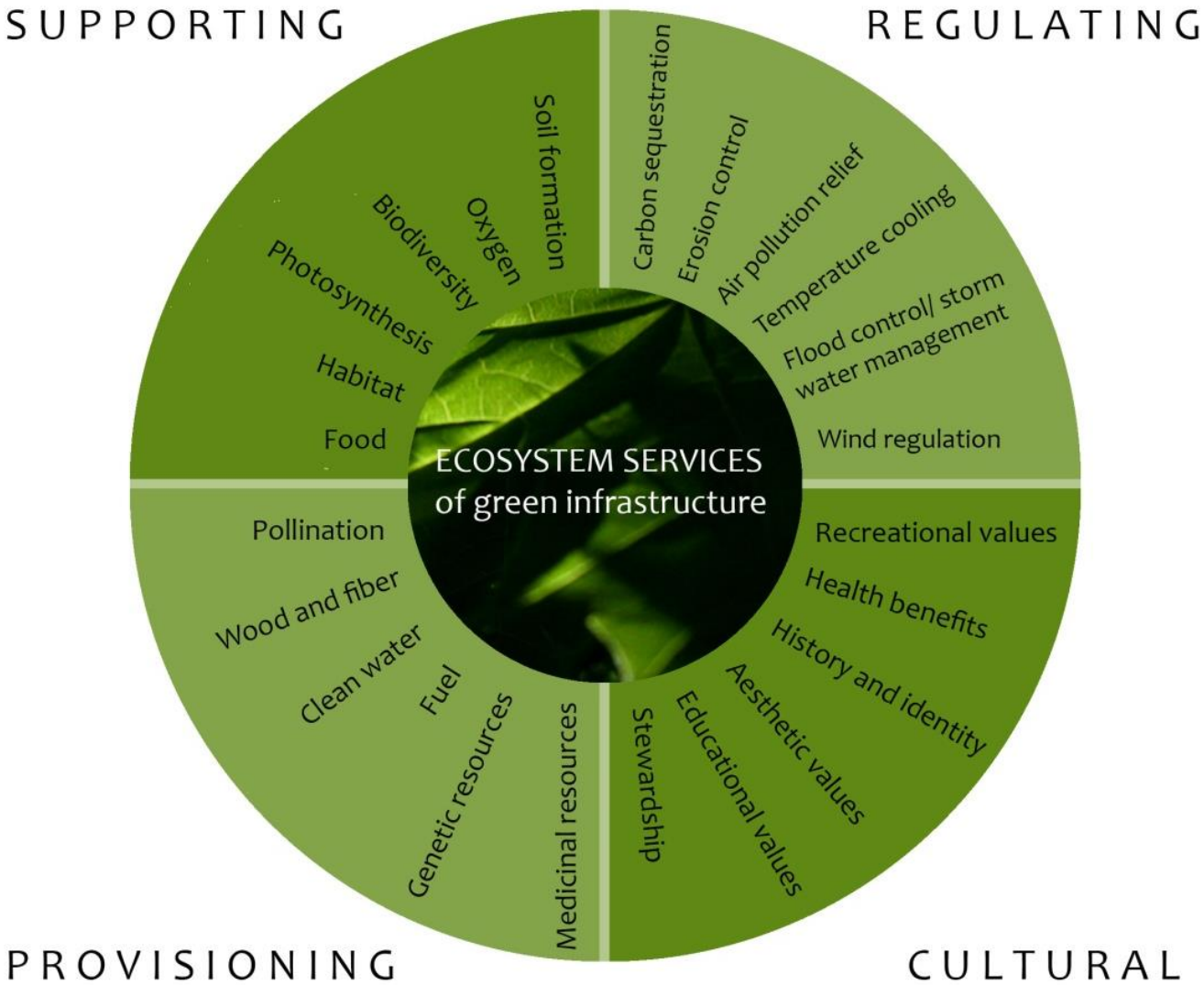
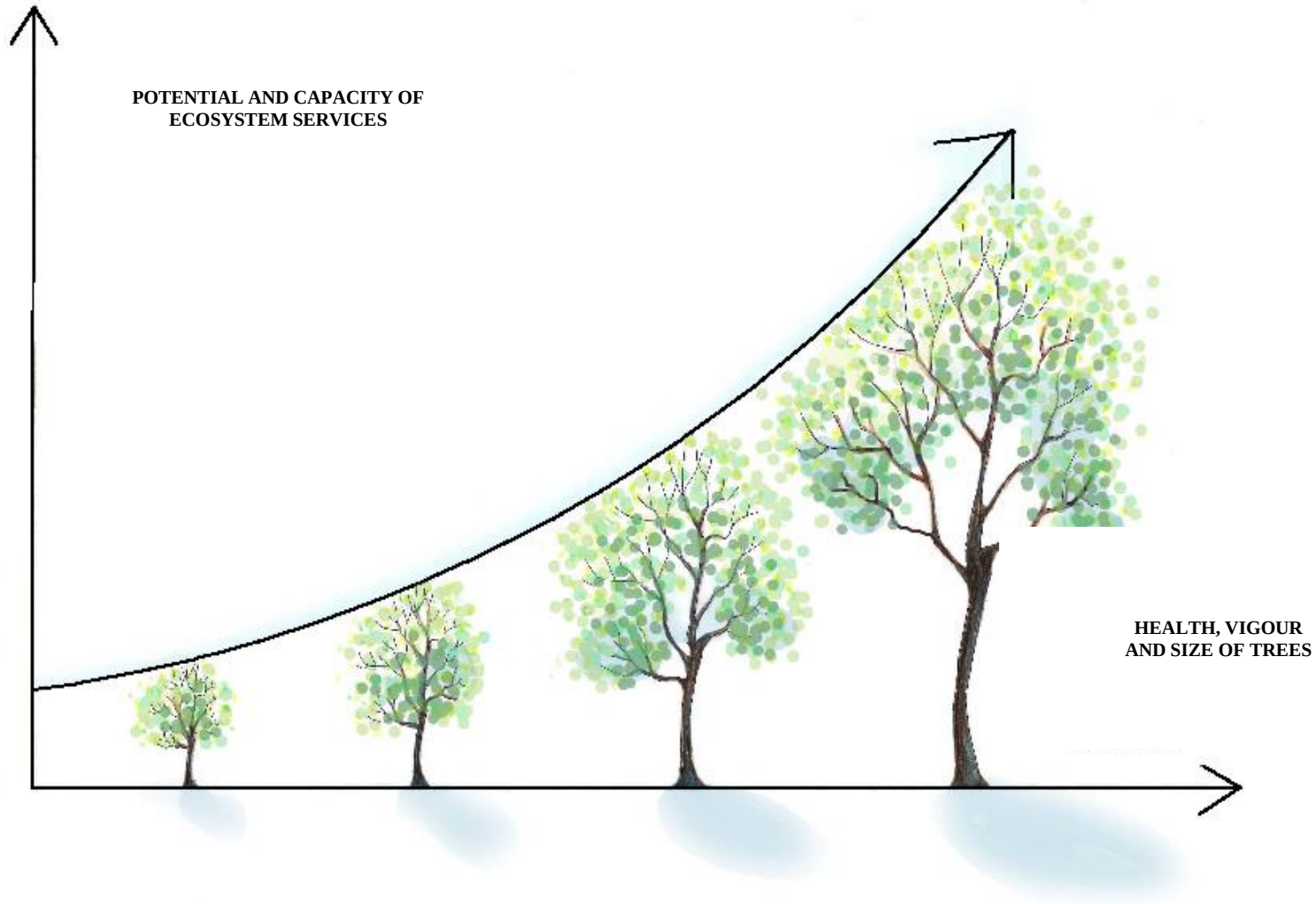
# Trees of tomorrow
# – which are they and how should we find them?

**Henrik Sjöman**
**Gothenburg Botanical garden / Swedish University of Agricultural Science**
**henrik.sjoman@slu.se**

# Trees and ecosystem services




(Deak Sjöman, 2016)


POTENTIAL AND CAPACITY OF
ECOSYSTEM SERVICES
HEALTH, VIGOUR
AND SIZE OF TREES


*Acer pseudoplatanus*, Lund Sweden


25-40%

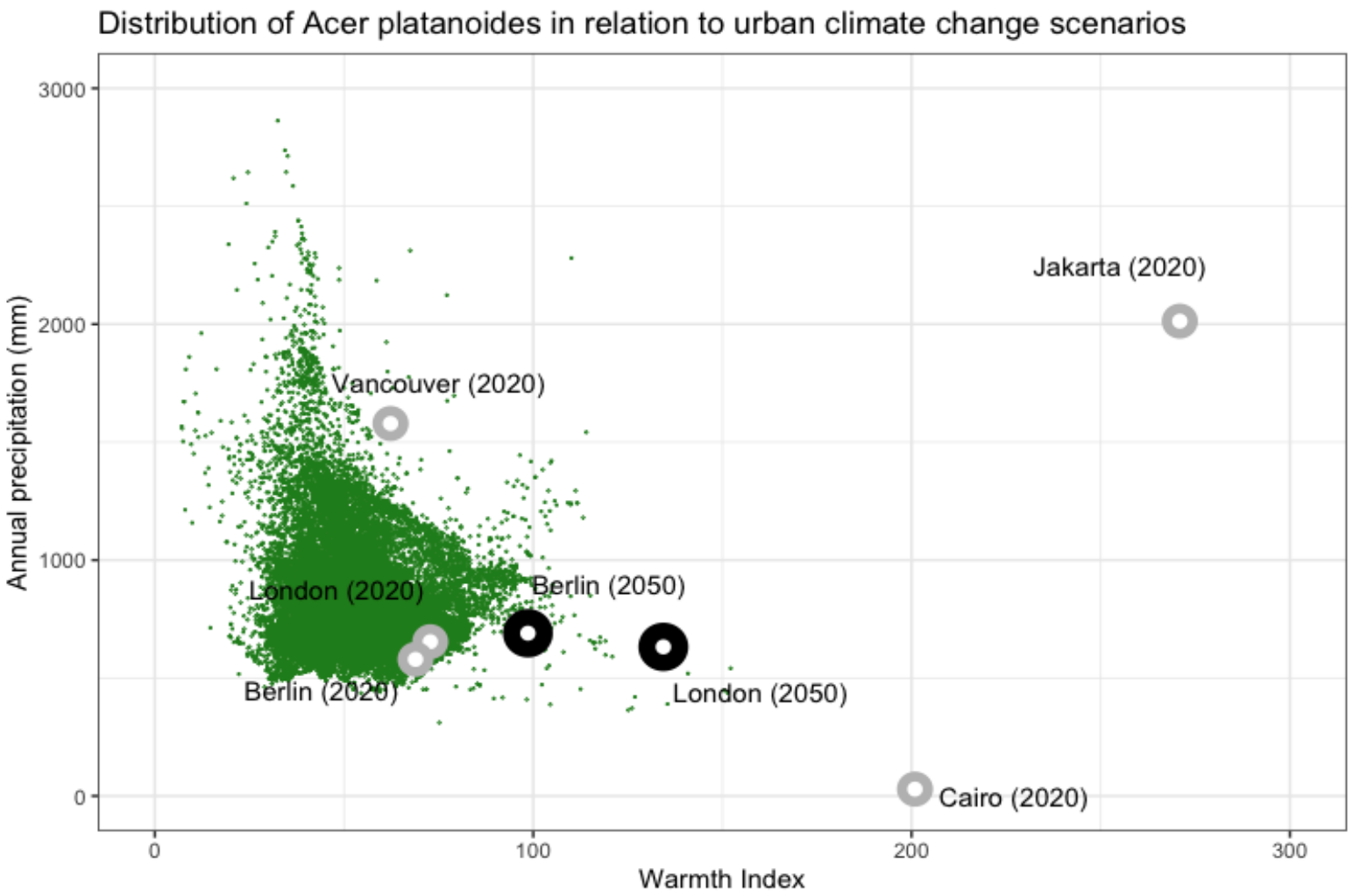
# Challange:

**Develop knowledge and experience of different tree species capacity for different growing habitats**

“Everybody has a plan until they get punched in the face”.

# Question 1:

Do we have already collected and discovered the best genetic material of the species and are these already in cultivation?




(Sjöman and Watkins – in press)

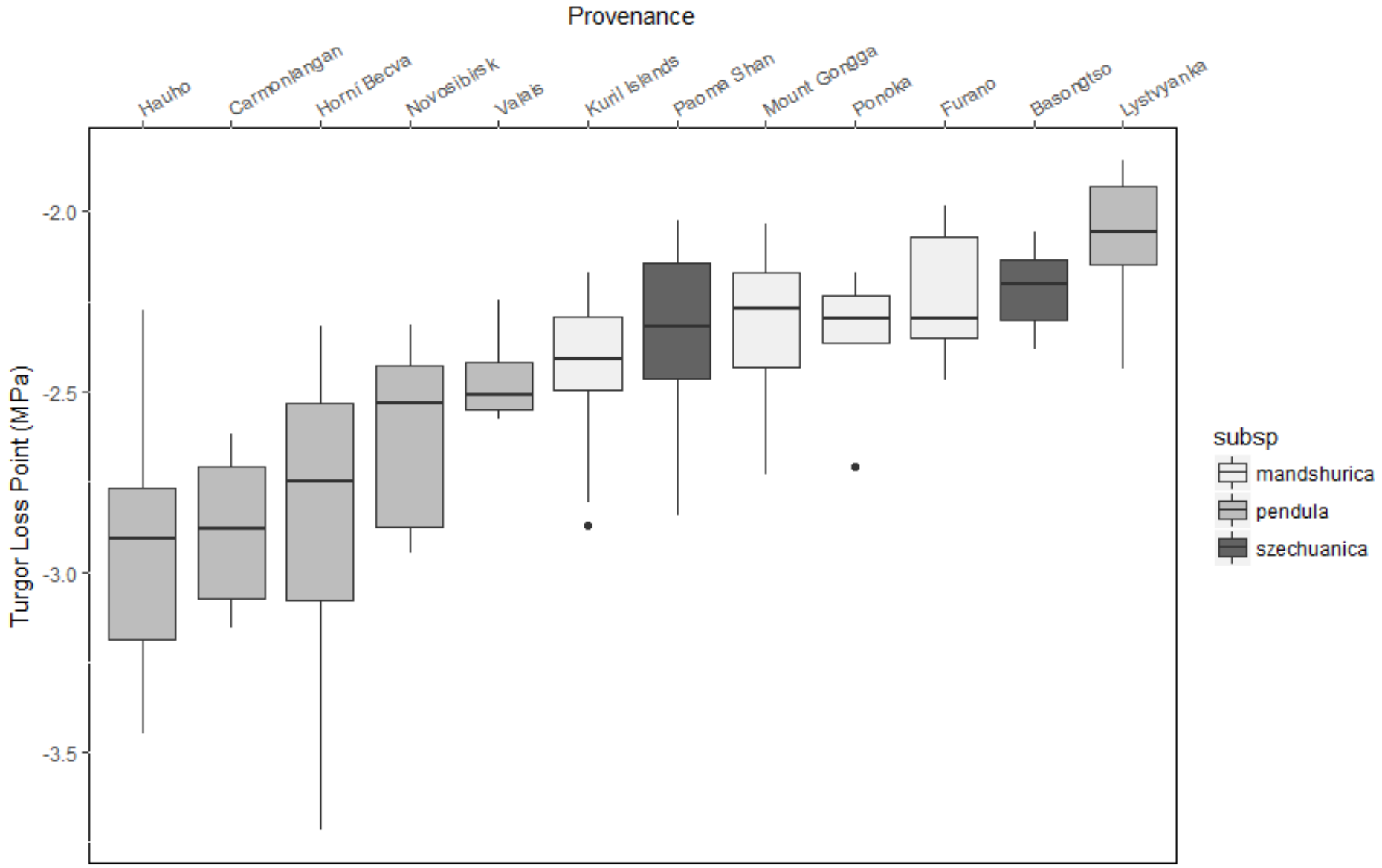
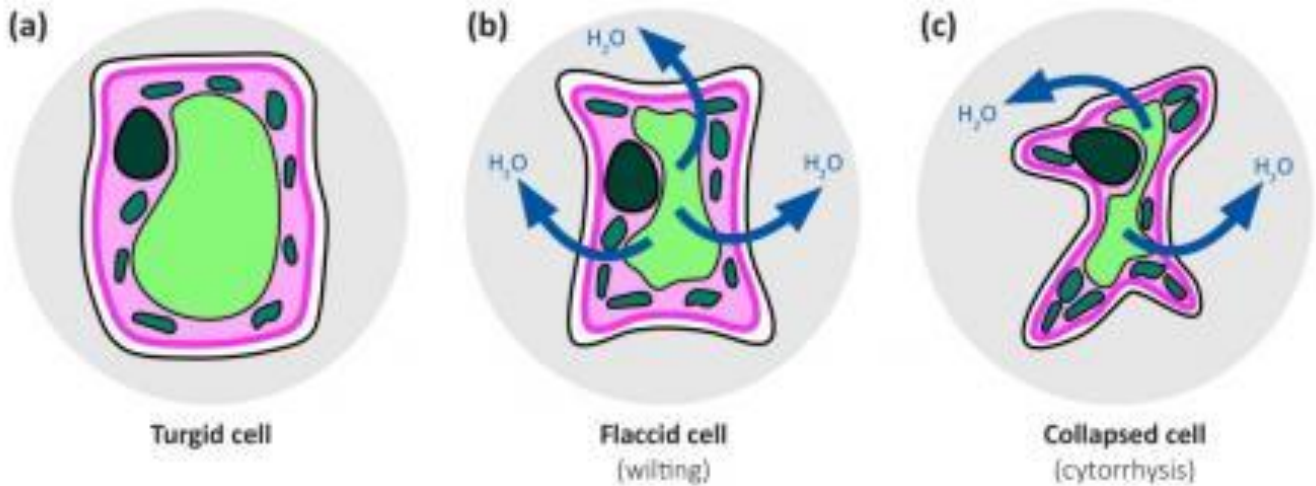



Figure 2. Boxplot of the estimated leaf turgor loss point from different collection sites. The sub-species is denoted in different tones of grey. (Hannus et al. – in press)




**Turgid cell**

**Flaccid cell**
(wilting)

**Collapsed cell**
(cytorrhysis)

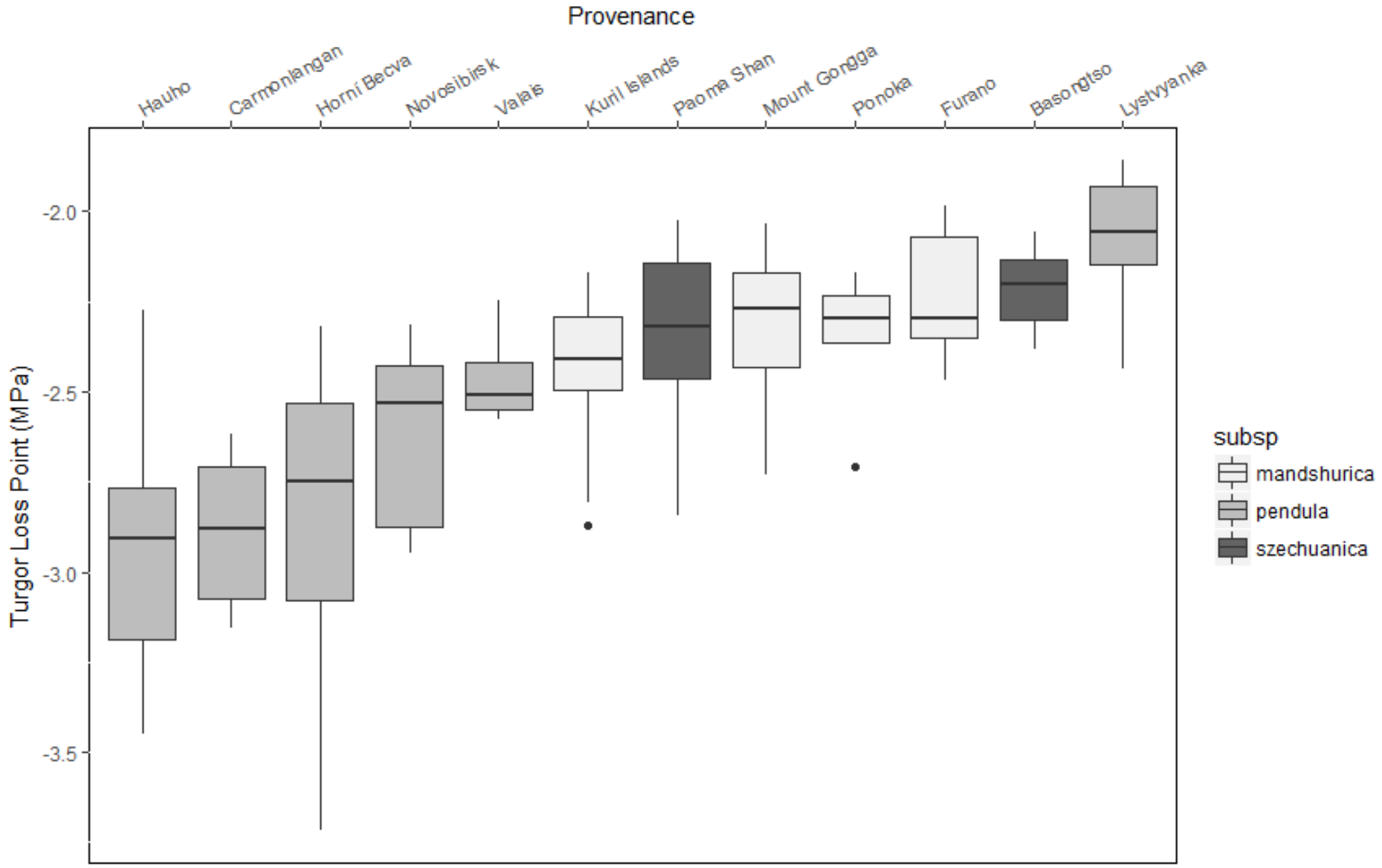
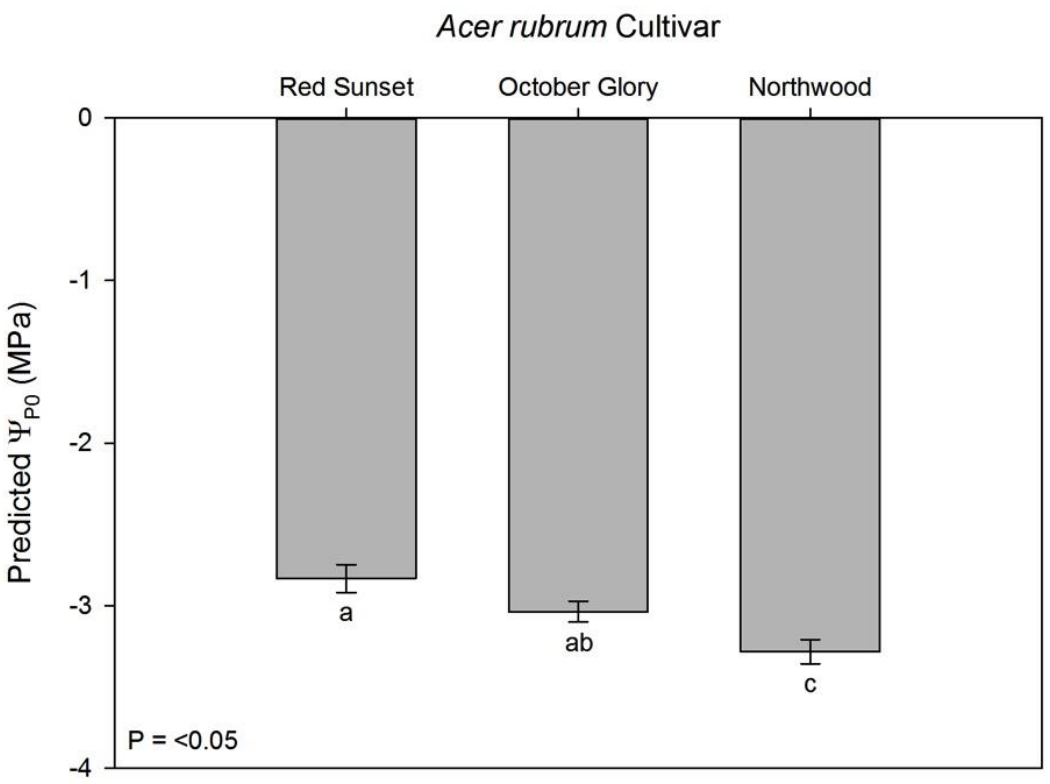
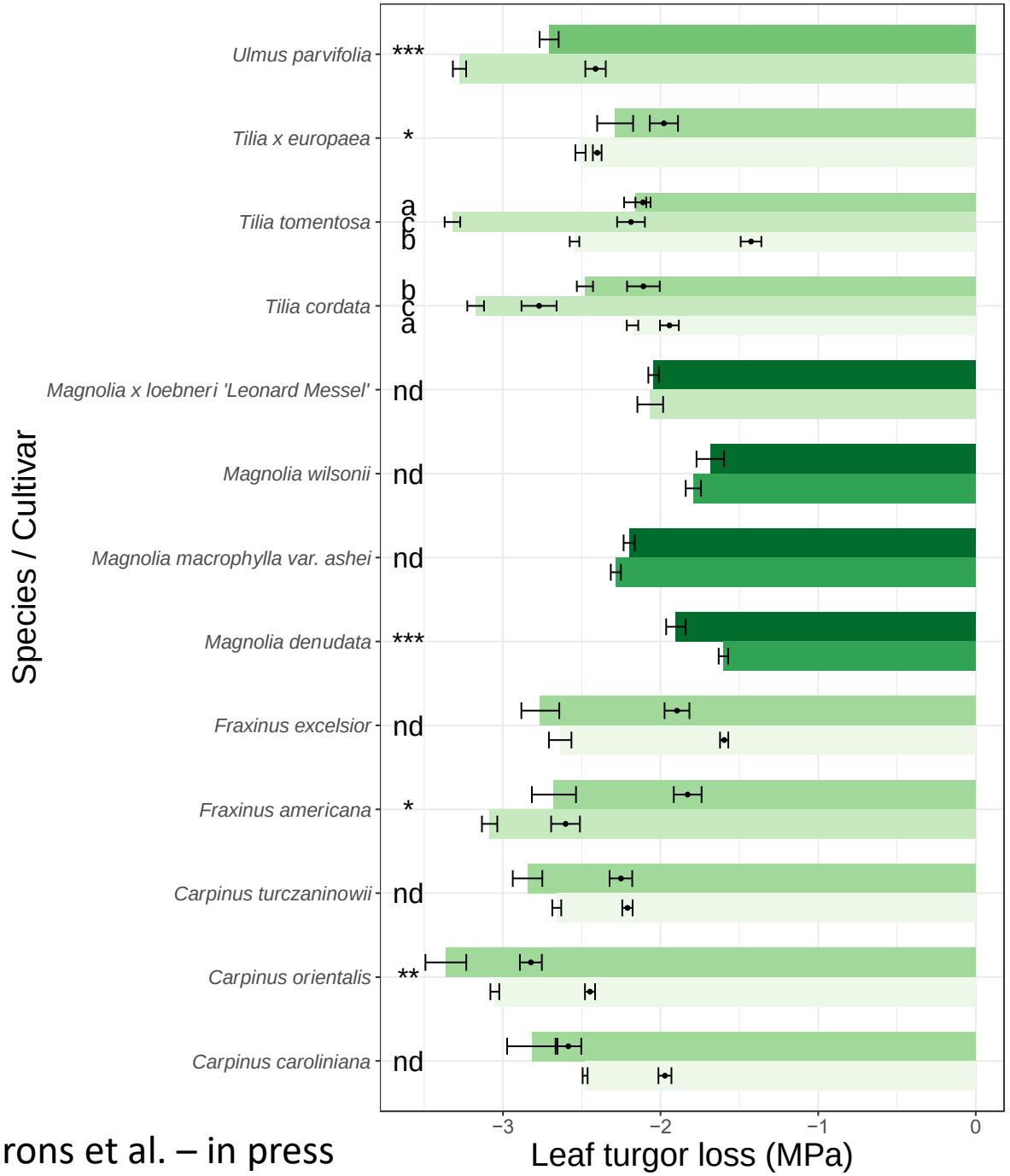



Figure 2. Boxplot of the estimated leaf turgor loss point from different collection sites. The sub-species is denoted in different tones of grey. (Hannus et al. – in press)

# *Acer rubrum*




(Sjöman, Hirons & Bassuk 2015)



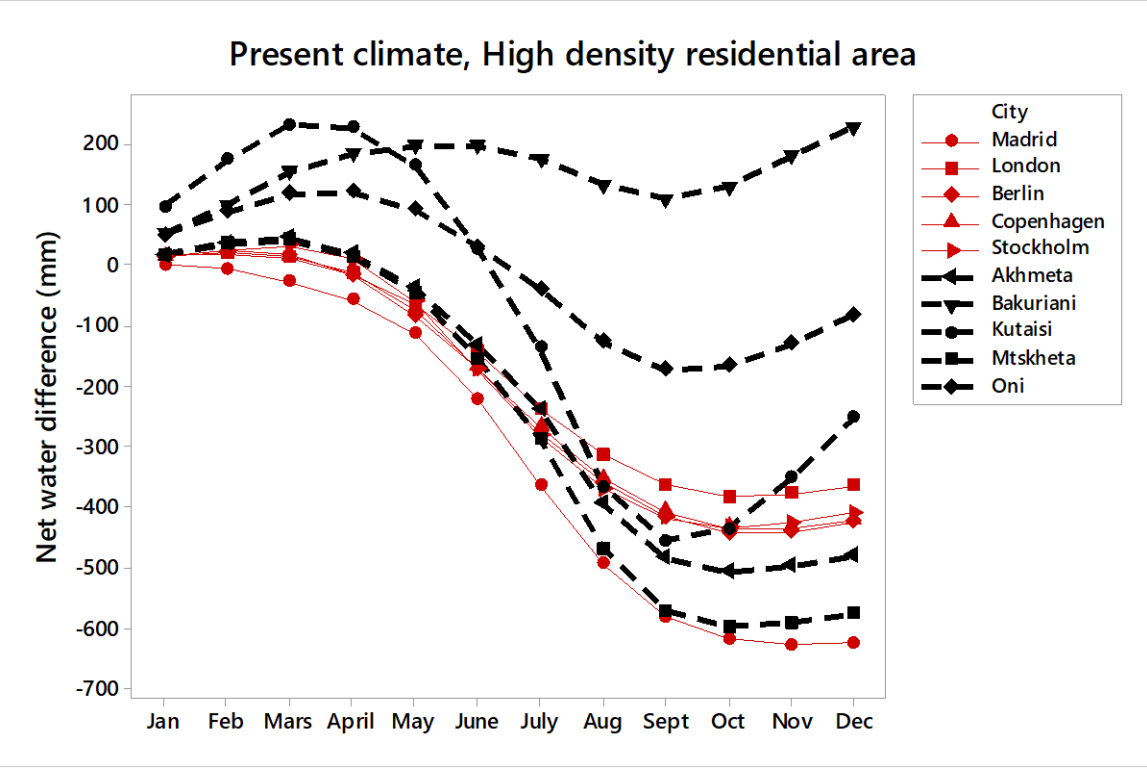

Hirons et al. – in press

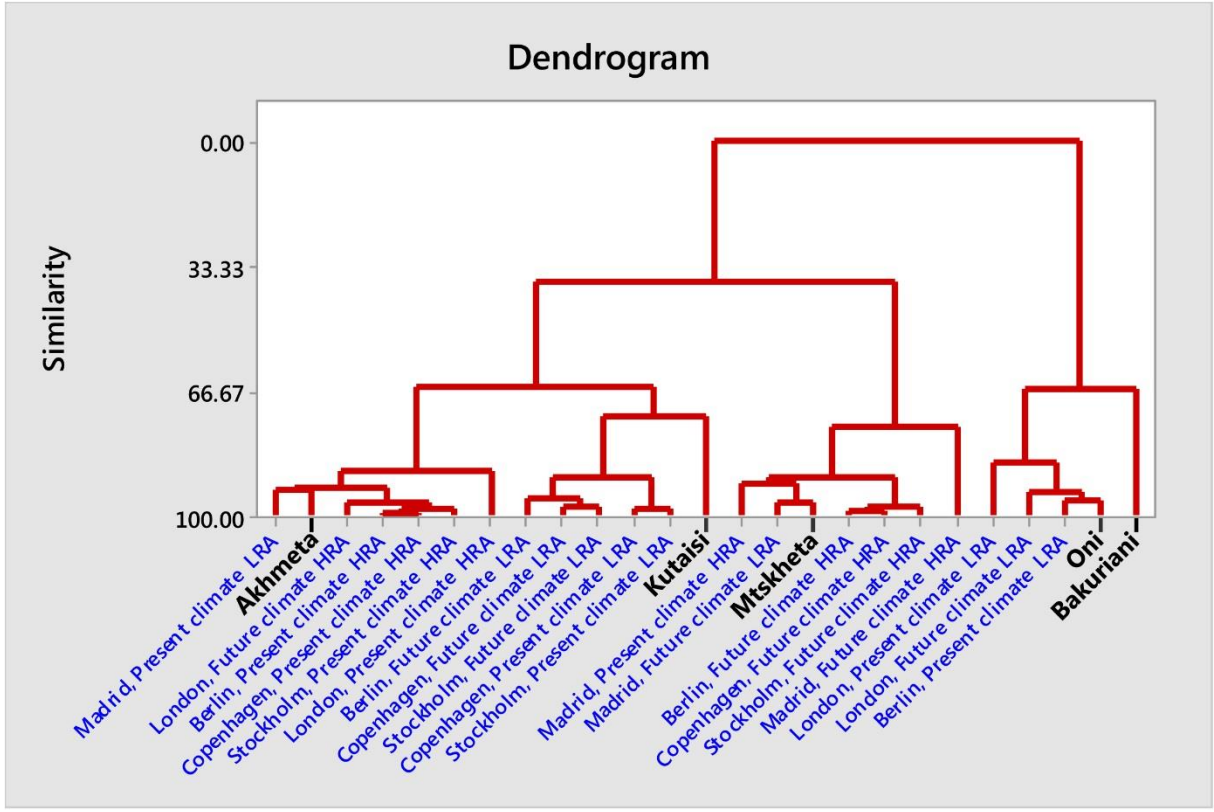

*Tilia tomentosa, Moldavia 2010*

$$PET = 16\left(\frac{L}{12}\right)\left(\frac{N}{30}\right)\left(\frac{10T_a}{I}\right)^{\alpha}$$

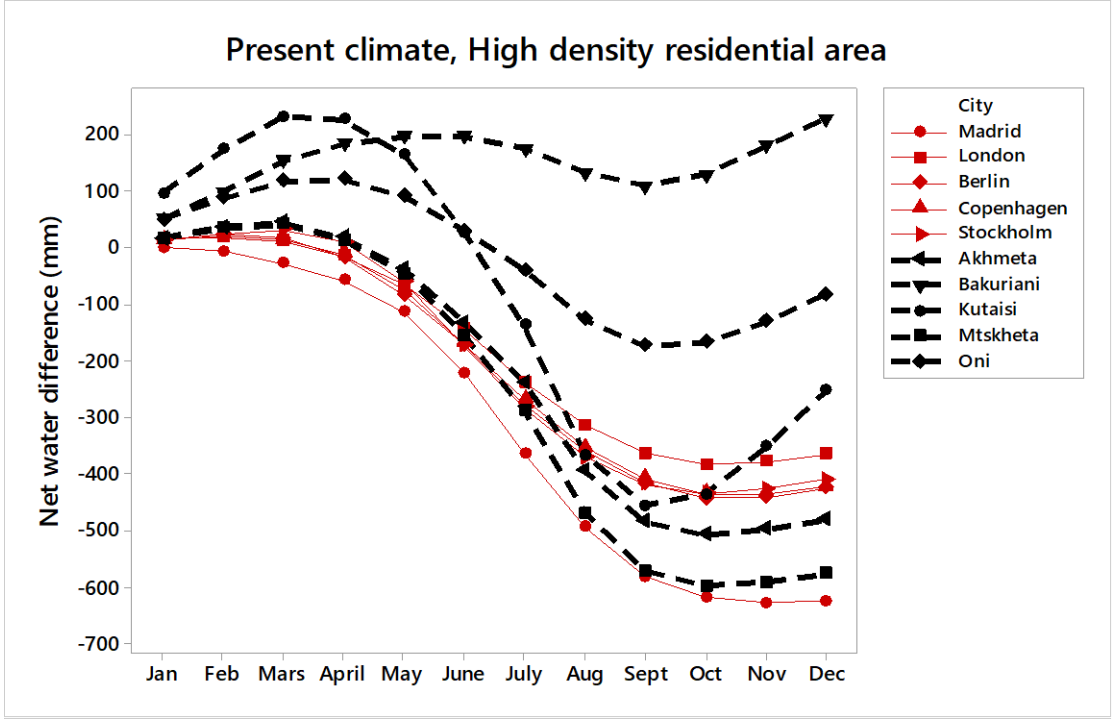
$$\alpha = (6{,}75 \times 10^{-7})\mathrm{I}^3 - (7{,}71 \times 10^{-5})\mathrm{I}^2 + (1{,}792 \times 10^{-2})\mathrm{I} + 0{,}49239$$

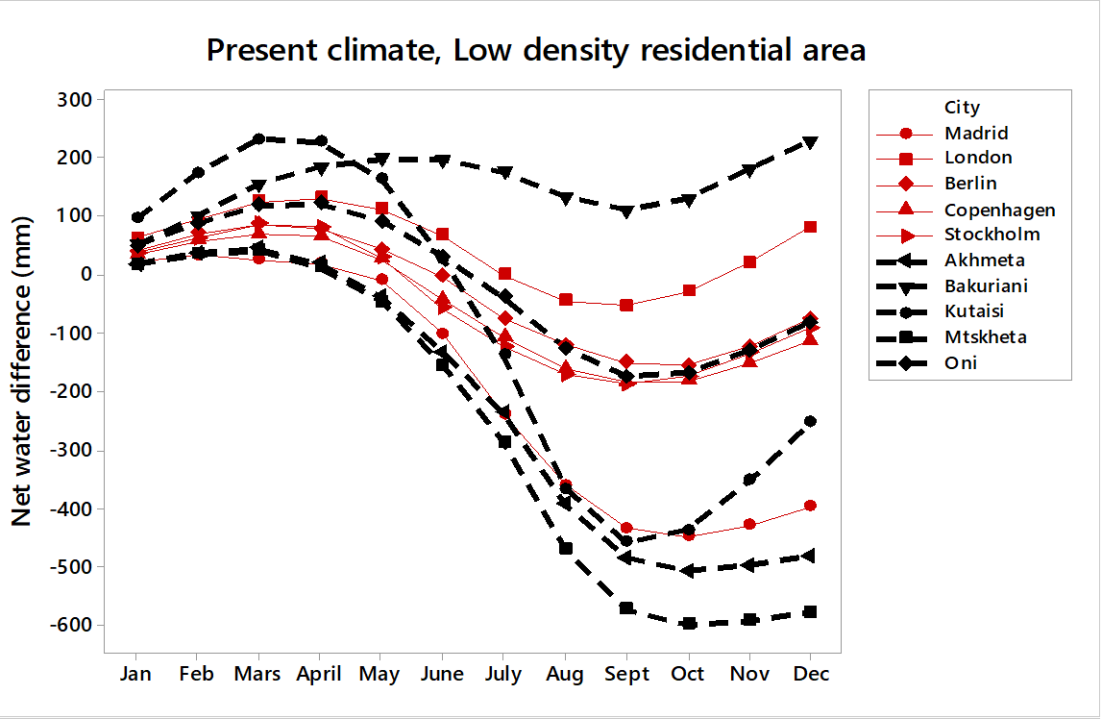
$$I = \sum_{i=1}^{12}\left(\frac{T_{ai}}{5}\right)^{1{,}514}$$




(Sjöman et al. 2019)


Present climate, High density residential area
Net water difference (mm)
200
100
0
-100
-200
-300
-400
-500
-600
-700
Jan Feb Mars April May June July Aug Sept Oct Nov Dec
City
Madrid
London
Berlin
Copenhagen
Stockholm
Akhmeta
Bakuriani
Kutaisi
Mtskheta
Oni


Present climate, Low density residential area
Net water difference (mm)
300
200
100
0
-100
-200
-300
-400
-500
-600
Jan Feb Mars April May June July Aug Sept Oct Nov Dec
City
Madrid
London
Berlin
Copenhagen
Stockholm
Akhmeta
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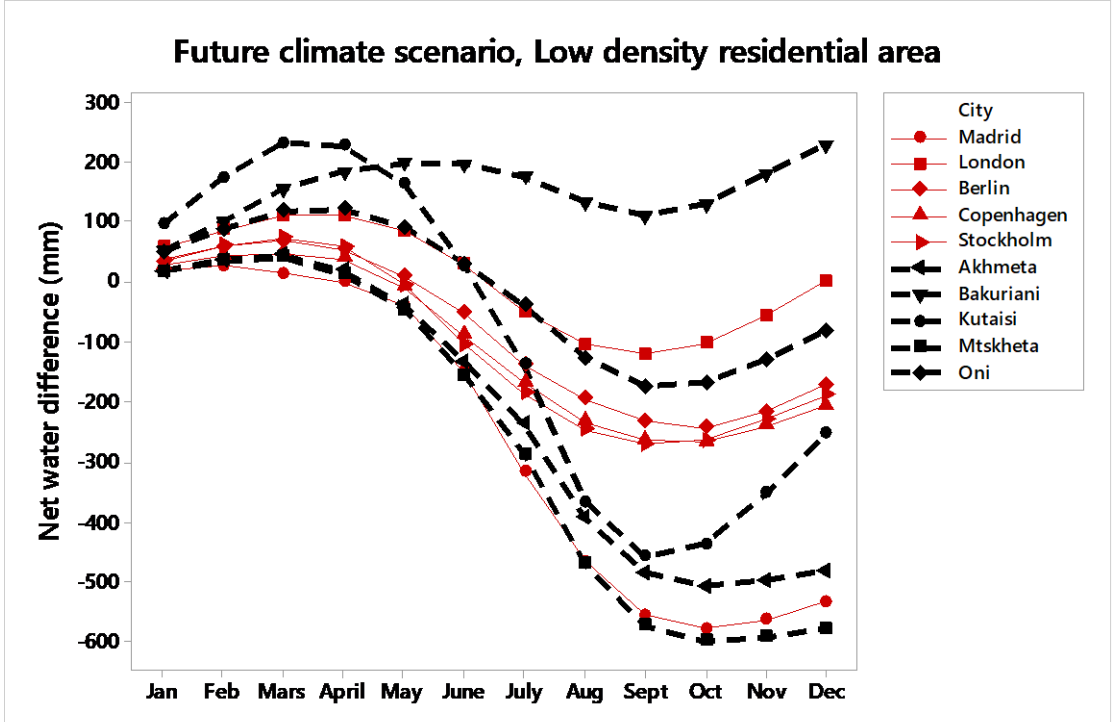
Mtskheta
Oni


Future climate scenario, Low density residential area
Net water difference (mm)
300
200
100
0
-100
-200
-300
-400
-500
-600
Jan Feb Mars April May June July Aug Sept Oct Nov Dec
City
Madrid
London
Berlin
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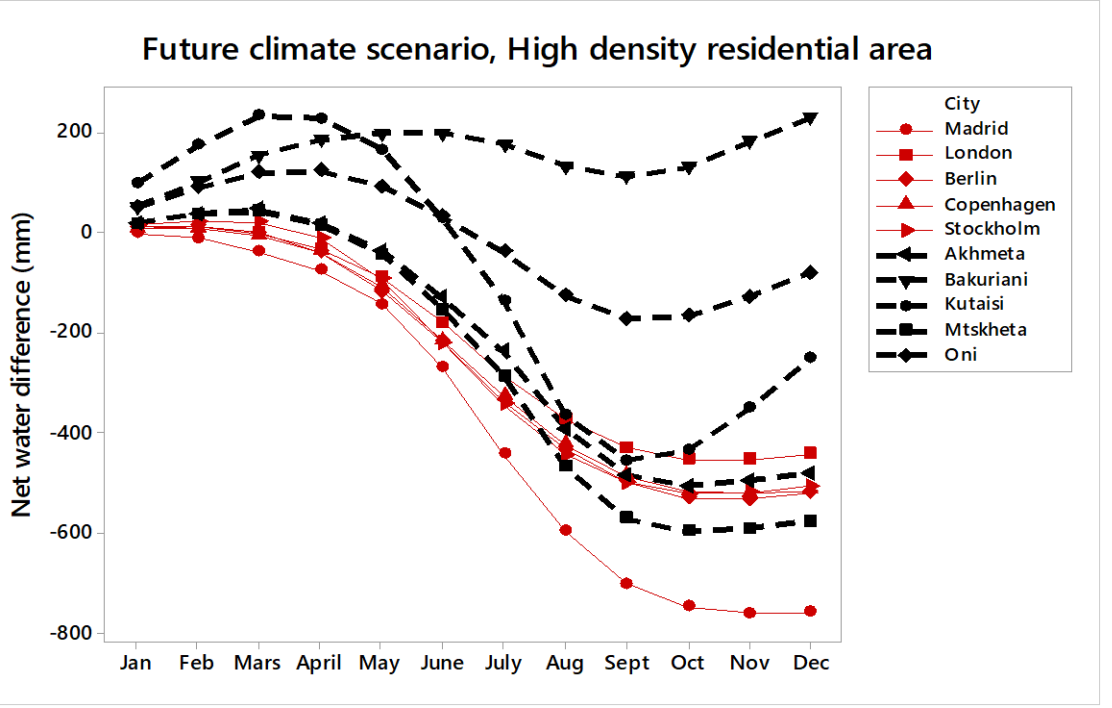

Future climate scenario, High density residential area
Net water difference (mm)
200
0
-200
-400
-600
-800
Jan Feb Mars April May June July Aug Sept Oct Nov Dec
City
Madrid
London
Berlin
Copenhagen
Stockholm
Akhmeta
Bakuriani
Kutaisi
Mtskheta
Oni


Steppe Forests in Central Georgia


*Carpinus orientalis*

Steppe forest with *Zelkova carpinifolia* (west Georgia)

Zelkova carpinifolia


*Celtis caucasica* (northeast Georgia)

# What do we grow in nurseries?

**Q 1:** Do you have information from which geographical region the genetic material the species you have in your production origin from?

**Q2:** Do you know from which type of ecosystem the genetic material of the species you have in your production origin from?

**Q3:** Where is the plant material propagated?

Acer platanoides
Acer rubrum
Betula pendula
Carpinus betulus
Liriodendron tulipifera

| Nursery | Q1 | Q2 | Q3 |
|---|---|---|---|
| German 1 | No | No | Locally – Northern Germany |
| German 2 | No | No | Acer platanoides – Northwest Germany<br>Acer rubrum – Holland<br>Betula pendula – Northwest Germany<br>Carpinus betulus – Northwest Germany<br>Liriodendron tulipifera - Holland |
| German 3 | No | No | Holland |
| German 4 | Acer platanoides – local source, northern Germany<br>Acer rubrum – No<br>Betula pendula – local source, northern Germany<br>Carpinus betulus – local source, northern Germany<br>Liriodendron tulipifera - No | No | Locally in northern Germany & Holland |
| German 5 | No | No | Locally – Northern Germany |
| German 6 | No | No | Holland |
| Holland 1 | Acer platanoides – Holland, Belgium or Germany<br>Acer rubrum – No<br>Betula pendula – Holland, Belgium or Germany<br>Carpinus betulus – Holland, Belgium or Germany<br>Liriodendron tulipifera - No | No | Holland, Belgium and Germany |
| Holland 2 | No | No | Holland |
| Holland 3 | Holland and Germany | No | Holland and Germany |
| Holland 4 | No | No | Holland |
| Holland 5 | No | No | Holland mainly – some in Germany |
| Holland 6 | No | No | Holland mainly – some in Germany |
| Holland 7 | No | No | Holland |
| England 1 | No | No | Acer platanoides – Holland<br>Acer rubrum – Holland<br>Betula pendula – UK<br>Carpinus betulus – Holland<br>Liriodendron tulipifera - Holland |
| England 2 | Acer platanoides – local source, Kent, UK<br>Acer rubrum – No<br>Betula pendula – local source, Midlands & Scotland UK<br>Carpinus betulus – local source, Kent, UK<br>Liriodendron tulipifera – USA (no more detailed info) | No | No info |
| England 3 | No | No | Holland and Germany |

Table 1. Category A nurseries

| Nursery | Q1 | Q2 |
|---|---|---|
| German 1 | Acer platanoides – northern Germany<br>Acer rubrum – No (maybe Canada)<br>Betula pendula –northern Germany<br>Carpinus betulus – northern Germany<br>Liriodendron tulipifera – seeds from planted trees in southern Germany, no more info | No |
| German 2 | No | No |
| Holland 1 | Acer platanoides – Hungary<br>Acer rubrum – No<br>Betula pendula – Holland<br>Carpinus betulus – Holland and Hungary<br>Liriodendron tulipifera - No | No |
| Holland 2 | Acer platanoides – Holland<br>Acer rubrum – No<br>Betula pendula – Holland<br>Carpinus betulus – Germany and Hungary<br>Liriodendron tulipifera - No | No |
| Holland 3 | Acer platanoides – Holland<br>Acer rubrum – No<br>Betula pendula – Holland<br>Carpinus betulus – Holland<br>Liriodendron tulipifera - No | No |
| Holland 4 | Acer platanoides – several seed sources from UK, Germany, France and Holland<br>Acer rubrum – No<br>Betula pendula – Germany and UK<br>Carpinus betulus – Holland<br>Liriodendron tulipifera - No | No |
| Holland 5 | All over Europe from different seed sources – differ from year to year | No |
| England 1 | Acer platanoides – several seed sources in UK<br>Acer rubrum – No<br>Betula pendula – several seed sources in UK<br>Carpinus betulus – several seed sources in UK<br>Liriodendron tulipifera - No | No |

Table 2. Category B nurseries

# Question 2:

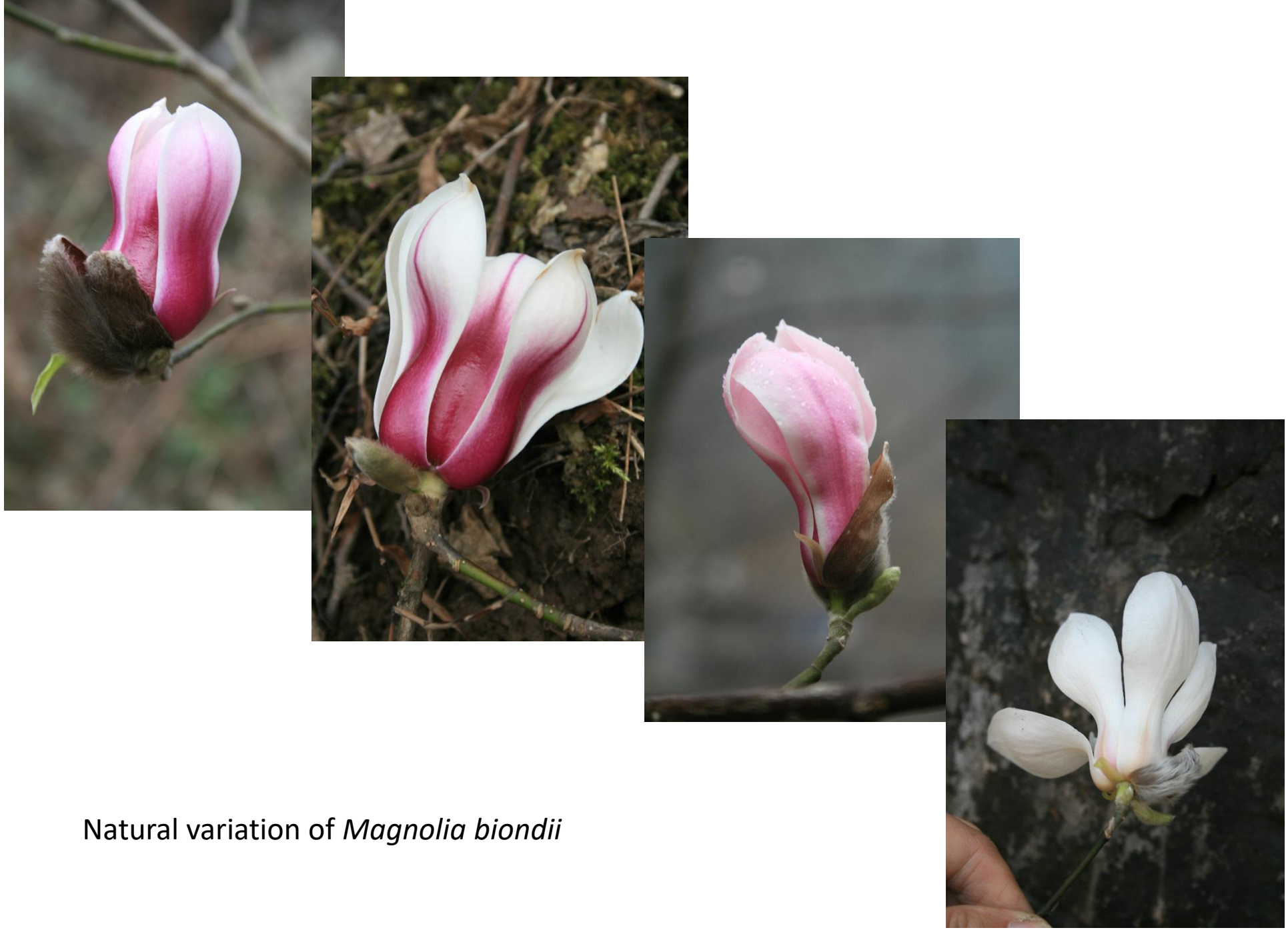
Do we have already collected and discovered the best horticultural material of the species?

Betula albosinensis

Betula albosinensis, Qingling Mt. China

*Parrotia persica* (south east Azerbadjan)

# Magnolia biondii



Natural variation of *Magnolia biondii*

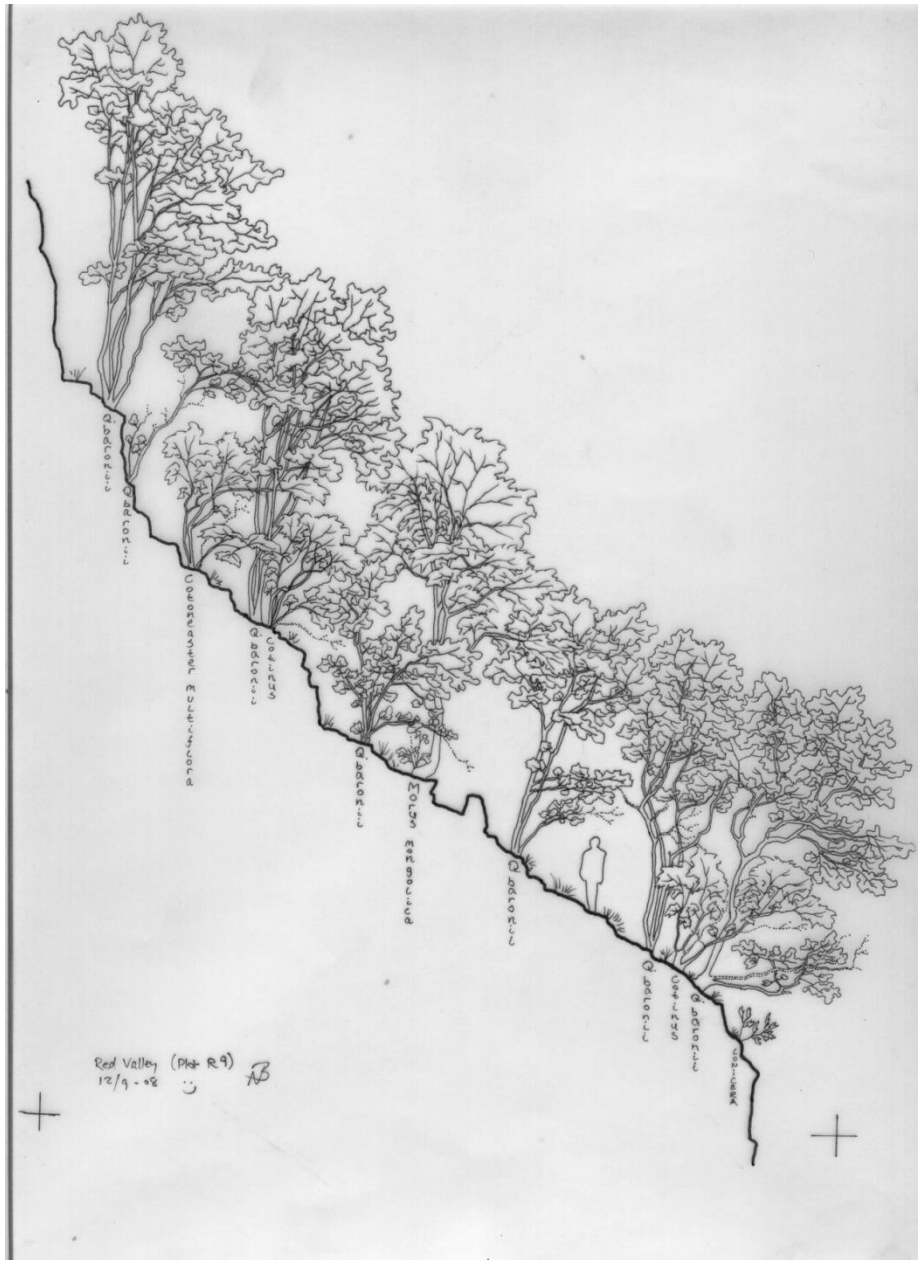
Oak- and silverlime forests, Northeast Romania

Collection of elite types of silver lime (*Tilia tomentosa*) in Romania 2015 & 2017 in collaboration with Iasi Botanical Garden

# Question 3:

Do we know how to grow and cultivate the trees of tomorrow?

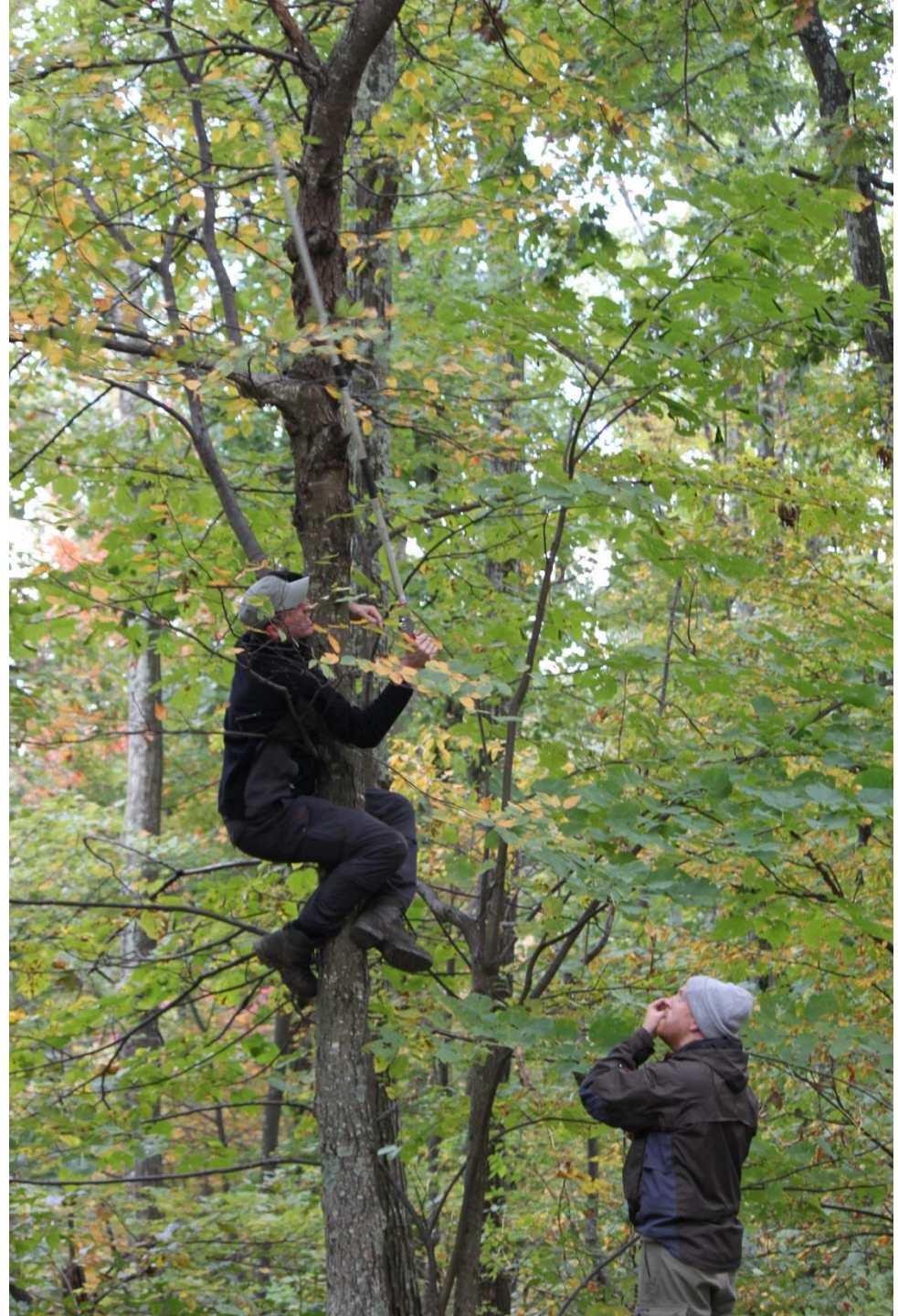
# Qinling Mt. China


Red Valley (Plot R9)
12/9-08


Quercus aliena


Taibai Mt. 2008. Anders Busse Nielsen (Sjöman et al. 2010)


喝山城 冰爽
开盖有奖!
盖内兑奖标识:




KARAMELL KUNGEN


Alnarp 2012


PRIME

# Future Flora

## Selecting plants for climate change

www.futureflora.org


PLANT
GEEK!

# Native or exotic tree species for urban environments?

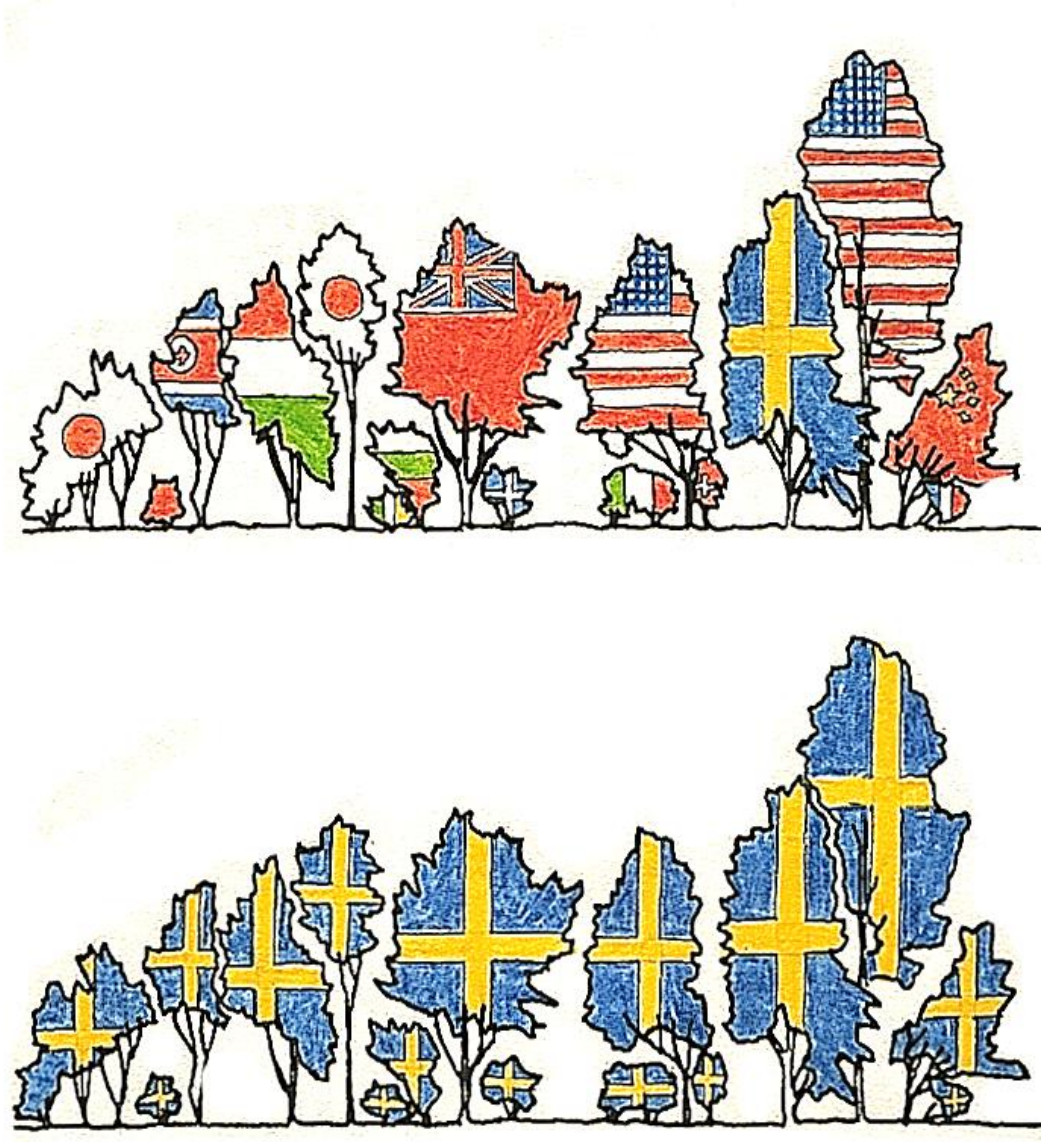


Illustration: Roland Gustavsson

Urban Forestry & Urban Greening 18 (2016) 237–241

Contents lists available at ScienceDirect

Urban Forestry & Urban Greening

journal homepage: www.elsevier.com/locate/ufug

Short communication

# Diversification of the urban forest—Can we afford to exclude exotic tree species?

Henrik Sjöman[a,b,*], Justin Morgenroth[c], Johanna Deak Sjöman[a], Arne Sæbø[d], Ingo Kowarik[e]

[a] Swedish University of Agricultural Sciences, Faculty of Landscape Planning, Horticulture and Agricultural Science, Department of Landscape Architecture, Planning and Management, P.O. Box 66, SE-23053 Alnarp, Sweden
[b] Gothenburg Botanical Garden, Carl Skottsbergs Gata 22A, SE-413 19 Gothenburg, Sweden
[c] New Zealand School of Forestry, University of Canterbury, Christchurch, New Zealand
[d] Bioforsk, Vest Særheim, Postvegen 213, 4353 Klepp st., Norway
[e] Technische Universität Berlin, Department of Ecology, Rothenburgstr. 12, D 12165 Berlin, Germany

ARTICLE INFO

*Article history:*
Received 22 April 2015
Received in revised form 20 May 2016
Accepted 11 June 2016
Available online 16 June 2016

*Keywords:*
Diversity
Invasive trees
Resilience
Tree selection
Urban trees
Urban forestry
Urban planning

ABSTRACT

Introduced tree species represent a substantial component of urban forests in cities all over the world. Yet there is controversy about the further use of introduced tree species. Many practice orientated publications,research papers and governmental websites in the fields of urban planning, urban forestry, and urban ecology argue for planting native species and avoiding introduced species. Such arguments for native-only species selection are also touted by environmental groups and the media. Consequently the debate has sometimes spiralled away from a sensible and rational platform where invasion risks and biodiversity loss are discussed, to a groundless and unreasonable argument where exotic species are generally considered incapable of providing ecosystem services. From a European perspective, we here aim to curate a set of necessary considerations for current and future discussions on native and non-native plant material in sustainable urban development. Using examples from Northern and Central Europe we illustrate that in some regions the catalogue of native tree species may be too limited to fulfil ecosystem services and resilience in harsh urban environments. A main message from our line of arguments is that we cannot afford to generally exclude non-native tree species from urban greening. If "native-only" approaches become incorporated in regional, national or international policy documents or legislation there is a risk that urban ecosystem resilience will be compromised, particularly in regions with extreme environmental conditions. Since both invasion risks and sizes of native species pools vary conspicuously at regional to continental scales we also argue to adapt urban policies on using non-native trees to regional contexts.



## 1. Introduction

Introduced tree species represents substantial component of urban forests in cities all over the world (e.g. Cowett and Bassuk, 2014; Sjöman et al., 2012; Yang et al., 2012; Freire Moro et al., 2014). Yet there is controversy about the further use of introduced tree species. Many practice orientated publications, research papers and governmental websites in the fields of urban planning, urban forestry, and urban ecology argue for planting native species and avoiding introduced species (Kendle and Rose, 2000).

Similarly, guidelines and evaluation programs for sustainable urban development recommend the preference of native over non-native tree species. In the UK, for example, an important instrument for setting standards for best practice in sustainable design (BRE Environmental Assessment Method) emphasises and encourages the use of native plants (BREEAM, 2011). In the US, a similar quality programme, LEED (Leadership in Energy & Environmental Design), recommends native plants in order to reach high performance, though it allows non-native species as long they are site adapted and well-performing (USGBC, 2014). In Sweden, the Green Area Factor approach is a comparable programme to secure sustain-

* Corresponding author at: Swedish University of Agricultural Sciences, Faculty of Landscape Planning, Horticulture and Agricultural Science, Department of Landscape Architecture, Planning and Management, P.O. Box 66, SE-23053 Alnarp, Sweden.
*E-mail addresses:* henrik.sjoman@slu.se (H. Sjöman), justin.morgenroth@canterbury.ac.nz (J. Morgenroth), johanna.deak.sjoman@slu.se (J.D. Sjöman), Arne.Sabo@bioforsk.no (A. Sæbø), kowarik@tu-berlin.de (I. Kowarik).

http://dx.doi.org/10.1016/j.ufug.2016.06.011
1618-8667/

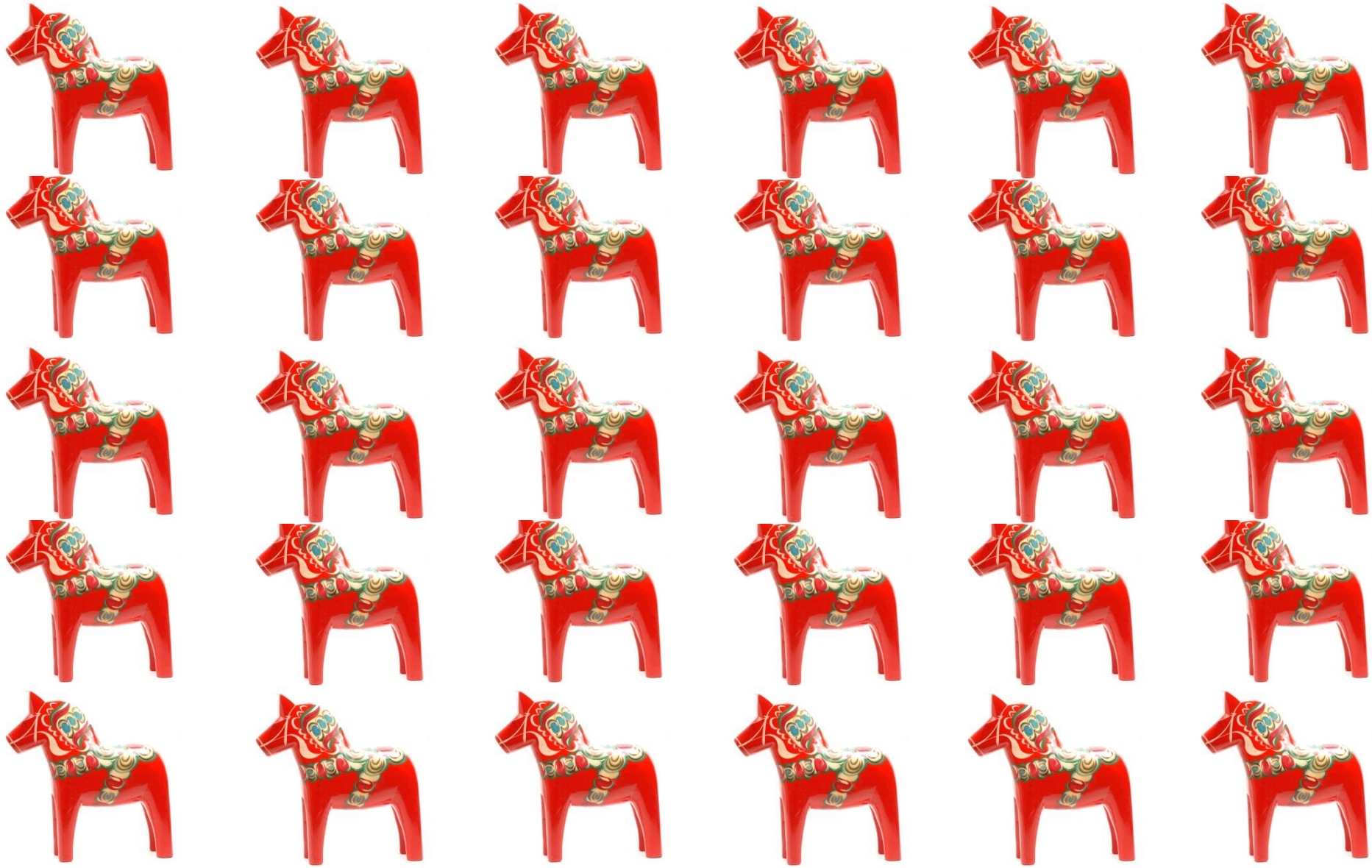
# Sustainable urban environments AND Native tree species

# How is the future of only native tree species for urban environments?

- Sweden have total 30 native tree species

  ✓Which is (or will get) infested by serious diseases or insect attacks?

  ✓Which remaining species have the capacity to develop into large healthy trees in inner-city environments?




Dutch Elm Disease (*Ophiostoma novo-ulm)*


*Robinia pseudoacacia* ’Unifoliola’

Juniperus communis

Prunus avium

Carpinus betulus

Sorbus intermedia

# Sustainable urban environments AND Native tree species


RHO