn species called *Frangula caroliniana*, which doesn't grow here in MN.

Figure 2. Glossy buckthorn displaying symptoms of rust infection. Photo credit to Nicholas Greatens.

Figure 3. Reed canary grass infected with rust fungus. Photo credit to Nicholas Greatens.

TreeIQ: So what about the other host for this rust?

N.G.: Reed canary grass is the other host.

TreeIQ: And reed canary grass is a problem species?

N.G.: It's a huge problem – probably one of the worst invasive plants in Minnesota. If you go to some of the wetlands around here, it almost completely dominates them along with glossy buckthorn, cattails and the common reeds.

TreeIQ: So we're just getting lucky and it's infecting two of these really bad invasives?

N.G.: Yeah, it is kind of lucky. Usually, we think of rust diseases as being really harmful to plants and our forests. For example, there is a bad rust disease on white pine (white pine blister rust), *Cronartium ribicola*, which also affects currants. There's other rusts that infect hawthorns pretty severely, apples can get cedar apple rusts, quinces get bad rusts – yeah, there are lots.

TreeIQ: Are you hopeful this rust can be utilized as a potential biocontrol?

N.G.: We're not certain about its biocontrol potential at this point. Certainly this is going to keep infecting these two invasives naturally. It will probably negatively impact both of these plants, especially the glossy buckthorn, since there will be a reduction in seed production.

There is potential though. We don't know this for sure yet, but we think it's somewhat promising for controlling reed canary grass, which is also interesting, because there are very few controls of this grass that we can use right now. The idea is to harvest spores from infected plants, grown in a greenhouse for example, and infect reed canary grass earlier in the season than would normally occur naturally. This could be especially useful when you are trying to ward off reed canary grass in places without a lot of natural infection, for example in an ecological restoration. In that type of situation, you have this invasive grass competing with all the native grasses and wildflowers you just planted, so spraying this rust everywhere and infecting young reed canary grass seedlings could help reduce its competiveness.

TreeIQ: Are you also considering off-target effects such as negative impacts on other species?

N.G.: We are looking at a lot of native grasses and important forage grasses that could be affected. So far we haven't seen too much infection - it seems to be pretty specific to reed canary grass. But this is all very preliminary data.

TreeIQ: So these new strains of rust that you have, did you collect them from campus, greater MN, other places?

N.G.: Yeah, all over. We have some from Duluth, some from southeast MN, a lot from the metro area, and we have some collaborators in New England who've sent us samples of infected *F. alnus* which we infected reed canary grass with and made isolates from.

If anyone sees a particularly severe infection on either glossy buckthorn or reed canary grass, we'd love to see it or get a sample. If anyone sees rust on the MN native buckthorn, *Rhamnus alnifolia,* that would also be fascinating.

Other forms of crown rust affect *Elaeagnus* (Russian olive) and *Shepherdia* (silver buffaloberry) in western Minnesota. If anyone finds rust on those species, we would love to see that!

If you think you may have an interesting sample for Nick, you can get in contact with him via email at great013@umn.edu.

Figure 4. (Left) Close-up of rust symptoms on reed canary grass. *(Right)* Rust fungus on glossy buckthorn. Photo credit to Nicholas Greatens.

Can't You Smell That Smell? The Smell of Firewood In The Woodstove

Gary Johnson, Department of Forest Resources, University of Minnesota

Every winter, usually in January, we'd go up in the woods and drop a large shagbark hickory, drag it back to the yard and for the next couple of weeks it was my job to buck it up, split it into fireplace size pieces and stack it for the next heating season. There it is, two weeks…I was slow. And if we were "lucky," one of the osage orange trees in the field would die and we'd buck and split that up, too. Osage oranges aren't nearly as big as shagbark hickories, so it wouldn't take me quite as long.

The colder it was the better it was for splitting those two types of trees, but if you've ever split osage orange with a maul, you know it was like hitting petrified wood until a fracture started. Splitting the hickory was much easier and I always liked the CRACK! it made when the maul split it and sent the halves or quarters flying. As much work as it was, the reward was sitting by a hot hickory fire and smelling that smell, the smell of hickory smoke. The osage orange didn't reward us with the same fragrance, but oh boy, the heat it would put out would drive you to the other side of the room.

So, why would you work so hard to split up stubborn chunks of wood like hickory or osage orange or ironwood? It's all about BTUs, those British Thermal Units that are a measurement of the amount of heat given off by wood when burning. If you're going to go through all of the work of cutting down a tree, bucking it up and splitting it, you might as well get the most BTUs for your sweat. Ditto if you're buying the firewood…you might as well get the most BTUs for your dollar.

This table of tree species that grow in the upper Midwest and their corresponding BTU values was sourced from the World Forest Industries website and should help you the next time you decide to drop and drag a tree or just have a face cord delivered for your wood stove. Happy heating, folks.

Tree Species	Million BTUs per Cord
Osage orange	32.9
Shagbark hickory	27.7
Ironwood	27.1
Black birch	26.8
Black locust	26.8
Blue beech, aka Musclewood	26.8
Bitternut hickory	26.5
Honeylocust	26.5
Apple	25.8
Mulberry	25.7
Beech	24
Red oak	24
White oak and Bur oak	24
White ash	23.6
Yellow birch	21.8
Red elm	21.6
Hackberry	20.8
Tamarack	20.8
Coffeetree	20.8
Gray birch	20.3
Paper birch	20.3
White birch	20.2
Black walnut	20
Cherry	20
Green ash	19.9

Tree Species	Million BTUs per Cord
Black cherry	19.5
American elm	19.5
Sycamore	19.1
Black ash	18.7
Red maple	18.1
Boxelder	17.9
Jack pine	17.1
Red pine	17.1
Catalpa	15.9
Hemlock	15.9
Black spruce	15.9
Aspen	14.7
Butternut, aka White walnut	14.5
Willow	14.3
White pine	14.3
Balsam fir	14.3
Cottonwood	13.5
American basswood	13.5
Northern white cedar	12.2

UFore Gravel Bed Research Update

By Tracy Few, University of Minnesota, Department of Forest Resources

Since 2006, the Urban Forestry Outreach Research and Extension nursery at the University of Minnesota has been conducting research on tree and shrub species responses to gravel bed performance (survival and root growth) and transplant success. During the 2018-2019 season, 22 tree and shrub species and/or cultivated varieties were tested for their response to growing in gravel and surviving subsequent transplanting into a soil-based landscape at the nursery (Table 1). All trees were stocked in the gravel beds during the spring of 2018, assessed for their root growth in autumn of 2018, planted out in the fields and landscapes during November and December of 2018, and finally assessed for their survival performance in June of 2019.

Gravel beds for this study are located in the UFore nursery on the University of Minnesota St. Paul campus. Four gravel beds with different mixtures of sand and gravel as well as different wind and sun exposures were used: Bed 1, a 3-sided bed made of portable traffic barriers and moderate shade, ground bed, 100% pea stone; Bed 2, an in-ground bed, full sun; Bed 3, 100% pea stone, full sun and wind exposure; and Bed 4, a raised bed, 90% pea stone and 10% coarse sand, full sun, full wind exposure. Beds 2, 3, and 4 are watered four times a day starting at 10 a.m. at three hour intervals for ten minutes each. Bed 1 is watered four times a day starting at 5 a.m. and ending at 11 p.m. for 10 minutes each time. No supplemental nutrients were added to any of the gravel beds.

All trees and shrubs were measured with a caliper, six inches up from the first root. The average caliper was calculated for each group of trees being planted in its respective gravel bed. Trees were planted in holes or trenches. The first root was covered with a gravel to a depth of 10 inches. If needed, the roots were pruned when the root system was very large and unmanageable for planting. In Beds 3 and 4, trees and shrubs were planted east to west, beginning on the south end of the bed. In Bed 1 trees and shrubs were planted north to south, starting on the east side of the bed. In Bed 2, trees and shrubs were planted east to west on the north side on the bed. The trees were planted as close together as possible, without branches or roots overlapping with one another. Trees were planted from May 18th to June 12th, 2018.

At the end of the study, each group of trees and shrubs was assessed for survival, growth rate and root mass development. Growth rate was a measure of caliper increase. Root mass development was evaluated against a white grid board (Figure 1). If minimal root development occurred, there would be a maximum amount of white background when the root system was placed against the grid board. This then would be graded as a 1. If most or all of the white background was covered with roots, this would then be graded as a 5. Grades 2, 3 and 4 would be stages between the two extremes.

Figure 1: Grading harvested root systems on a 1-5 scale. This root system received a grade of 5.

Table 1: Gravel bed tree and shrub species for the 2018-2019 study.

Species	Number	Avg. Caliper (mm)	2019 Root Grades	Survival Rate%
American Mountain Ash	25	4.16	1.4	76
American Mountain Ash	25	4.4	1.1	92
Chokecherry	25	5.7	1.3	96
Chokecherry	25	5.9	1.9	100
Lilac (Syringa villosa)	25	3	2.8	100
Lilac (Syringa villosa)	25	3.3	3.2	100
Skunkbush Sumac	25	7	1.4	100
Skunkbush Sumac	25	5.9	1.7	88
Arrowwood Viburnum	15	6.4	3.8*	100
Arrowwood Viburnum	15	6.6	2.8	100
Grey Dogwood	10	4.1	3.1*	100
Grey Dogwood	10	4.8	2.1	100
Silky Dogwood	10	5	2.4	100
Silky Dogwood	10	5.5	2.3	100
Red Oak	10	8.1	1.2	100
Red Oak	10	7.5	1.3	70
Bicolor Oak	10	8.1	2.8*	100
Bicolor Oak	10	8	2	100

Serviceberry	10	3.7	1	90
Serviceberry	10	3.4	1.1	90
Bitternut Hickory	25	9.32	1.1	100
Bitternut Hickory	25	7.2	1.3	96
White Oak	15	10.9	1.6	100
White Oak	15	11.1	2.5**	
Cornelian Cherry Dogwood	5 (7')	24.6	3	100
Cornelian Cherry Dogwood	5 (6')	21	3	100
Green Mt Silver Linden	10	50.7	1.5	0.0
Eyestopper Cork Tree	10	19.5	3	100
Pacific Sunset Maple	10	35.4	3.5	70
Scarlet Oak	10	11.1	1	0.0
Zelkova serrata	5	14.6	4	20
Zelkova serrata	5	13.6	4	40
Acer x Freeman Matador maple	20	22	2	90
Silver Queen Silver Maple	10	20.3	3.5	100
Kiwi Sunset Zelkova	5	32.8	4	0.0***
Kiwi Sunset Zelkova	5	30.6	4	0.0***
Majestic Skies Oak	10	16.7	1.7	100

**Trees and shrubs grown in 100% pea stone.*

***Trees and shrubs grown in 90% pea stone, 10% coarse sand by volume.*

****Trees actually survived but only watersprouts and suckers were alive, so the trees were considered functionally lost.*

Discussion

Most species performed reasonably well in the gravel bed and post-transplant into a soil-based landscape. The exceptions to the root development generalization were the oaks (red, white, scarlet, 'Majestic Skies' northern pin oak), bitternut hickory, serviceberry, mountain-ash and skunkbush sumac. Within all of the oaks tested, white oaks grown in the 90:10 pea stone:sand bed and bicolor oak developed very acceptable fine root masses.

Zelkova performed very well in the gravel beds yet had very low post-transplant survival rates. This should be put into the perspective that they were planted out in the soil-based landscape in early December. Air temperatures immediately plunged into an early, cold winter with no snow cover until the third week of January. It is suspected that the main cause of mortality was due to fine root mortality due to very cold soil temperatures.

Lindens continue to be unpredictable performers and silver linden ranked very low in fine root development and survival. It is recommended that when possible, bare-root lindens are planted in the landscapes or potted up in the spring rather than installed in gravel beds.

Scarlet oak was an experiment that didn't turn out well. It is marginally hardy to southeast Minnesota and the winter of 2018-2019 was exceptionally long and cold. Just too much for scarlet oak.

Of all species tested, the best performers in and after the gravel beds included the arrowwood viburnum, Cornelian cherry dogwood, the 'Silver Queen' silver maple, and the 'Eye Stopper' male cork tree. 'Pacific Sunset' maple (a *platanoides* x *truncatum* variety), also performed well although its post-transplant survival rate wasn't as good as the previously-mentioned three trees and one shrub.

2019—2020 Gravel Bed Study Update

The next gravel bed performance study began in June 2019 and will conclude in the summer of 2020. In June 2019, 3 tree and shrub species were planted in the UFore nursery gravel beds following the same design described above, with the exception that their calipers were not measured before installment in the gravel beds. Canaan fir and Ponderosa pine were planted in Bed 1 (medium shade); Nanking cherry in Bed 3 (full sun); Nanking cherry, Canaan fir, and Ponderosa pine in Bed 4 (full sun). Root growth (grading on a 5 point scale) and gravel bed survival rate were measured in September 2019 (Table 2). The surviving trees were all transplanted into the soil-based landscape at the nursery within the month. Transplanted trees were watered twice per day for a month when it did not rain.

Table 2: Gravel bed tree and shrub species for the 2019-2020 study.

Species	Number	2019 Root Grades	Survival Rate (%)
Nanking Cherry	13	3.9*	100
Nanking Cherry	12	3**	92
Canaan Fir	25	3**	44
Ponderosa Pine	25	4**	4
Canaan Fir	25	2.8*	84
Ponderosa Pine	25	1.6*	48

**Trees and shrubs grown in 100% pea stone.*

***Trees and shrubs grown in 90% pea stone, 10% coarse sand by volume.*

This is the first year we tested Nanking cherry, Canaan fir, and Ponderosa pine at the nursery. They had fair performances in the gravel bed trial. The Nanking cherry had better root growth in the 100% peastone bed, nevertheless both groups had high survival rates (Table 2). Canaan fir root growth was slightly better in Bed 4 (90:10 mixture), but survival rate was higher in Bed 1 (Fig. 2). Ponderosa pine did not do well in Bed 4 with only one tree surviving, which accounts for the root grade of 4. The Ponderosa pine in Bed 1 had a poor root grade of 1.6, and had a higher survival rate of 48%. These results were surprising because Ponderosa pine has little to no tolerance for shade, yet it had a better survival rate in the medium shade Bed 1 than the full sun Bed 4. We believe the high mortality was due to the planting stock since both groups received the same amount of water in well-drained soils. More trials with these species would be needed to learn which gravel bed environments would produce optimal root systems and survival of trees and shrubs.

Do you have gravel bed performance data you'd like to share? Contact us at treesins@umn.edu.

Figure 2: Balsam fir harvested from 100% pea stone with a root grade of 3.

Figure 3: Aerial view of UFore nursery gravel beds on UMN St. Paul Campus.

About this publication

TreeIQ - The MN Tree Inspector Quarterly **is a publication produced by the University of Minnesota in collaboration with agency partners.** ***TreeIQ*** **is a seasonal electronic newsletter devoted to providing timely technical information and community connections for Minnesota's Certified Tree Inspectors.**

The University of Minnesota offers certification and recertification opportunities and proctors new certification exams at the certification workshops. For more information on the Tree Inspector program, the certification, and other frequently asked questions, please visit us at *www.mntreeinspector.com*.

Contact *treesins@umn.edu* with any questions or submissions.

The Minnesota Certified Tree Inspector program was first implemented in 1974 and has since supported hundreds of participating communities around the state.

The Tree Inspector Program is administered by the Minnesota Department of Natural Resources in partnership with the University of Minnesota's Forestry Department.

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