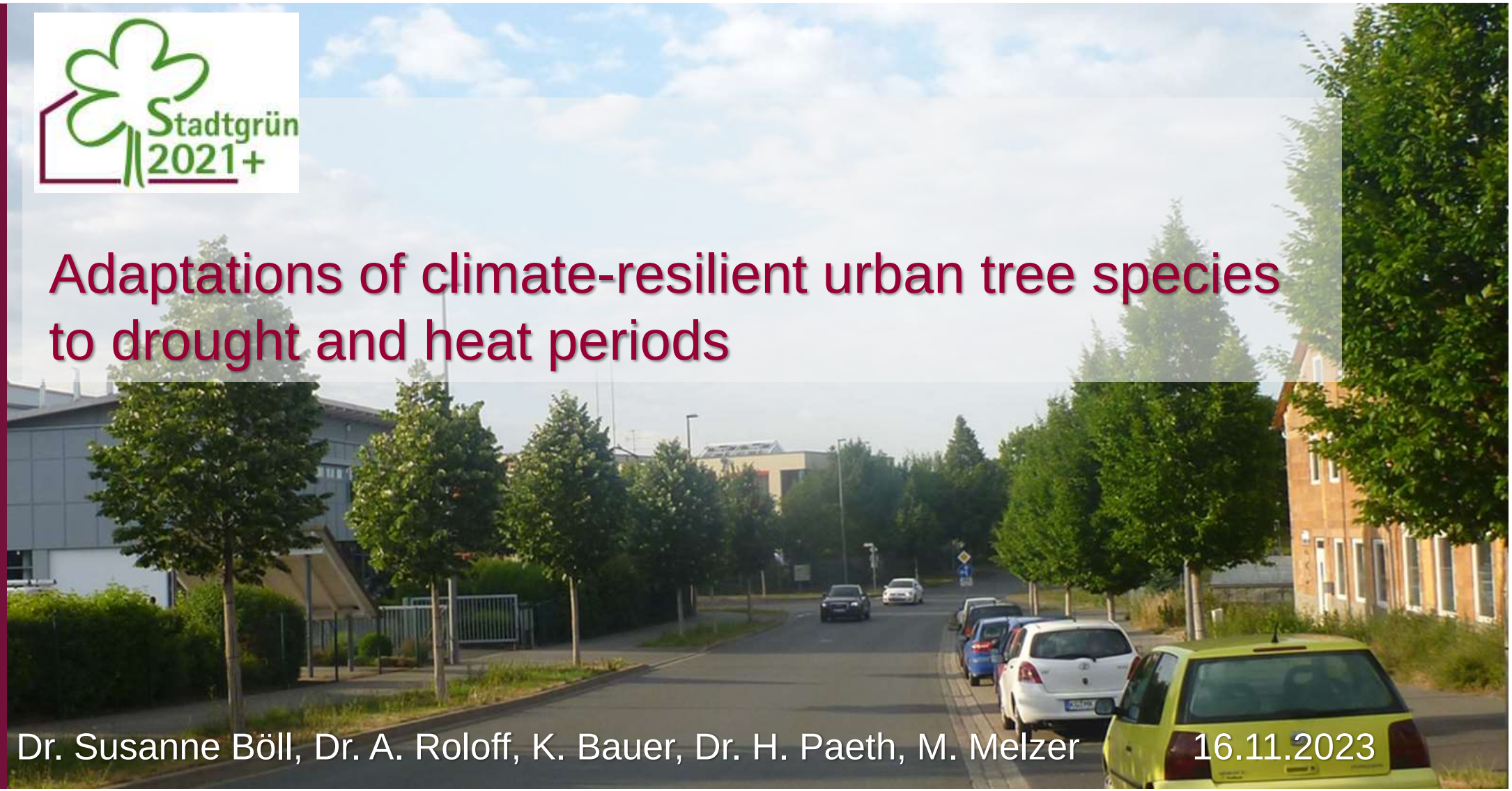
Bayerische Landesanstalt für
Weinbau und Gartenbau

Stadtgrün 2021+

Adaptations of climate-resilient urban tree species to drought and heat periods



Dr. Susanne Böll, Dr. A. Roloff, K. Bauer, Dr. H. Paeth, M. Melzer

16.11.2023

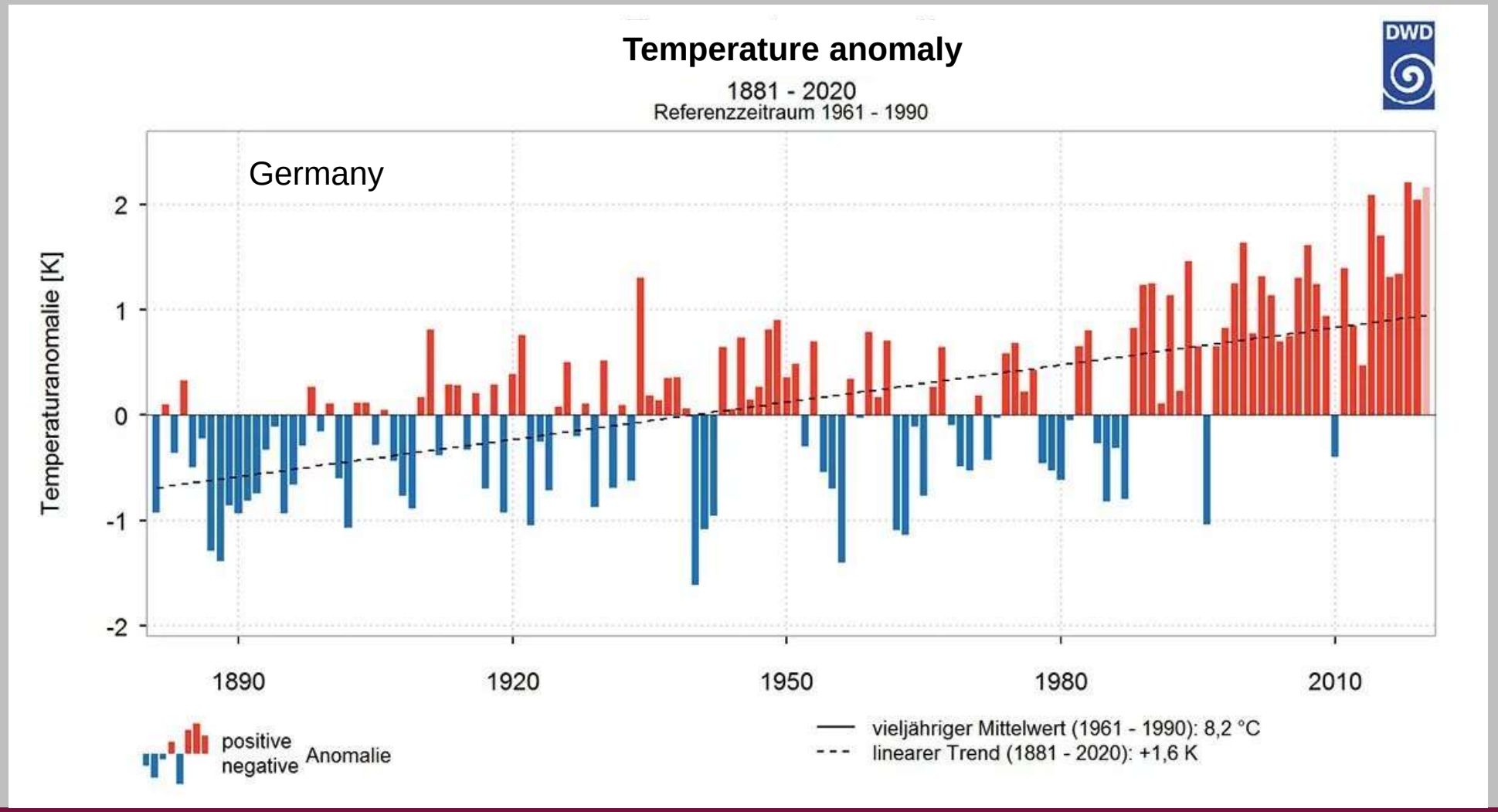
www.lwg.bayern.de

Important ecosystem services of urban trees

1 adult tree has the same cooling capacity as 10 air conditions

source: University of Wageningen, NL

Stress-tolerant urban trees



progressive urbanisation + climate change

Stress-tolerant urban trees

Effects of increasing drought and heat stress

Extreme summer 2003, 2015, 2018, 2019, 2020, 2022 …

Stress-tolerant urban trees

- summer linden
- winter linden
- mountain maple
- Norway maple
- London plane
- chestnut
- common ash

- (formerly elms)

Bsp. Jena (D. Knopf, ProBaum 2016)

only few major tree species in the cities!

Stress-tolerant urban trees

Need of more urban tree species !

2009: 20 test tree species

Versuchsbaumarten	dt. Name	Herkunft
Acer buergerianum	Dreizahnahorn	Bergwälder Japans
Acer monspessulanum	Frz. Ahorn	Mittel-/Südeuropa
Alnus x spaethii	Purpurerle	Späth, Berlin, 1908
Carpinus betulus Frans Fontaine	Hainbuche	GA Eindhoven, NL 1983
Celtis australis	Zürgelbaum	Südeuropa, N-/W- Afrika
Fraxinus ornus	Blumenesche	Südeuropa, Westasien
Fraxinus pennsylvanica Summit	Rotesche	Mitte/ Osten USA, Sorte 1957
Ginkgo biloba	Ginkgo	China
Gleditsia triacanthos Skyline	Gleditsie	Nordamerika, Sorte 1957
Liquidambar styraciflua	Amberbaum	Osten USA
Magnolia kobus	Kobushi-Magnolie	Japan
Ostrya carpinifolia	Hopfenbuche	Südeuropa, Kleinasien
Parrotia persica	Eisenholzbaum	Nordiran, S-Rußland
Quercus cerris	Zerreiche	Mittel-/Südeuropa, Kleinasien
Quercus x hispanica Wageningen	Span. Eiche	NAK Selektion, Ede, NL 1979
Quercus frainetto Trump	Ungarische Eiche	Osteuropa, NL 1979
Sophora japonica Regent	Jap. Schnurbaum	China, Korea, Sorte USA 1964
Tilia tomentosa Brabant	Silberlinde	SO-Europa, Kleinasien, 1930
Ulmus Lobel	Ulme	Wageningen, NL 1973
Zelkova serrata Green Vase	Jap. Zelkove	China, Korea, Sorte USA 1983

Stress-tolerant urban trees

Need of more urban tree species !

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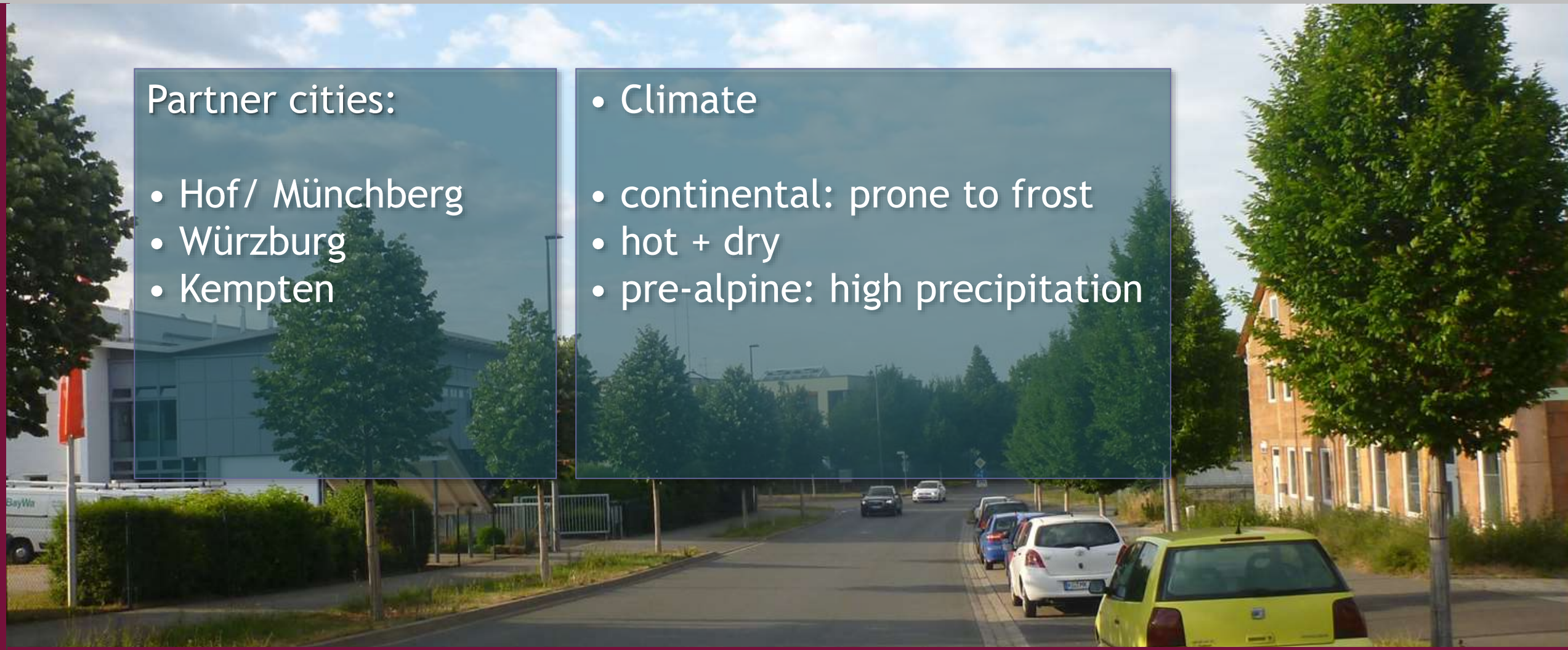
Alnus x spaethii	Purpurerle	Späth, Berlin, 1908
Carpinus betulus Frans Fontaine	Hainbuche	GA Eindhoven, NL, 1983
Celtis australis		Afrika
Fraxinus ornus		asien
Fraxinus penn		Sorte 1957
Ginkgo biloba		
Gleditsia triac		e 1957
Liquidambar s		
Magnolia kob		
Ostrya carpini		sien
Parrotia persi		nd
Quercus cerri		Kleinasien
Quercus x his		e, NL 1979
Quercus frain		79
Sophora japo		te USA 1964
Tilia tomentos		asien, 1930
Ulmus Lobel	Ulme	Wageningen, NL 1973
Zelkova serrata Green Vase	Jap. Zelkove	China, Korea, Sorte USA 1983

2015: 10 test tree species

Versuchsbaumarten	dt. Name
Acer opalus	Schneeballahorn
Acer rubrum Somerset	Rotahorn "Somerset"
Eucommia ulmoides	Guttaperchabaum
Juglans nigra	Schwarznuss
Malus tschonoskii	Wollapfel
Platanus orientalis	Morgenländische Platane
Sorbus latifolia Henk Vink	Breitblättrige Mehlbeere
Tilia americana Redmond	Amerikanische Linde
Tilia mongolica	Mongolische Linde
Ulmus Rebona	Ulme

Stress-tolerant urban trees



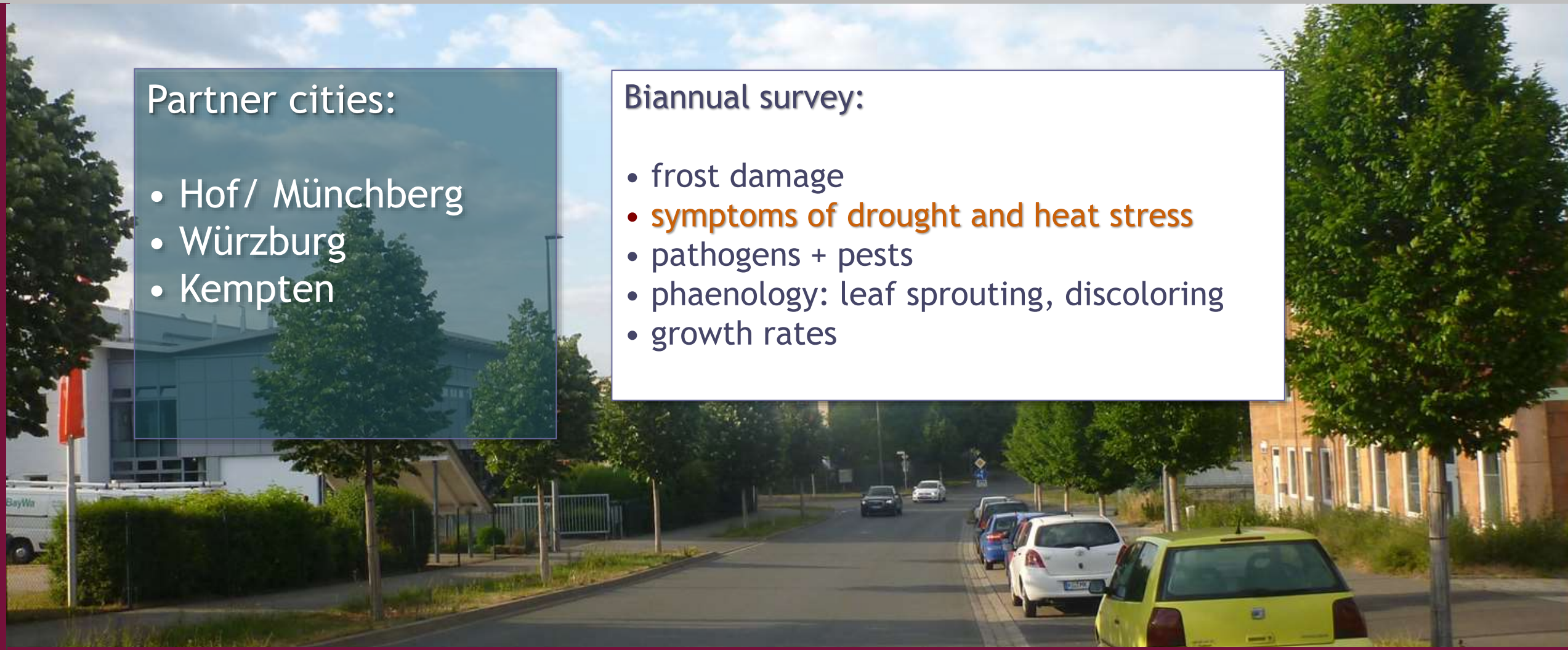
Partner cities:

- Hof/ Münchberg
- Würzburg
- Kempten

- Climate

- continental: prone to frost
- hot + dry
- pre-alpine: high precipitation

Stress-tolerant urban trees



Partner cities:

- Hof/ Münchberg
- Würzburg
- Kempten

Biannual survey:

- frost damage
- symptoms of drought and heat stress
- pathogens + pests
- phaenology: leaf sprouting, discoloring
- growth rates

Evaluation: survey + growth rates

Stress - tolerant urban trees

„Best-of“ tree lists for climatically different test sites (Bavarian cities)

Hof/ Münchberg	Kempten	Würzburg
Alnus x spaethii	*Alnus x spaethii*	*Acer monspessulanum*
Fraxinus ornus	*Fraxinus ornus*	*Alnus x spaethii*
Fraxinus pennsylvanica Summit	*Gleditsia triacanthos* Skyline	*Carpinus betulus* Frans Fontaine
Gleditsia triacanthos Skyline	*Magnolia kobus*	*Fraxinus ornus*
Liquidambar styraciflua	*Quercus frainetto* Trump	*Gleditsia triacanthos* Skyline
Magnolia kobus	*Styphnolobium japonicum* Regent	*Ostrya carpinifolia*
Quercus cerris	*Ulmus* Lobel	
Styphnolobium japonicum Regent		
Ulmus Lobel		
		Brabant
Ac		*Ulmus* Lobel
Jug		
Malus tschonoskii		*Acer opalus*
Tilia americana Redmond		*Malus tschonoskii*
Ulmus Rebona		*Sorbus latifolia* Henk Vink
		Tilia americana Redmond
		Tilia mongolica
		Ulmus Rebona

https://www.lwg.bayern.de/mam/cms06/landespflege/dateien/lwg_st adtgruen_falzflyer_englisch_bf.pdf

2010

2015

Jahresmittel (DWD):

T °C:	6,4	6,9	9,1
mm:	742	1273	602

Stress - tolerant urban trees

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Hof/ Münchberg	Kempten	Würzburg
Alnus x spaethii	*Alnus x spaethii*	*Acer monspessulanum*
Fraxinus ornus	*Fraxinus ornus*	*Alnus x spaethii*
Fraxinus pennsylvanica Summit	*Gleditsia triacanthos* Skyline	*Carpinus betulus* Frans Fontaine
Gleditsia triacanthos Skyline	*Magnolia kobus*	*Fraxinus ornus*
Liquidambar styraciflua	*Quercus frainetto* Trump	*Gleditsia triacanthos* Skyline
Magnolia kobus	*Styphnolobium japonicum* Regent	*Ostrya carpinifolia*
Quercus cerris	*Ulmus* Lobel	*Quercus cerris*
Styphnolobium japonicum Regent		*Quercus frainetto* Trump
Ulmus Lobel	*Eucommia ulmoides*	*Styphnolobium japonicum* Regent
	Juglans nigra	*Tilia tomentosa* Brabant
Acer opalus	*Ulmus* Rebona	*Ulmus* Lobel
Juglans nigra		
Malus tschonoskii		*Acer opalus*
Tilia americana Redmond		*Malus tschonoskii*
Ulmus Rebona		*Sorbus latifolia* Henk Vink
		Tilia americana Redmond
		Tilia mongolica
		Ulmus Rebona

2010

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Stress - tolerant urban trees

Reactions to heat and drougt stress

But how do they do it ??

August Würzburg

Stress - tolerant urban trees

Stress-tolerant urban trees

Adaptations to heat and drought stress

- **Genetically fixed**, origin-related adaptations

  e.g. leathery or hairy leaves, lowering of the water potential
- **Adaption** – medium-term adaptations

  e.g. smaller leaves, smaller, but more stomata
- **Acclimation** – short-term adaptations

  e.g. faster closing of stomata during drought periods

Stress-tolerant urban trees

species of continental origin

Genetic adaptations due to geographic origin

Stress-tolerant urban trees

species of continental origin

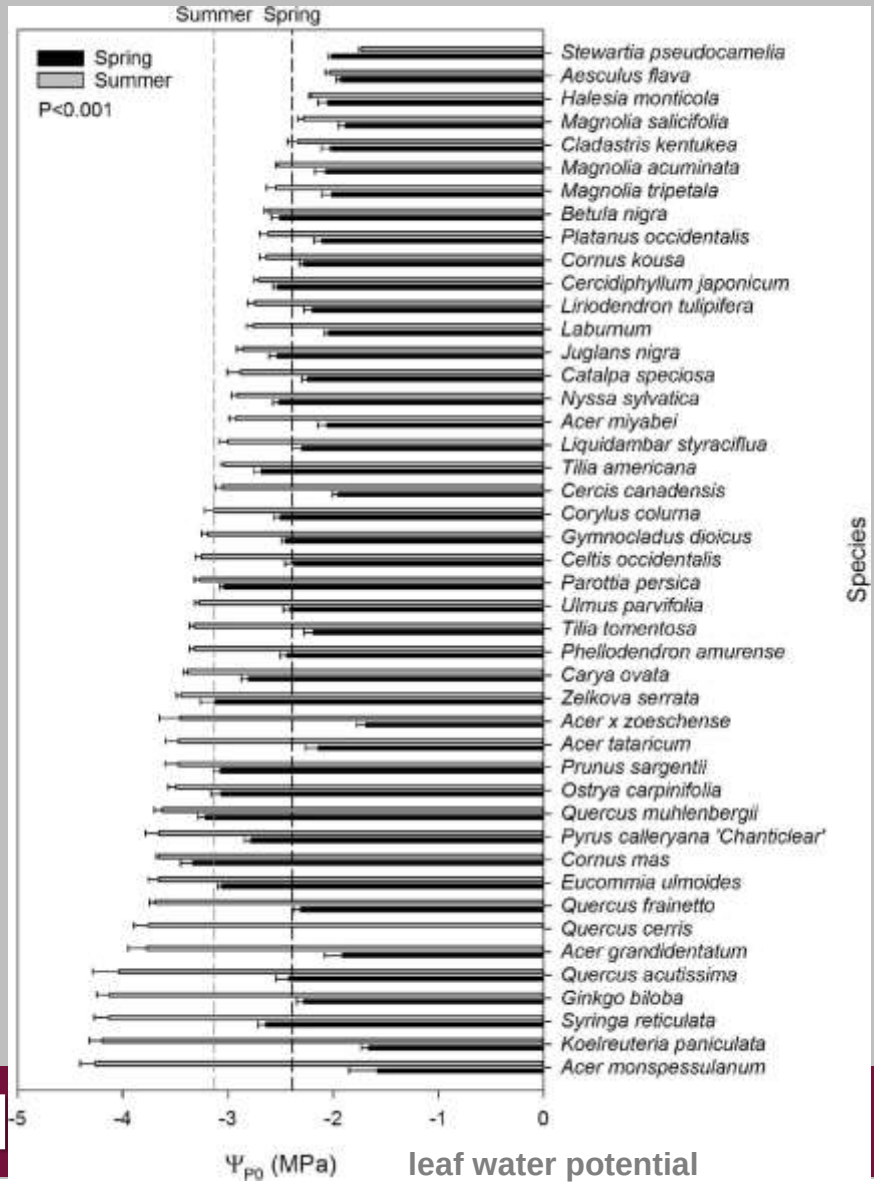
Versuchsbaumarten	Trockenstressanpassungen
Acer buergerianum	%
Acer monspessulanum	kleine, ledrige, glänzende Blätter
Acer opalus	derbe Blätter, helle Unterseite
Acer rubrum 'Somerset'	kleine Blätter (Blattwedeln)
Alnus x spaethii	gefiederte Blätter
Carpinus betulus 'Frans Fontaine'	derbe Blätter, sichtbare Hauptnerven
Celtis australis	derbe Blätter, sichtbare Hauptnerven, Blattrollen ("Schiffchenbildung")
Eucommia ulmoides	glänzende Blätter
Fraxinus ornus	derbe Blätter
Fraxinus pennsylvanica 'Summit'	gefiederte Blätter
Ginkgo biloba	derbe Blätter
Gleditsia triacanthos 'Skyline'	gefiederte Blätter, lichte Krone
Juglans nigra	gefiederte Blätter
Liquidambar styraciflua	glänzende Blätter, Korkleisten
Magnolia kobus	%
Malus tschonoskii	silberne Blattunterseite
Ostrya carpinifolia	derbe Blätter, sichtbare Hauptnerven/ verdickte Leitungselemente
Parrotia persica	dunkelrote Blattverfärbung (trotzdem strahlungsempfindlich)
Quercus cerris	ledrige, kleine Blätter
Quercus x hispanica 'Wageningen'	kleine, derbe Blätter, Korkleisten
Quercus frainetto 'Trump'	glänzende, dick-ledrige Blätter
Sorbus latifolia 'Henk Vink'	glänzende Blätter, helle Unterseite, sichtbare Hauptnerven
Styphnolobium japonicum 'Regent'	gefiederte Blätter, grüne Triebe/ PS, lichte Krone
Tilia americana 'Redmond'	%
Tilia mongolica	kleine Blätter
Tilia tomentosa 'Brabant'	silberne Blattunterseite, dichter Haarfilz, einesenkte Stomata, Blattdrehen + Heliotropismus
Ulmus 'Lobel'	derbe Blätter, sichtbare Hauptnerven
Ulmus 'Rebona'	glänzende, derbe Blätter
Zelkova serrata 'Green Vase'	gefiederte Blätter

Genetic adaptations due to geographic origin

Stress-tolerant urban trees

Physiological adaptations

Leaf water potentials at the wilting point of different tree species



Acclimation:
Ψ_{P0} summer << Ψ_{P0} spring

Sjöman et al. 2018, Urban Ecosystems

Genetic adaptations d

Stress-tolerant urban trees

Physiological adaptations

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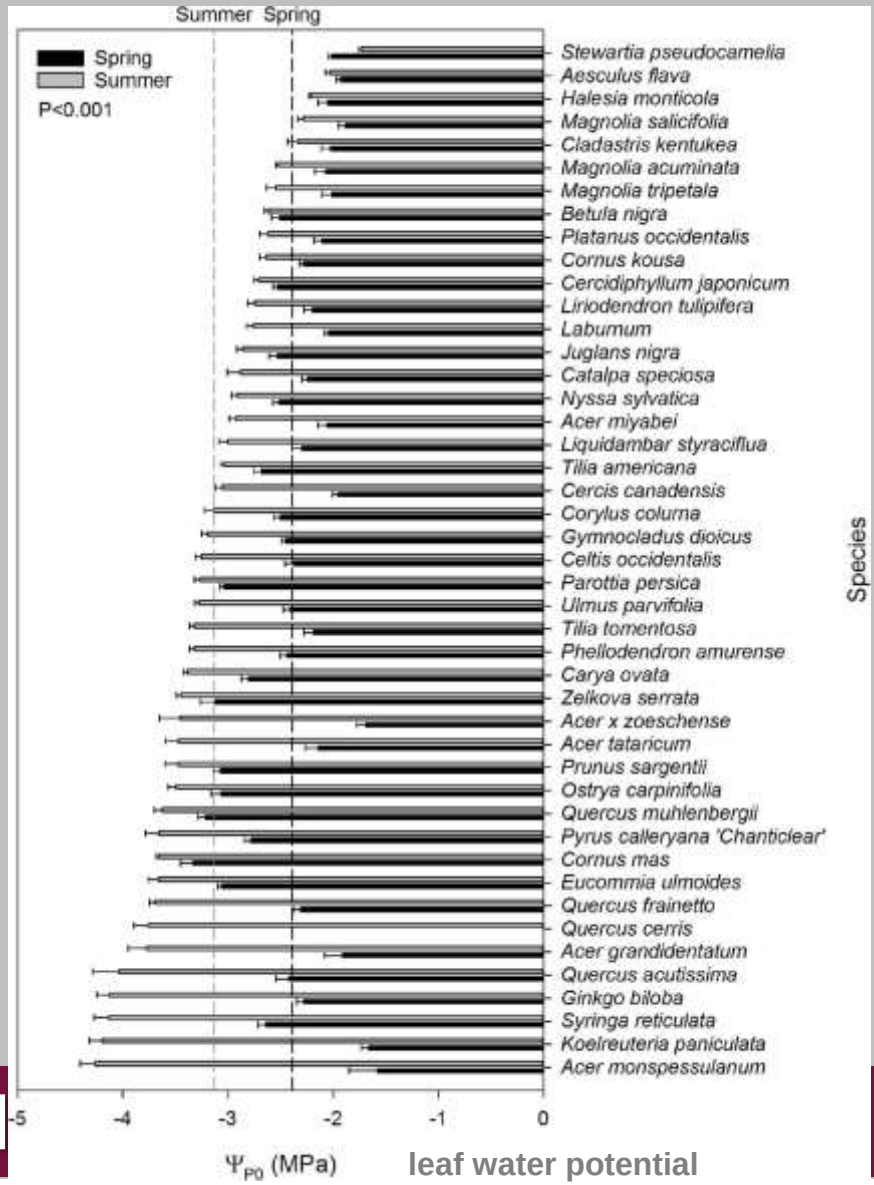

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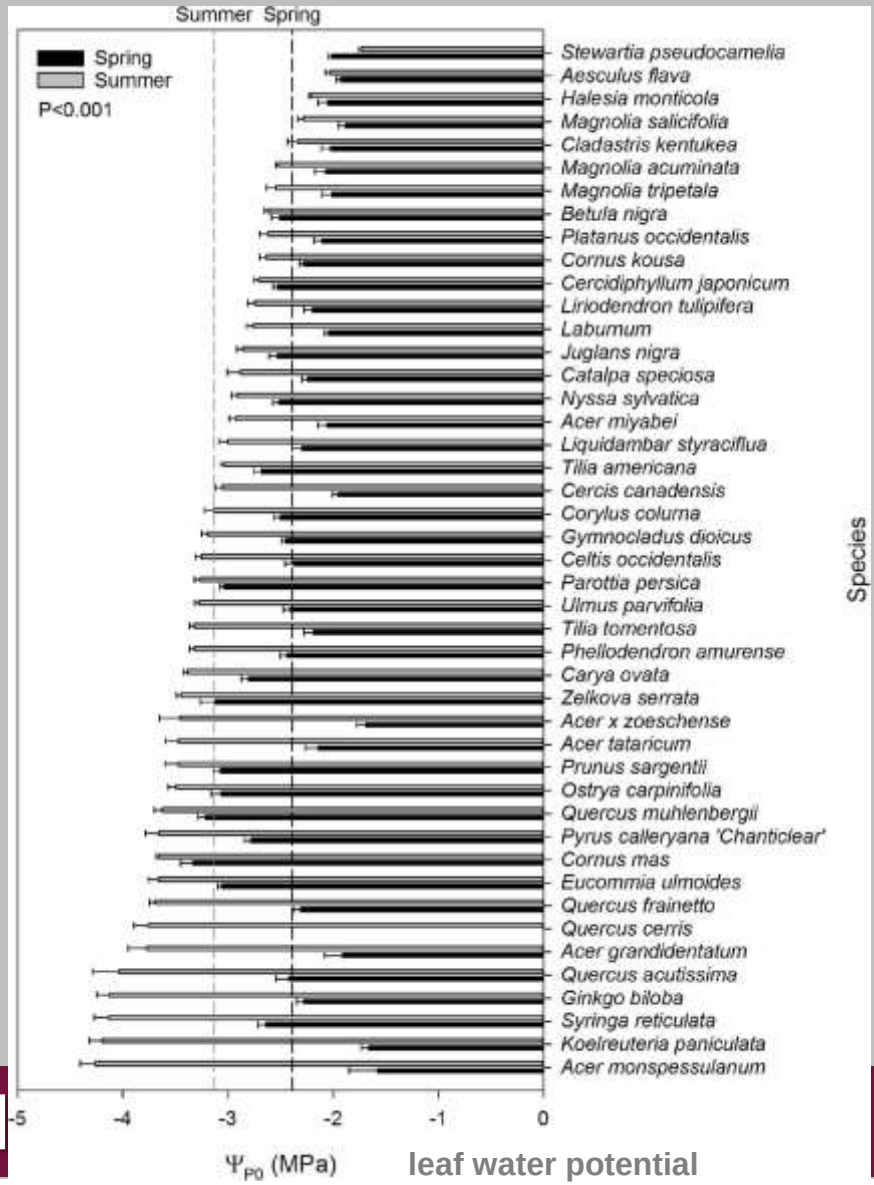

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Sjöman et al. 2018, Urban Ecosystems

Genetic adaptations d

Adaption: mid-term adaptations

„trade-off “ of investments

Adaptations to heat and drought stress

Stress-tolerant urban trees

Increase in the circumference of the trunk (cm) since planting

2010-2013

Versuchsbaumarten	Hof/ Münchberg	Kempten	Würzburg
A. buergerianum	7,4	3,8	9,1
A. monspessulanum	3,5	5,3	10,1
Alnus x spaethii	12,8	18,8	18,6
C.betulus Frans Fontaine	6,0	3,2	6,5
Celtis australis		4,8	8,1
Fraxinus ornus	7,5	4,8	10,9
F. pennsylvanica Summit	7,3	5,8	5,3
Ginkgo biloba	2,5	4,0	5,8
Gleditsia triacanthos Skyline	5,3	4,5	4,1
Liquidambar styraciflua	7,0	6,0	8,3
Magnolia kobus	6,1	3,3	3,9
Ostrya carpinifolia	8,3	4,3	9,1
Parrotia persica	5,5	5,6	6,8
Quercus cerris	7,9	4,3	7,6
Q. frainetto Trump	4,0	5,1	11,4
Q. hispanica Wageningen	8,8	4,0	6,0
Styphnolobium jap. Regent	9,3	5,8	7,4
Tilia tomentosa Brabant	12,4	4,8	12,0
Ulmus Lobel	10,5	10,0	8,4
Zelkova serrata Green Vase	7,6	10,4	10,0
Mittel	8,0	5,8	8,3

2010-2019

Versuchsbaumarten	Hof/ Münchberg	Kempten	Würzburg
A. buergerianum	18,0	13,4	22,4
A. monspessulanum	16,5	15,8	27,6
Alnus x spaethii	36,5	53,1	43,9
C.betulus Frans Fontaine	14,8	13,5	21,6
Celtis australis	tot	18,4	26,0
Fraxinus ornus	29,8	20,6	34,3
F. pennsylvanica Summit	23,8	22,3	24,7
Ginkgo biloba	.	7,2	23,3
Gleditsia triacanthos Skyline	14,8	14,9	16,3
Liquidambar styraciflua	19,3	18,8	21,3
Magnolia kobus	24,9	18,0	16,5
Ostrya carpinifolia	21,5	16,5	31,8
Parrotia persica Vanessa	15,0	15,5	19,5
Quercus cerris	27,4	14,0	27,1
Q. frainetto Trump	18,1	22,8	39,7
Q. hispanica Wageningen	27,0	18,5	18,3
Styphnolobium jap. Regent	38,9	25,8	25,7
Tilia tomentosa Brabant	40,6	21,5	31,8
Ulmus Lobel	26,2	36,2	27,3
Zelkova serrata Green Vase	23,0	31,0	26,8
Mittel	24,2	20,9	26,3

Adaptations to heat and drought stress

Adaption: mid-term adaptations

increase of sclerophylly
&
decrease of leaf size

Increase of sclerophylly 2018/2019

Sclerophyll-Index (leaves: mg dry weight/cm^2)

Würzburg	2017	2020
Fraxinus ornus	9,3	9,3
Fraxinus pennsylvanica Summit	8,9	10,7
Fraxinus excelsior Westhofs Glorie	8,0	9,8
Tilia cordata Greenspire	8,4	8,7
Tilia mongolica	9,9	11,1
Tilia tomentosa Brabant	8,0	10,1

Stress-tolerant urban trees

Sclerophylly & leaf area of native vs. Southeast European tree species before and after 2018/2019

Sclerophyll-Index (mg dry weight/cm²)

Würzburg	2017	2020
Fraxinus ornus	9,3	9,3
Fraxinus pennsylvanica Summit	8,9	10,7
Fraxinus excelsior Westhofs Glorie	8,0	9,8
Tilia cordata Greenspire	8,4	8,7
Tilia mongolica	9,9	11,1
Tilia tomentosa Brabant	8,0	10,1

average leaf area (cm²)

Würzburg	2017	2020	% Diff
Fraxinus ornus	17,8	17,9	0,5
Fraxinus pennsylvanica Summit	19,6	16,4	-16,5
Fraxinus excelsior Westhofs Glorie	12,0	13,5	12,7
Tilia cordata Greenspire	34,8	19,5	-44,0
Tilia mongolica	22,9	22,8	-0,3
Tilia tomentosa Brabant	61,2	38,5	-37,2

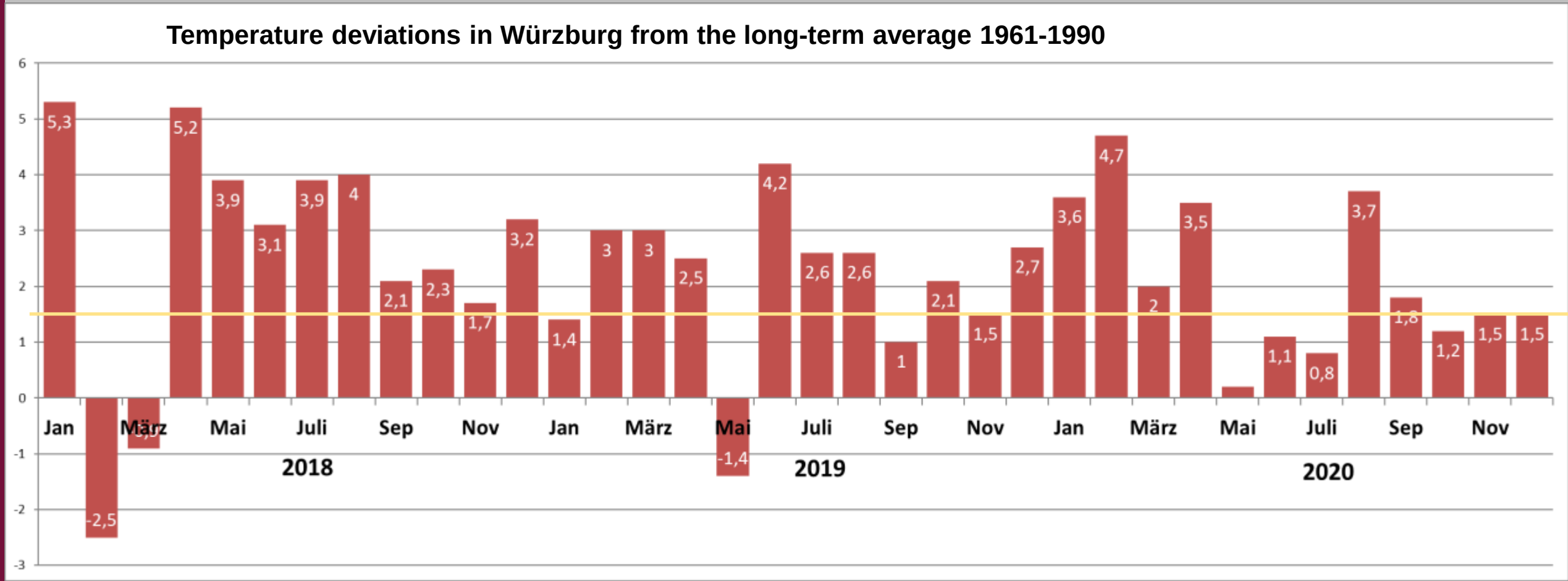
Adaptations to heat and drought stress

Acclimation: short-term adaptations

extention of the vegetation period

Stress-tolerant urban trees

Steppe summer in Würzburg



Stress-tolerant urban trees

Did test tree species also have a shortened vegetation period?

Leaf discoloration (calendar week)

Würzburg	2011	2012	2013	2014	2015	2011-2014
Acer buergerianum	41	40	42	43	44	**42**
Acer monspessulanum	42	41	42	43	44	**42**
Alnus x spaethii	45	43	47	42	46	**44**
Carpinus betulus **Frans Fontaine**	39	39	43	44	42	**41**
Celtis australis	43	42	42	41	42	**42**
Fraxinus ornus	41	40	42	43	41	**42**
Fraxinus pennsylvanica **Summit**	35	36	40	38	40	**37**
Ginkgo biloba (männl. Selektion)	41	41	43	42	44	**42**
Gleditsia triacanthos **Skyline**	34	36	39	37	40	**37**
Liquidambar styraciflua	41	42	43	43	44	**42**
Magnolia kobus	36	38	42	42	45	**40**
Ostrya carpinifolia	43	42	43	43	41	**43**
Parrotia persica	42	43	43	43	44	**43**
Quercus cerris	41	42	43	44	43	**43**
Quercus frainetto **Trump**		43	42	43	44	**43**
Quercus x hispanica **Wageningen**						
Sophora japonica **Regent**	41	41	42	40	43	**41**
Tilia tomentosa **Brabant**	42	43	43	44	41	**43**
Ulmus **Lobel**		42	44	45	45	**44**
Zelkova serrata **Green Vase**	43	41	41	40	43	**41**

Adaptations to heat and drought stress

Stress-tolerant urban trees

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Carpinus betulus **Frans Fontaine**	39	39	43	44	42	**41**
Celtis australis	43	42	42	41	42	**42**
Fraxinus ornus	41	40	42	43	41	**42**
Fraxinus pennsylvanica **Summit**	35	36	40	38	40	**37**
Ginkgo biloba (männl. Selektion)	41	41	43	42	44	**42**
Gleditsia triacanthos **Skyline**	34		39	37	40	**37**
Liquidambar styraciflua	41		43	43	44	**42**
Magnolia kobus	36		42	42	45	**40**
Ostrya carpinifolia	43		43	43	41	**43**
Parrotia persica	42	43	43	43	44	**43**
Quercus cerris	41	42	43	44	43	**43**
Quercus frainetto **Trump**		43	42	43	44	**43**
Quercus x hispanica **Wageningen**						
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Tilia tomentosa **Brabant**	42	43	43	44	41	**43**
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No!

Adaptations to heat and drought stress

Stress-tolerant urban trees

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Alnus x spaethii	45	43	47	42	46	44	43	**45**
Carpinus betulus Frans Fontaine	39	39	43	44	43	41	45	**42**
Celtis australis	43	42	42	41	42	39	41	**42**
Fraxinus ornus	41	40	42	43	42	41	40	**42**
Fraxinus pennsylvanica Summit	35	36	40	38	37	38	38	**37**
Ginkgo biloba (männl. Selektion)	41	41	43	42	45	42	40	**42**
Gleditsia triacanthos Skyline	34	36	39	37	36	36	36	**36**
Liquidambar styraciflua	41	42	43	43	44	43	41	**43**
Magnolia kobus	36	38	42	42	44	40	39	**40**
Ostrya carpinifolia	43	42	43	43	43	40	40	**42**
Parrotia persica	42	43	43	43	44	43	41	**43**
Quercus cerris	41	42	43	44	44	43	41	**43**
Quercus frainetto Trump		43	42	43	43	41	42	**42**
Quercus x hispanica Wageningen		halb-immergrüne Art						
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Adaptations to heat and drought stress

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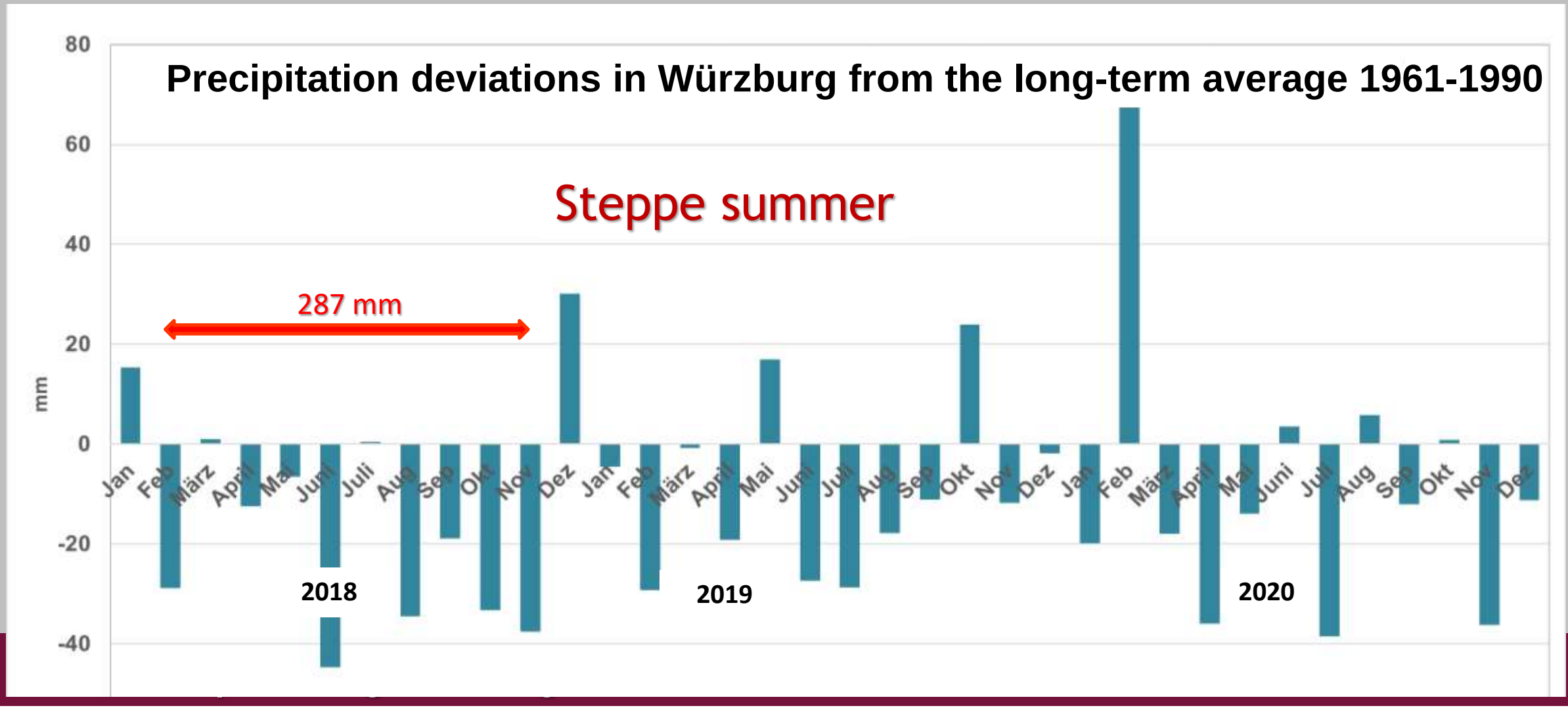
Liquidambar styraciflua	41	42				43	41	**43**
Magnolia kobus	36	38				40	39	**40**
Ostrya carpinifolia	43	42				40	40	**42**
Parrotia persica	42	43	43	43	44	43	41	**43**
Quercus cerris	41	42	43	44	44	43	41	**43**
Quercus frainetto Trump		43	42	43	43	41	42	**42**
Quercus x hispanica Wageningen		halb-immergrüne Art						
Sophora japonica Regent	41	41	42	40	42	42	40	**41**
Tilia tomentosa Brabant	42	43	43	44	42	41	39	**43**
Ulmus Lobel		42	44	45	44	42	40	**43**
Zelkova serrata Green Vase	43	41	41	40	41	41	40	**41**

Yes (No)

Adaptations to heat and drought stress

Stress-tolerant urban trees



Stress-tolerant urban trees

Did test tree species also have a shortened vegetation period?

Leaf discoloration (calendar week)

Würzburg	2011	2012	2013	2014	2016	2017	2019	2011-2017*
Acer buergerianum	41	40	42	43	43	40	43	**42**
Acer monspessulanum	42	41	42	43	43	42	43	**42**
Alnus x spaethii	45	43	47	42	46	44	44	**44**
Carpinus betulus **Frans Fontaine**	39	39	43	44	43	41	44	**42**
Celtis australis	43	42	42	41	42	39	43	**42**
Fraxinus ornus	41	40	42	43	42	41	44	**42**
Fraxinus pennsylvanica **Summit**	35	36	40	38	37	38	41	**37**
Ginkgo biloba (männl. Selektion)	41	41	43	42	45	42	44	**42**
Gleditsia triacanthos **Skyline**	34	36	39	37	36	36	40	**36**
Liquidambar styraciflua	41	42	43	43	44	43	44	**43**
Magnolia kobus	36	38	42	42	44	40	45	**40**
Ostrya carpinifolia	43	42	43	43	43	40	45	**42**
Parrotia persica	42	43	43	43	44	43	43	**43**
Quercus cerris	41	42	43	44	44	43	44	**43**
Quercus frainetto **Trump**		43	42	43	43	41	43	**42**
Quercus x hispanica **Wageningen**		halb-immergrüne Art						
Sophora japonica **Regent**	41	41	42	40	42	42	40	**41**
Tilia tomentosa **Brabant**	42	43	43	44	42	41	44	**43**
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Adaptations to heat and drought stress

Stress-tolerant urban trees

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Parrotia persica	42	43	43	43	44	43	43	**43**
Quercus cerris	41	42	43	44	44	43	44	**43**
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Zelkova serrata **Green Vase**	43	41	41	40	41	41	44	**41**

No!

Adaptations to heat and drought stress

Acclimation: short-term adaptations

control of leaf temperature

Stress-tolerant urban trees

Extreme summer 2018 - 2020

native tree species	SE European tree species
Tilia cordata	***Tilia tomentosa***
Carpinus betulus	***Ostrya carpinifolia***

Do Southeast European tree species have lower leaf temperatures ?

Stress-tolerant urban trees

Cooperation: 2018: Prof. Roloff, Masterstudent K. Bauer
2019: Prof. Paeth, Bachelorstudent M. Melzer

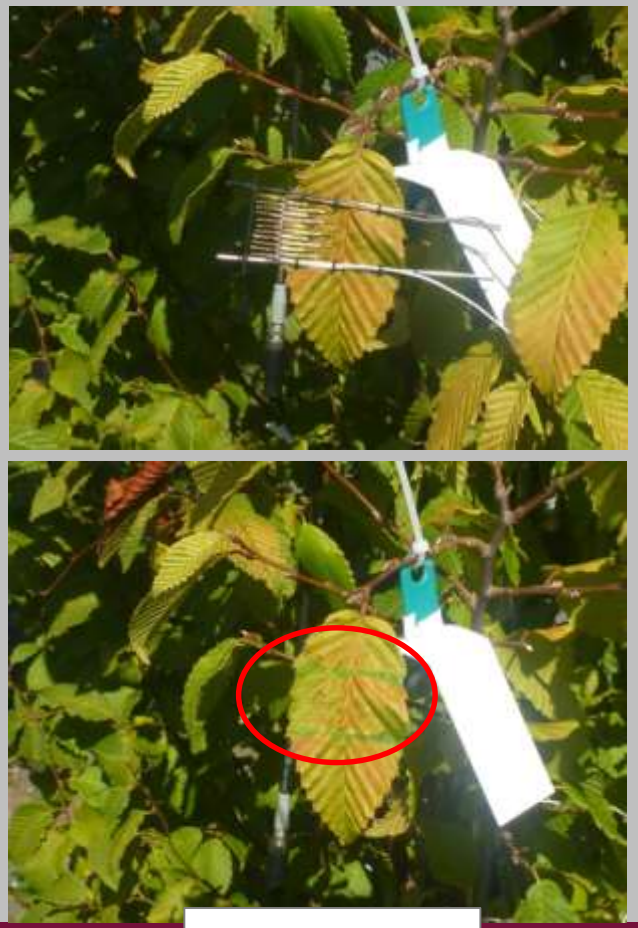
Do Southeast European tree species have lower leaf temperatures ?

Stress-tolerant urban trees

maximum temperature values in Würzburg

2018

T_{air} : 41,0°C
T_{leaf} : 42,1°C
$\Delta T_{leaf\text{-}air}$: 3,2°C
$\Delta T_{crown\text{-}air}$: -10,7°C
$T_{bark\ South}$: 45,1°C
$\Delta T_{Bark\ South\text{-}Nord}$: 13,3°C
$T_{substrate}$: 62,4°C



horn beam

2019

T_{air} : 43,4°C
T_{leaf} : 44,5°C
$\Delta T_{leaf\text{-}air}$: 3,8°C
$\Delta T_{crown\text{-}air}$: -10,0°C
$T_{bark\ South}$: 49,9°C
$\Delta T_{bark\ South\text{-}Nord}$: 18,2°C
$T_{substrate}$: 66,4°C

extreme summer 2018/ 2019

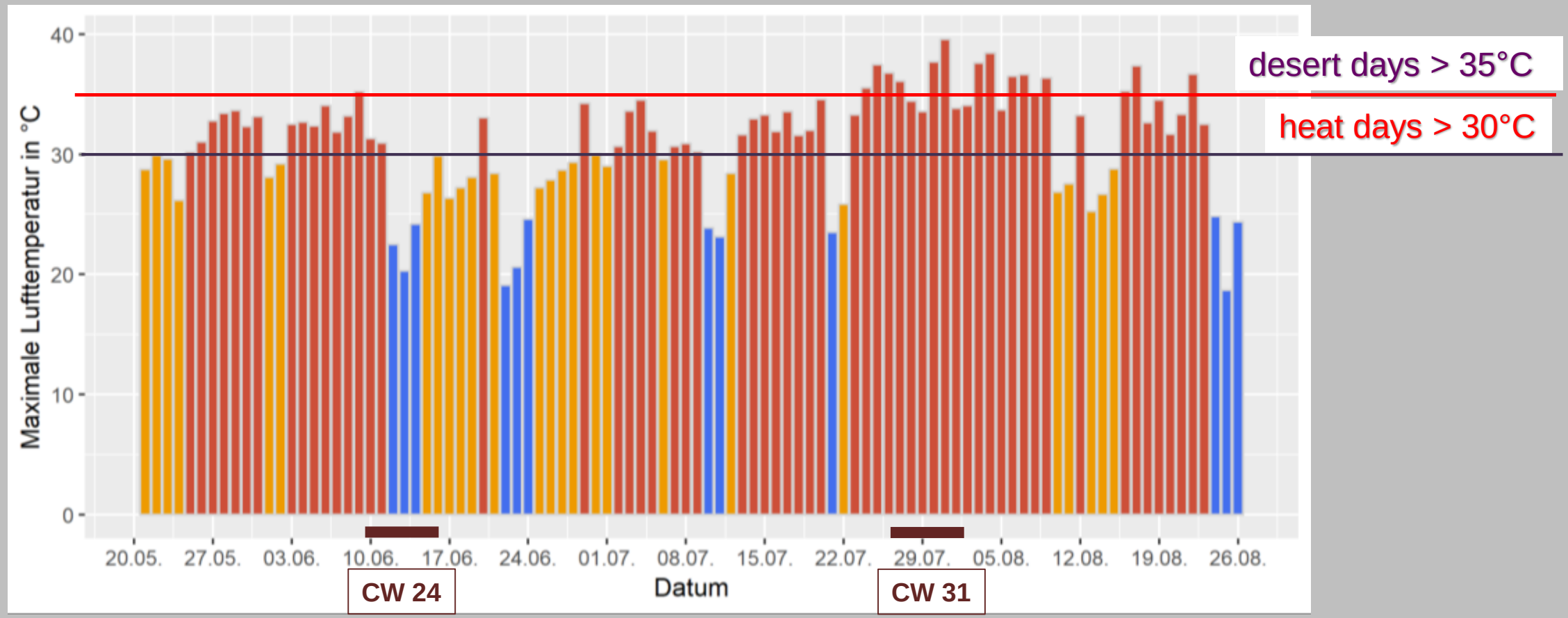
Stress-tolerant urban trees

maximum temperature values in Würzburg

2018		2019	
T_{Luft} :	41,0°C	T_{Luft} :	43,4°C
T_{Blatt} :	42,1°C	T_{Blatt} :	44,5°C
$\Delta T_{Blatt-Luft}$:	3,2°C	$\Delta T_{Blatt-Luft}$:	3,8°C
$\Delta T_{Krone-Luft}$:	-10,7°C	$\Delta T_{Krone-Luft}$:	-10,0°C
$T_{Borke\ Süd}$:	45,1°C	$T_{Borke\ Süd}$:	49,9°C
$\Delta T_{Borke\ Süd-Nord}$:	13,3°C	$\Delta T_{Borke\ Süd-Nord}$:	18,2°C
$T_{Substrat}$:	62,4°C	$T_{Substrat}$:	66,4°C

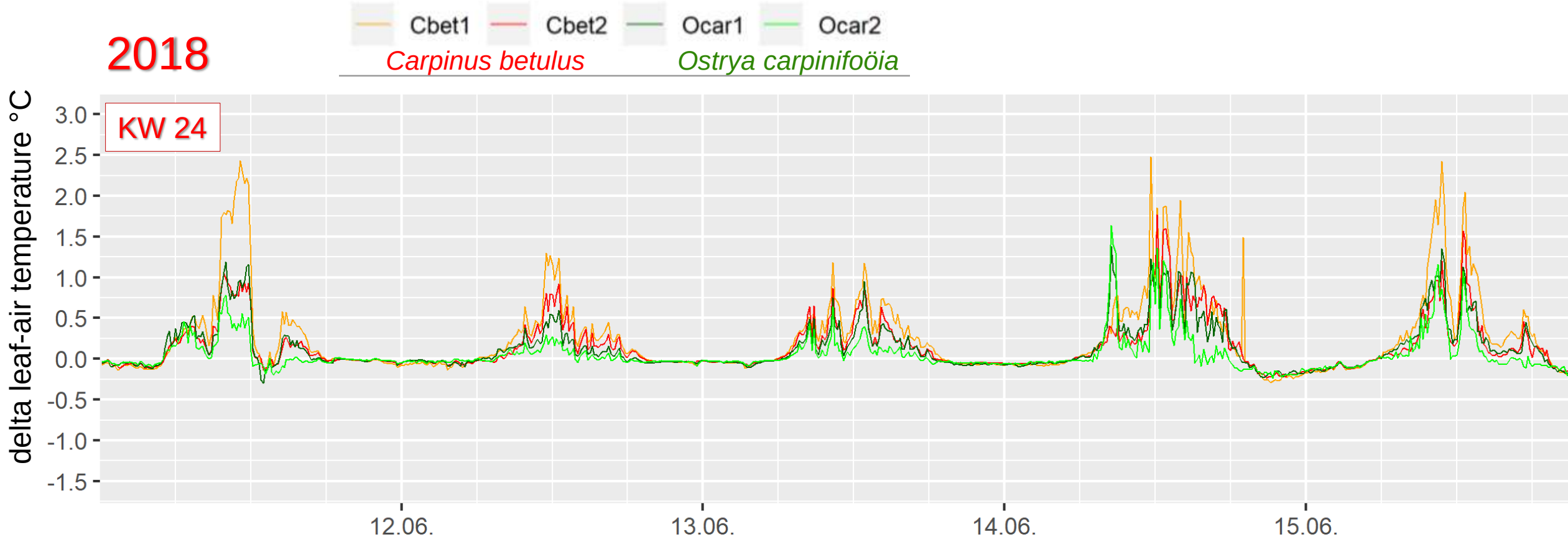
extreme summer 2018/ 2

Stress-tolerant urban trees



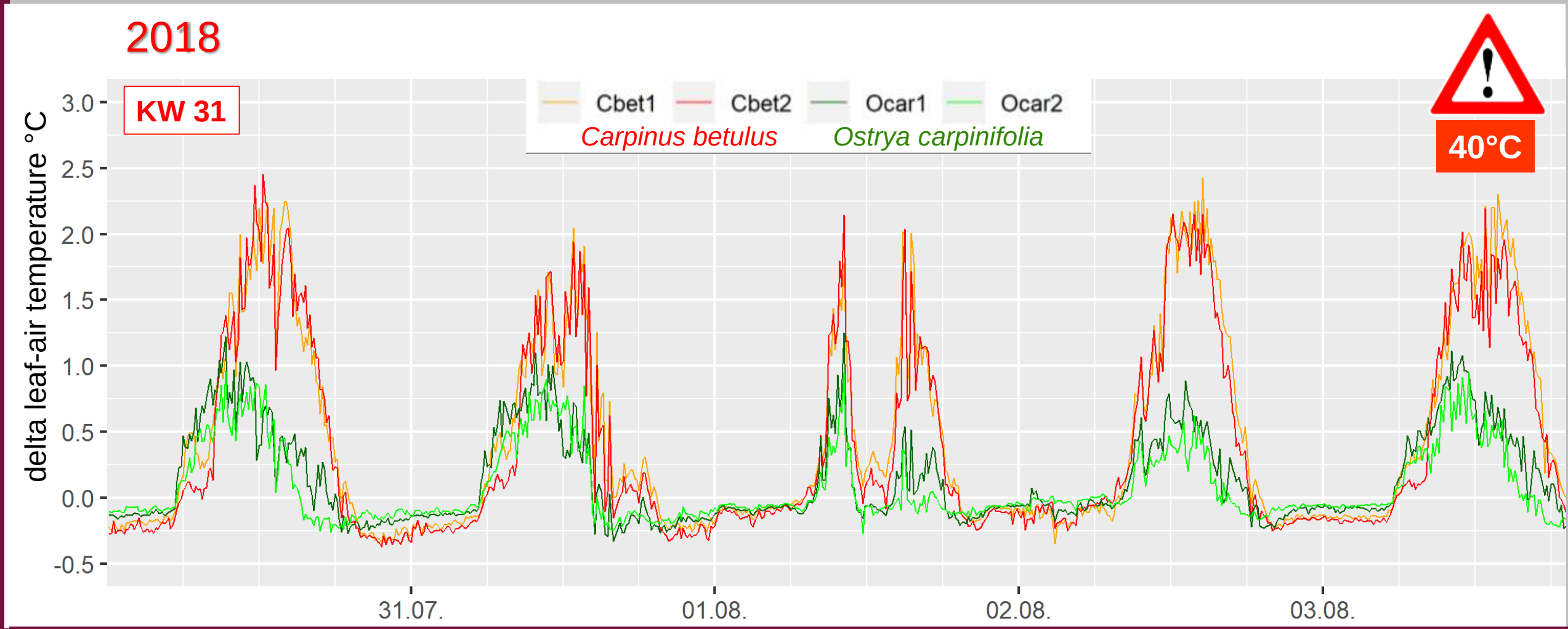
extreme summer 2018

Stress-tolerant urban trees



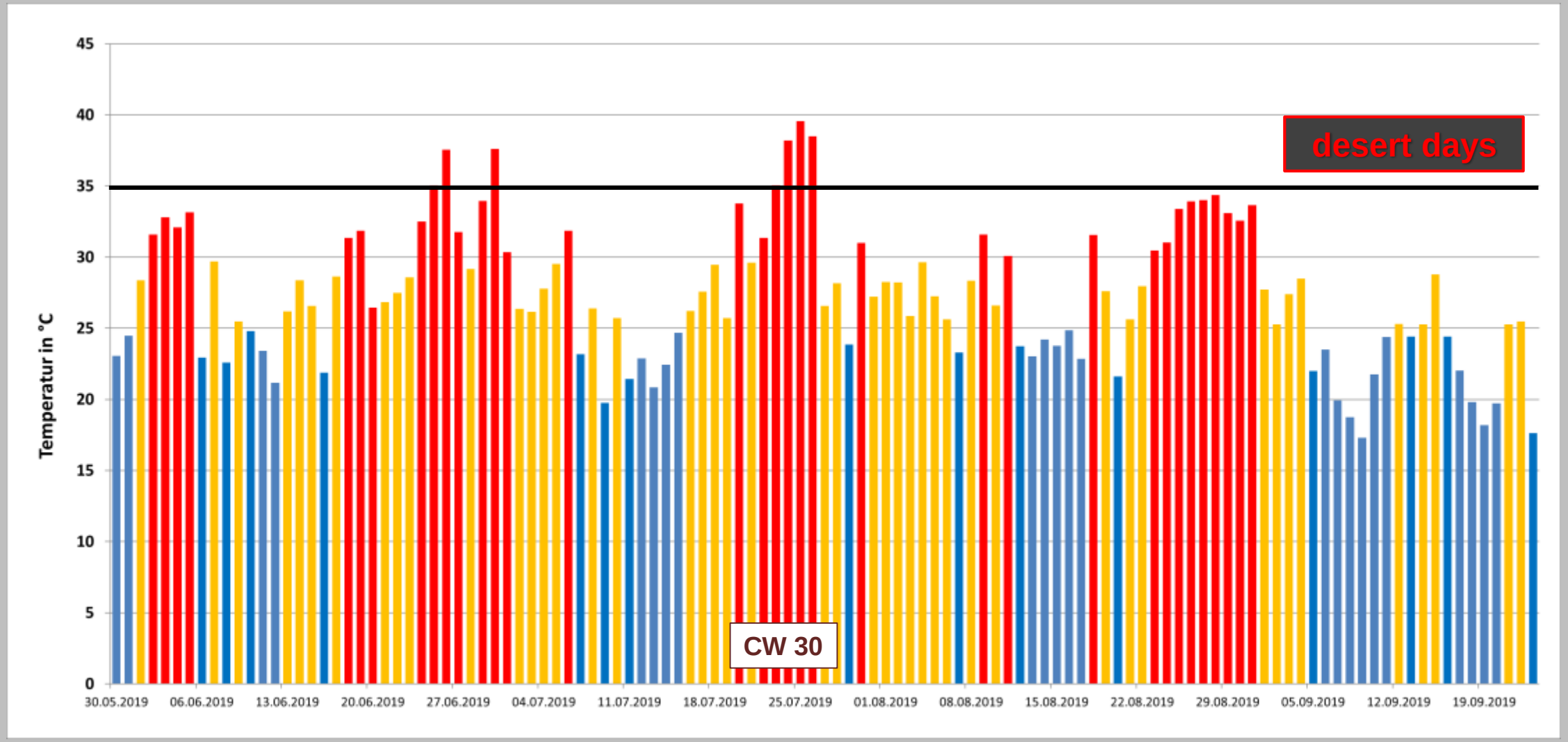
Air - leaf temperature of hornbeam vs. hop hornbeam

Stress-tolerant urban trees



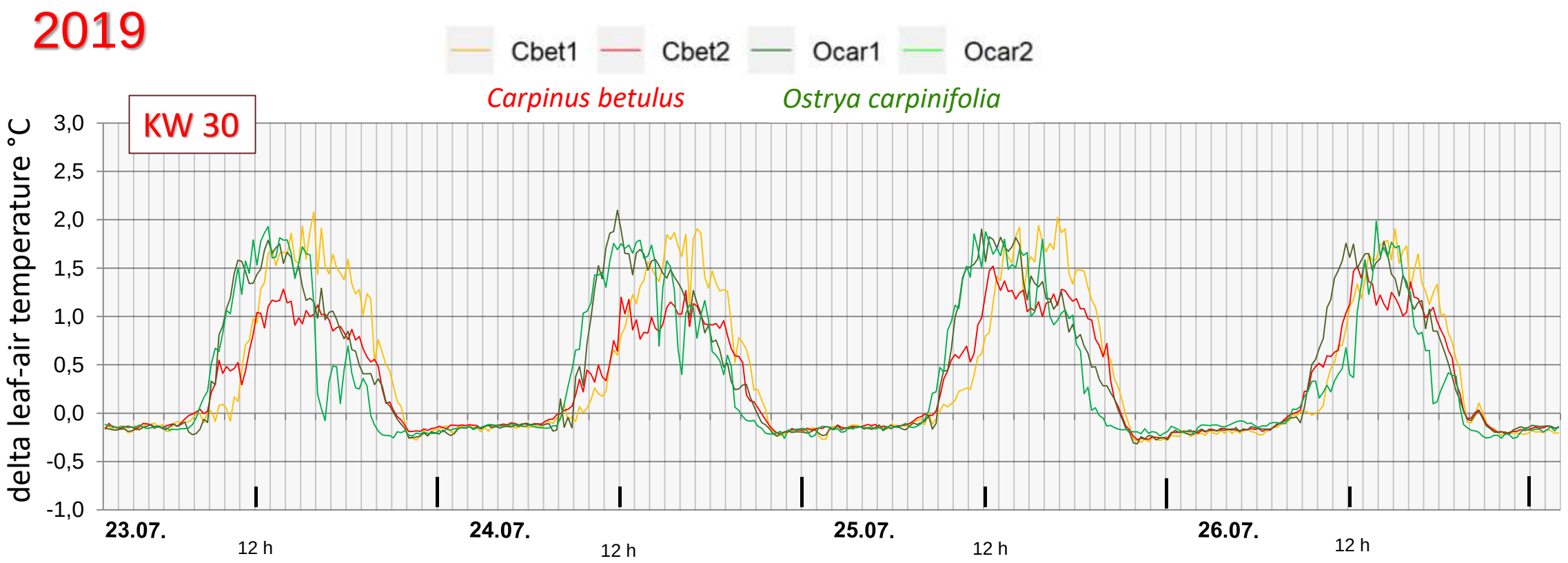
Air - leaf temperature of hornbeam vs. hop hornbeam

Stress-tolerant urban trees



Extreme summer 2019

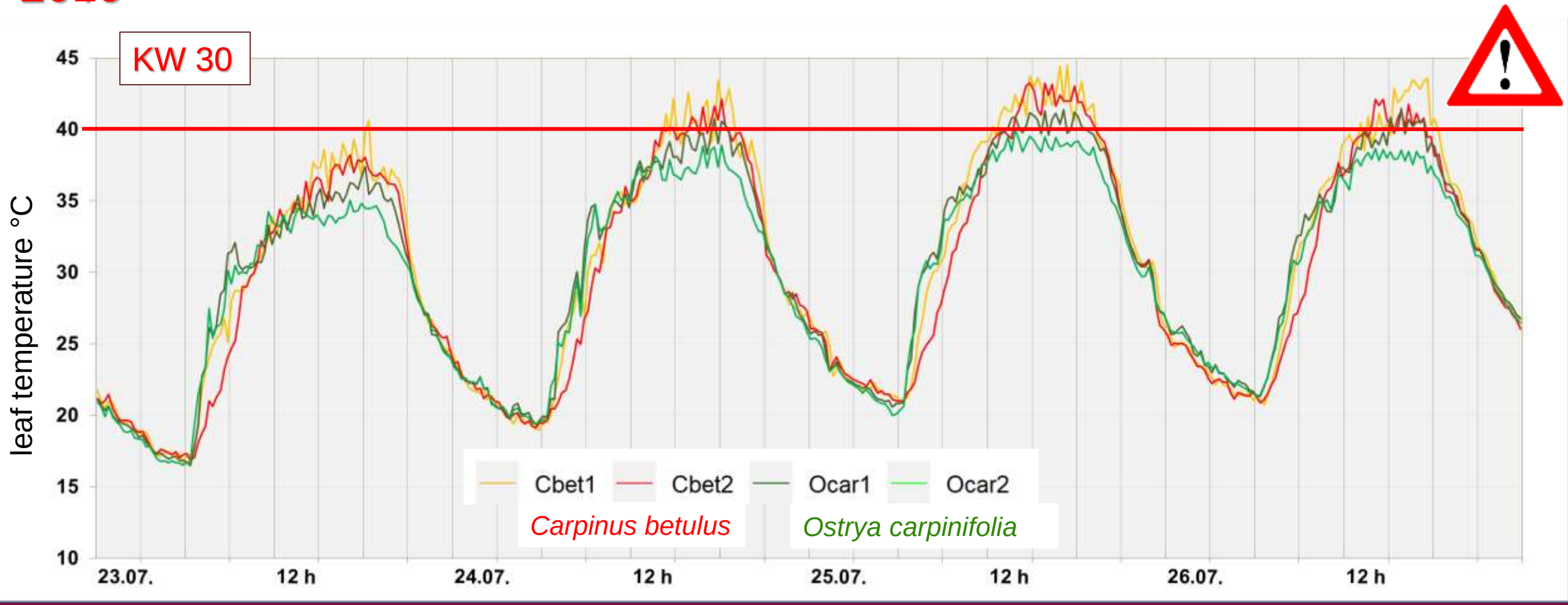
Stress-tolerant urban trees



Air - leaf temperature of hornbeam vs. hop hornbeam

Stress-tolerant urban trees

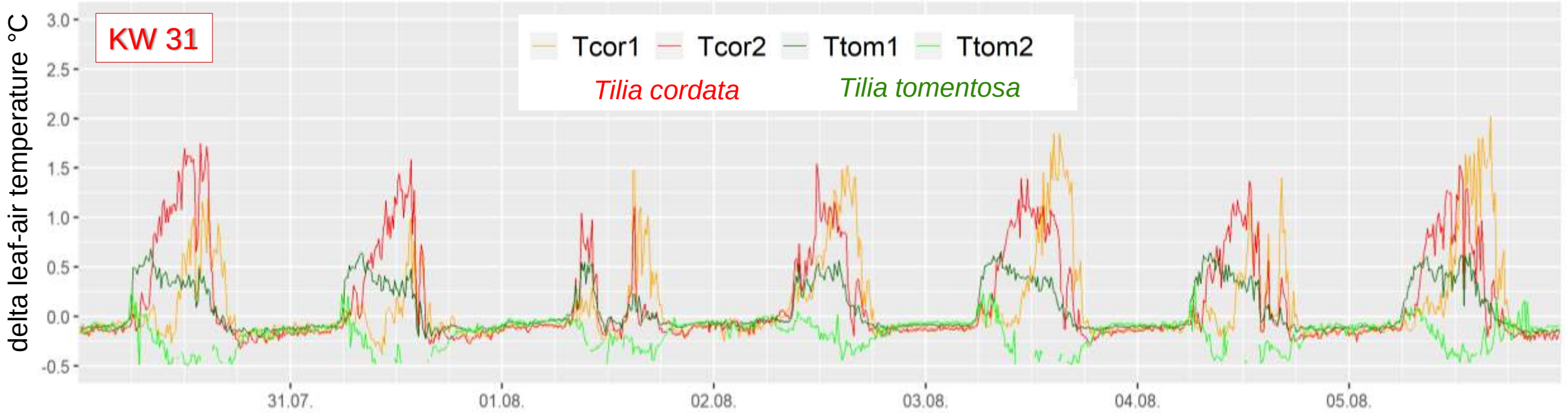
2019



leaf temperature of hornbeam vs. hop hornbeam

Stress-tolerant urban trees

2018

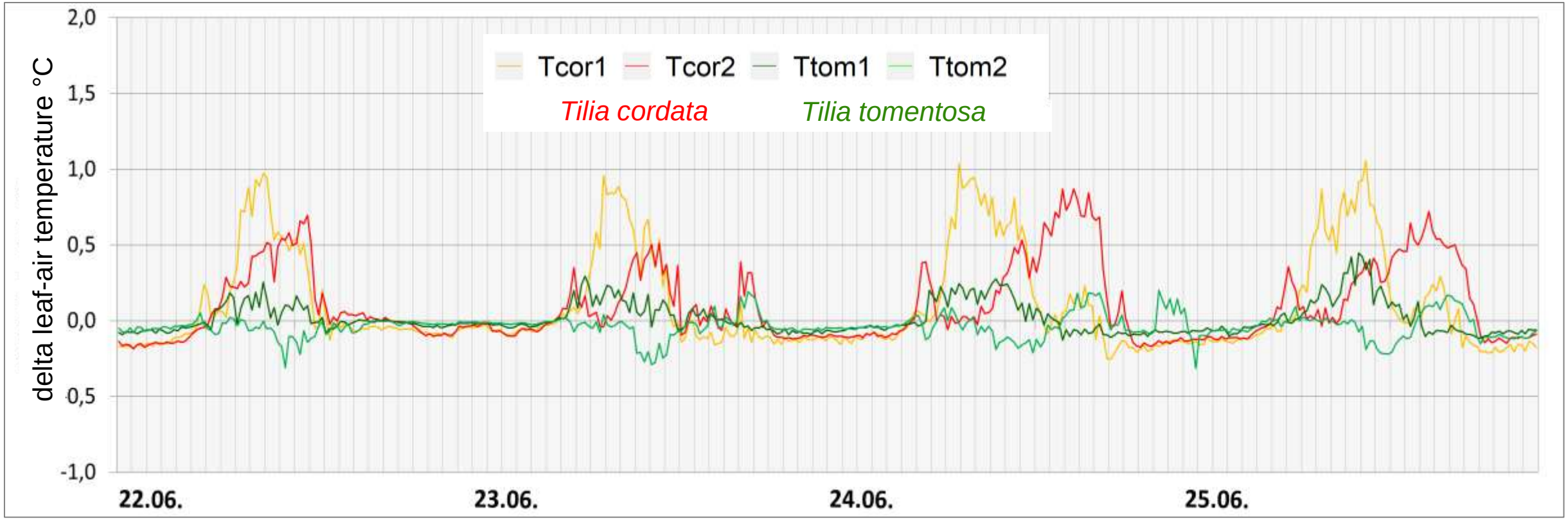


Air - leaf temperature of winter linden vs. silver linden

Stress-tolerant urban trees

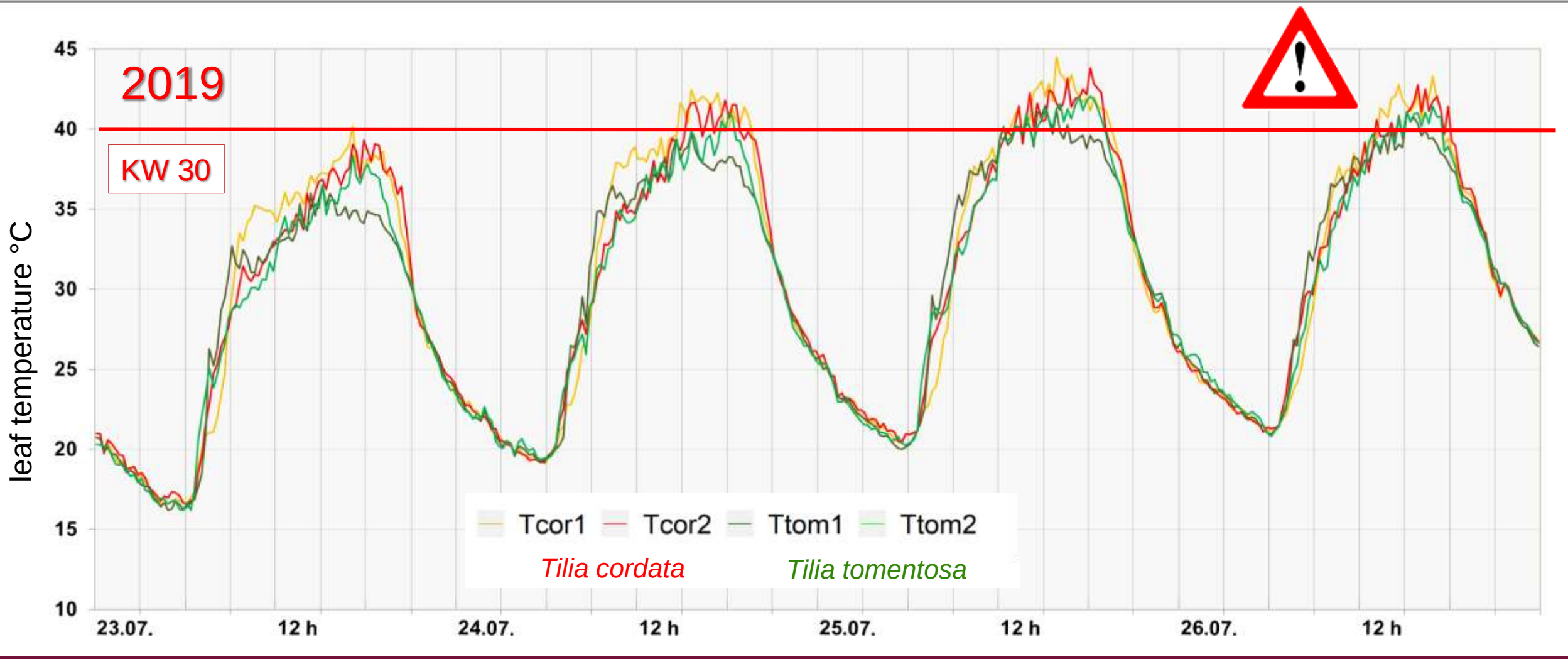
2019

KW 25



Air - leaf temperature of winter linden vs. silver linden

Stress-tolerant urban trees



leaf temperature of winter linden vs. Silver linden

Stress-tolerant urban trees

heat acclimation of silver linden

Stress-tolerant urban trees

Hieracium pilosella

heat acclimation of silver linden

Stress-tolerant urban trees

Conclusion

- Due to their origin, Southeastern European tree species are better adapted to heat and drought than native tree species.
- They can control their leaf temperatures during prolonged periods of heat to such an extent that they stay vital.
- After the end of heat waves in extreme summers, they, as well as other continental species, can compensate for assimilation losses by an extended vegetation period and, unlike common urban tree species, start the next growing season with adeqate nutrient resources.

Stress-tolerant urban trees

2018: Konrad Bauer, Master student, Prof. Roloff, TU Dresden

2019: Marvin Melzer, Bachelor student, Prof. Paeth, Uni Würzburg

Stress-tolerant urban trees

Thank you for your attention!

2018: Konrad Bauer, Master student, Prof. Roloff, TU Dresden

2019: Marvin Melzer, Bachelor student, Prof. Paeth, Uni Würzburg