Actions to mitigate threats towards forests in the Nordic countries

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UNIVERSITY OF COPENHAGEN

International networks

Pathway analysis

Impact evaluation

Sentinel Networks

Biocontrol

Common presentation, Punkaharju June 2016:

Forest and tree pests in the Nordic and Baltic countries

Hans Peter Ravn, Christer Björkman, Arturas Gedminas, Brynja Hrafnkelsdóttir, Paal Krokene, Åke Lindelöw, Jurate Lynikiene, Seppo Neuvonen, Göran Nordlander, Antti Pouttu, Olle Rosenberg, Martin Schroeder, Kaljo Voolma, Jan Weslien, Tiina Ylioja and Bjørn Økland

From Jan. 1. 2015, Metla is part of the Natural Resources Institute Finland. www.luke.fi

SUOMEKSI PÅ SVENSKA IN ENGLISH AUF DEUTSC

LIETUVOS AGRARINIŲ IR MIŠKŲ MOKSLŲ CENTRAS
Lithuanian Research Centre for Agriculture and Forestry




Nordic forest entomological cooperation goes back to 1949

Ekenäs, Jan 1981

Climate change versus invasive species

Just natural change in distribution and abundance –

- or transition to new areas outside area of natural distribution

Oak processionary moth
Thaumetopoea processionea

Green spruce aphid
Elatobium abietinum

Ermine moth
Yponomeuta spp.

Spruce bark beetle
Ips typographus

Potentially Invasive Insects (Tree pests) recorded from DK (for some interception only)

- **Cottony Camellia Scale**, *Pulvinaria floccifera – 1975*
- **Plane leaf miner**, *Phyllonorycter platani - 1977*
- **The Rhododendron leafhopper**, *Graphocephala fennahi – 2002*
- **Horse chestnut leafminer**, *Camararia ohridella – 2002*
- **Bow-legged fir aphid**, *Cinare curvipes - 2002*
- **Leaf blotch miner moth**, *Phyllonorycter robiniella – 2003*
- **Horse chestnut scale**, *Pulvinaria regalis - 2006*
- More species of **weevils**, *Otiorhynchus apenninus, O. aurifer – 2006-07*
- **Hawthorn Jewel Beetle**, *Agrilus sinuatus – 2007*
- **Asian Longhorn Beetle**, *Anoplophora glabripennis - 2008*
- **The western conifer seed bug**, *Leptoglossus occidentalis - 2009*
- **Black locust gall midge**, *Obolodiplosis robiniae – 2009*
- **Citrus Longhorned Beetle**, - *Anoplophora chinensis - 2011*
- **Cypress aphid**, *Cinara cupressi – 2012*
- **Box moth,** *Cydalima perspectalis - 2013*

CHALLENGES
Globalisation (I) and/or Climate change (C)

- European spruce bark beetle – *Ips typographus* **C**
- Green spruce aphid - *Elatobium abietinum* **C**
- Bird-cherry ermine - *Yponomeuta evonymella* **C**
- Hawthorn jewel beetle - *Agrilus sinuatus* **I & C**
- Two spotted oak borer - *Agrilus biguttatus* **C**
- Fir bark beetle – *Cryphalus piceae* **I & C**
- Larch bark beetle - *Ips cembrae* **I & C**
- Six-spined engraver beetle – *Ips sexdentatus* **I & C**
- Pygmy elm bark beetle - *Scolytus pygmaeus* **I & C**
- Oak Processionary Moth - *Thaumetopoea processionea* **C**
- Asian Longhorned Beetle – ALB (+CLB) **I**
- Pine Wood Nematode - *Bursaphelenchus xylophilus* **I & C**
- Emerald Ash Borer – EAB – *Agrilus planipennis* **I**
- Bronze Birch Borer - BBB - *Agrilus anxius* **I**

International Networking on invasive pests

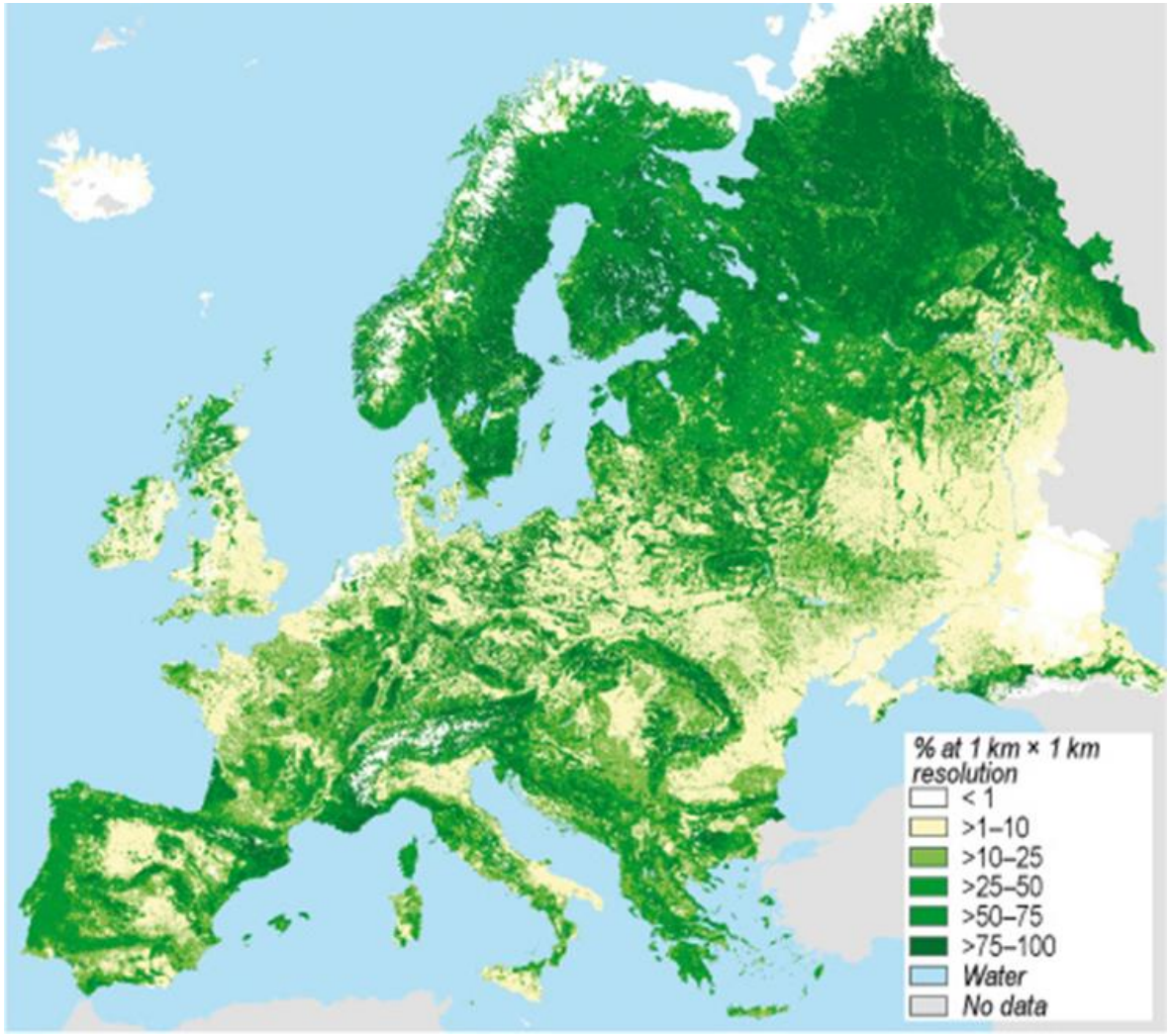
Actors:

- EU
- Nordic Council (SNS)
- EFSA
- National Environmental and Plant Health Agencies
- EPPO
- IUCN
- CABI
- Research Institutions
- NGOs

Actions:

- Regulations and rules
- COST-Actions
- Research projects
- PRA-panels
- EKE-panels
- Conferences
- Other networking activities

Network co-operation in practice



Forest cover in Europe, as percentage of land area (METLA)

- Visits by MSc –and PhD-students.
- Common projects
- Exchange of information at meetings
- Small common projects
- Common publications
- Circulation of requests

Large Larch Bark Beetle – *Ips cembrae*

May 1995: First record in DK

SKOVBRUGETS SKADEDYR

NY AGGRESSIV BARKBILLEART PÅ LÆRK

Af Hans Peter Ravn, Statens Planteavlsforsøg, Lyngby, og Susanne Harding, Sektion for Zoologi, KVL

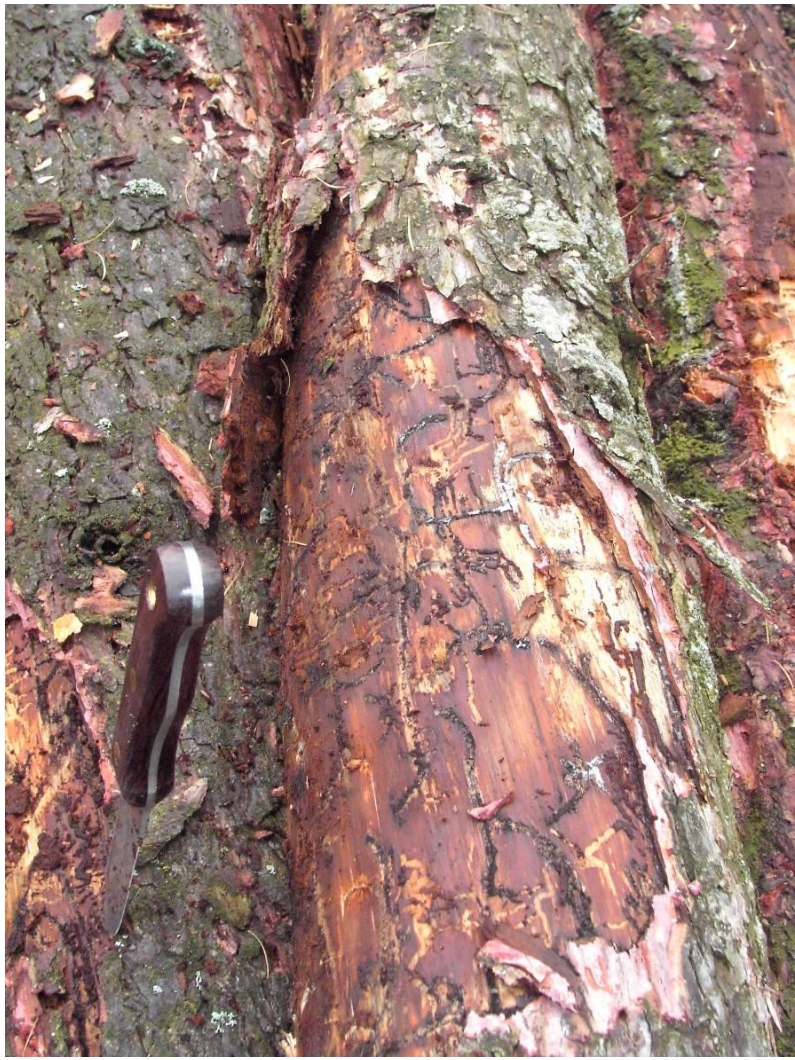
Der er grund til at holde øje med lærken i år. En barkbilleart, som andre steder i Europa er et af de alvorligste skadedyr på lærk, er for første gang fundet herhjemme.

Billens udbredelse og angrebenes omfang kendes endnu ikke. Men der er eksempler på omfattende angreb på stående træer.

Skovene opfordres til at holde øje med barkbillen og indberette fund.

Fig. 1a. Stor lærkebarkbille, Ips cembrae, fundet første gang i Danmark i Grib skov, marts 1995. Foto: H.P.R.

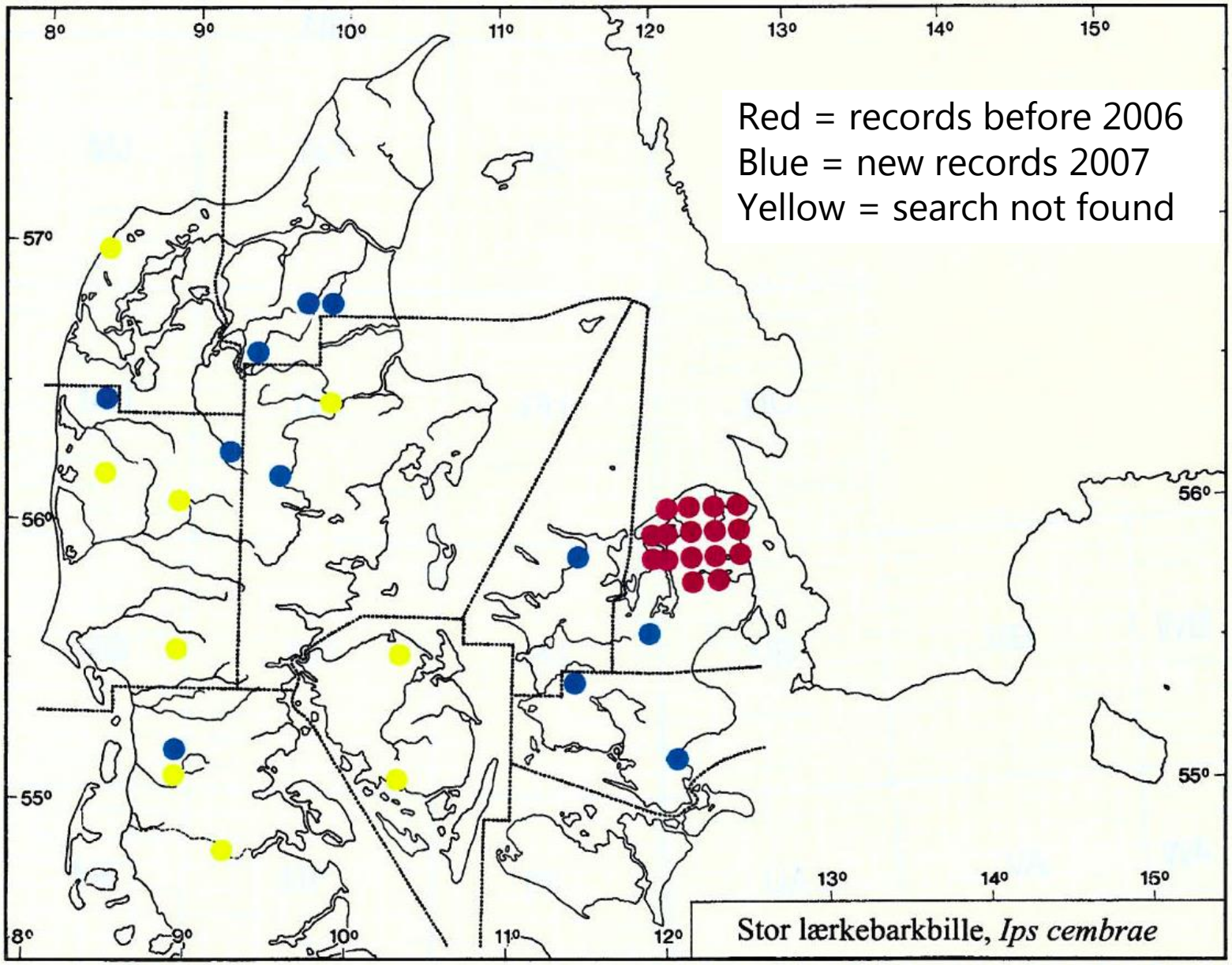
Fig. 1b. Lærkebevoksning med angreb på stående træer af stor lærkebarkbille, Grib skov marts 1995. Foto: J. Martin.



Large Larch Bark Beetle – *Ips cembrae*

November 2006: First records in Jutland

Elytra cavity shiny and with bristle row:



(2011)

This summer 12 pheromone traps from SLU in DK.

Alien species of forest insects discovered in Sweden since 2000

Species	**Year of detection**	
	SE	DK
Ips amitinus	2012	-
Ips cembrae	2011	2005
Ips sexdentatus	Native	2006
Phloeosinus thujae	2011	
Leptoglossus ocidentalis	2011	2009
Cyclorhipidion bodoanum	2009	
Tetropium gabrieli	2007	1890
Pityophtorus pityographus	2007	
Pulvinaria regalis	2006	2006
Xyleborinus attenuatus	2005	
Cameraria ohridella	2003	2002
Arge pullata	2002	1971
Cryphalus piceae		2007

Åke Lindelöw

Those, we really fear:

- *Agrilus planipennis*, Emerald Ash Borer
- *Agrilus anxius*, Bronce Birch Borer
- *Anoplophora* spp. Asian Longhorned Beetle, Citrus Longhorned Beetle
- *Polygraphus proximus,* Four-eyed fir bark beetle
- Pine Wood Nematode

Impact scoring system

EICAT

Environmental Impact Classification of Alien Taxa

Lion fish *Pterois volitans* © Brian Gratwick CC BY 2.0

Human activities are transforming natural environments by moving species beyond the limits of their native geographic ranges into areas in which they do not naturally occur. Many of these alien species have become invasive, causing substantial changes to ecosystems and leading to native species extinctions. Invasive Alien Species (IAS) have become one of the major threats to biodiversity across the world.

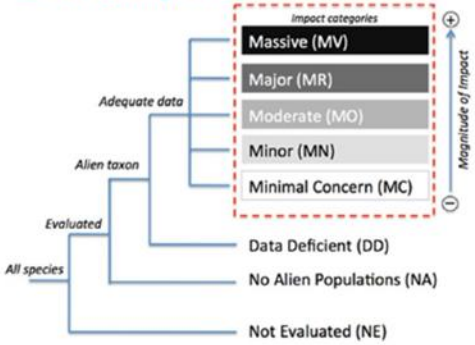
It is important to recognise harmful invasive alien species at an early stage of introduction in order to mitigate negative impacts. There is therefore a critical need for the capacity to evaluate, compare, and predict the magnitudes of the impacts of different alien species, in order to determine and prioritise appropriate actions where necessary.

The IUCN Species Survival Commission Invasive Species Specialist Group (ISSG) have developed a tool to support this prioritisation process.

Environmental Impact Classification of Alien Taxa (EICAT)

EICAT is an assessment process that classifies alien species into one of five categories, according to the **magnitude of the detrimental impacts to the environment**.

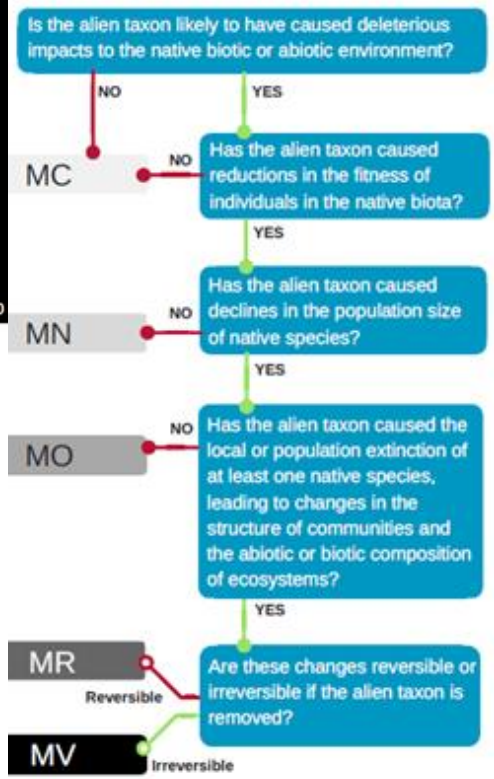
EICAT Categories



To assign species to each of the categories, EICAT uses semi quantitative criteria for each type of **impact mechanism** (see box opposite). The scheme also includes categories for species that are Not Evaluated, have No Alien Population, or are Data Deficient, and a method for assigning uncertainty to all the classifications.

The EICAT category is assigned based on the level of biological organization affected (individuals → populations → communities) and the severity and reversibility of this impact (see decision chart below).

EICAT decision chart



Impact mechanisms

1. Competition
2. Predation
3. Hybridisation
4. Disease transmission
5. Parasitism
6. Poisoning/Toxicity
7. Bio-fouling
8. Grazing/Herbivory/Browsing
9. Rooting/Digging
11. Flammability
12. Interaction with other invasive species

In order to indicate the highest probable impact of an alien species, and report on its current level of impact, EICAT assesses both the **Maximum Recorded Impact** (i.e. the highest level of impact ever documented for the taxa), and their **Current Impact** (i.e. the current highest level of impact documented for the taxa), caused under any of the impact mechanisms.

EICAT is managed by the IUCN SSC Invasive Species Specialist Group alongside the IUCN Global Species Programme. Its peer reviewed assessments will be published on the IUCN Global Invasive Species Database (www.iucngisd.org).

EICAT CAN

- distinguish alien taxa causing impacts of low concern from those with significant deleterious effects.
- facilitate comparisons of the level of impact by alien taxa among regions and taxonomic groups.
- facilitate predictions of potential future impacts of alien taxa in the target region and elsewhere.
- aid in the prioritisation and evaluation of management actions.

EICAT CANNOT

- replace a risk assessment.
- function as a statutory list of harmful invasive species.

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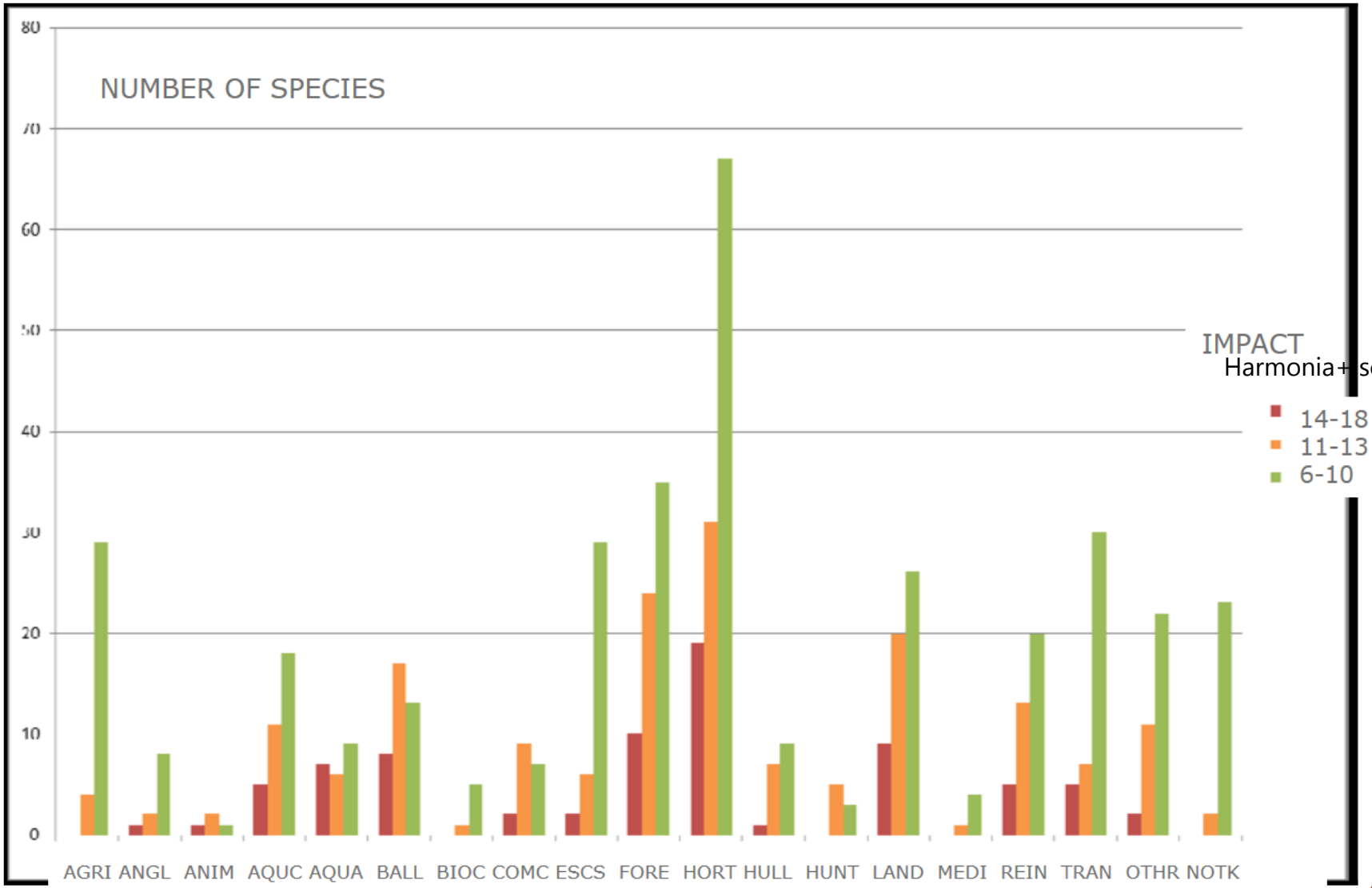
SSC Species Survival Commission

ISSG Invasive Species Specialist Group

IUCN

Pathway versus impact



For some specific quarantine insects the pathway of introduction is wellknown and almost exclusive – e.g. ALB *Anoplophora glabripennis*

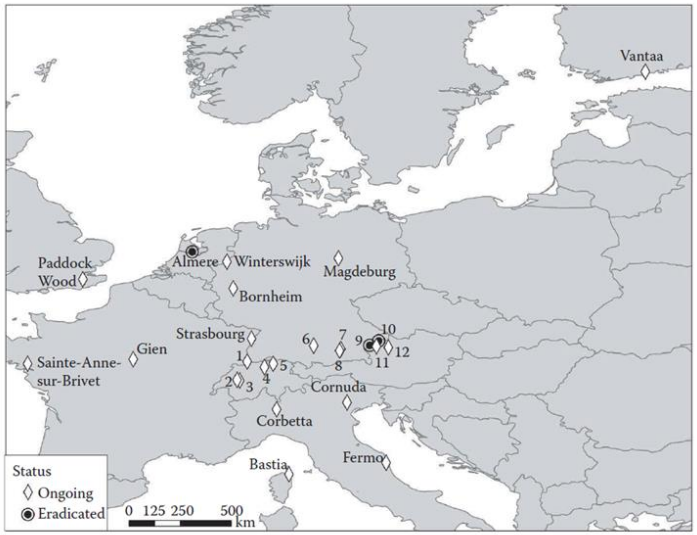


FIGURE 13.7 Locations of outbreaks of *Anoplophora glabripennis*, the Asian longhorn beetle, in Europe as of February 2016. 1 = Weil am Rhein, DE; 2 = Marly, CH; 3 = Brunisried, CH; 4 = Berikon, CH; 5 = Winterhur, CH; 6 = Ziemetshausen, DE; 7 = Feldkirchen, DE; 8 = Neubiberg, DE; 9 = Braunau am Inn, AT; 10 = Neukirchen am Inn, DE; 11 = Geinberg, AT; and 12 = Gallspach, AT (AT = Austria, CH = Switzerland, DE = Germany).

Help us keep out this beetle

The Asian longhorn beetle

- can attack and kill healthy trees.

Beetles enter the UK as grubs hidden in tunnels in timber imported from Japan, Korea and in particular China, notably in wooden crates and dunnage.

Damage caused by larval feeding under bark (Photograph by James E. Appleby, University of Illinois).

Check your crates for signs of infestation

Look for:

- Oval holes and tunnels > 3 mm, made by feeding grubs (larvae)
- Round adult emergence holes, up to 12 mm diameter
- Piles of accumulating coarse sawdust
- Creamy white grubs with dark mouthparts
- Adult beetles during the spring and early summer.

Adult Beetle emerging from crate.

Larvae feeding within wood (USDA).

Protect our trees from beetle attack.

Report any suspicious symptoms to one of the contact numbers below.

Keep any specimens in a crush-proof container, a film canister is ideal.

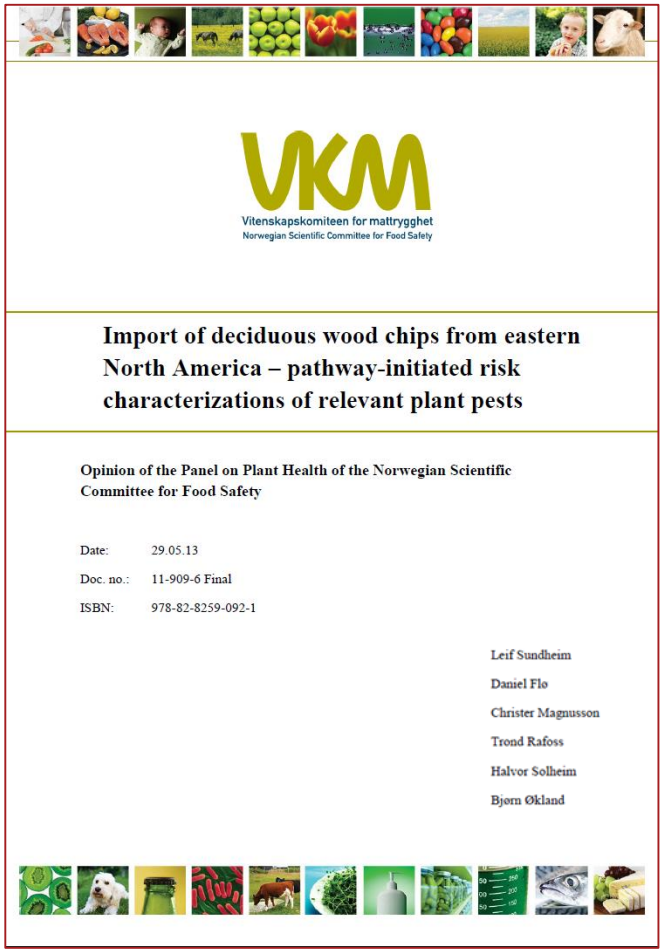
Forestry Commission

F.C. Plant Health Service	Tel: 0131 314 6414 Fax: 0131 314 6148
F.C. Forest Research	Tel: 01420 22255 Fax: 01420 23653

The increasing use and transportation of wood (chips) for biofuel is a possible pathway many problematic buprestid beetles.

The ten insect species selected for risk characterization were: 1) *Agrilus anxius*; 2) *Agrilus planipennis*; 3) *Agrilus bilineatus*; 4) *Chrysobothris femorata*; 5) *Agrilus hornt*; 6) *Agrilus granulatus liragus*; 7) *Agrilus granulatus granulatus*; 8) *Hylurgopinus rufipes*; 9) *Agrilus politus*; 10) *Scolytus schevyrewi*. The four selected fungal pest species were: 1) *Ceratocystis fagacearum*; 2) *Davidiella populorum*; 3) *Phellinus spiculosus*; 4) *Phellinus everhartii*. The ranking of the species given here is according to the likelihood of arriving with relevant pathways of wood chips, the presence of susceptible hosts in Norway, the similarity of climate between Norway and the areas of origin, and the severity of damages they may cause in Norwegian forests. The ranking order indicates which species could undergo full pest risk assessment first. However, the order is uncertain since the behaviour of the species under new conditions is unknown. Also, *Agrilus anxius* has already been risk assessed for Norway.

It is concluded that the whole commodity of wood chips across tree species should be considered, instead of distinguishing only certain tree species hosting each of the insects and fungi in the present report. Due to the methods of harvesting and the high diversity of tree species in the area of origin, it is a significant probability of importing wood of regulated tree species in commodities that officially are declared as limited to legal tree species, and inspection control to detect illegal tree species in wood chips is very difficult.



VKM
Vitenskapskomiteen for mattrygghet
Norwegian Scientific Committee for Food Safety

Import of deciduous wood chips from eastern North America – pathway-initiated risk characterizations of relevant plant pests

Opinion of the Panel on Plant Health of the Norwegian Scientific Committee for Food Safety

Date: 29.05.13
Doc. no.: 11-909-6 Final
ISBN: 978-82-8259-092-1

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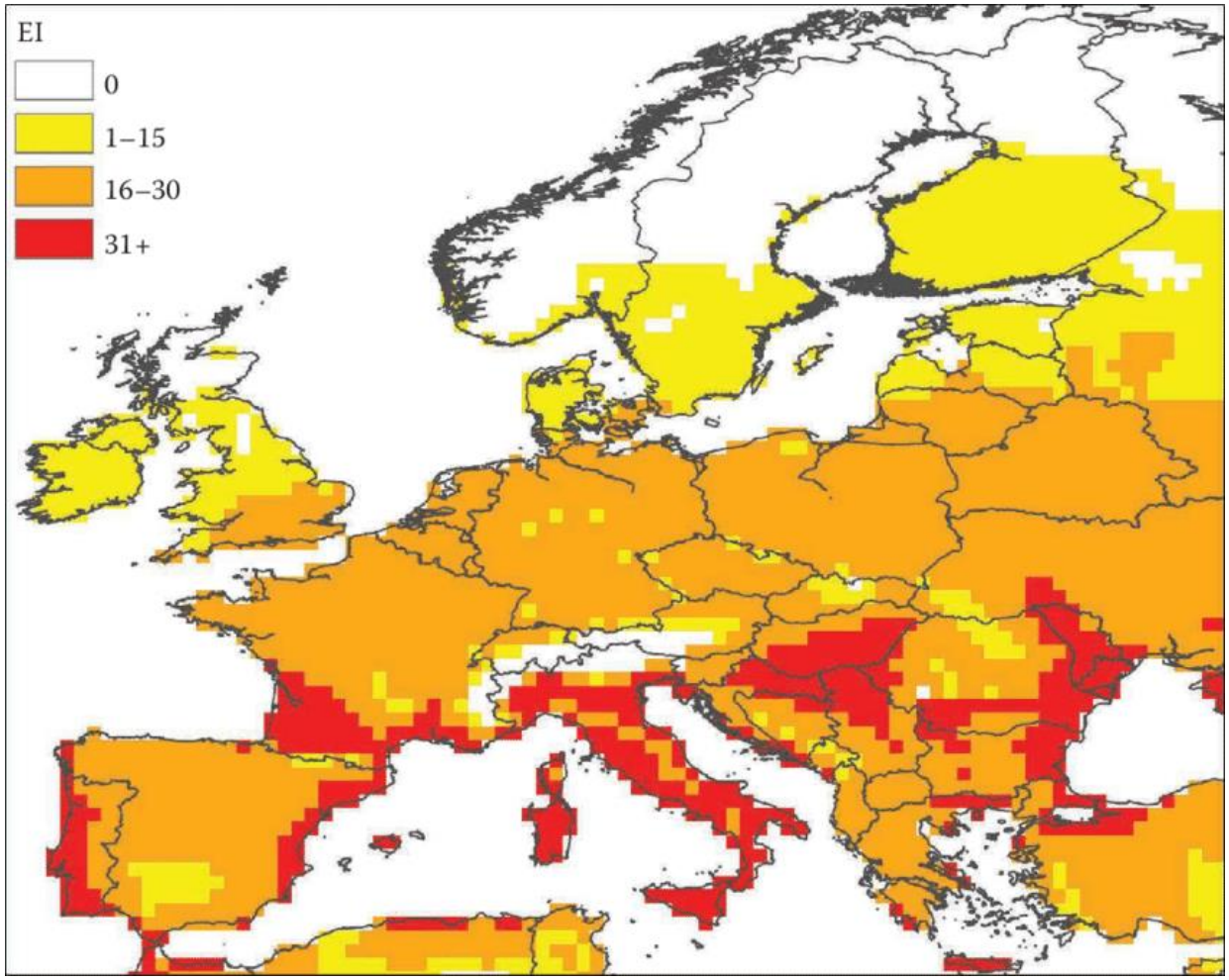
Developmental models might predict the risk of establishment after introduction



Environmental index for *Anoplophora glabripennis* in Europe based on a CLIMEX model (McLeod et al 2002)Available at: http://www.efsa.europa.eu/en/supporting/pub/319e.htm.)

International Plant Sentinel Network (IPSN) as an early-warning system for future pest threats

- Botanic gardens and arboreta (BG&A) are an exceptional resource.

Pinus sylvestris PlantSearch map - 224 institutions

Quercus robur PlantSearch map - 208 institutions

International Plant Sentinel Network

Organisms have been identified using the UK Plant Health Risk Register as having key research gaps that can be addressed using sentinel plants:

Blueberry Scorch Virus; susceptibility of bilberry

Dendrolimus superans and *D. sibiricus*; determining current host range

Agapanthus gall midge; surveys of South African gardens to determine whether it is native/distribution in country –developed in collaboration with the RHS.

Candidatus Phytoplasma fraxini (Ash yellows phytoplasma); improving host lists

Sirococcus blight of cedars; determining current spread across Europe – developed in collaboration with Forest Research

International Plant Sentinel Network

IPSN Member Gardens	Country
Auckland Botanic Gardens	New Zealand
Beijing (southern) Botanical Garden	China
Botanischer Garten der Universitat Potsdam	Germany
Charles University Botanic Garden (Botanicka zahrada University Karlovy)	Prague
Christchurch Botanic Gardens	New Zealand
Core Facility Botanical Garden, Vienna	Austria
Dunedin Botanic Gardens	New Zealand
The Eden Project	UK
Giardino Botanico Alpino alle Viotte di M. Bondone	Italy
Helsinki University Botanic Garden	Finland
Melbourne Royal Botanic Gardens	Australia
Mlyňany Arboretum SAS	Slovakia
Museo Orto Botanico di Roma	Italy
National Botanic Gardens, Glasnevin	Ireland
Orto Botanico dell`Univerita della Tuscia	Italy
Royal Botanic Gardens Edinburgh	UK
Royal Botanic Gardens Kew	UK
Royal Botanic Gardens Sydney	Australia
Royal Horticultural Society's Garden Wisley	UK
Shanghai Botanical Gardens	China
Shanghai Chenshan Botanical Garden	China
Shenzhen Fairy Lakes Botanical Gardens	China
South China Botanical Garden	China
Stellenbosch University Botanical Gardens	South Africa
The Yorkshire Arboretum	UK
Xiamen Botanical Garden	China

Classical Biocontrol – the classic cure

- The obvious cure
- However, not always straight forward
- There might be other regulating factors than natural enemies

100 years of biological control of invasive alien plants in South Africa: History, practice and achievements

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How it all started

On 26 June 1906, the fourth Parliamentary Select Committee on Agricultural Cooperation met in Cape Town to debate the apparently intractable scourge to agriculture, and the wider community, of dense infestations of sweet prickly pear (*Opuntia ficus-indica*) in the Eastern Cape and Karoo.[1,2] Originating from Central America, this plant had been in South Africa since at least the 1750s, and by the 1890s had invaded an estimated 314 000 ha, which increased to about 1 million ha by the 1950s.[1] Dr G.H. Maasdorp, a member of the Legislative Assembly of the Cape and a medical practitioner in Graaff-Reinet,[3] which was literally in the thick of the prickly pear problem at the time, presented his perceptive views to the Committee[1,4]:

> *...I think we should find out what are the conditions in those countries in which* [the prickly pear] *is indigenous whether it is in the nature of a pest there or not...it may possibly be that in those countries this plant has some natural enemy for keeping* [it] *within bounds. ...and whether it would not be possible to transport that natural enemy to this country. It is a difficulty I think with all imported plants...that where they do not meet their natural enemies they...become a pest.*

Dr Maasdorp had succinctly explained the fundamental principles of weed biological control (WBC) (i.e. the use of imported plant-feeding or plant-damaging organisms, 'natural enemies', also called WBC agents, to suppress problematic plants). However, a crucial point had apparently been missed: WBC is effective only because the imported natural enemies themselves are devoid of their own natural enemies and thus have the potential for rapid population expansion on the targeted weeds in the country of introduction. In any event, a quarter of a century of political prevarication ensued because sweet prickly pear has several beneficial attributes (it bears copious quantities of edible fruits, and spineless varieties had long been cultivated as a drought-fodder crop) and it was only in 1933 that permission was ultimately granted to release a biological control agent against sweet prickly pear in South Africa[1,5] – the now-famous cactus moth, *Cactoblastis cactorum*.

Perhaps unbeknown to the Select Committee was the fact that, during the late 16th century, India had inadvertently illustrated the efficacy of WBC. In an attempt to obtain the commercially valuable dye-producing cochineal insect, *Dactylopius coccus*, entrepreneurs had erroneously imported another species, *Dactylopius ceylonicus*, from South America. This mistake resulted in the decimation of large areas of an extremely problematic cactus, called drooping prickly pear (*Opuntia monacantha*) between 1796 and 1809. *Dactylopius ceylonicus* was subsequently introduced into Ceylon (Sri Lanka) where it also successfully controlled the drooping prickly pear.[6]

Seemingly, news of this 'Deadly Indian Cochineal' reached South Africa only in 1910[1,7] and, in 1913, in South Africa's first venture in WBC, *D. ceylonicus* was imported and released as a biological control agent against drooping prickly pear, which, at the time, was highly invasive along the coast from the Western Cape to Durban. Lounsbury[7] recorded that

> [in] *about September, 1913, ...some material of the Indian species* [of cochineal was placed] *in a clump of Monacantha* [sic] *prickly pear growing* [near] *Pietermaritzburg. ...The insect soon spread...and in the following winter only the trunk-like stems were standing. The joints had blighted and fallen down...in masses...presenting a most miserable spectacle.*

The cochineal insects were then more widely distributed to other parts of the country, and within a few years drooping prickly pear had been completely controlled and has remained so ever since. Unfortunately this extraordinary precedent carries the misleading connotation that WBC is quick and easy, when in fact, in the majority of cases, WBC requires protracted research, success is not assured, and the benefits are often manifested only after many years have elapsed.

It is also tempting to conclude from these early records that South Africans were pioneers in WBC. That is not the case, but they were not far behind. The first research-based WBC project commenced in 1902 in Hawaii where several insect species were released as biological control agents against lantana, *Lantana camara*, but with little success.[8] In 1903, the Australians deliberately imported cochineal insects from India against drooping prickly pear[6] (and they provided the initial culture of *D. ceylonicus* that was imported into South Africa in 1913[7]). The 1903 attempt in Australia failed but further releases in 1914 were a resounding success. This success motivated the Australians to mount, in 1920, what was to become recognised as the most extensive and accomplished of any WBC project

Conclusions

- Co-operation – national as well as international is important in meeting the challenges from an increasing influx of exotic organisms
- We need to be more strategic in the efforts – focus on most important pathways and places of origin with most similar living conditions.

- With a strong network – international co-operation - might help us anticipate the challenges ☺

Thank you for your attention!