



WELCOME TO

# THE LANDSCAPE BELOW GROUND **IV**

International Conference on Tree Root Development in Urban Soils

October 15 through 17, 2018

Presented by

The Morton  
Arboretum®

ISA  
International Society of Arboriculture®

## WELCOME TO THE LANDSCAPE BELOW GROUND IV

Since 1993, The Landscape Below Ground conferences have provided a forum for the latest research and management practices on all elements of tree root development in urban soils. Their impact on arboriculture has been significant over the last 25 years. Practices now used every day, such as load-bearing soils that provide space for root growth beneath pavement, were introduced to international audiences at the conferences.

We are so pleased that you can join us to carry on this tradition at the Fourth Landscape Below Ground Conference, presented by The Morton Arboretum and the International Society of Arboriculture. During this year's program, researchers and tree care professionals from around the world will gather to expand upon this legacy of innovation, explore the latest advances in the field, and look ahead to see what new collaborations and information are needed to further advance practice in the future.


We encourage you to make the most of your time here with the world's leading root and soil researchers as we work to further our common goals of advancing tree care and planting and supporting healthy, long-lived trees for a greener future.

### QUESTIONS AND ASSISTANCE

If you need assistance during the conference, the staff at the conference registration desk will be happy to answer any questions you might have.

### CONTINUING EDUCATION (CEUS)

Sign-in sheets for ISA Continuing Education Units (CEUs) will be circulated after each conference session. Please remember to sign in for each session you attend. The full list of CEUs for each talk can be found at [landscapebelowground.org](http://landscapebelowground.org) and at the conference registration desk.

Certified Arborist CEUs will be indicated by the following icon  with the number of credits that apply inside.

### INFORMATION ONLINE

Visitor information, shuttle times for Monday workshops, and abstracts for the conference presentations are available online at [landscapebelowground.org](http://landscapebelowground.org).

### CELL PHONES

Please silence cell phones during sessions as a courtesy to presenters and participants.

### SPREAD THE WORD

Please use #LBGIV on social media posts related to the conference. Follow The Morton Arboretum and International Society for Arboriculture on Twitter at @MortonArboretum and @ISArboriculture.

### WI-FI ACCESS

Wireless Internet access is available in the hotel meeting space:  
Network: attwifi  
Passcode: Landscapes  
Guests registered for the conference block at the hotel can also access Wi-Fi in their rooms.

### POSTERS

Poster presenters will be available at their posters during the afternoon break on Tuesday, October 16 and the morning break on Wednesday, October 17. Posters will be displayed in the foyer outside the Regency Ballroom.

**WORKSHOPS | THORNHILL EDUCATION CENTER, THE MORTON ARBORETUM**

8:30 to 11:30 a.m.	<b>What Root Pathogens and Roots Need</b> <sup>3</sup> Jim Chatfield, Joe Boggs, The Ohio State University, USA Chrissy Balk, The Davey Tree Expert Company, USA	<b>Planting Trees: Specifications, Installation, and Early Maintenance</b> <sup>3</sup> Ed Gilman, University of Florida Emeritus, USA Gary Watson, The Morton Arboretum, USA
1:00 to 4:00 p.m.	<b>Natural, Disturbed Urban, and Manufactured Soils: Learning from Soils at The Morton Arboretum</b> <sup>3</sup> Peter MacDonagh, Kestral Design Group, USA Michelle Catania, Meghan Midgley, The Morton Arboretum, USA	<b>Assessing the Stability of Urban Trees</b> <sup>3</sup> Jake Miesbauer, The Morton Arboretum, USA Philip J.E. van Wassenauer, Urban Forest Innovations., Canada Ken R. James, University of Melbourne, Australia
9:00 to 11:00 a.m. and 1:00 to 3:00 p.m.	<b>Tram and Walking Tour of the Gateway to Tree Science: A Living Exhibit</b> <sup>2</sup> Chuck Cannon and Center for Tree Science staff, The Morton Arboretum, USA	

**OPENING GENERAL SESSION | REGENCY BALLROOM**

8:00 a.m.	<b>Welcome to The Landscape Below Ground</b> Gerard Donnelly, President and CEO, The Morton Arboretum, USA Skip Kincaid, Board of Directors, International Society of Arboriculture, USA	
8:20 a.m.	<b>Twenty-Five Years of The Landscape Below Ground</b> Gary Watson, The Morton Arboretum, USA Ed Gilman, University of Florida Emeritus, USA L.R. Costello, University of California Emeritus and Oracle Oak Nursery, USA	
8:40 a.m.	<b>The Ideal Nursery Root System: How We Got There and Can We Specify It</b> <sup>75</sup> Ed Gilman, University of Florida Emeritus, USA	
9:20 a.m.	<b>Planting and Managing Trees in Engineered Soils and Constructed Spaces</b> <sup>75</sup> Nelda Matheny, James R. Clark, HortScience   Bartlett Consulting, USA	
10:00 a.m.	Break	
10:30 a.m.	<b>Root Growth in Structural Soil Under Porous and Non-porous Asphalt After 12 Years</b> <sup>5</sup> Nina Bassuk, Cornell University, USA	
11:10 a.m.	Poster Introductions	
12:10 p.m.	Lunch in the Majestic Ballroom	

## CONCURRENT SESSION |

## PINE ROOM

## MAPLE ROOM

**MANAGING URBAN SOILS**

1:10 p.m.

Soil Management Practices, Tree Resource Allocation Patterns, and Pest Resistance **.5**  
Daniel Herms, The Davey Tree Expert Co., USA

**TREE ANCHORAGE AND STABILITY**

Root Plate Stability and Failure in Winds **.5**  
Ken R. James, University of Melbourne, Australia

1:40 p.m.

Experiments and Applications for Biochar as a Soil Amendment for the Green Industry **.5**  
Chris Fields-Johnson, Chelsi Abbott,  
The Davey Tree Expert Co., USA

Tree Stability Recovery After Root Failure **.5**  
Philip J.E. van Wassenaeer, Urban Forest Innovations Inc.,  
Canada  
Andreas Detter, Brudi and Partner TreeConsult, Germany  
Stephen Rust, Faculty of Resource Management,  
Hochschule für angewandte Wissenschaft und Kunst,  
Germany

2:10 p.m.

Mexico City Urban Soils Quality Evaluation as a Support for Trees **.5**  
Vivian Alvarez Islas, Silke Cram Heydrich,  
Blanca Prado Pano, Universidad Nacional  
Autónoma de México, Mexico  
Alicia Chacaol Hilú, Universidad Nacional Autónoma  
de México, Mexico  
Isabelle Barois Boullard, Instituto de Ecología A.C.,  
Mexico

Boulevard Tree Failures During Wind-loading Events **.5**  
Gary Johnson, University of Minnesota, USA

2:40 p.m.

Break  
Poster session

## CONCURRENT SESSION |

## PINE ROOM

## MAPLE ROOM

**MANAGING URBAN SOILS (CONT.)**

3:10 p.m.

Using Forest Soils to Help Understand Restoration Thresholds for Tree Establishment Along Highway Roadsides **.5**  
Darby McGrath, Jason Henry, Ryan Munroe,  
Vineland Research and Innovation Centre, Canada

**TREE ANCHORAGE AND STABILITY (CONT.)**

Determination of Strain Patterns Across the Root-Stem Transition Zone in Trees **.5**  
Gregory Dahle, West Virginia University, USA  
Jake Miesbauer, The Morton Arboretum, USA

3:40 p.m.

Does Matching Organic Amendment Chemistry with Tree Litter Chemistry Enhance Tree Survival, Growth, and Health in a Roadside Soil? **.5**  
Meghan Midgley, The Morton Arboretum, USA

The Development of 3D Imaging Techniques to Measure Root Volume and Stability **.5**  
Jake Miesbauer, The Morton Arboretum, USA  
Andrew Koeser, University of Florida Gulf Coast  
Research & Education Center, USA

4:10 p.m.

Organic Matter Improves Tree Establishment in Degraded and Compacted Urban Soils **.5**  
Peter Somerville, Stephen J. Livesley, Claire Farrell,  
Peter B. May, University of Melbourne, Australia

Patterns of Dissymmetric Radial Root Growth in Response to Wind Exposure in Two Maple Species **.5**  
Jason Grabosky, Rutgers University, USA

4:40 p.m.

Sessions End

7:00 to 9:00 p.m.

Social in the Majestic Ballroom  
Networking and discussion of new knowledge needed for improving practice

CONCURRENT SESSION |

PINE ROOM

MAPLE ROOM

**TREE ROOTS AND THE BUILT ENVIRONMENT**

**TREE ROOT DEVELOPMENT AND MANAGEMENT**

8:00 a.m. **A Test of Tree Protection Zones: Responses of Live Oak (*Quercus virginiana* Mill) Trees to Root Severance Treatments** .5  
 Andrew R. Benson, Justin A. Morganroth, The University of Canterbury, New Zealand  
 Andrew K. Koeser, The University of Florida, USA

**Patterns and Implications of Root Turnover in Trees** .5  
 M. Luke McCormack, The Morton Arboretum, USA

8:30 a.m. **Street Trees, Construction, & Longevity: Tree Growth and Response Over Forty Years (1979–2018)** .5  
 Richard Hauer, University of Wisconsin-Stevens Point, USA  
 Andrew Koeser, Gulf Coast Research and Education Center, University of Florida, USA  
 David Sivyer, Randy Krouse, City of Milwaukee, USA

**Soil Aeration in Two Street Tree Establishment Methods** .5  
 Anu Riikonen, Antti Kämäräinen, Asko Simojoki, Leena Lindén, University of Helsinki, Finland

9:00 a.m. **A Computer Vision Approach to Automated Detection of Tree Root Locations Using Ground Penetrating Rader (GPR)** .5  
 Justin Miron, Andrew A. Millward, Ryerson University, Canada

**Influence of Penetration Resistance on Root Growth Patterns of *Tilia x europaea* L, *Robinia pseudoacacia* L, *Aesculus hippocastanum* L.** .5  
 Els Couenberg, Natura Ingenium, Netherlands

9:30 a.m. **Below-Ground Urban Tree Management Research and Practices in Shanghai** .5  
 Hu Yonghong, Chenshan Botanical Garden, China

**The Rooting Environment Under Permeable Pavements: What's Different and What's Not** .5  
 Francisco J. de la Mota Daniel, Susan Day, Virginia Tech, USA

10:00 a.m. **Break**  
 Poster session

CONCURRENT SESSION |

PINE ROOM

MAPLE ROOM

**TREE PRODUCTION, PLANTING, AND ESTABLISHMENT**

**PLANTING SITE DESIGN**

10:30 a.m. **Evaluating the Missouri Gravel Bed and a Wood Chip Production Method for Transplant Success** .5  
 Kelby Fite, Liza Holmes, Elden LeBrun  
 Bartlett Tree Research Laboratories, USA

**Building Green Streets in Cities: Insights from Oslo, Norway** .5  
 Ingjerd Solfeld, Norwegian University of Life Sciences, Norway

11:00 a.m. **Across Three Species, Smaller Transplanted Container-Grown Stock Offers Rapid Growth and Economic Advantages Compared to Larger Container-Grown Trees** .5  
 Lauren M. Garcia Chance, Clemson University, USA  
 Michael A. Arnold, Todd Watson, Leonardo Lombardini, Charles R. Hall, Sean T. Carver, Andrew R. King, Texas A&M University, USA

**Characterising the Below-Ground Environment in Novel Street Tree Installations in Sweden** .5  
 Tobias Emilsson, Anna Levinsson, Swedish University of Agricultural Sciences, Sweden

11:30 a.m. **Container Type Affects Nursery Production and Landscape Establishment of *Pyrus calleryana* 'Glen's Form' (Chanticleer®)** .5  
 Alison S. O'Connor, James E. Klett, Anthony J. Koski, Colorado State University, USA

**Tracking Urban Tree Growth Comparing Paved and Non-Paved Root Zone Treatments in a Working Streetscape Over Time; the Case Study of McCarren Park, New York City** .5  
 Allyson Salisbury, The Morton Arboretum, USA  
 Jason Grabosky, Rutgers University, USA

12:00 p.m. **Lunch in the Majestic Ballroom**

## CONCURRENT SESSIONS |

## PINE ROOM

## MAPLE ROOM

**TREE PRODUCTION, PLANTING,  
AND ESTABLISHMENT (CONT.)****PLANTING SITE DESIGN (CONT.)**

1:00 p.m.	The Lessons Learned From Twenty Years of Containerised Tree Production .5 Keith Sacre, Barcham Trees LLC, United Kingdom	Application of Structural Soil: Lessons Learned in the Netherlands .5 Michiel Mol, Ewout de Graaff, Henry Kuppen, Wendy Batenburg, The Netherlands
1:30 p.m.	Toward Developing Well-Structured Root Systems in Containers via Root Pruning .5 L.R. Costello, University of California Emeritus and Oracle Oak Nursery, USA	New Municipal Public Tree Plantings Requirements—Minimum Soil Volume Standards for Select North American Cities .5 Peter MacDonagh, Kestrel Design Group, USA
2:00 p.m.	Nursery Root Production on Trees .5 Connor Shaw, Possibility Place Nursery, USA	Below the Hardscape: The Key to Healthy Urban Trees .5 Dean Bowie, GreenBlue Urban, Canada
2:30 p.m.	Break	

**CLOSING GENERAL SESSION | REGENCY BALLROOM**

3:00 p.m.	The Effects of Soil Compaction on the Growth and Establishment of Street Trees in Urban Melbourne, Australia .5 Gregory M. Moore, Alicia Fitzgerald, May B. May, University of Melbourne, Australia
3:30 p.m.	Root Development and Tree Growth Associated with Various Soil Treatments Under Pavement .5 Tom Smiley, Bartlett Tree Experts, USA
4:00 p.m.	Soil Profile Rebuilding: Rehabilitating Compacted Urban Soils on Site .5 Susan Day, Department of Forest Resources and Environmental Conservation, Virginia Tech, USA Yujuan Chen, Tree People, USA
4:30 p.m.	The Landscape Below Ground—Past, Present, and Future
5:00 p.m.	Sessions End

## POSTERS

**Impact of Biochar Urban Soil Application on Growth and Physiology of Newly Planted Live Oak Saplings**

Kamran Abdollahi, Southern University, USA

**Low Impact *In Situ* Field Studies of Fine Root Growth of Urban Street Trees—A Pilot Study Using Scanners and Root Sampling Zones**Frida Andreasson, Ann-Mari Fransson  
Swedish University of Agricultural Sciences, Sweden**Assessment of Root System Quality in Container-Grown Trees**

Marie V. Ambusk and Gordon Mann, Trees ROI

**A Case Study of Rooting Patterns on Soil-Type Interfaces**

Els Couenberg, Natura Ingenium, The Netherlands

**Root Architecture Altered by Taproot Pruning**Marvin Lo, Gary Watson, The Morton Arboretum, USA  
Shannon Hankin, Frank Balestri, formerly The Morton Arboretum, USA**Species Variation in Root Tolerance of Poor Soil Conditions**Marvin Lo, Gary Watson, The Morton Arboretum, USA  
Angela Hewitt, Frank Balestri, formerly The Morton Arboretum, USA**Community Gravel Beds as Options for Restoration Programs**

Gary Johnson, University of Minnesota, USA

**Comparing Static and Dynamic Assessment of Root System Stability After Root Severance**Marvin Lo, Jake Miesbauer, Gary Watson, The Morton Arboretum, USA  
Frank Balestri, formerly The Morton Arboretum, United States**Designing a Dynamic Urban Ground: Interpreting Root System Research for Landscape Architects**

Gwendolyn McGinn, Studio Outside, USA

**Enhancing Tree Transplant Success Through the Manipulation of Root Hydraulic Conductance**

Brandon M. Miller, Nina L. Bassuk, Cornell University, USA

**Root Penetration of PVC Pipes**

Gregory M. Moore, Susan Bendel, Peter B. May, University of Melbourne, Australia

**Balancing Carbon Expenses and Sequestration in Street Tree Plantings**Anu Riikonen, Jukka Pumpanen, Mari Mäki  
University of Helsinki, Finland**Osmotic Adjustment and Gas Exchange Response During Drought for Two Tree Species (*Quercus bicolor* & *Betula pendula*) Grown in Containers with Limited Soil Volume**

Miles Schwartz Sax, Nina Bassuk, Henrik Sjöman, Cornell University, USA

**Sustainable Growth Medium for Urban Roadside Tree Planting**Erik Solfeld, Norwegian Public Roads Administration, Norway  
Ingjerd Solfeld, Norwegian University of Life Sciences, Norway**NYC Department of Parks and Recreation Trees & Sidewalks Program**

Tyler Wilcox, Ben Osborne, NYC Department of Parks and Recreation Trees &amp; Sidewalks Program, New York, New York, USA

## EXHIBITORS

Thank you to our exhibitors! Please visit them in the Atrium from 7:30 a.m. to 5:00 p.m. on October 16-17.

DeepRoot Green Infrastructure, LLC  
Environmental Design, Inc.  
GRO Horticultural Enterprises Inc  
GreenBlue Urban  
High Caliper Growing

Historic Tree Care  
Illinois Arborists Association (IAA)  
Supersonic Air Knife  
Tree Care Industry Association (TCIA)

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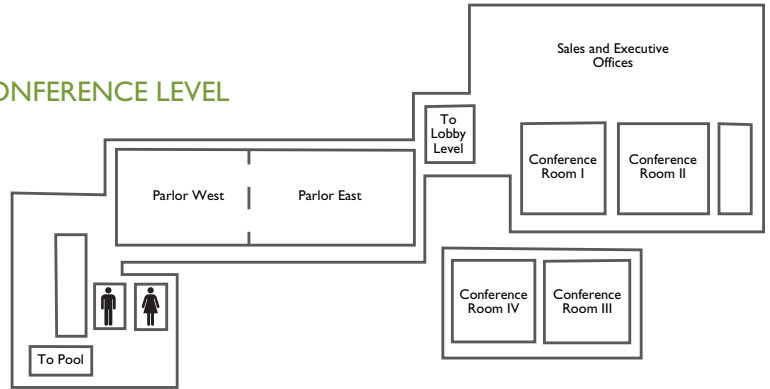
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