SCBI Tree Disease Guide

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Introduction

The aim of this guide is to identify tree species of concern within the SCBI ForestGEO plot, and the diseases that are most likely to affect them, so that we can properly identify the causes of decline.

Methods & Definitions

Tree species concern levels

We assigned concern levels – high (H), moderate (M), or low (L) – to each tree species based on results of the SCBI ForestGEO mortality census, IUCN status, and the presence and lethally of pest and pathogen species.

Concern level based on observed tree mortality rates alone was defined as follows:

Concern level based on the fraction of alive but unhealthy ("AU" status) trees observed in the latest census was defined as follows:

Overall concern level was determined as follows:

1. If IUCN Red List status was anything other than "Least Concern", the species was flagged as high concern
2. If an exotic pest or disease with high / moderate lethality was known to be present in region, any species affected by that pest/ disease was flagged as H/M concern.
3. If either mortality rate or AU concern level was M or H, overall concern was assigned to match the highest concern level, but lowered one level in the case of species with <50 individuals in the plot and only one M or H ranking.
4. If IUCN Red List status was anything other than "Least Concern", there were no known highly lethal exotic pests or diseases present, and both mortality and AU concern levels were low, the species was flagged as low concern.

Identifying tree species - disease pairs

Tree Species of Concern

Table 1. Summary of the health/ mortality status of all tree species in the SCBI ForestGEO plot. Included is IUCN status, n of living individuals ≥ 10 cm DBH in the SCBI ForestGEO plot, numbers of known species of forest insects or pathogens (FIP) and exotic FIP (EFIP) affecting the species, levels of concern based on mortality rates and "alive-unhealthy" (AU) status, and overall level of concern based on these metrics. Codes: H = high, M = moderate; L = low. Tree species codes are defined in the document SCBI_ForestGEO_sp_ecology.csv.

					current concern level		
Tree species code	IUCN status	n living	n FIP	n EFIP	mortality status	AU status	overall
acne	Least concern	11	10	1	L	M	L
acpl	Least concern	7	9	1	L	L	L
acru	**Least concern**	**170**	**11**	**1**	**L**	**M**	**M**
aial		**3**	**1**	**1**	**M**	**H**	**M**
caco	Least concern	213	5	0	M	L	L
cagl	Least concern	710	4	0	L	L	L
caovl		292	4	0	L	L	L
cato	Least concern	604	4	0	L	L	L
cade	**Critically Endangered**	**1**	**1**	**1**	**L**	**L**	**H**
ceoc	**Least concern**	**35**	**0**	**0**	**H**	**M**	**M**
divi	Least concern	1	0	0	L	L	L
fagr	Least concern	343	7	2	L	L	L
fram	**Critically Endangered**	**125**	**10**	**1**	**H**	**H**	**H**
frni	**Critically Endangered**	**2**	**10**	**1**	**H**	**H**	**H**
frpe	**Critically Endangered**	**10**	**9**	**1**	**H**	**H**	**H**
juci	**Endangered**	**1**	**4**	**1**	**M**	**H**	**H**
juni	**Least concern**	**107**	**4**	**0**	**L**	**M**	**M**
litu	Least concern	2097	4	0	L	L	L
nysy	Least concern	484	0	0	L	L	L
pato		2	0	0	M	L	L
pipu	Least concern	1	12	0	L	L	L
pist	**Least concern**	**76**	**14**	**0**	**L**	**M**	**M**
pivi	Least concern	2	12	0	M	L	L
ploc	Least concern	27	1	0	L	M	L
prav	**Least concern**	**39**	**2**	**0**	**H**	**M**	**M**
prse	Least concern	10	2	0	M	L	L
qual	**Least concern**	**353**	**13**	**2**	**L**	**H**	**H**
quco	**Least concern**	**1**	**13**	**2**	**L**	**H**	**M**
qufa	**Least concern**	**1**	**13**	**2**	**L**	**H**	**M**
qumi	**Least concern**	**2**	**13**	**2**	**H**	**H**	**M**

(continued)

Tree species code	IUCN status	n living	n FIP	n EFIP	mortality status	AU status	overall
qumu	Least concern		13	2			
qupr	**Least concern**	**177**	**13**	**2**	**H**	**M**	**H**
quru	**Least concern**	**311**	**14**	**2**	**L**	**M**	**M**
quve	**Least concern**	**222**	**13**	**2**	**H**	**H**	**H**
rops	**Least concern**	**2**	**3**	**0**	**H**	**H**	**M**
saal	**Least concern**	**41**	**3**	**0**	**H**	**H**	**M**
tiam	Least concern	120	4	2	L	L	L
ulam	**Endangered**	**7**	**12**	**4**	**H**	**L**	**H**
ulru	**Least concern**	**72**	**12**	**4**	**H**	**H**	**H**

Tree- Disease Matrix

Table 2. Matrix of forest insects and pathogens likely to occur at the SCBI ForestGEO plot, and the tree taxa they affect. Tree species codes are defined in the document SCBI_ForestGEO_sp_ecology.csv.

Part 1/2: Tree species codes ACNE-FRPE

disease	acne	acpl	acru	aial	amar	astr	beth	caca	caco	cagl	caovl	cato	cade	ceoc	ceca	chvi	coal	cofl	coam	crpr	divi	elum	eual	fagr	fram	frni	frpe	havi	ilve
Xylella fastidiosa (Bacterial Leach Scorch)	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Anoplophora glabripennis (Asian Longhorn Beetle)	**1**	**1**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Nakacisina disstria (Forest Tent Caterpillar)	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Glycobius speciosus (Maple Borer)	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Heterocampa guttivitta (Saddled Prominent)	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ennomos subsignaria (Elm Spanworm)	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	0	0
Phellinus igniarus / Phellinus laevigatus / Phellinus tremulae (White Trunk Rot)	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Climacodon septentrionale (Northern Tooth Bracket Fungus)	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	0	0
Cicadellidae (leafhoppers)	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	1	0	0	0
Boisea trivittata (Boxelder Bug)	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Paracelemensia acerofoliella (Maple Leafcutter)	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Aphis gossypii (Aphid)	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lycorma delicatula (Spotted Lanternfly)	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Scolytus quadrispinosus (Hickory Bark Beetle)	0	0	0	0	0	0	0	0	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hyphantria cunea (Fall Webworm)	0	0	0	0	0	0	0	0	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	0
Heterocampa manteo (Variable Oakleaf Caterpillar)	0	0	0	0	0	0	0	0	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	0
Nectria cinnabarina (Coral Spot Canker)	0	0	0	0	0	0	0	0	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	0
Ophignomonia leptostyla (Walnut Anthracnose)	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cryphonectria parasitica (Chesnut Blight)	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Neofusicoccum spp. (Stem Canker)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Agrilus planipennis (Emerald Ash Borer)	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**1**	**1**	**0**	**0**

Part 1/2: Tree species codes ACNE-FRPE *(continued)*

disease	acne	acpl	acru	aial	amar	astr	beth	caca	caco	cagl	caovl	cato	cade	ceoc	ceca	chvi	coal	cofl	coam	crpr	divi	elum	eual	fagr	fram	frni	frpe	havi	ilve
Synanthedon scitula (Dogwood Borer)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0
Discula distructiva (Dogwood Anthracnose)	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Cryptococcus fagisuga Lindinger (Woolly Beech Scale)	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**0**
Neconectria spp. , Nectria coccinea (Beech Bark Disease)	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**0**
Litylenchus crenatae n. sp (Beech Leaf Disease)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Alsophila pometaria (Fall Cankerworm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	0	0
Candidatus Phytoplasma (Ash Yellows)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	0
Podosesia syringae (Lilac Ash Borer)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	0
Ophiognomonia clavigignenti-juglandacearum (Butternut Canker)	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Geosmithia morbida (Thousands Cankers Disease)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Neonectria galligena (Nectrua Canker)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Part 2/2: Tree species codes JUCI-ULRU

disease	libe	litu	loma	nysy	pato	pipu	pist	pivi	ploc	prav	prpe	prse	qual	quco	qufa	qumi	qumu	qupr	quru	quve	rops	rhpe	romu	rual	rupe	ruph	saca	saal	tiam
Xylella fastidiosa (Bacterial Leach Scorch)	0	0	0	0	0	0	0	0	1	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0
Anoplophora glabripennis (Asian Longhorn Beetle)	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Nakacisina disstria (Forest Tent Caterpillar)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0
Ennomos subsignaria (Elm Spanworm)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0
Cicadellidae (leafhoppers)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	1
Aphis gossypii (Aphid)	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hyphantria cunea (Fall Webworm)	0	1	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0
Heterocampa manteo (Variable Oakleaf Caterpillar)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	1
Nectria cinnabarina (Coral Spot Canker)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Alsophila pometaria (Fall Cankerworm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Euzophera ostricolorella (Root Collar Borer)	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Odontopus calcaetus (Yellow Poplar Weevil)	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Ceratocystis spp. (Bluestain Fungus)	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ophiostoma spp. (Bluestain Fungus)	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sirex noctilio (Sirex Woodwasp)	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Scleroderris lagerbergii (Sclerroderis Canker)	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ips pini (Pine Engraver Beetle)	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ips grandicollis (Southern Pine Engraver)	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ips calligraphus (Six-spined Ips)	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ips avulsus (Small Southern Pine Engraver)	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Choristoneura pinus (Jack Pine Budworm)	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cronartium quercuum (Fusiform Rust)	0	0	0	0	0	1	1	1	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0
Phellinus pini (Red trunk Rot)	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dendroctonus frontalis Zimmermann (Southern Pine Beetle)	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cronartium ribicola (White Pine Blister Rust)	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
pineus strobi (Pine Bark Adelgid)	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Part 2/2: Tree species codes JUCI-ULRU *(continued)*

disease	libe	litu	loma	nysy	pato	pipu	pist	pivi	ploc	prav	prpe	prse	qual	quco	qufa	qumi	qumu	qupr	quru	quve	rops	rhpe	romu	rual	rupe	ruph	saca	saal	tiam
Euzophera semifuneralis (American Plum Borer)	0	0	0	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Apiosporina morbosa (Black Knot Disease)	0	0	0	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lymantria dispar (Gypsy Moth)	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Phytophthora ramorum (Sudden Oak death)	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Agrilus bilineatus (Two Lined Chestnut Borer)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0
Armillaria spp. (Honey Fungus)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0
Ceratocystis fagacearum (Oak Wilt)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0
Anisota senatoria (Orangestriped Oakworm)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0
Enaphalodes rufulus (Red Oak Borer)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Phellinus robiniae / Phellinus rimosus / Polyporus (Heart Rot Fungus)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Odontota dorsalis (Black Locust Leaf Miner)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Megacyllene robiniae (Locust Borer)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Raffaelea lauricola (Laurel Wilt)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Xyleborus glabratus (Redbay Ambrosia Beetle)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Popillia japonica (Japanese Beetle)	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**0**
Thrips calcaratus (Basswood Thrips)	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**0**
Scolytus multistriatus (Smaller European Elm Bark Beetle)	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**
Scolytus schevyrewi (Banded Elm Bark Beetle)	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**
Ophiostoma ulmi/Ophiostoma nova-ulmi/Ophiostoma himal-ulmi (Dutch Elm Disease)	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**
Scaphoideus luteolus Van Duzee (Whitebanded Leafhopper)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Hylurgopinus rufipes (Native Elm Bark Beetle)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1

Pictoral guide to most important pests & diseases

Insect pests

(these should be arranged logically. My preference would be to organize by type (categories below, from Tree-and-Forest-Health-Guide.pdf), then alphabetically. To make this work, we'll need to insert a column with type in the matrix)

Sapsuckers

Defoliators

Root/Shoot/Twig Insects

Bark Beetles/ Wood Borers

(insect species) *(insert brief description of symptoms to look for, pictures)*

Diseases

Rusts

Root

Cankers

Foliage

Vascular