Warmer climates and the implications for pests and diseases

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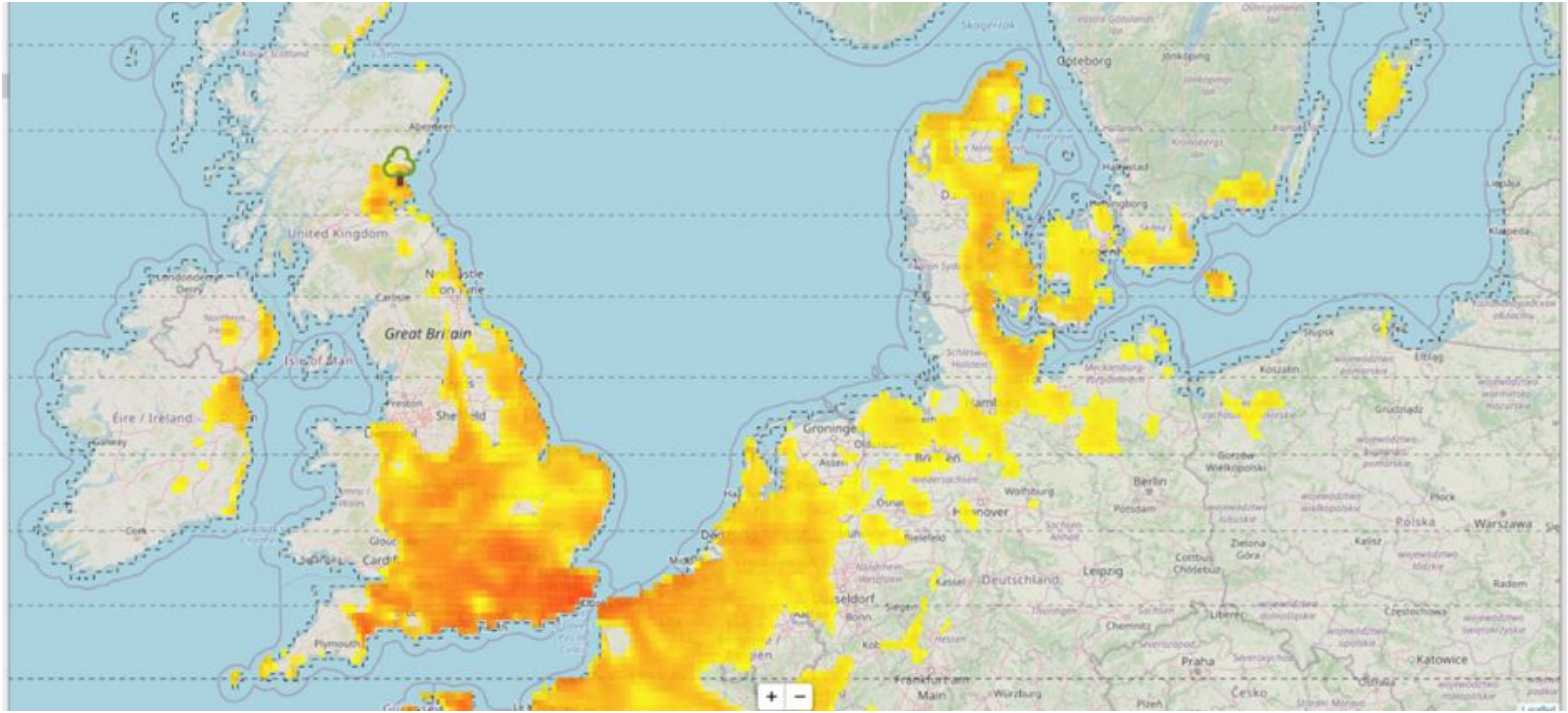
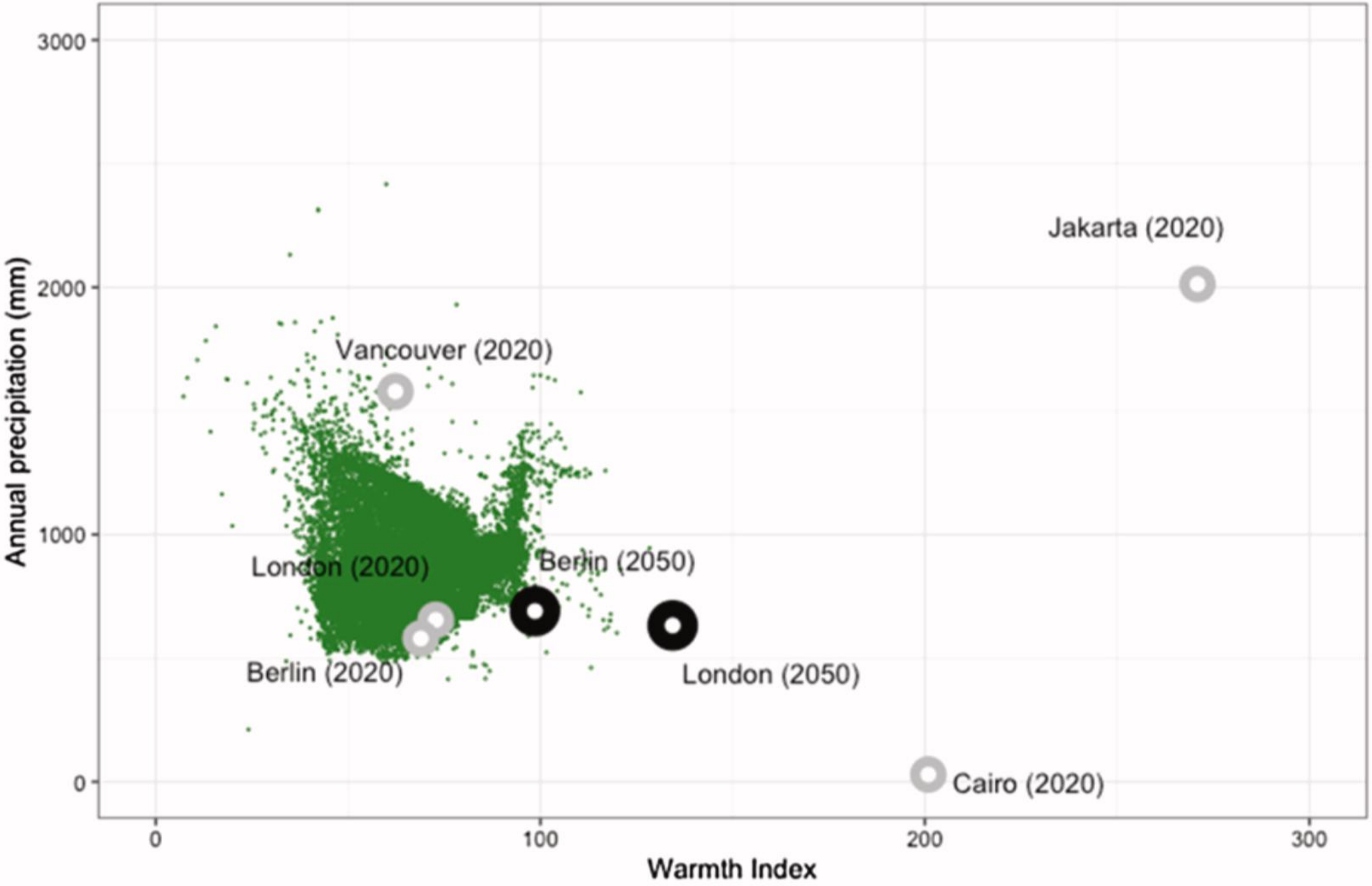
1. Green infrastucture from a plant's perspective



Places with current climates that St Andrews will expect to experience in 2073

Image: Forest Research

Distribution of Carpinus betulus in relation to urban climate change scenarios



What do we know about the origin of our urban trees? – A north European perspective.
Sjoman and Watkins, 2020; Urban Forestry & Urban Greening 56 (2020) 126879.

Plant Health Centre
Scotland's Centre of Expertise

Scottish Government
Riaghaltas na h-Alba
gov.scot

Assessment of plant biosecurity risks to Scotland from large-scale plantings for landscaping and infrastructure projects

PHC2019/05: Project Final Report

Forest Research

Ecological Solutions and Evidence
BRITISH ECOLOGICAL SOCIETY

DATA ARTICLE

GIbase1.0: A database of green infrastructure plant species in England and Scotland

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Abstract

1. The contributions of constructed Green Infrastructure (GI) to biodiversity are often used to justify urban development projects, yet in many cases these contributions have been difficult to quantify.
2. As a result, a wide range of GI features are designed and implemented, often without knowledge of whether these features contribute meaningfully to biodiversity or if there are biosecurity risks presented by their design or procurement. Our understanding of design practices could be significantly improved if researchers and policymakers were able to draw upon a data resource that recorded the specifications used in development projects and facilitated easy access to them.
3. In the United Kingdom, planning Portals act as substantial and untapped repositories of grey literature, containing highly detailed data with a diverse spatial coverage, recording the diversity and extent of existing habitats and specifications for proposed species assemblages. However, they are difficult to navigate or query, making it challenging to use these resources to gain macro-level insights from the data held within the portals.
4. In this paper, we present GIbase 1.0, a new dataset that incorporates plant specifications from development projects across England and Scotland along with trait data associated with each species.
5. To demonstrate the utility of the dataset, in a separate exercise we tested whether these data could be used to inform policymakers and researchers about current procurement and planting practices. To this end, we assessed the proposed GI features that are submitted by developers to local planning authorities as part of the planning process and then carried out fieldwork to record the extent to which these specifications were delivered. The findings from this work are published separately (Karlsdottir et al., 2021).

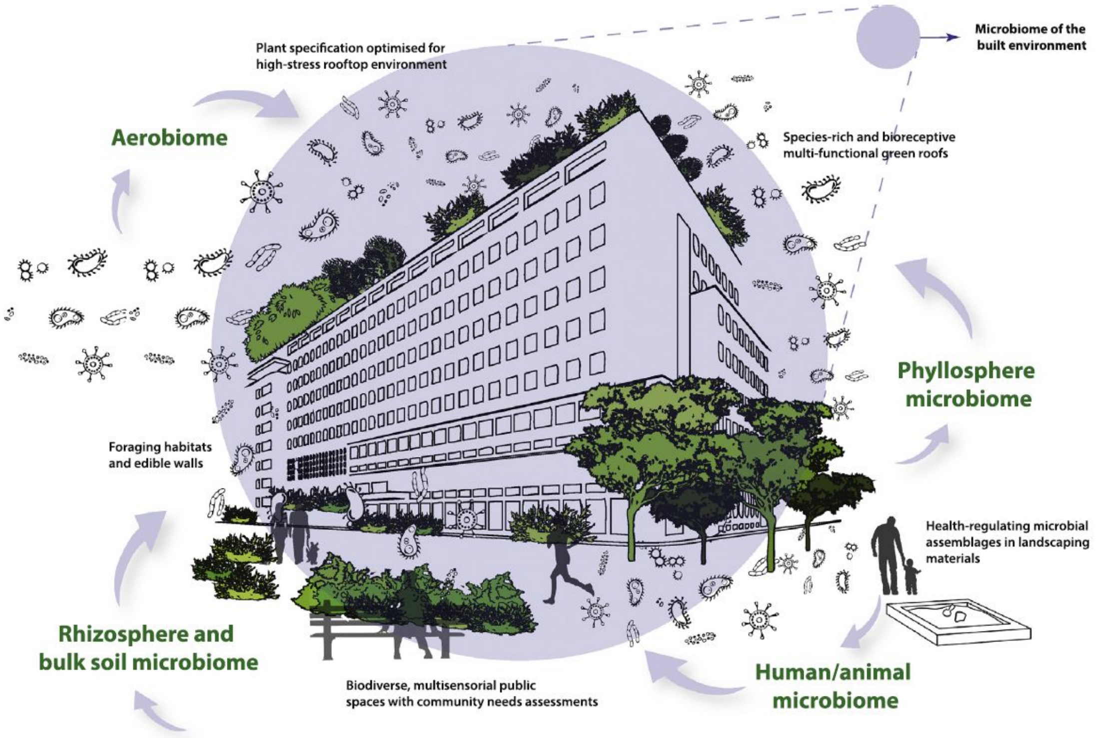
TABLE 1 The most frequently specified plants in England and Scotland

Shrub and herbaceous planting		Hedges		Trees	
Species	%	Species	%	Species	%
Pachysandra terminalis	2.79	*Carpinus betulus*	32.84	*Fagus sylvatica*	21.95
Lavandula angustifolia 'Hidcote'	2.54	*Fagus sylvatica*	16.55	*Crataegus monogyna*	10.78
Sarcococca confusa	2.45	*Ilex aquifolium*	9.01	*Betula pendula*	9.24
Prunus laurocerasus 'Otto Luyken'	2.27	*Prunus spinosa*	7.45	*Corylus avellana*	8.98
Mahonia aquifolium	2.16	*Crataegus monogyna*	6.25	*Carpinus betulus*	6.22
Cornus sanguinea 'Midwinter FIre'	1.77	*Photinia x fraseri* 'Red Robin'	3.23	*Sorbus aucuparia*	4.17
Hedera helix	1.4	*Acer campestre*	3.21	*Alnus glutinosa*	4.05
Hakonechloa macra 'Alboaurea'	1.2	*Fagus sylvatica* 'Atropurpurea Group'	2.47	*Ilex aquifolium*	3.6
Liriope muscari 'Monroe White'	1.16	*Escallonia* 'CF Ball'	2.34	*Quercus petraea*	3.17
Viburnum tinus 'Eve Price'	1.09	*Rosa canina*	1.75	*Prunus avium*	2.82

Key findings

- Only 27% of green infrastructure schemes delivered in accordance with plans approved by the Local Authority
- 57% of schemes included plant species known to be invasive or likely to become invasive
- 50 species account for 80% of all plants specified

2. Can we adapt existing systems to include the environmental microbiome?



Microbiome-Inspired Green Infrastructure: A Toolkit for Multidisciplinary Landscape Design.
Watkins et al, 2020; Trends in Biotechnology, December 2020, Vol. 38, No. 12

Project initiation: embedding collaborative approaches in assessment and brief formation

RIBA work stage	Landscape architect's core tasks	Core tasks for microbiologists and other specialist scientific advisers
Stage 0 Strategic definition	• Horizon scanning • Engage public health experts, environmental microbiologists, and microbial ecologists in design team	• Develop MIGI aims and objectives by identification of priorities for human health and ecosystem services • Prepare an ethics statement to ensure that MIGI prioritises socioecological inclusivity
Stage 1 Preparation and brief	• Landscape assessment • Stakeholder consultation • Agree procurement route • Overcome commercial pressures and value engineering by consulting nurseries and materials suppliers at early design stages; consider practices such as contract growing to ensure high biosecurity standards and accurate supply of materials	• Define brief for biodiversity, bioreceptivity, and interaction • Ecological assessment • Investigate effects of different green infrastructure network configurations and landscape connectivity on environmental microbiota • Identify potential landscape-scale impacts of plant health issues • Identify opportunities to deliver supporting and regulating ecosystem services, including nutrient cycling, soil formation, and primary production • Assess effects of wind, pollution, and land use at various scales on microbial diversity

Design: anticipating management decisions and landscape use

RIBA work stage	Landscape architect's core tasks	Core tasks for microbiologists and other specialist scientific advisers
Stage 2 Concept design	• Strategic landscape planning • Site modelling • Supply chain preparation	• Advise designers on plant selection and growth substrates to manage soil biodiversity and allelopathic factors • Consult with civil engineer to identify opportunities for managing nitrogen cycling in soil water systems • Risk assessment to identify any potentially harmful aspects of MIGI, including carbon sequestration and nitrogen accumulation • Establish MIGI in places where children spend time, such as play areas and skate parks, and integrate MIGI strategies with cultural trends • Identify which cultural practices (such as foraging and recreational activities) could maximise cobenefits • Consider microbiome inoculants in landscape materials, depending on results of ecological assessments
Stage 3 Developed design	• Resolve layout design of MIGI features • Consult microbial ecologists to select plant species and design soil structures • Carry out detailed specification of plants • Engage nurseries to begin contract growing	• Consider impacts of aspect, hydrology, and cultural uses on microbial habitats • Maximise macro-biodiversity, such as by using structurally diverse urban meadows instead of amenity grasslands • Evaluate project development against aims and objectives • Anticipate future management regimes and create potential for microbiome rewilding
Stage 4 Technical design	• Complete landscape specification • Prepare landscape management plan	• Create biosecurity plan for construction phase • Prepare plan for Stage 7 microbiome monitoring

Planting and management: ensuring continuity

RIBA work stage	Landscape architect's core tasks	Core tasks for microbiologists and other specialist scientific advisers
Stage 5 Construction	• Evaluate contractor's sustainability and biosecurity credentials • Weigh value engineering recommendations against whole-life costs	• Ensure that contractors understand MIGI objectives • Monitor works at critical stages, such as nursery inspection, sourcing of growth media, and inoculation (if a bioaugmentation strategy is used)
Stage 6 Handover and close out	• Record 'as built' information to allow future evaluation	• Conduct snagging survey to ensure MIGI features are correctly installed
Stage 7 In use and evaluation	• Record species establishment and sociocultural uses of MIGI features	• Ensure that spirit of MIGI aims is not lost by providing training to management team • Update MIGI management plan as needed • Biogeochemical monitoring of interactome and ecosystem services

3. Developing a digital design workflow

UK Plant Health Risk Register

Department for Environment, Food & Rural Affairs

Download Entire Risk Register

Please click the "Download CSV" button below to download all the publicly available Risk Register information in .csv (Comma Separated Values) format.

This file format uses comma characters (",") as delimiters, with the first row being the header values.

Download CSV

Risk Register 23_04_2023 11_21_51

F66 | Insect

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S
1	Date Added	Status	Pest famil	Pest Name	Common	Type of pe	EU and EP	High level	Key uncer	Potential i	Climate ur	Potential i	Current Di	Potential i	UK Distrib	Potential i	Hosts unc	Potential i	Impact un
1392	30/03/2020	Live	Longidorid	Xiphinema rivesi (non-European populations)	A dagger n	Nematode	Regulated quarantine pest (non-European populations). EPPO A2												
1393	12/03/2020	Live	Longidorid	Xiphinema tarjanense	; Xiphinem	Nematode	Regulated quarantine		Rapid addition via a workshop. Some areas of assessment may require more research.										
1394	08/10/2013	Live	Longidorid	Xiphinema thornei		Nematode													
1395	15/08/2014	Live	Curculioni	Xyleborus glabratus	redbay am	Insect	Regulated quarantine pest (as Scolytidae spp. (non European)). Provisional quarantine pest (Great Britain). EPPO Alert												
1396	09/04/2021	Live	Xanthomo	Xylella fastidiosa	Alfalfa dw	Bacterium	Regulated quarantine		Impacts due to the pest itself in the UK climate								The host lists are con	Detections c	
1397	23/05/2017	Live	Xanthomo	Xylella taiwanensis		Bacterium			This is a recently desc		How cold-adaptable X. taiwanensis might be.						Unknown if it infects more hosts t		
1398	08/10/2013	Live	Pseudomo	Xylophilus ampelinus	Bacterial b	Bacterium	Provisional quarantine pest (Great Britain). Regulated non quarantine pest (Northern Ireland). EPPO A2												
1399	22/04/2014	Live	Curculioni	Xylosandrus compactus	Black coff	Insect	General plant health powers apply. Previously EPPO Alert.												
1400	08/10/2013	Live	Curculioni	Xylosandrus crassiusculus	; Apple bar	Insect	EPPO Alert												
1401	04/06/2014	Live	Curculioni	Xylosandrus germanus	Black timb	Insect													
1402	28/06/2016	Live - Arch	Cerambyci	Xylotoles griseus	New Zeala	Insect													
1403	08/10/2013	Live	Cerambyci	Xylotrechus (Turanoclytus) namanganensis	Namangar	Insect	Provisional quarantin		The suitability of the		Whether the UK is sui		Fine details of distribution are lacking; meaning detailed climatic s						What level c
1404	08/10/2013	Live	Cerambyci	Xylotrechus altaicus	Alta larch l	Insect	Provisional quarantine pest (Great Britain). EPPO A2												
1405	06/02/2015	Live	Cerambyci	Xylotrechus chinensis	Mulberry b	Insect	Provisional quarantine pest (Great Britain). EPPO Alert (2018)												
1406	18/05/2017	Live	Cerambyci	Xylotrechus grayii		Insect	Provisional quarantine pest (Great Britain)												
1407	08/10/2013	Live - Arch	Acholeplas	Yucatan lethal decline phytoplasma		Phytoplasr	EPPO A1												
1408	25/07/2022	Live	Tephritida	Zacerata asparagi		Insect	Regulated quarantine pest (Northern Ireland)												
1409	14/07/2017	Live - Arch	Drosophili	Zaprionus indianus		Insect			Taxonomy: part of a		The overwintering col		Other species in the complex may have spre				Older host records ma		What factor
1410	17/07/2017	Live - Arch	Drosophili	Zaprionus tuberculatus		Insect			Taxonomy: part of a		The overwintering col		Other species in the c		Whether this species		Older host records may refer to o		
1411	08/10/2013	Live	Tephritida	Zeugodacus cucumis	Cucumber	Insect	Regulated quarantine pest. EPPO A1												
1412	08/10/2013	Live	Tephritida	Zeugodacus cucurbitae	melon fly;	Insect	Regulated quarantine pest. EPPO A1												
1413	26/05/2022	Live	Tephritida	Zeugodacus spp.		Insect	Regulated quarantine pest. Genus regulated in Northern Ireland; only certain named species regulated in Great Britain.												
1414	14/07/2016	Live	Tephritida	Zeugodacus tau		Insect	Regulated quarantine pest (as Bactrocera tau)												
1415	26/05/2022	Live	Tephritida	Zonosemata electa	Pepper; m	Insect	Regulated quarantine pest (Northern Ireland)												
1416																			

Risk Register 23_04_2023 11_21_

Xylella fastidiosa

Alfalfa dwarf; Anaheim disease; California vine disease; Dwarf disease of alfalfa; Dwarf disease of lucerne; Leaf scald of oleander; Leaf scald of plum; Leaf scorch; Phony disease of peach; Pierce's disease of grapevine; Variegated chlorosis of citrus

Major hosts

Acacia dealbata; Acer pseudoplatanus; Acer rubrum; Amaranthus retroflexus; Artemisia arborescens; Asparagus acutifolius; Carya illinoinensis; Chenopodium album; Cistus; Coffea; Coprosma repens; Cyperaceae; Dodonaea viscosa; Eremophila maculata; Euphorbia terracina; Ficus carica; Fortunella; Fraxinus angustifolia ssp. angustifolia; Grevillea sulphurea; Hebe; Helichrysum italicum; Hibiscus; Juglans regia; Laurus nobilis; Lavandula; Lavandula angustifolia; Lavandula dentata; Ligustrum; Lonicera japonica (var. japonica); Medicago sativa; Myrtus communis; Nerium oleander; Olea europaea; Pelargonium graveolens; Platanus occidentalis; Polygala myrtifolia; Prunus; Prunus avium ssp./var. avium; Prunus cerasifera; Quercus rubra; Quercus suber; Rosa Floribunda hybrids; Rosmarinus officinalis; Cytisus scoparius; Streptocarpus; Ulmus americana; Vaccinium; Vinca minor; Vitis labrusca; Vitis riparia; Vitis vinifera ssp. vinifera; Westringia fruticosa; Citrus

Relative risk rating 60
Relative risk rating (mitigated) 30

Xylosandrus germanus

Black timber bark beetle; Smaller alnus bark beetle; tea root borer

Major hosts

Abies; Acer; Alnus; Betula; Camellia sinensis; Carpinus betulus; Carya; Castanea; Cornus; Corylus avellana; Fraxinus; Juglans nigra; Juglans regia; Magnolia; Picea; Picea abies; Pinus densiflora; Pinus parviflora; Pinus sylvestris; Populus; Prunus; Pseudotsuga menziesii var. menziesii; Quercus; Salix; Styrax; Ulmus glabra; Vitis vinifera ssp. vinifera; Fagus sylvatica

Relative risk rating 60
Relative risk rating (mitigated) 60

Top of the pops: the top 40 tree genera and species most at risk in GB from pests and diseases

Prunus	2429	**Salix**	1233	**Olea europapaea**	861
Malus	2303	**Populus**	1230	**Ficus**	850
Pinus	2293	**Abies**	1226	**Pseudotsuga menziesii**	836
Vitis vinifera	2248	**Ulmus**	1226	**Prunus cerasus**	811
Citrus	2137	**Pyrus**	1191	**Vitis**	796
Prunus persica	2004	**Vaccinium**	1086	**Pyrus communis**	791
Malus domestica	1721	**Prunus armeniaca**	1049	**Pinus contorta**	789
Prunus domestica	1693	**Pinus sylvestris**	1025	**Picea abies**	774
Quercus	1652	**Betula**	993	**Fraxinus**	756
Prunus avium	1571	**Rubus**	970	**Morus alba**	746
Rosa	1507	**Quercus robur**	960	**Persea americana**	735
Picea	1324	**Morus**	948	**Pinus radiata**	732
Larix	1299	**Acer**	942	**Juglans regia**	682
				Cydonia oblonga	674

4. Next steps

Reinforcing the biosecurity continuum: two discussion points

Embracing probability

A diverse treestock is essential to mitigate biosecurity risks.

However, not all risks are equal and it is easy to make assumptions. We need to not only develop data that allow us to weigh risks accurately and reasonably, but become comfortable with not being able to guarantee what the right tree is for a given place.

Harness existing tools

The green infrastructure sector sits at the intersection of a highly complex combination of industries. We need to find new ways to use the tools we have at our disposal so that different expertises can collaborate.

The RIBA Plan of Works, the GB Plant Health Risk Register and BIM systems all have untapped potential.

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