Tree species selection for a warmer climate

Dr Andrew Hirons

URBAN PLANT INSTITUTE

University Centre Myerscough


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DAILY STAR
THOUGHT FOR THE DAY
Slap it all over, suncream, that is!
MONDAY, APRIL 24, 2023
PROUD TO LOVE ANIMALS
80P
Terminator ET on way
PAGE 7
VIC-TORY! FIRST EVER ALL MANC CUP FINAL
SEE STARSPORT
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DAILY STAR
THOUGHT FOR THE DAY
FADI NICKED
Barry girl dies at 33
FREE INSIDE
YOUR GAMES & GADGETS PULLOUT
Hottest day in Britain EVER
Workers told: Stay at home
Gritters stop roads melting
39c
RECORD BAKER


MAY THE FARCE BE WITH YOU
PAGE 8
FOUR HOT SPELLS
Coronation heat!
by ALISTAIR GRANT
SIZZLE do nicely! Get your knotted hankie out Chas. The King's Coronation will spark a burst of hot spells. Brits will enjoy four heatwaves and 26C roasts in May. Phew – what a corker.
Full story: Pages 4-5
26C RECORD TEMPERATURES
SWELTER TO BE REAL BELTER


Is this the end of the movie star?
You love her so much right now! The top tracks by Kelis – ranked
The Guardian
Drought alert: new rules on way as climate crisis bites
Fears for NHS patient data after cyber-attack
Unions warn on cost of living crisis


DAILY Mirror
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MELT
First ever red alert on deadly heatwave issued
Extreme Heat
41C scorcher to close roads and stop trains
NHS braced for casualties, schools to shut
FREE INSIDE TODAY
National Trust
Family pass for every reader


How 'Real Housewives' helped to heal my grief
Kasia Delgado
Dark truths about motherhood
The new memoir for mums


i
Day of reckoning for Truss and Mordaunt
Earth sends a warning
Dark truths about motherhood
The new memoir for mums

The consequences...

More than 12,000 trees planted across a city have died because they were not watered enough during the summer heatwave.

Gloucester City Council announced in February that it would plant 12,800 saplings across the city as part of its aim to become carbon neutral.

Councillors have since been told that 95% of them - about 12,100 - have died.

The council blamed the trees' demise on the "unprecedented" hot and dry weather.

Lack of aftercare kills 12,000 trees planted in Gloucester

2 days ago

Climate change

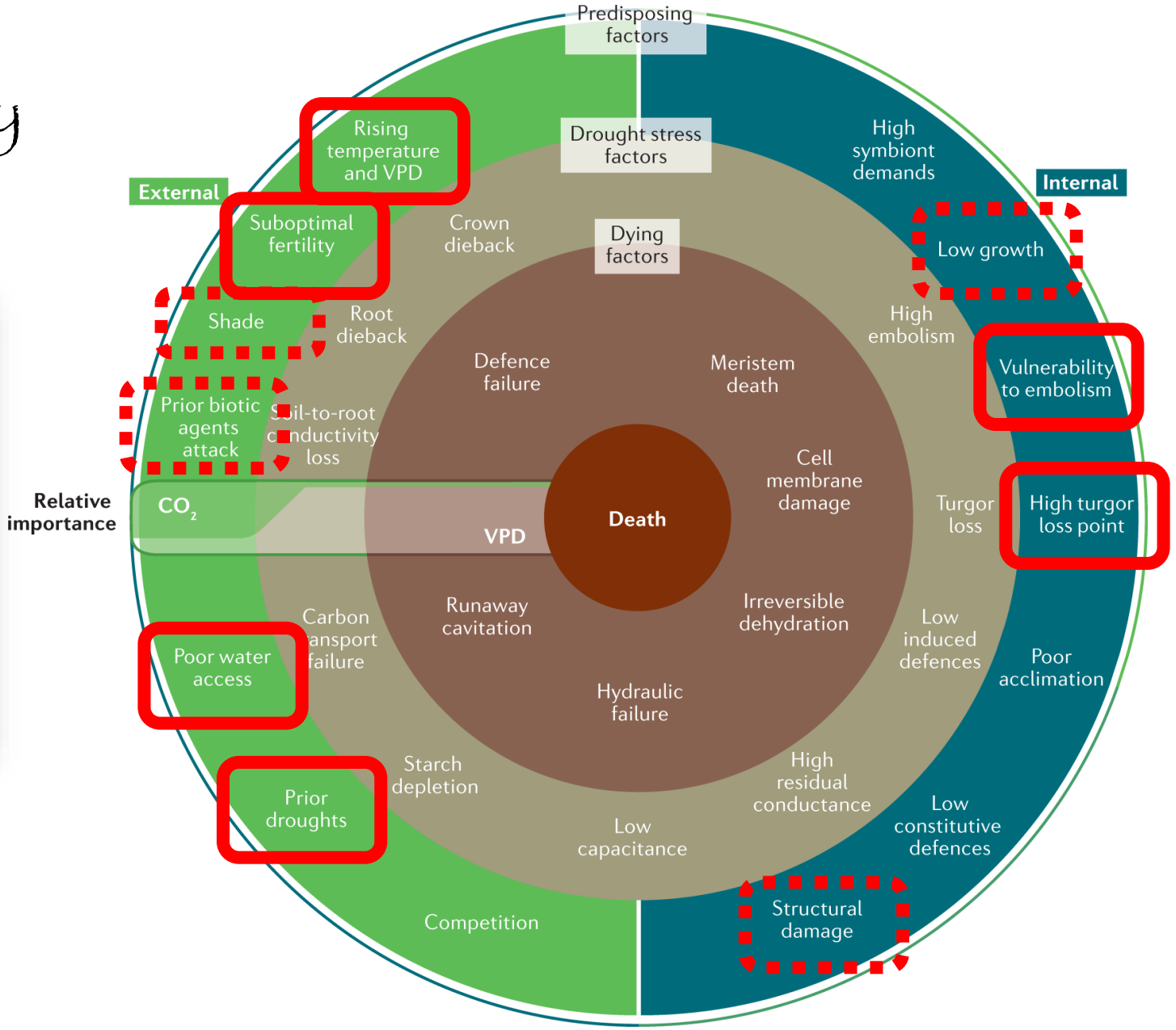
Drivers of tree mortality

REVIEWS

Check for updates

Mechanisms of woody-plant mortality under rising drought, CO_2 and vapour pressure deficit

Nate G. McDowell[1,2]✉, Gerard Sapes[3], Alexandria Pivovaroff[1], Henry D. Adams[4], Craig D. Allen[5], William R. L. Anderegg[6], Matthias Arend[7], David D. Breshears[8], Tim Brodribb[9], Brendan Choat[10], Hervé Cochard[11], Miquel De Cáceres[12], Martin G. De Kauwe[13,14,15], Charlotte Grossiord[16,17], William M. Hammond[18], Henrik Hartmann[19], Günter Hoch[7], Ansgar Kahmen[7], Tamir Klein[20], D. Scott Mackay[21,22], Marylou Mantova[11], Jordi Martínez-Vilalta[12,23], Belinda E. Medlyn[10], Maurizio Mencuccini[12,24], Andrea Nardini[25], Rafael S. Oliveira[26], Anna Sala[27], David T. Tissue[10], José M. Torres-Ruiz[11], Amy M. Trowbridge[28], Anna T. Trugman[29], Erin Wiley[30] and Chonggang Xu[31]



Heat stress in urban trees

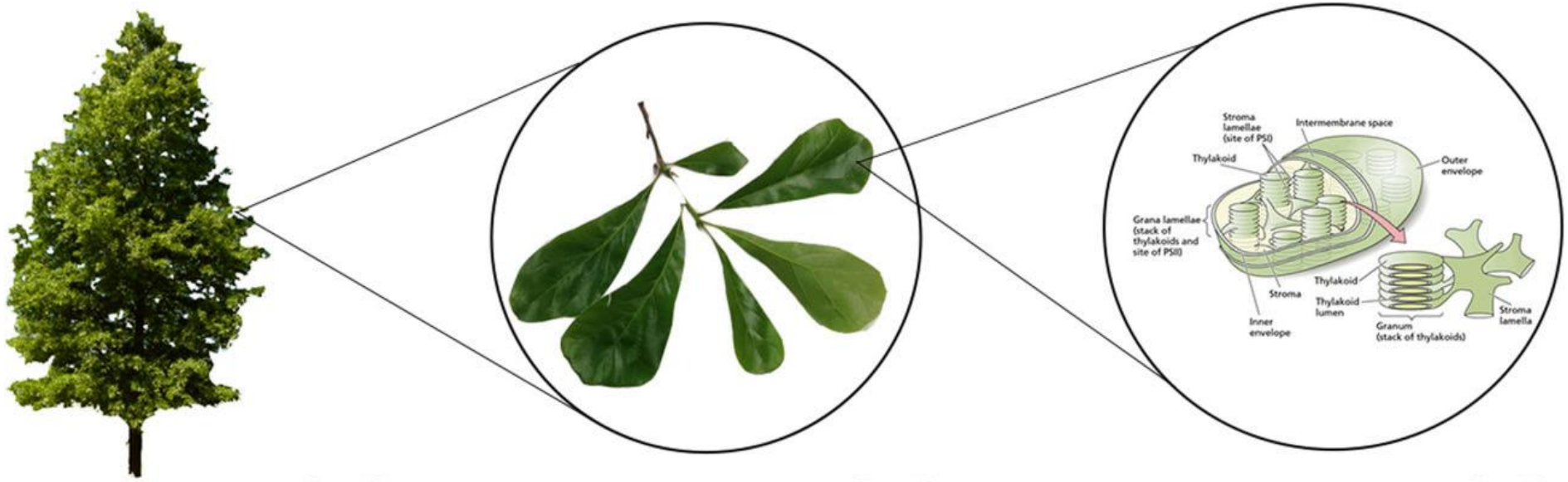
Plant, Cell & Environment
Plant, Cell and Environment (2015) **38**, 1699–1712 doi: 10.1111/pce.12417

Responses to heat

Review

Responses of tree species to heat waves and extreme heat events

Robert Teskey[1], Timothy Wertin[2], Ingvar Bauweraerts[3], Maarten Ameye[4], Mary Anne McGuire[1] & Kathy Steppe[3]

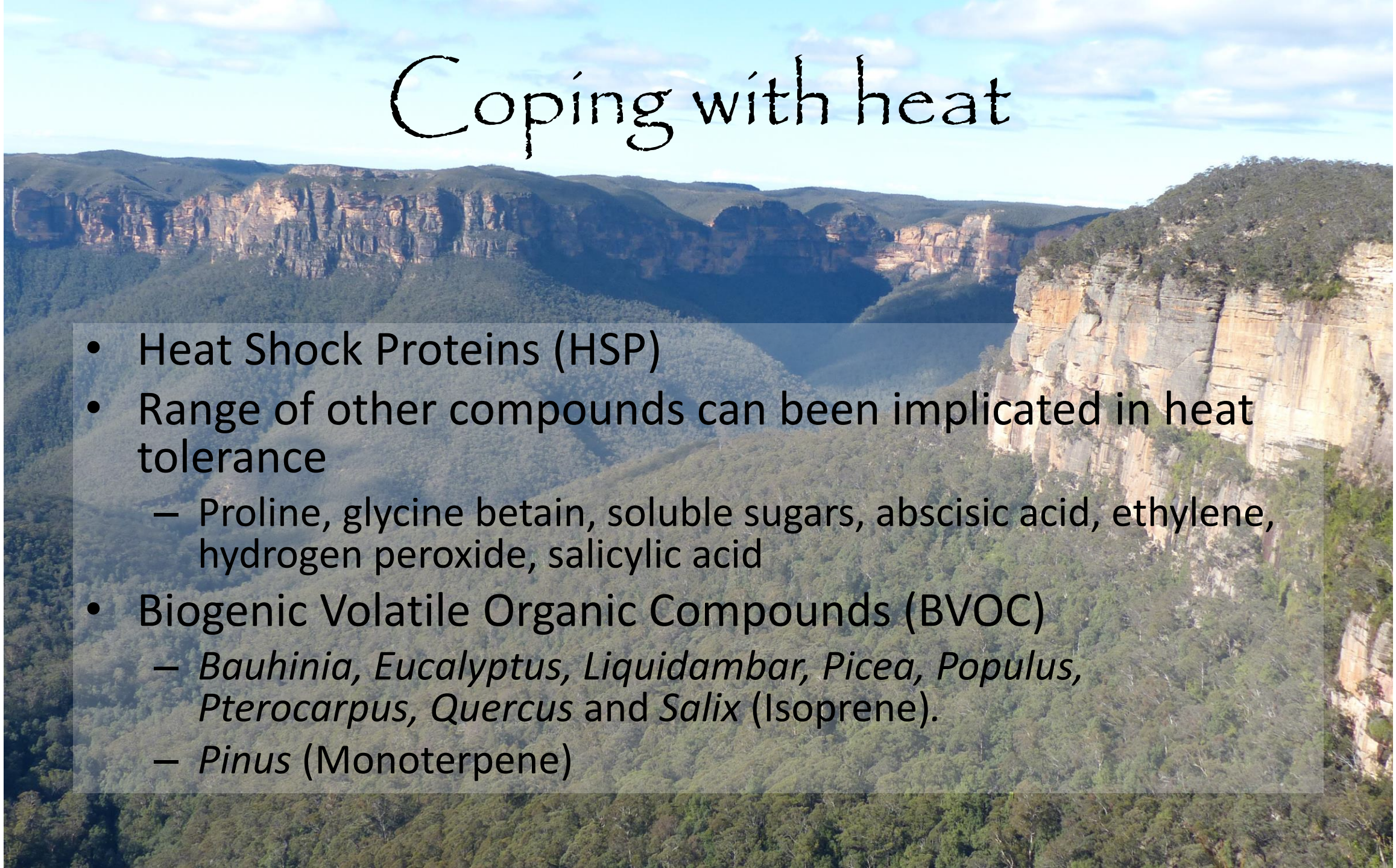


Process	Extreme heat	Acclimation	Target for genetic selection
Leaf area development	–	N	x
Leaf shedding	+	?	
Early budburst	0/+	N	x
Growth	–	Y	x
Mortality	+	Y	
Fecundity	–	Y	

Process	Extreme heat	Acclimation	Target for genetic selection
Photosynthesis	–	Y	x
Dark respiration	+	Y	
Photorespiration	+	Y	x
VOC emission	+/0	?	
Stomatal conductance	+/–	Y	x
Transpiration	+/–	N	

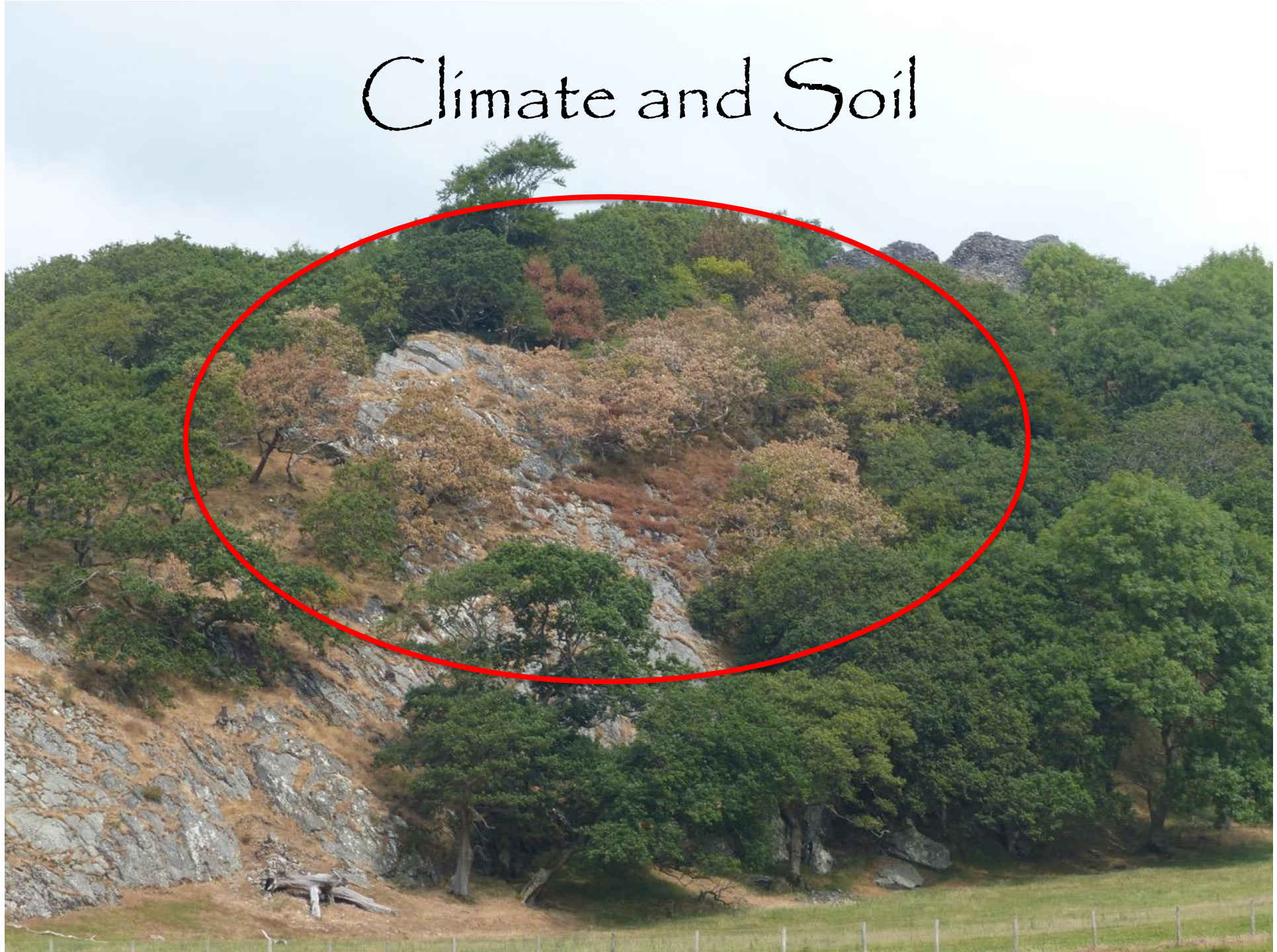
Process	Extreme heat	Acclimation	Target for genetic selection
PSII functioning	–	Y	
Thylakoid membrane fluidity	+	Y	
Rubisco activity	–	Y	x
HSP expression	+	Y	x

Coping with heat



- Heat Shock Proteins (HSP)
- Range of other compounds can been implicated in heat tolerance
  - Proline, glycine betain, soluble sugars, abscisic acid, ethylene, hydrogen peroxide, salicylic acid
- Biogenic Volatile Organic Compounds (BVOC)
  - *Bauhinia, Eucalyptus, Liquidambar, Picea, Populus, Pterocarpus, Quercus* and *Salix* (Isoprene).
  - *Pinus* (Monoterpene)

Climate and Soil



nature climate change

ARTICLES

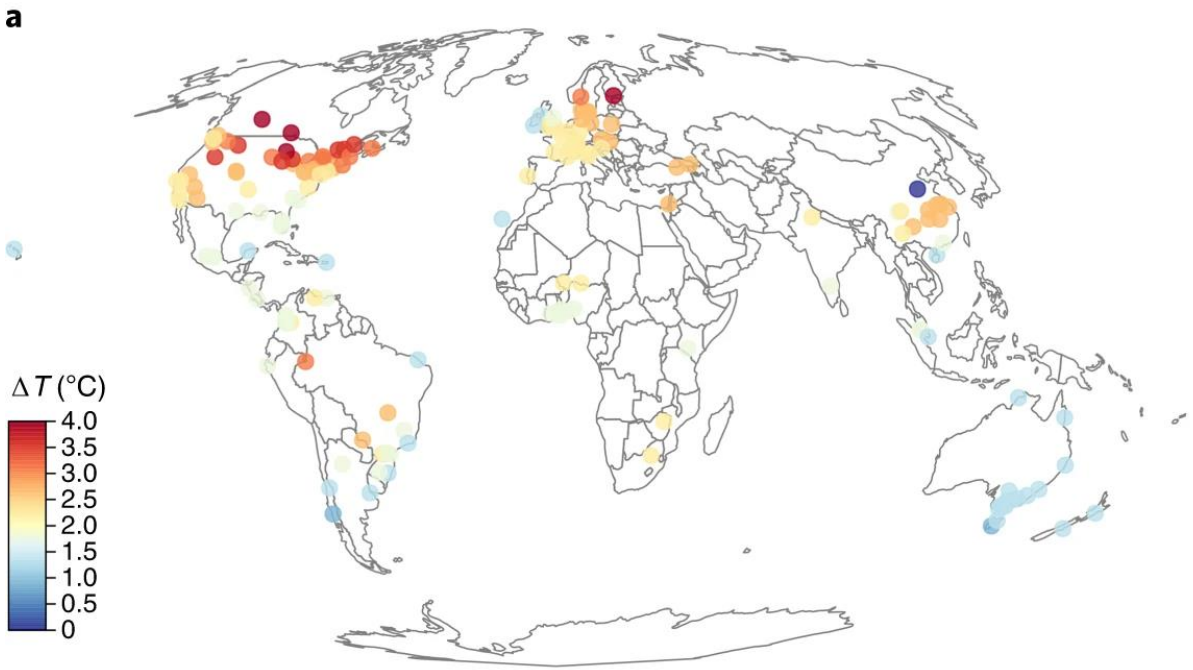
https://doi.org/10.1038/s41558-022-01465-8

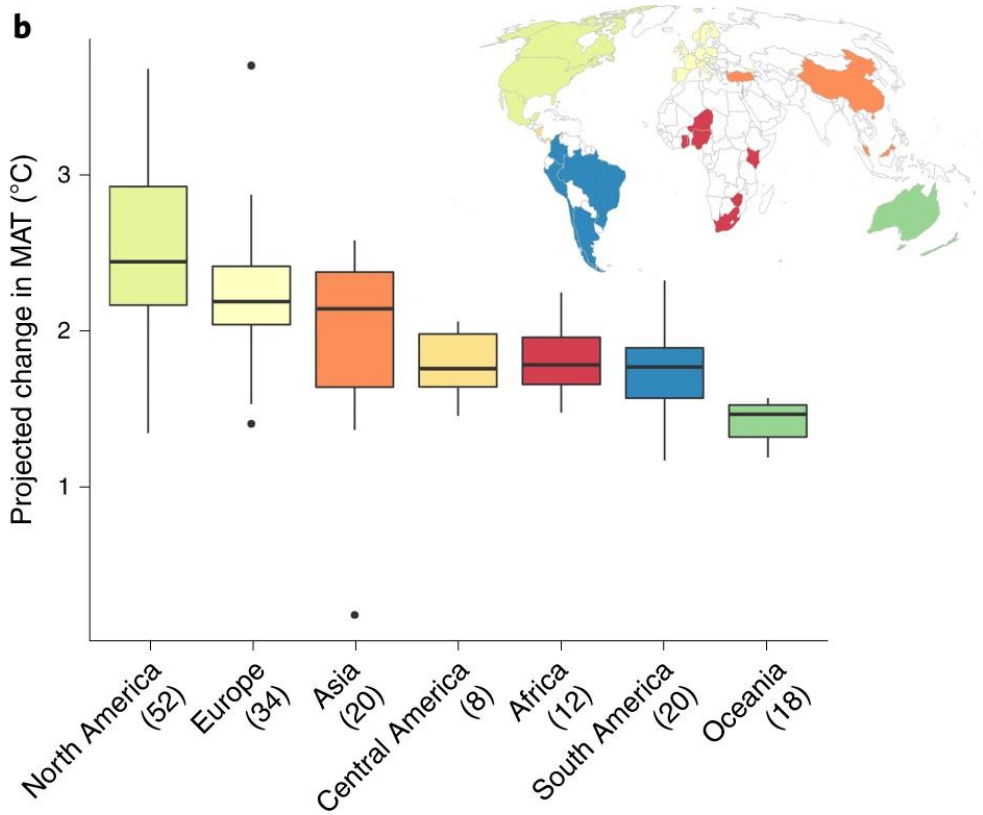
Check for updates

Climate change increases global risk to urban forests

Manuel Esperon-Rodriguez[1✉], Mark G. Tjoelker[1], Jonathan Lenoir[2], John B. Baumgartner[3], Linda J. Beaumont[4], David A. Nipperess[4], Sally A. Power[1], Benoît Richard[5], Paul D. Rymer[1] and Rachael V. Gallagher[1]

Urban forests are threatened by climate change





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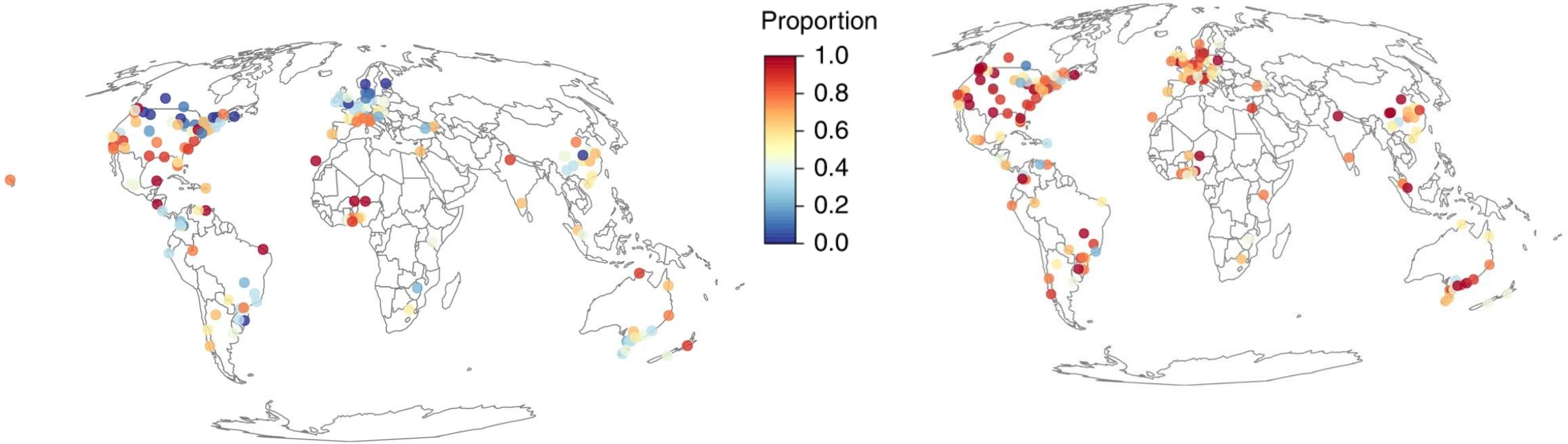


Mean Annual Temperature

Proportion of species currently exceeding their safety margin for MAT (**a**)

Proportion of species predicted to be at risk from projected changes in MAT by 2050 in 164 cities.

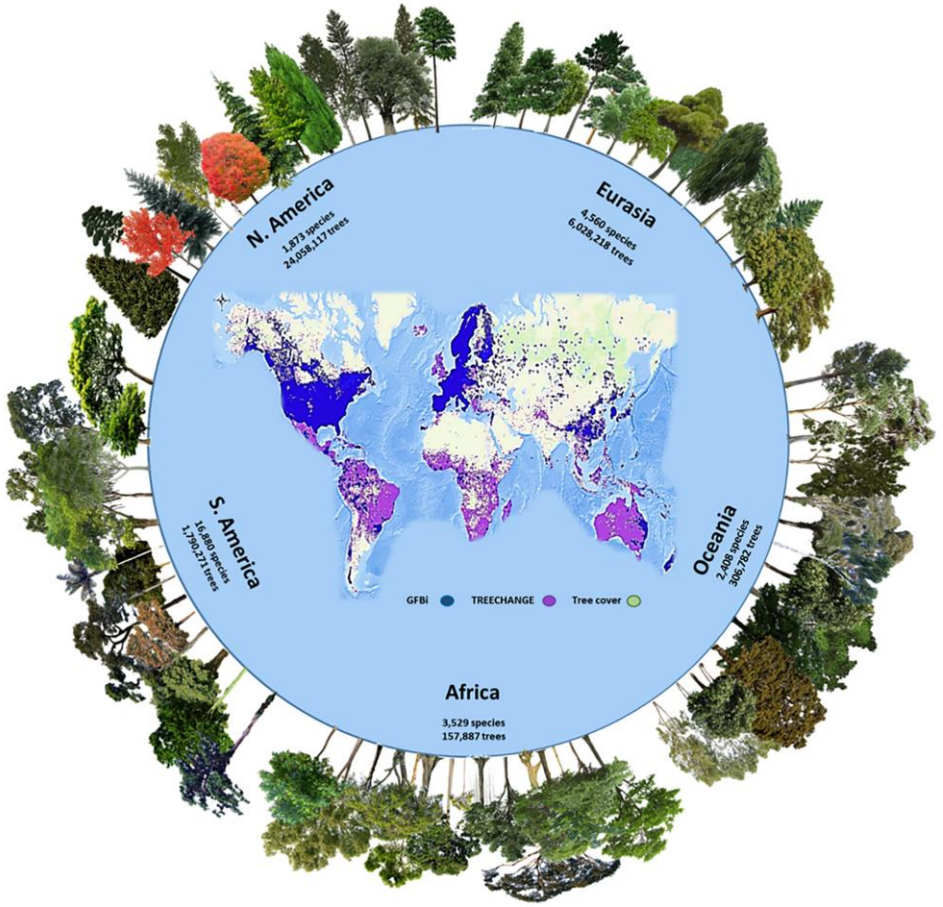
Esperon-Rodriguez et al., (2022) *Nature Climate Change*

About 73,000 tree species globally

The number of tree species on Earth

Roberto Cazzolla Gatti[a,b,c], Peter B. Reich[d,e,f,1], Javier G. P. Gamarra[g], Tom Crowther[h], Cang Hui[i,j], Albert Morera[k,l], Jean-Francois Bastin[m], Sergio de-Miguel[k,l], Gert-Jan Nabuurs[n], Jens-Christian Svenning[o,p], Josep M. Serra-Diaz[q], Cory Merow[r], Brian Enquist[s], Maria Kamenetsky[t], Junho Lee[u], Jun Zhu[v], Jinyun Fang[w], Douglass F. Jacobs[a], Bryan Pijanowski[a], Arindam Banerjee[x], Robert A. Giaquinto[y], Giorgio Alberti[z,aa], Angelica Maria Almeyda Zambrano[bb], Esteban Alvarez-Davila[cc], Alejandro Araujo-Murakami[dd], Valerio Avitabile[ee], Gerardo A. Aymard[ff,gg], Radomir Balazy[hh], Chris Baraloto[ii], Jorcely G. Barroso[jj], Meredith L. Bastian[kk,ll], Philippe Birnbaum[mm,nn], Robert Bitariho[oo], Jan Bogaert[m], Frans Bongers[n], Olivier Bouriaud[pp], Pedro H. S. Brancalion[qq], Francis Q. Brearley[rr], Eben North Broadbent[ss], Filippo Bussotti[tt], Wendeson Castro da Silva[uu,vv], Ricardo Gomes César[qq], Goran Češljar[ww], Víctor Chama Moscoso[xx], Han Y. H. Chen[yy], Emil Cienciala[zz,aaa], Connie J. Clark[bbb], David A. Coomes[ccc], Selvadurai Dayanandan[ddd], Mathieu Decuyper[eee,fff], Laura E. Dee[ggg], Jhon Del Aguila Pasquel[hhh], Géraldine Derroire[iii], Marie Noel Kamdem Djuikouo[jjj], Tran Van Do[kkk], Jiri Dolezal[lll,mmm], Ilija Đ. Đorđević[ww], Julien Engel[nnn], Tom M. Fayle[ooo], Ted R. Feldpausch[ppp], Jonas K. Fridman[qqq], David J. Harris[rrr], Andreas Hemp[sss], Geerten Hengeveld[ttt], Bruno Herault[uuu,vvv,www], Martin Herold[xxx,yyy], Thomas Ibanez[zzz,aaaa], Andrzej M. Jagodzinski[bbbb], Bogdan Jaroszewicz[cccc], Kathryn J. Jeffery[dddd], Vivian Kvist Johannsen[eeee], Tommaso Jucker[ffff], Ahto Kangur[gggg], Victor N. Karminov[hhhh], Kuswata Kartawinata[iiii,jjjj], Deborah K. Kennard[kkkk], Sebastian Kepfer-Rojas[llll], Gunnar Keppel[mmmm], Mohammed Latif Khan[nnnn], Pramod Kumar Khare[oooo], Timothy J. Kileen[pppp], Hyun Seok Kim[qqqq,rrrr,ssss,tttt], Henn Korjus[gggg], Amit Kumar[uuuu], Ashwani Kumar[vvvv], Diana Laarmann[gggg], Nicolas Labrière[wwww], Mait Lang[gggg,xxxx], Simon L. Lewis[yyyy,zzzz], Natalia Lukina[hhhh], Brian S. Maitner[aaaaa], Yadvinder Malhi[bbbbb], Andrew R. Marshall[ccccc,ddddd], Olga V. Martynenko[eeeee], Abel L. Monteagudo Mendoza[fffff], Petr V. Ontikov[ggggg], Edgar Ortiz-Malavasi[hhhhh], Nadir C. Pallqui Camacho[iiiii], Alain Paquette[iiiii], Minjee Park[a], Narayanaswamy Parthasarathy[kkkkk], Pablo Luis Peri[lllll], Pascal Petronelli[mmmmm], Sebastian Pfautsch[nnnnn], Oliver L. Phillips[yyyy], Nicolas Picard[g,ooooo], Daniel Piotto[ppppp], Lourens Poorter[n], John R. Poulsen[bbb], Hans Pretzsch[qqqqq], Hirma Ramírez-Angulo[rrrrr], Zorayda Restrepo Correa[sssss], Mirco Rodeghiero[ttttt,uuuuu], Rocío Del Pilar Rojas Gonzáles[vvvvv], Samir G. Rolim[wwwww], Francesco Rovero[xxxxx,yyyyy], Ervan Rutishauser[zzzzz], Purabi Saikia[aaaaaa], Christian Salas-Eljatib[bbbbbb,cccccc,dddddd], Dmitry Schepaschenko[eeeeee,ffffff], Michael Scherer-Lorenzen[ggggggg], Vladimír Šebeň[hhhhhh], Marcos Silveira[iiiiii], Ferry Slik[jjjjjj], Bonaventure Sonké[kkkkkk], Alexandre F. Souza[llllll], Krzysztof Jan Stereńczak[mmmmmm], Miroslav Svoboda[nnnnnn], Hermann Taedoumg[oooooo,pppppp], Nadja Tchebakova[eeeeee], John Terborgh[qqqqqq,rrrrrr], Elena Tikhonova[hhhh], Armando Torres-Lezama[ssssss], Fons van der Plas[tttttt], Rodolfo Vásquez[vvvvv], Helder Viana[uuuuuu,vvvvvv], Alexander C. Vibrans[wwwwww], Emilio Vilanova[xxxxxx], Vincent A. Vos[yyyyyy], Hua-Feng Wang[zzzzzz], Bertil Westerlund[aaaaaaa], Lee J. T. White[bbbbbbb,ccccccc,ddddddd], Susan K. Wiser[eeeeeee], Tomasz Zawiła-Niedźwiecki[fffffff], Lise Zemagho[kkkkkk], Zhi-Xin Zhu[ggggggg], Irié C. Zo-Bi[hhhhhhh], and Jingjing Liang[a,1]

ECOLOGY



Cazzolla Gatti *et al.,* (2022) *PNAS* Vol. 119 No. 6

Improving selection decisions

- Trait based assessment
- Biogeographical data analysis (e.g. SDMs)
- Ecophysiology

Using plant traits – PLC / P_{50}

LETTER

doi:10.1038/nature11688

Global convergence in the vulnerability of forests to drought

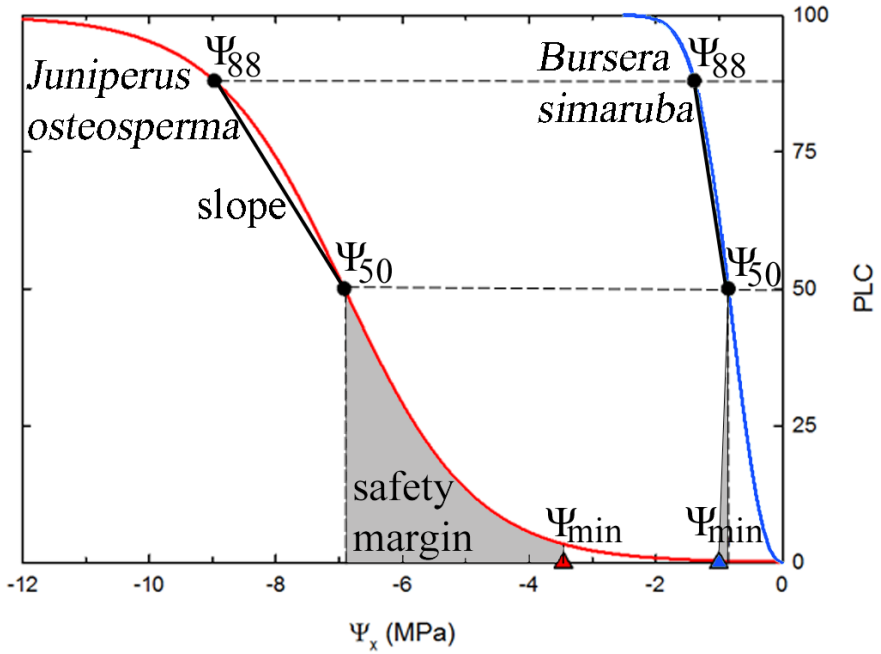
Brendan Choat[1*], Steven Jansen[2*], Tim J. Brodribb[3], Hervé Cochard[4,5], Sylvain Delzon[6], Radika Bhaskar[7], Sandra J. Bucci[8], Taylor S. Feild[9], Sean M. Gleason[10], Uwe G. Hacke[11], Anna L. Jacobsen[12], Frederic Lens[13], Hafiz Maherali[14], Jordi Martinez-Vilalta[15,16], Stefan Mayr[17], Maurizio Mencuccini[18,19], Patrick J. Mitchell[20], Andrea Nardini[21], Jarmila Pittermann[22], R. Brandon Pratt[12], John S. Sperry[23], Mark Westoby[10], Ian J. Wright[10] & Amy E. Zanne[24,25]

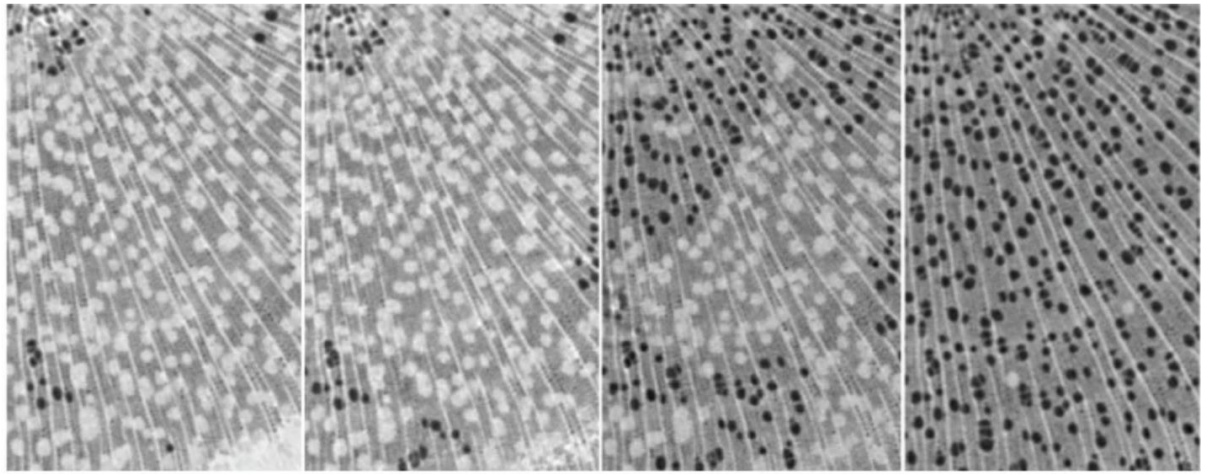
REVIEW

https://doi.org/10.1038/s41586-018-0240-x

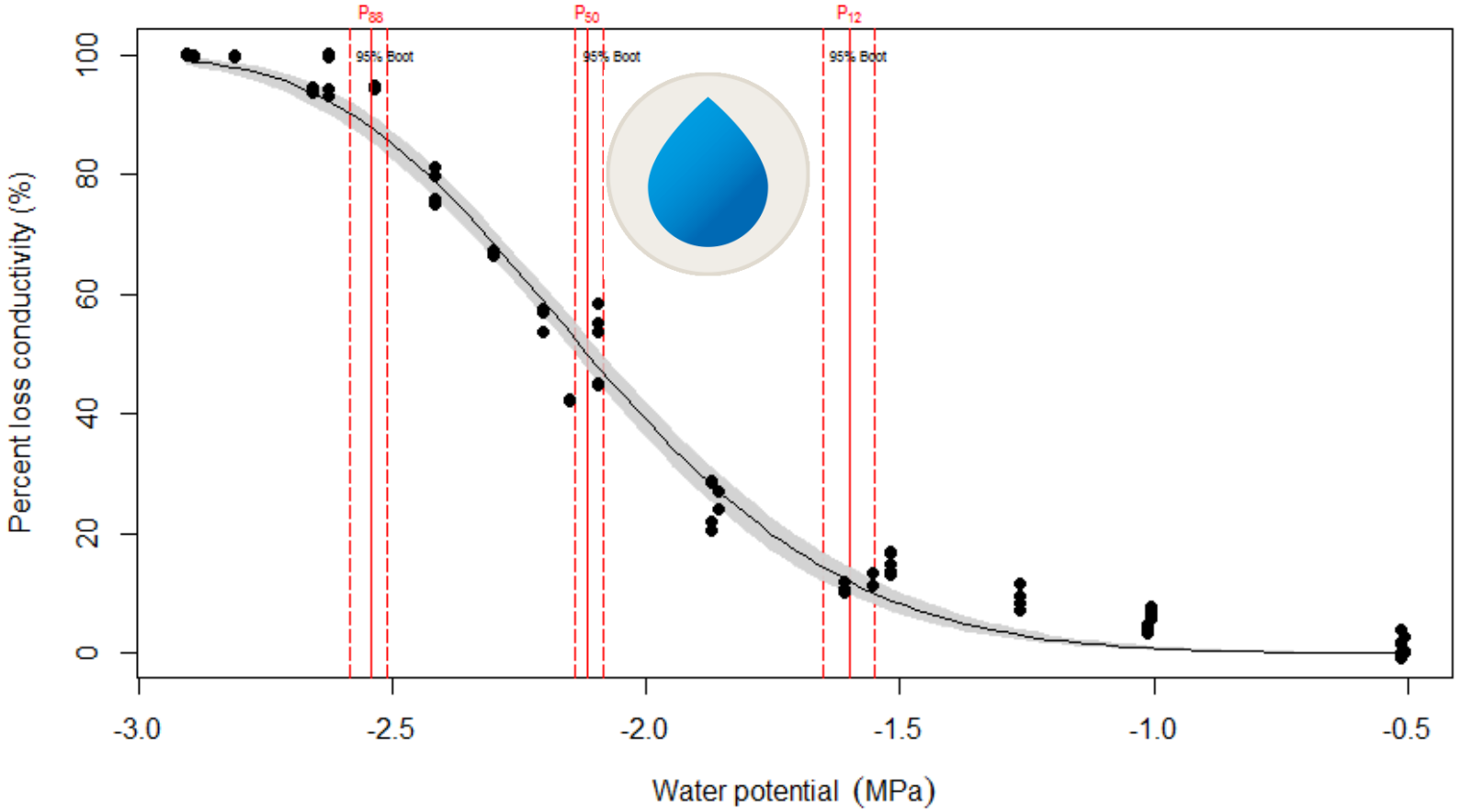
Triggers of tree mortality under drought

Brendan Choat[1*], Timothy J. Brodribb[2], Craig R. Brodersen[3], Remko A. Duursma[1], Rosana López[1,4] & Belinda E. Medlyn[1]





Vulnerability of amenity trees to embolism



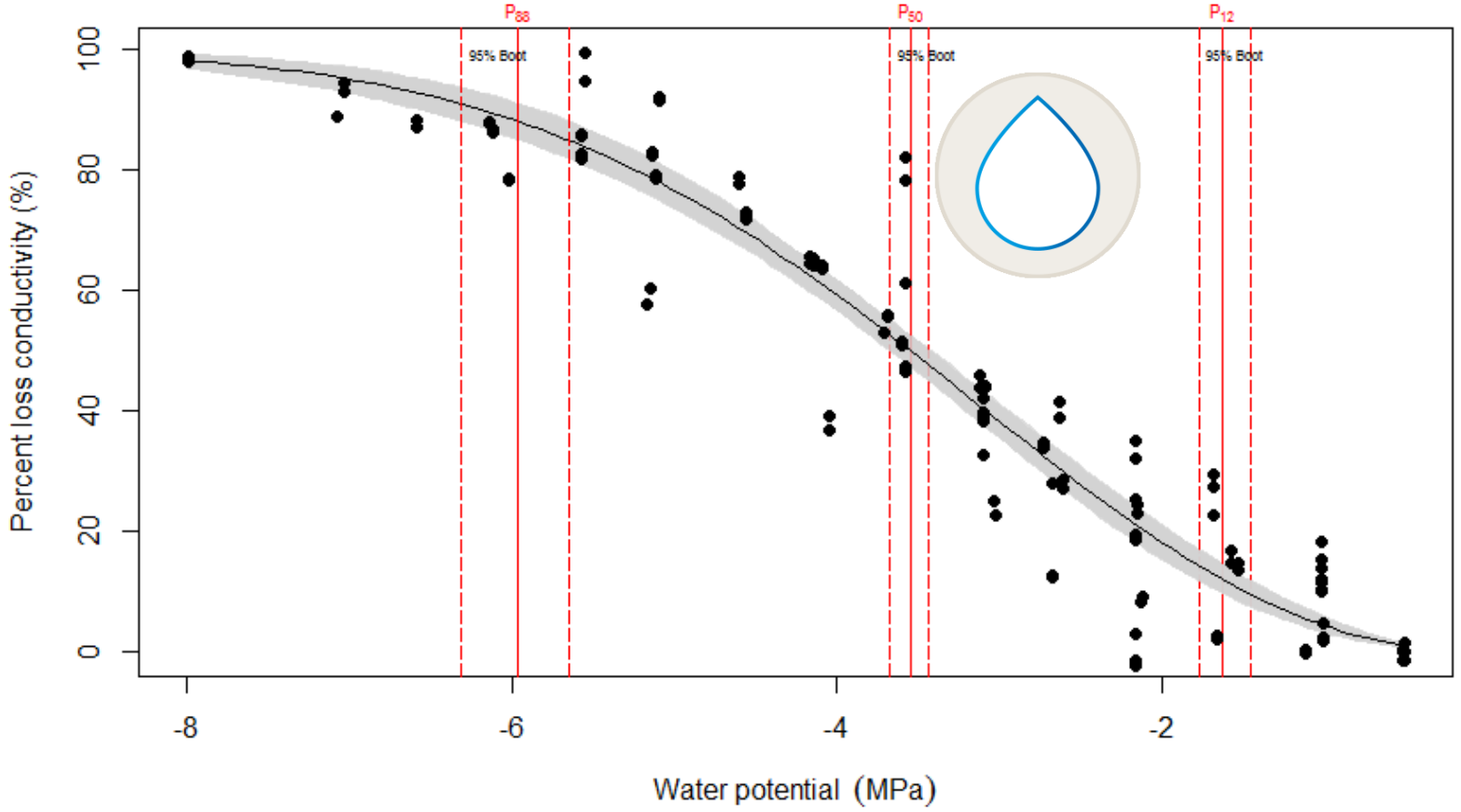
Cercidiphyllum japonicum

TREE FUND
Cultivating Innovation

fund trees

NERC SCIENCE OF THE ENVIRONMENT

Vulnerability of amenity trees to embolism



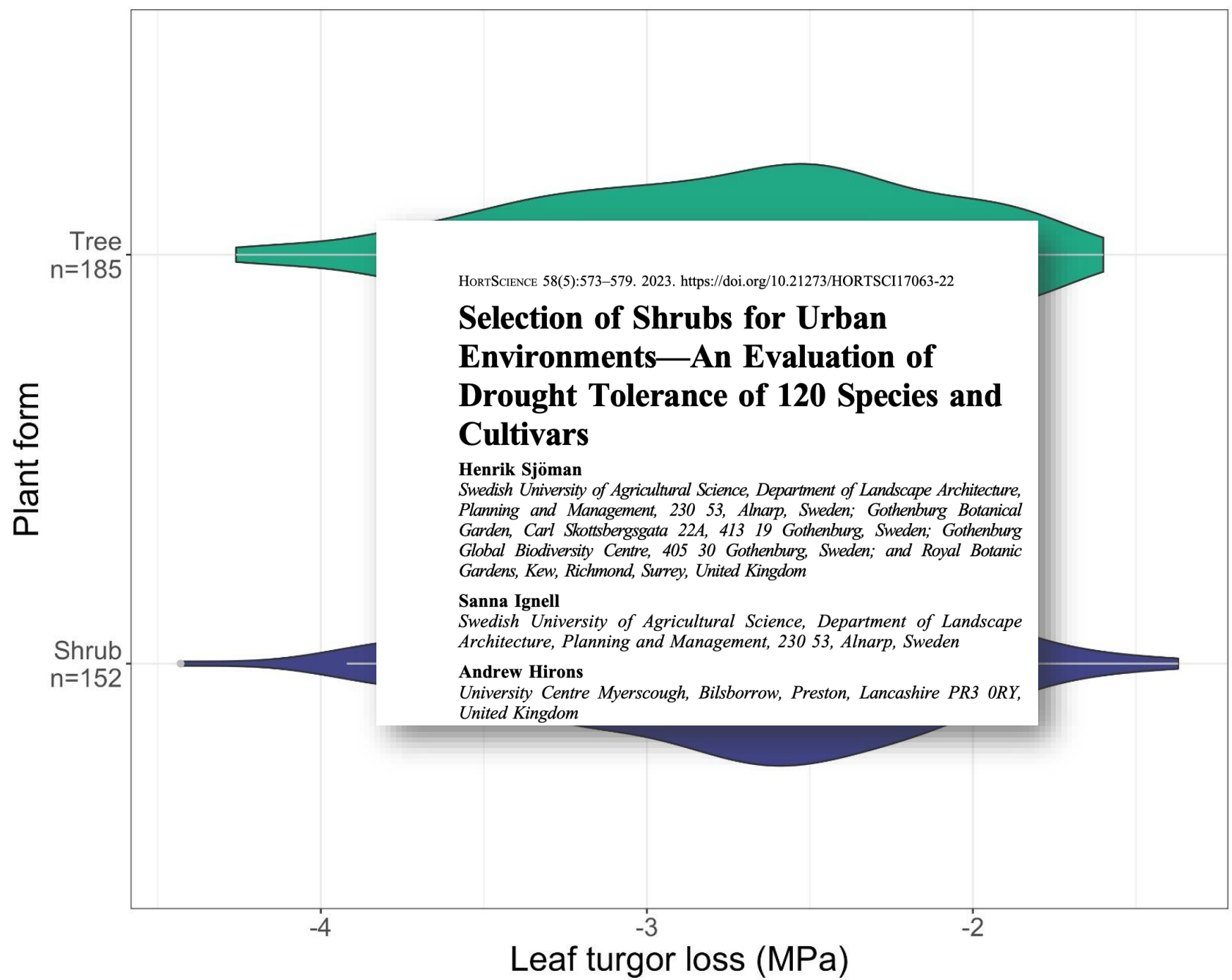
Eucommia ulmoides

TREE FUND
Cultivating Innovation

fund trees

NERC SCIENCE OF THE ENVIRONMENT

Consequences of high PLC



HortScience 58(5):573–579. 2023. https://doi.org/10.21273/HORTSCI17063-22

Selection of Shrubs for Urban Environments—An Evaluation of Drought Tolerance of 120 Species and Cultivars

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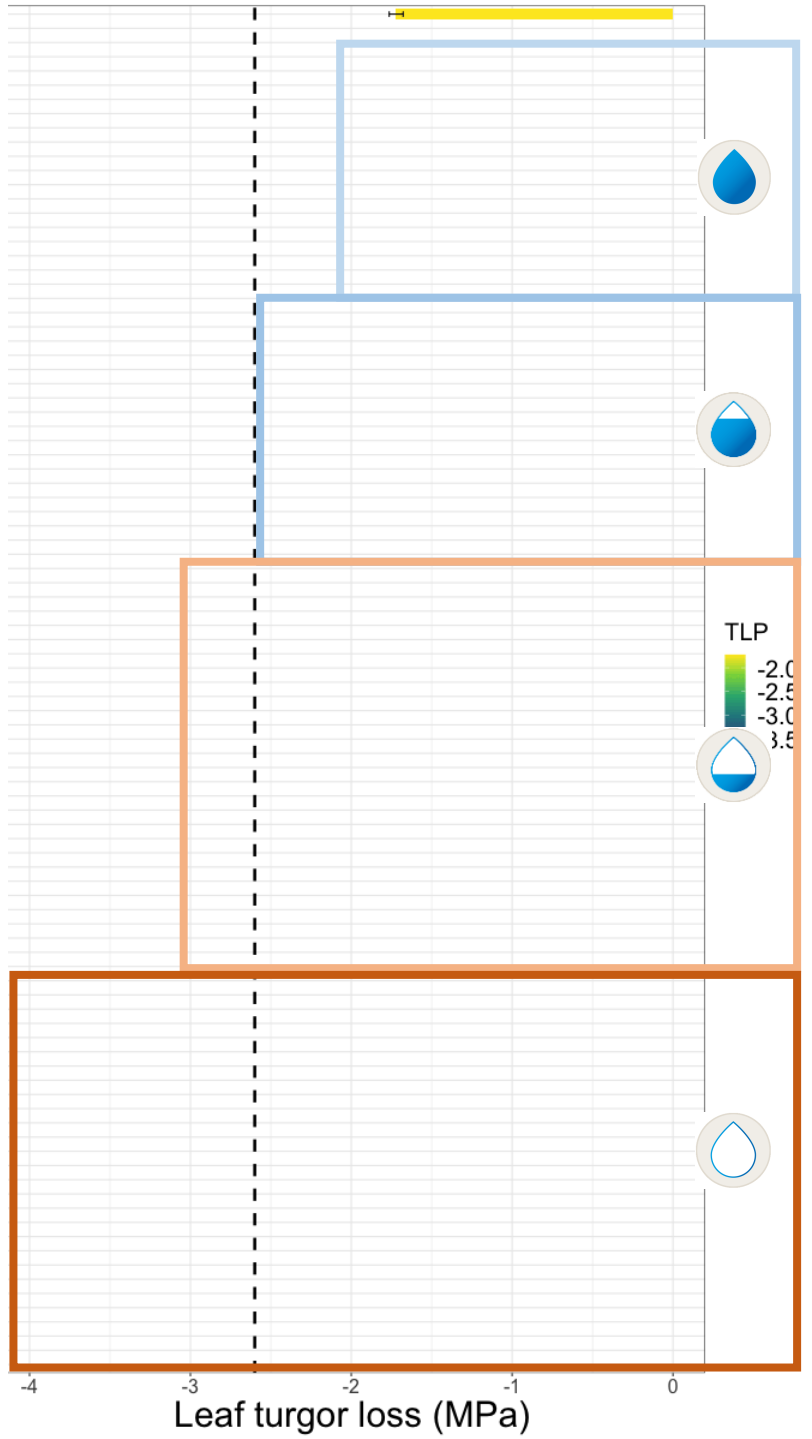
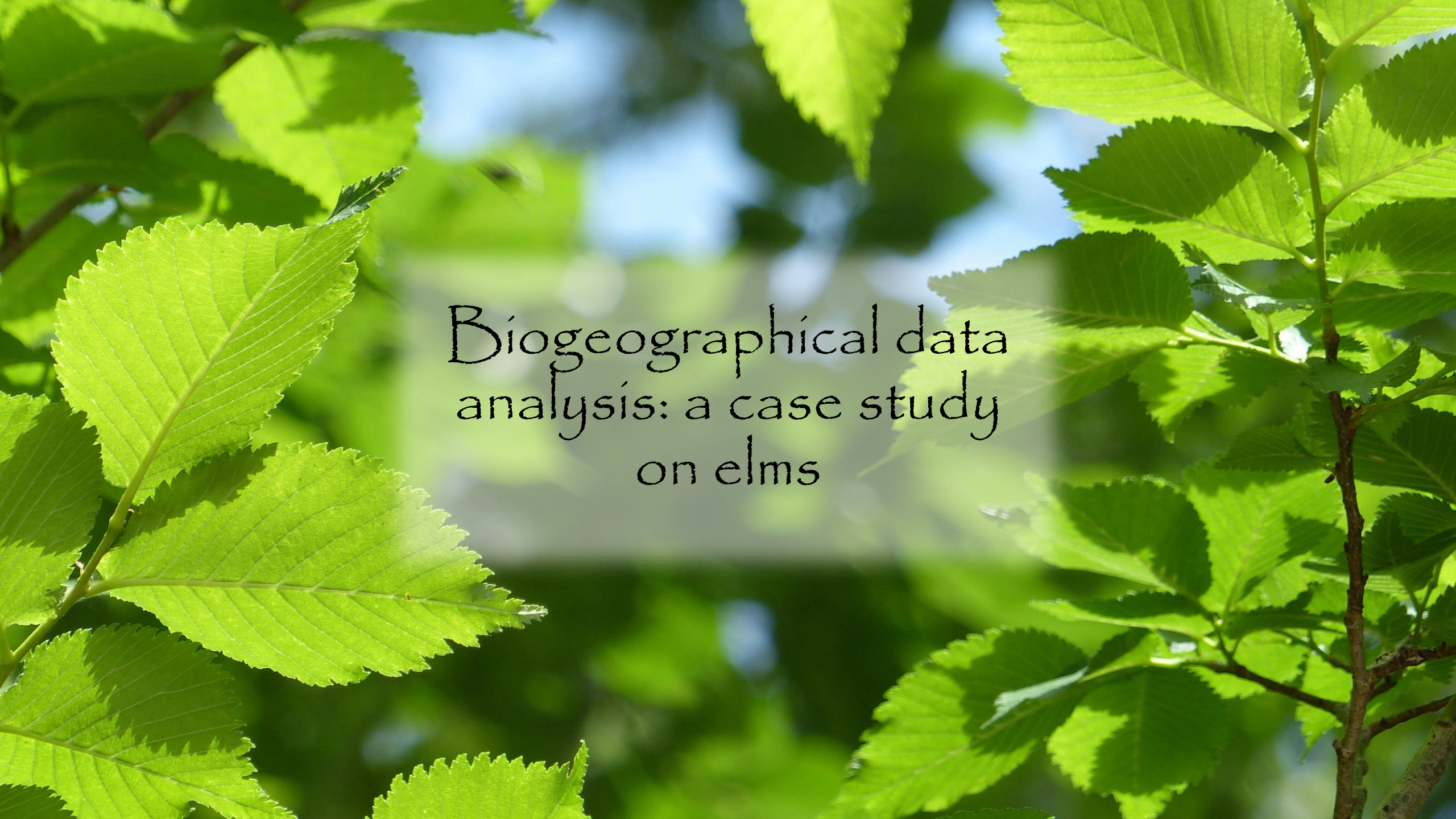
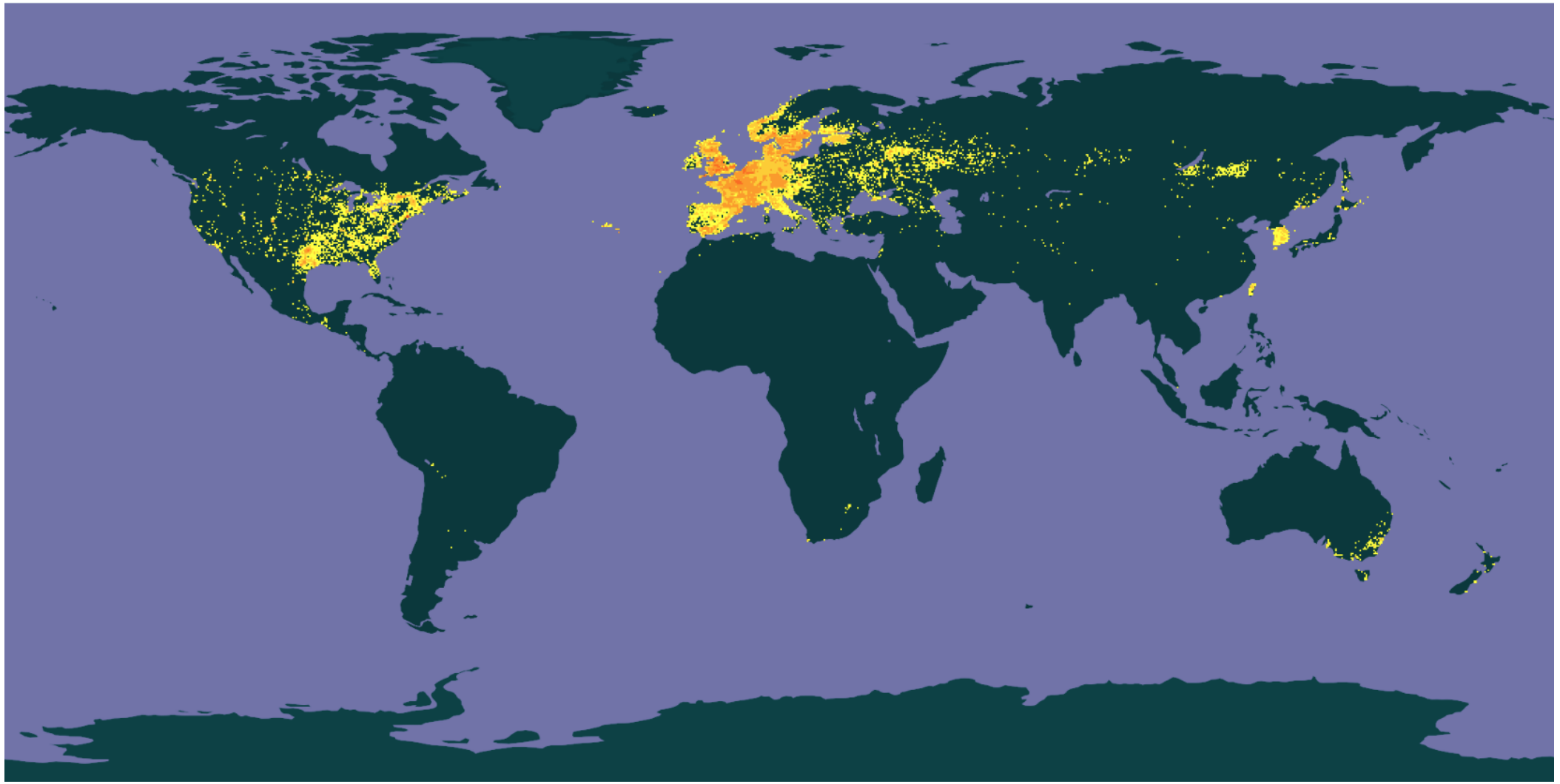




Biogeographical data analysis: a case study on elms

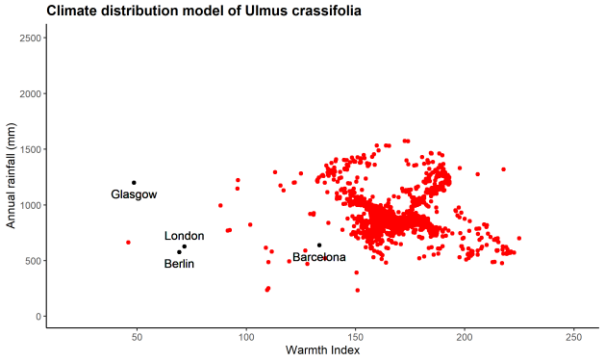
Global Distribution of *Ulmus*

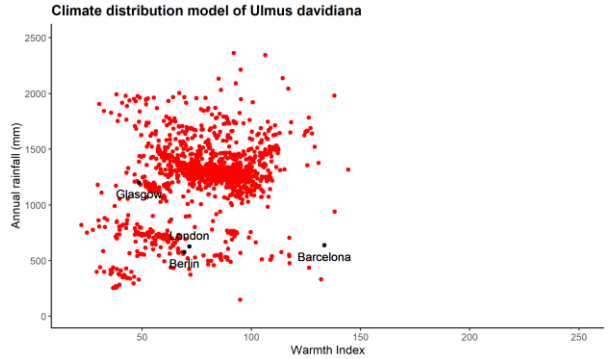


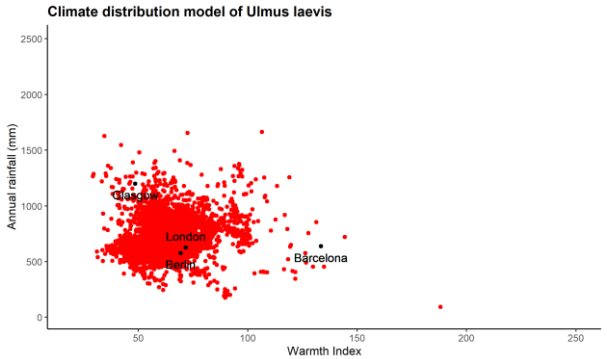
GBIF

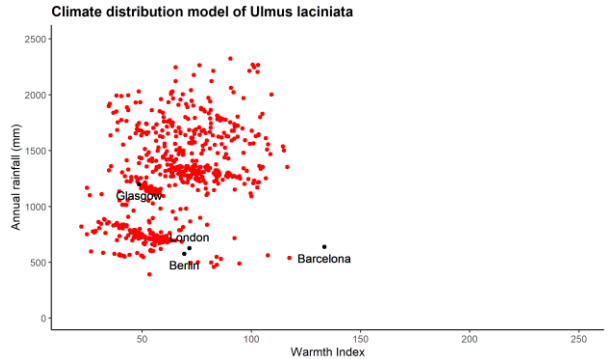
Climate Distribution Models of 14 *Ulmus* species

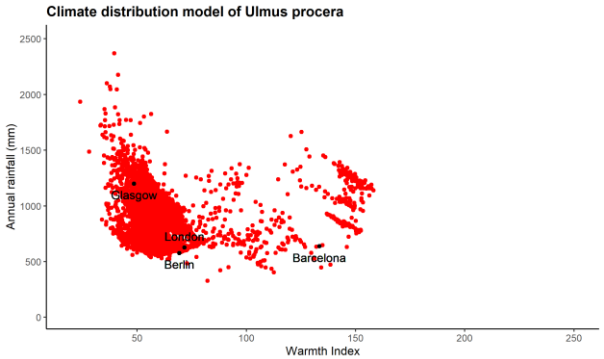
Watkins and Hirons *in prep.*

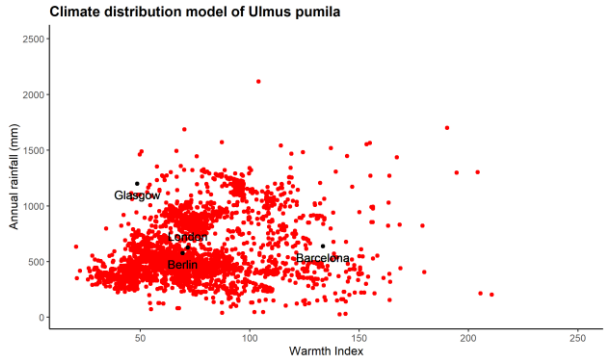


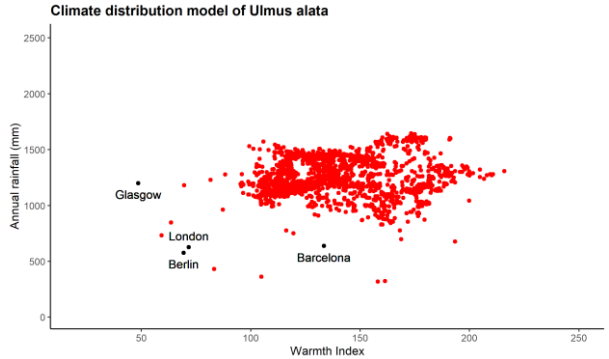


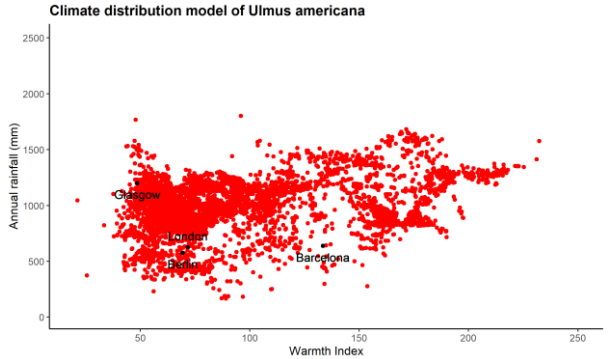


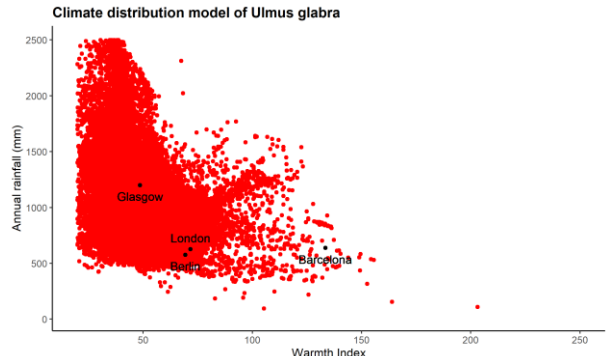


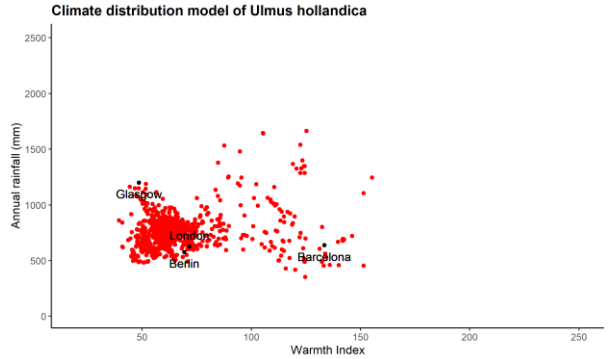


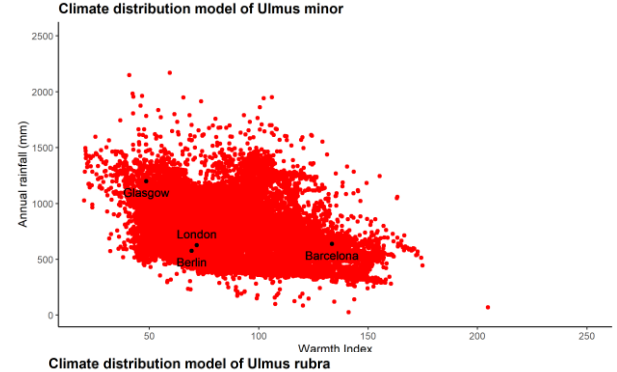


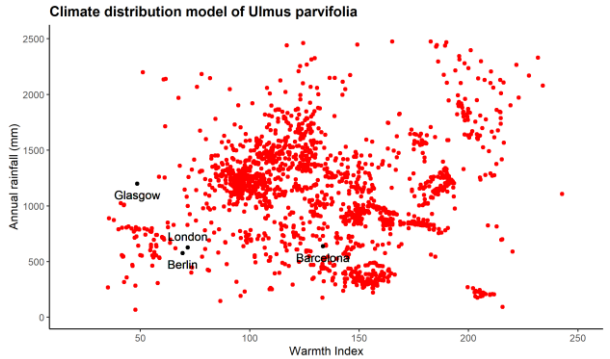


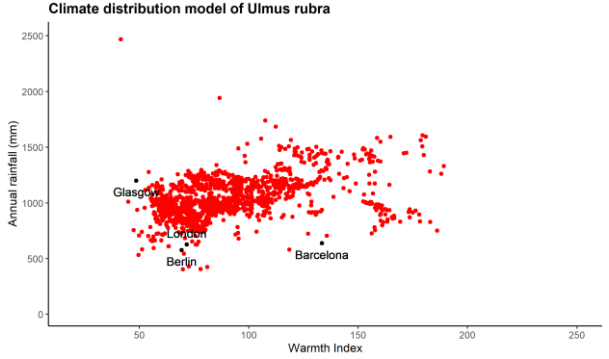


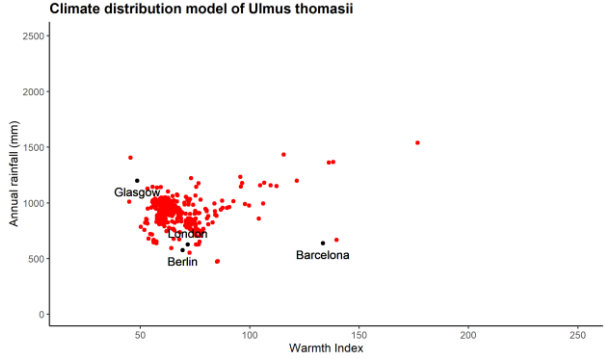






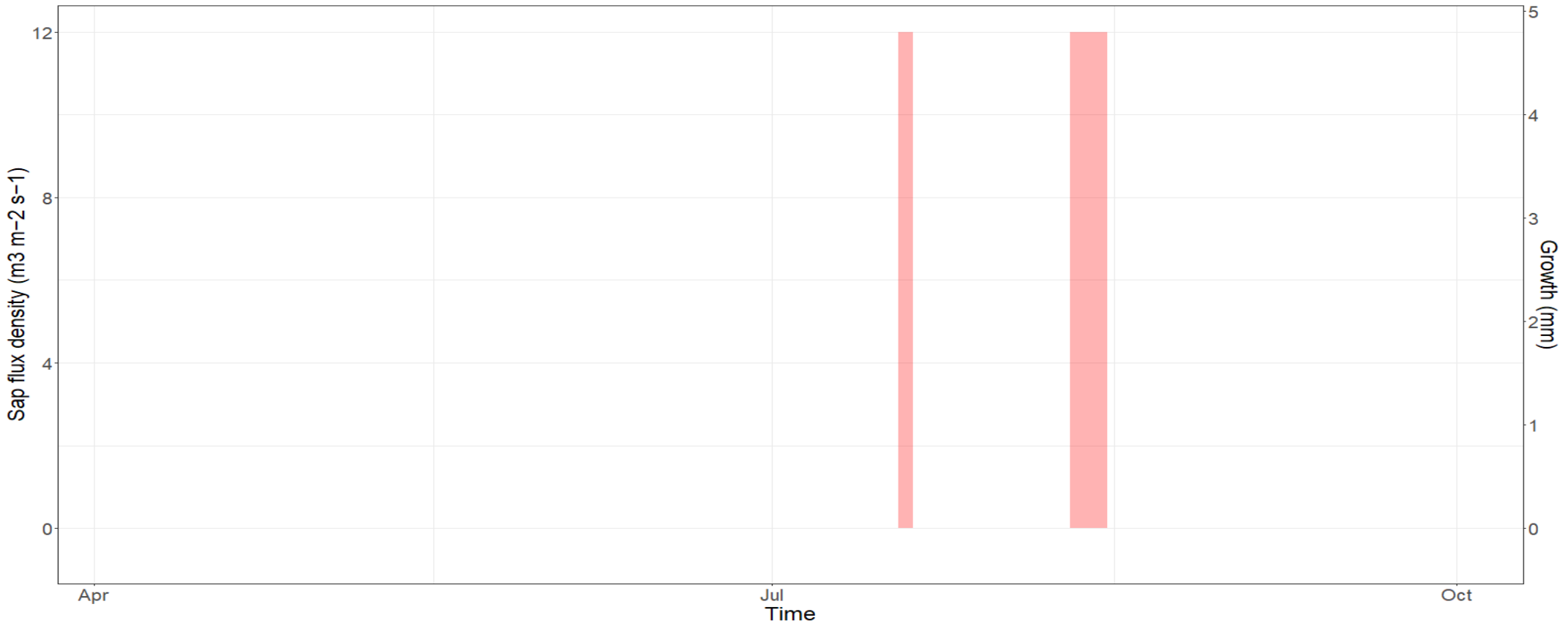






Tree Production Innovation Fund (TPIF)

Pyrus calleryana - Sap flow vs. growth



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Forestry Commission


Thanks for listening
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