Pathways for transfer of emerald ash borer and bronze birch borer to Europe

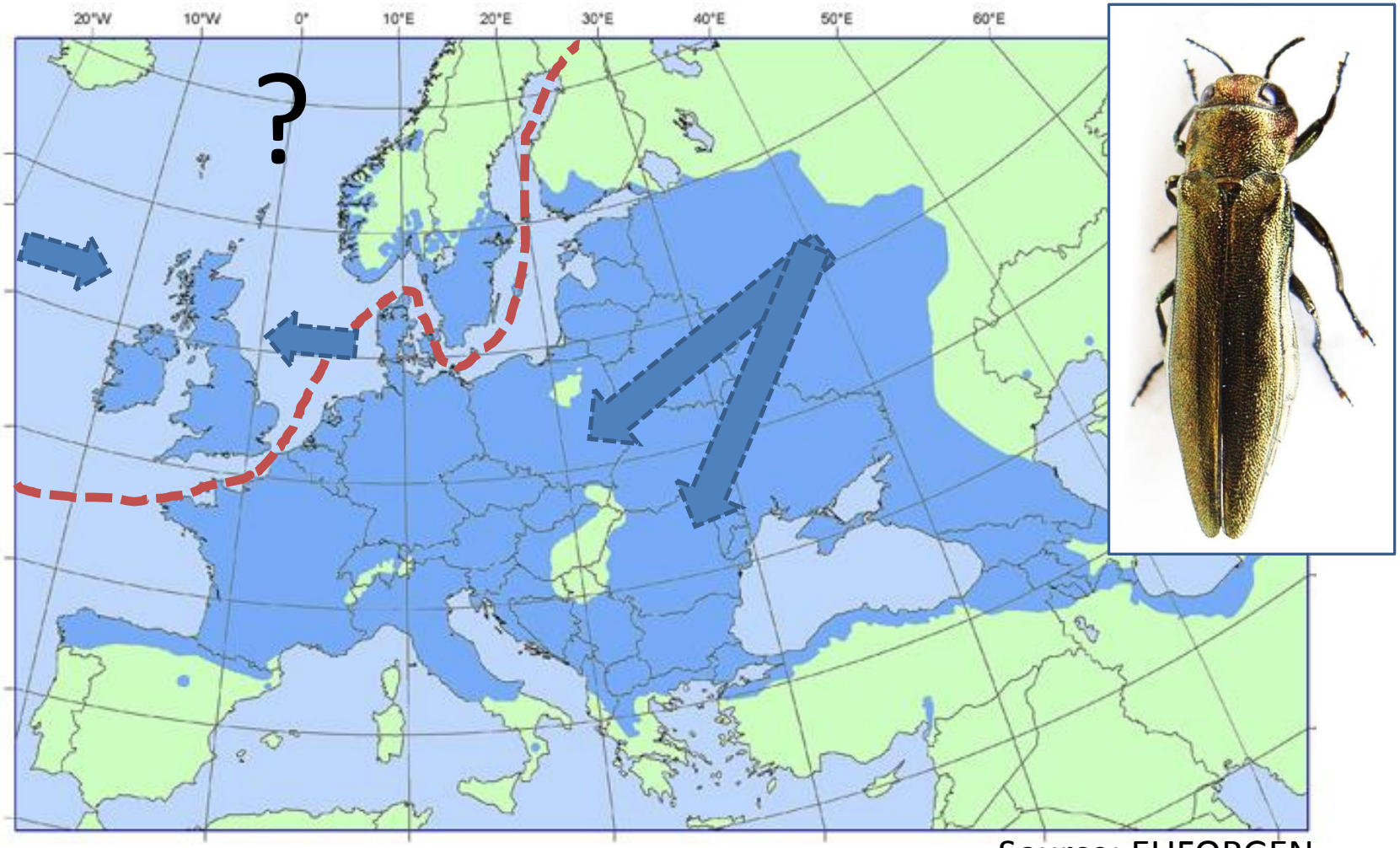
Bjørn Økland[1] and Daniel Flø[2]

1 NIBIO
NORWEGIAN INSTITUTE OF BIOECONOMY RESEARCH

2 VKM
Vitenskapskomiteen for mat og miljø
Norwegian Scientific Committee for Food and Environment

Emerald ash borer in Europe

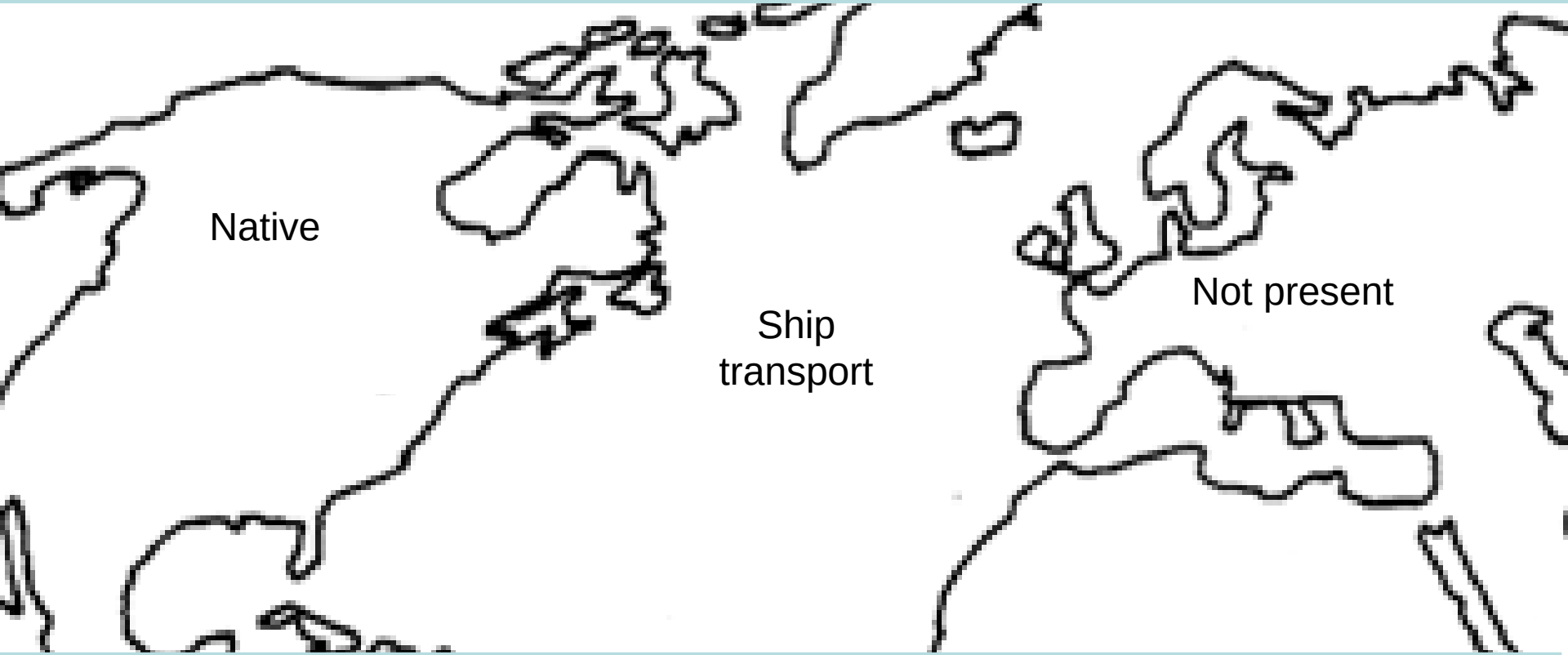
- Invasive range expansion on the continent hard to stop
- Slow the spread?
- UK and Scandinavia separated by sea – import a decisive factor



Source: EUFORGEN

Bronze birch borer to Europe?

- Transport overseas is necessary for arrival
- Import crucial factor for whole Eurasia



Eurasian birches less resistant

Katovich et.al. 2005:
"Bronze birch borers are known to attack all native and introduced birch species, although birch susceptibility varies"

Severely attacked
European white birch, *Betula pendula*
Whitebarked Himalayan birch, *Betula jacquemontii*
Commonly attacked
Paper birch, *Betula papyrifera*
Gray birch, *Betula populifolia*
Sweet birch, *Betula lenta*
Yellow birch, *Betula alleghaniensis*
Rarely attacked
River birch, *Betula nigra*

Exported N American birch - More infestations during drought years

High tree mortality in experiment

- Large block experiment with eight different birch species (Ohio)
- 100% mortality for the most widespread birch species in Northern Europe, *Betula pendula*, *B. pubescens,* and Asian *B. szetchuanica*

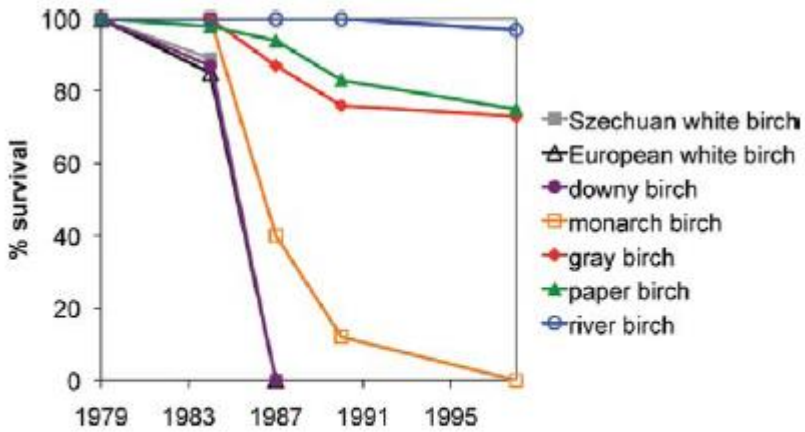
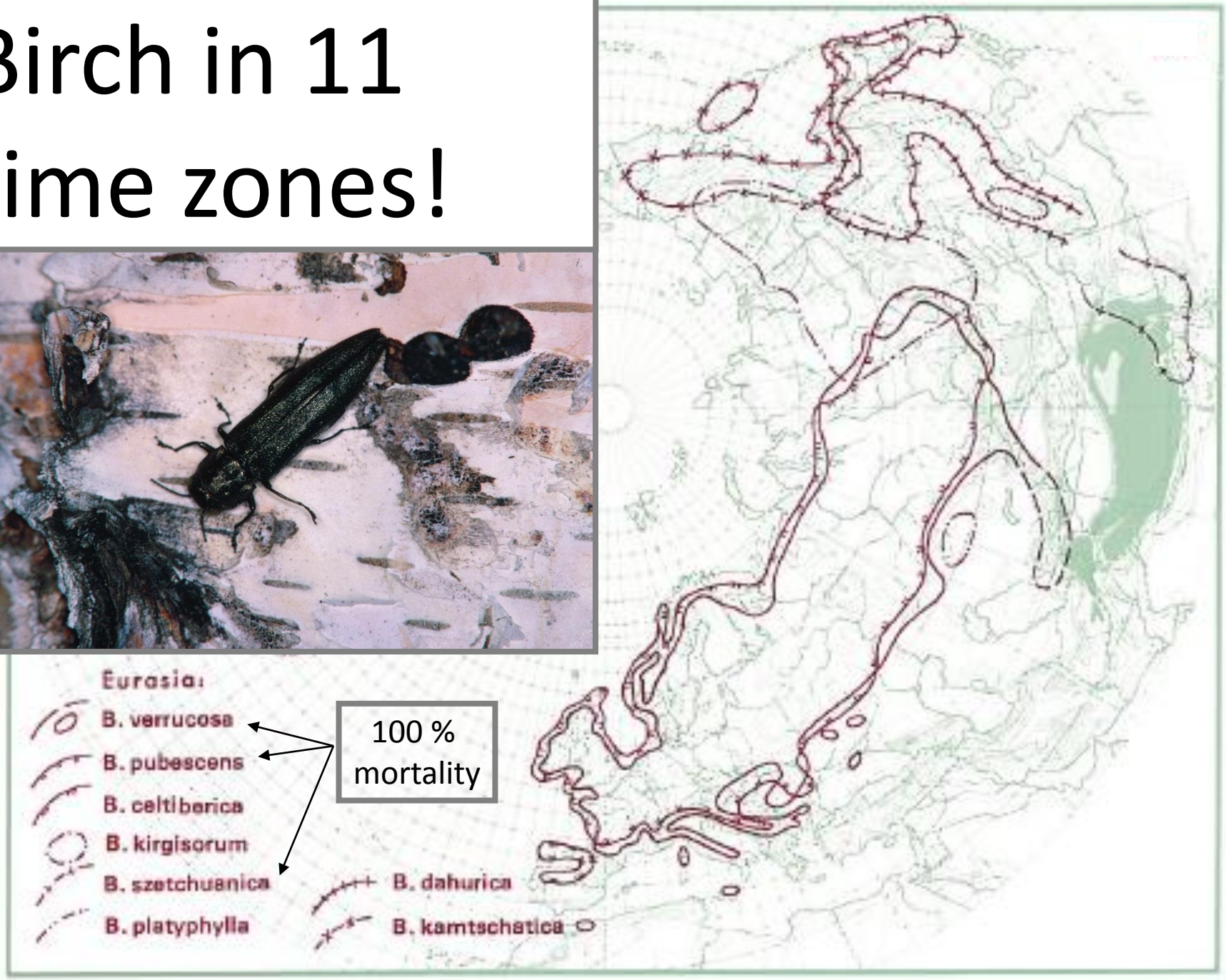


Fig. 1. Percent survival of seven birch (*Betula*) species in a common garden in Wooster, OH, USA from year of planting as two-year-old seedlings in 1979 through 1998.

Nielsen, D. G., Muilenburg, V. L. & Herms, D. A. 2011. Interspecific variation in resistance of Asian, European, and North American birches (Betula spp.) to bronze birch borer (Coleoptera: Buprestidae). Environmental Entomology, 40, 648-653

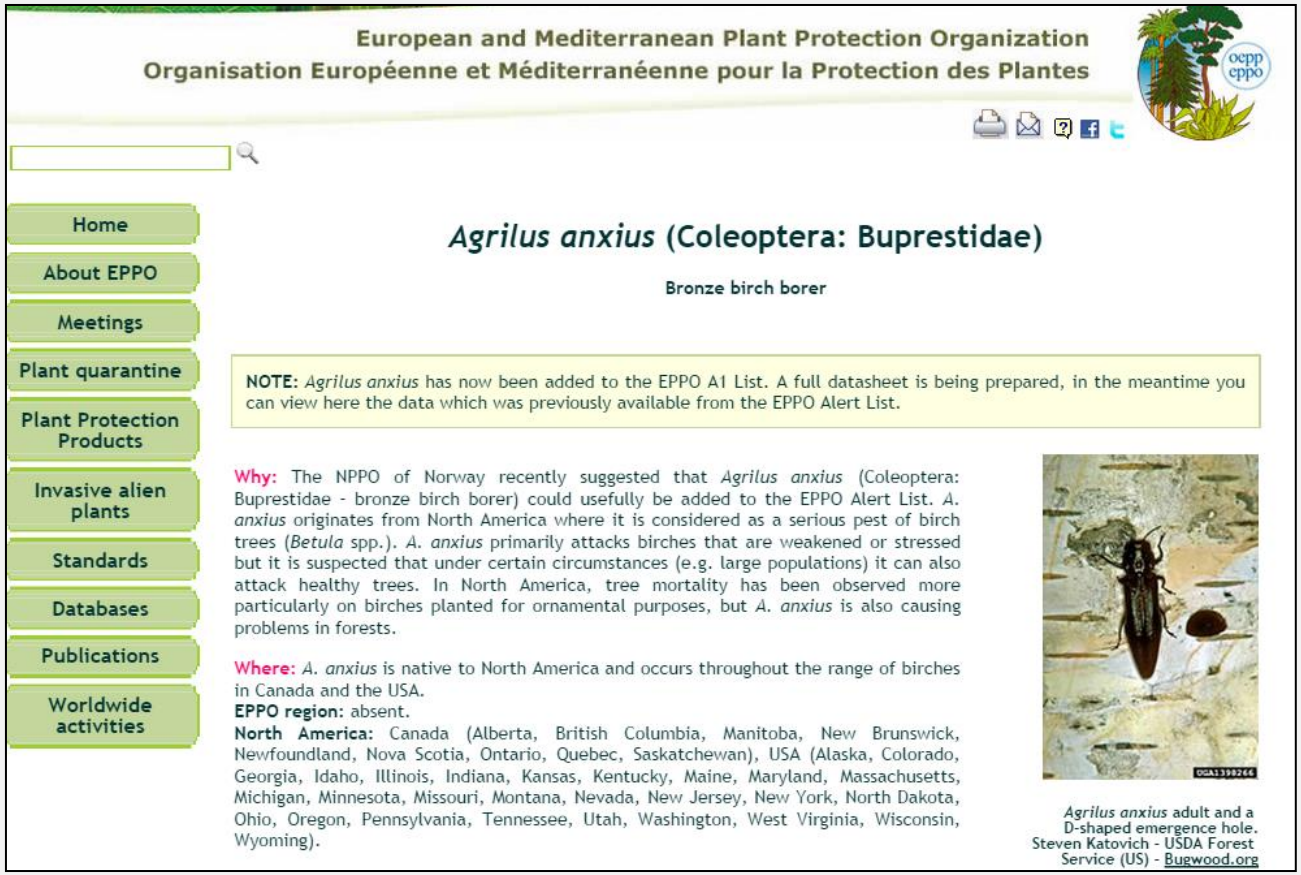
Birch in 11 time zones!



Birch is important in Northern Europe

- Big part of the forest volume in the Nordic countries, ranging from 11.6 % in Sweden to 28.2 % in Latvia.
- Used for various building and industry purposes
- Large areal cover, as for example about 30 % of the total forest cover in Norway
- Dominant tree species in large areas of forests ecosystems in Northern Europe
- High mortality indicates possible ecosystem effects

- EPPO alert list in 2010
- EPPO PRA in 2011 – A1 quarantine pests
- Norway: regulated in 2017



European and Mediterranean Plant Protection Organization
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Agrilus anxius (Coleoptera: Buprestidae)

Bronze birch borer

NOTE: *Agrilus anxius* has now been added to the EPPO A1 List. A full datasheet is being prepared, in the meantime you can view here the data which was previously available from the EPPO Alert List.

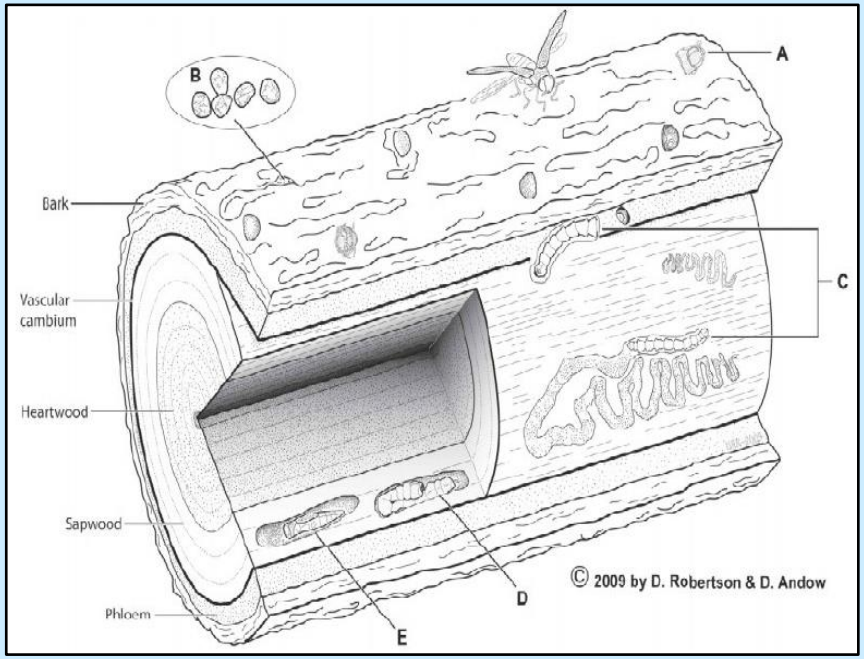
Why: The NPPO of Norway recently suggested that *Agrilus anxius* (Coleoptera: Buprestidae - bronze birch borer) could usefully be added to the EPPO Alert List. *A. anxius* originates from North America where it is considered as a serious pest of birch trees (*Betula* spp.). *A. anxius* primarily attacks birches that are weakened or stressed but it is suspected that under certain circumstances (e.g. large populations) it can also attack healthy trees. In North America, tree mortality has been observed more particularly on birches planted for ornamental purposes, but *A. anxius* is also causing problems in forests.

Where: *A. anxius* is native to North America and occurs throughout the range of birches in Canada and the USA.
EPPO region: absent.
North America: Canada (Alberta, British Columbia, Manitoba, New Brunswick, Newfoundland, Nova Scotia, Ontario, Quebec, Saskatchewan), USA (Alaska, Colorado, Georgia, Idaho, Illinois, Indiana, Kansas, Kentucky, Maine, Maryland, Massachusetts, Michigan, Minnesota, Missouri, Montana, Nevada, New Jersey, New York, North Dakota, Ohio, Oregon, Pennsylvania, Tennessee, Utah, Washington, West Virginia, Wisconsin, Wyoming).

Agrilus anxius adult and a D-shaped emergence hole. Steven Katovich - USDA Forest Service (US) - Bugwood.org

Pathways Betula from pest area (Canada,USA)

- Wood chips:
  (chipping not enough, heat treatment, fumigation)
- Plants for planting:
  (insect-proof conditions and inspections)
- Wood with or without bark:
  (heat treatment, remove outer sapwood)
- Furniture and other objects of untreated birch:
  (heat treatment, irradiation)



Wood chips of hosts regulated in UK and Norway

Table 2 GB entry requirements for non-coniferous woodchip originating outside the EU.

Species	Country of Origin	Entry Requirement
Birch (*Betula*)	Canada, USA	Official statement that it originates in a country known to be free of *Agrilus anxius*
Ash (*Fraxinus L.*), Japanese walnut (*Juglans ailantifolia*), Manshurin Walnut (*Juglans mandshurica*), David Elm (*Ulmus davidiana*) and Japanese Wingnut (*Pterocarya rhoifolia*)	Canada, China, Japan, Mongolia, North Korea, South Korea, Russia, Taiwan and the USA	Woodchips must originate in an area recognised (by the European Commission) as being free from Emerald Ash Borer. The name of the area must be declared on the accompanying phytosanitary certificate.

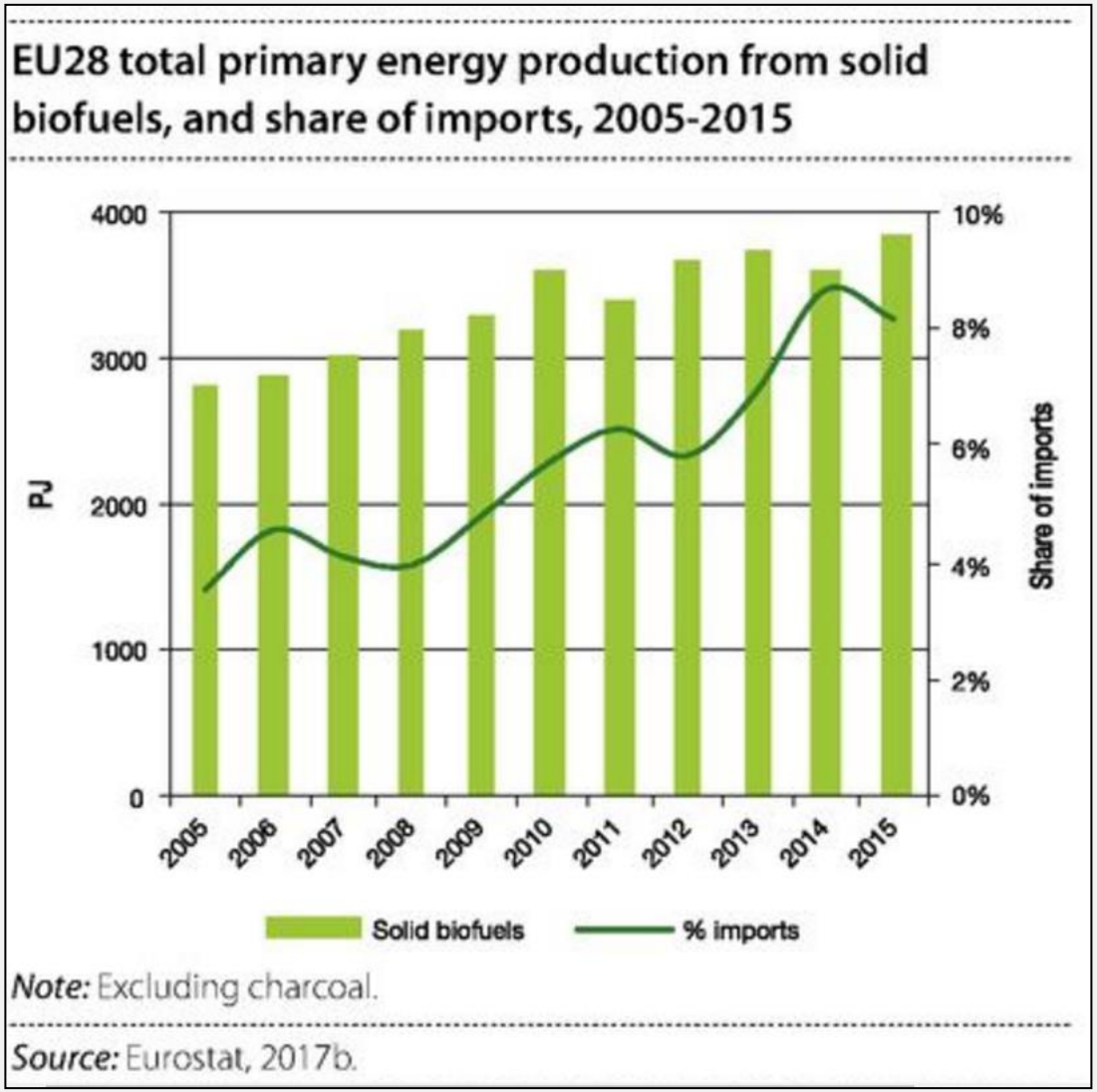
From: Forestry Commission

Plants or plant parts that are prohibited to import if they originate from:

Betula	Woodchip of *Betula*	Canada, USA
Fraxinus	Woodchip of *Fraxinus*	Area where *Agrilus planipennis* is present

From: Norwegian Food Safety Authority

Threefold increase solid biofuels



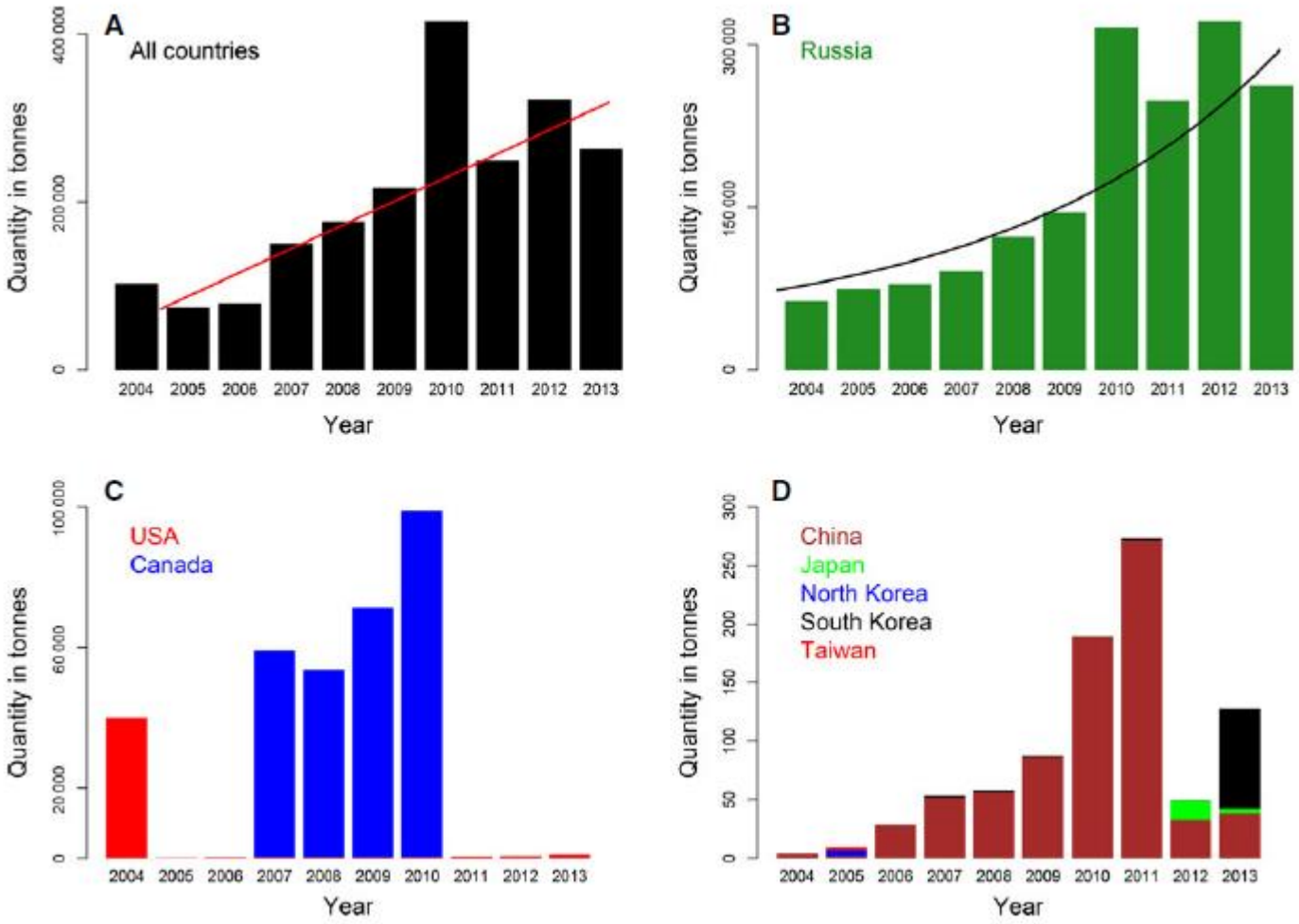
Pathways:

- Firewood
- Wood chips

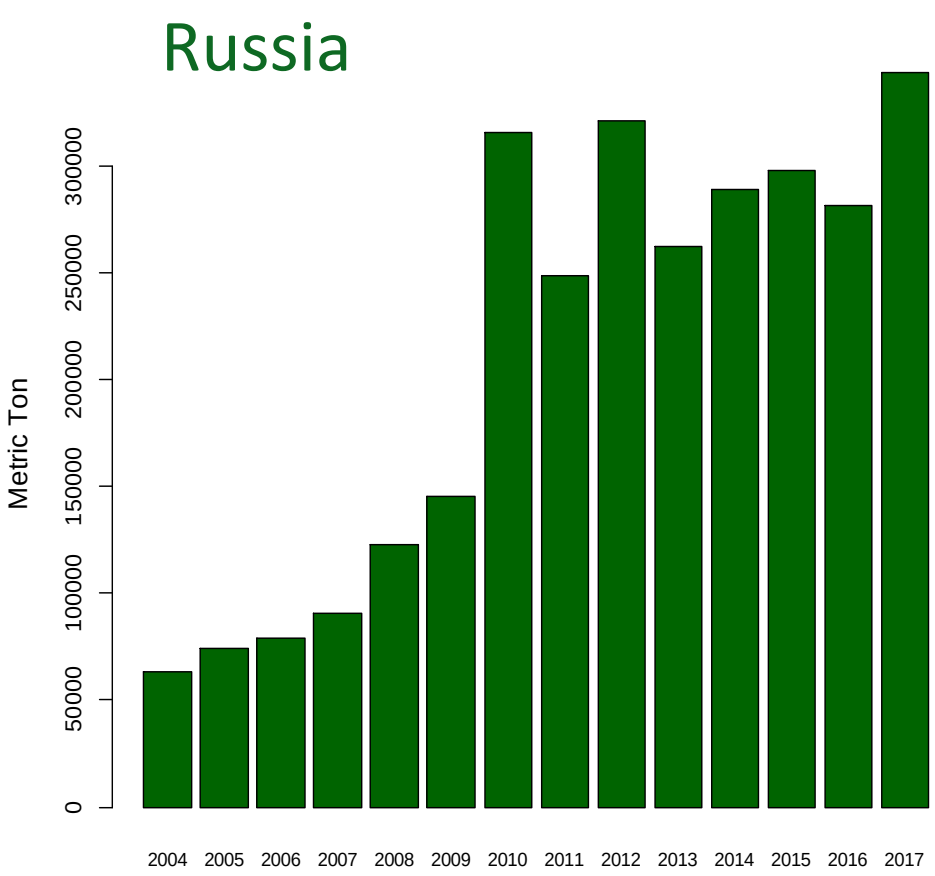
Safe:

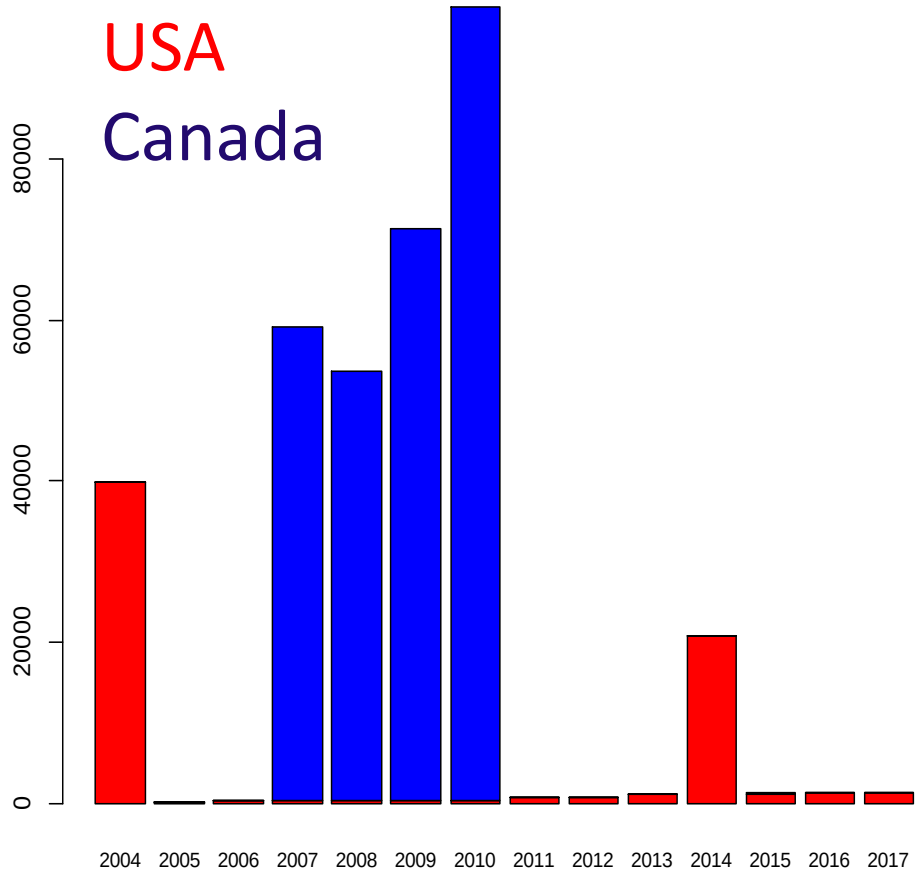
- Pellets
- Sawdust

DECIDUOUS WOOD CHIPS EXPORT TO THE EU
- STRONG INCREASE 2004 - 2013

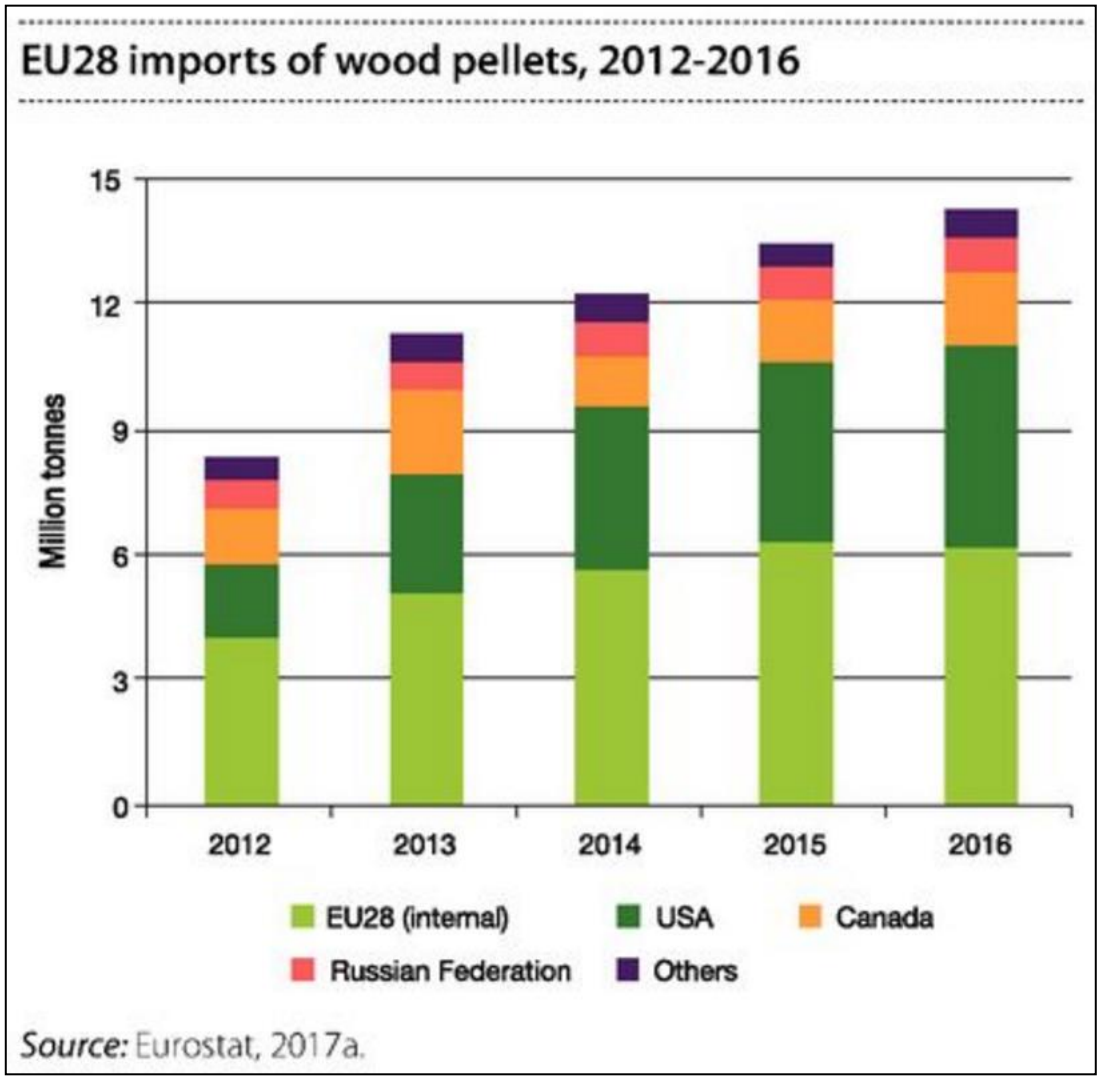


SLOWDOWN OF INCREASE OR DECLINE IN LAST YEARS





Import of wood pellets increasing



Case: wood chips imported to Biowood pellets factory in Western Norway in 2010

1 month production - 1 shipload ~100 mill. litres of chips

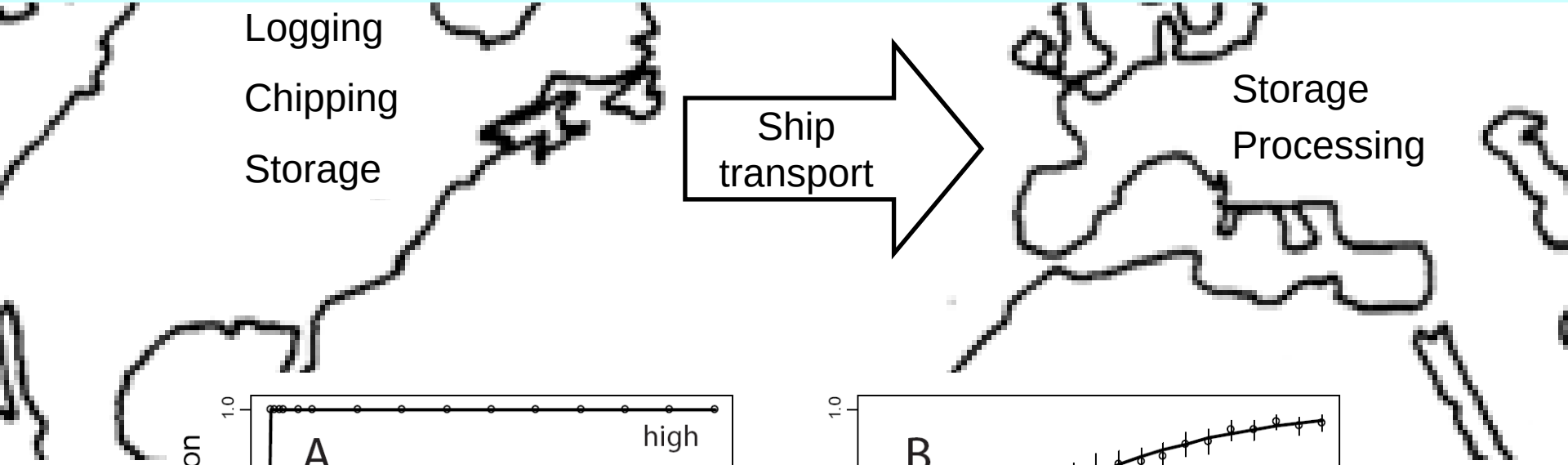
Pathway for bronze birch borer and emerald ash borer

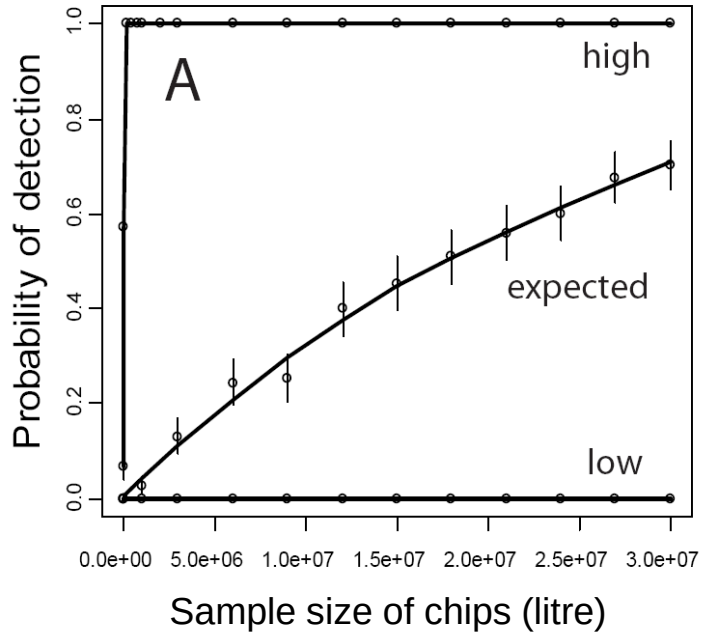
NPPO plant inspection: sample 60 litres per boat

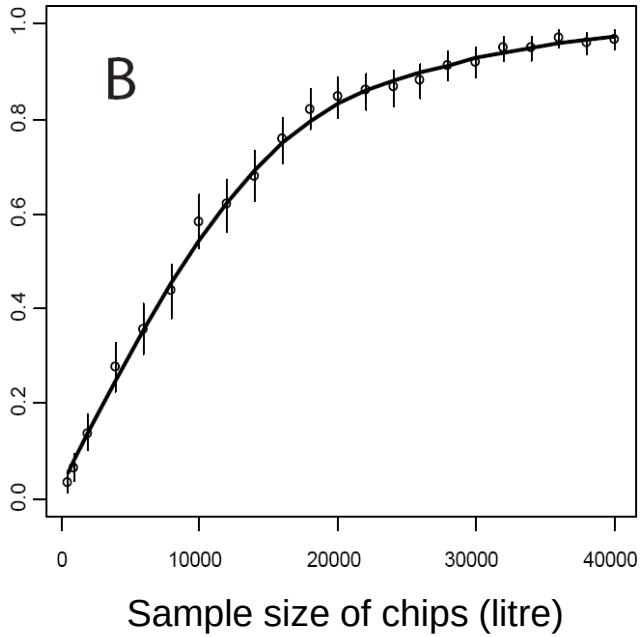
NPPO asked us to analyse their 60 litre inspection sample from first boat:

- 25% yellow birch (*Betula alleghaniensis*)
- 5% white birch (*Betula papyrifera*)
- Range 1.6 – 22.9 cm

Analysis of required sampling size per ship for detection of BBB inspection control







Økland, B., Haack, R.A. & Wilhelmsen, G. 2012. Detection probability of forest pests in current inspection protocols - A case study of the bronze birch borer. Scandinavian Journal of Forest Research 27: 285-297.

Result - Very unlikely to detect the insects

- The probability of pest detection for current sampling protocols used by port inspectors was very low (< 0.00005)
- A 90 % chance of detection may require sampling **27 million litres of wood chips** per shipload

Økland, Haack & Wilhelmsen 2012. *Detection probability of forest pests in current inspection protocols.* Scand. J. For Res 27: 285-297

Is chipping to a smaller size a solution?

- Emerald ash borer pupae 11-16 mm:
  - Survival documented in 10-cm chips*

- Bronze birch borer smaller 7- 12 mm:
  - Survival is likely – not tested

*McCullouch DG, Poland TM, Cappaert D, Clark EL, Fraser I, Mastro V, Smith S and Pell C (2007) Effects of chipping, grinding, and heat on survival of emerald ash borer, Agrilus planipennis (Coleoptera : Buprestidae), in chips. Journal of Economic Entomology 100:1304-1315.

Killed by bisection or compression?

No EAB 2.5- × 2.5-cm hexagonal openings:
- Not statistical power to exclude survival at low rate
- BBB prepupae are even smaller

Bisected
(6 mm max thickness)

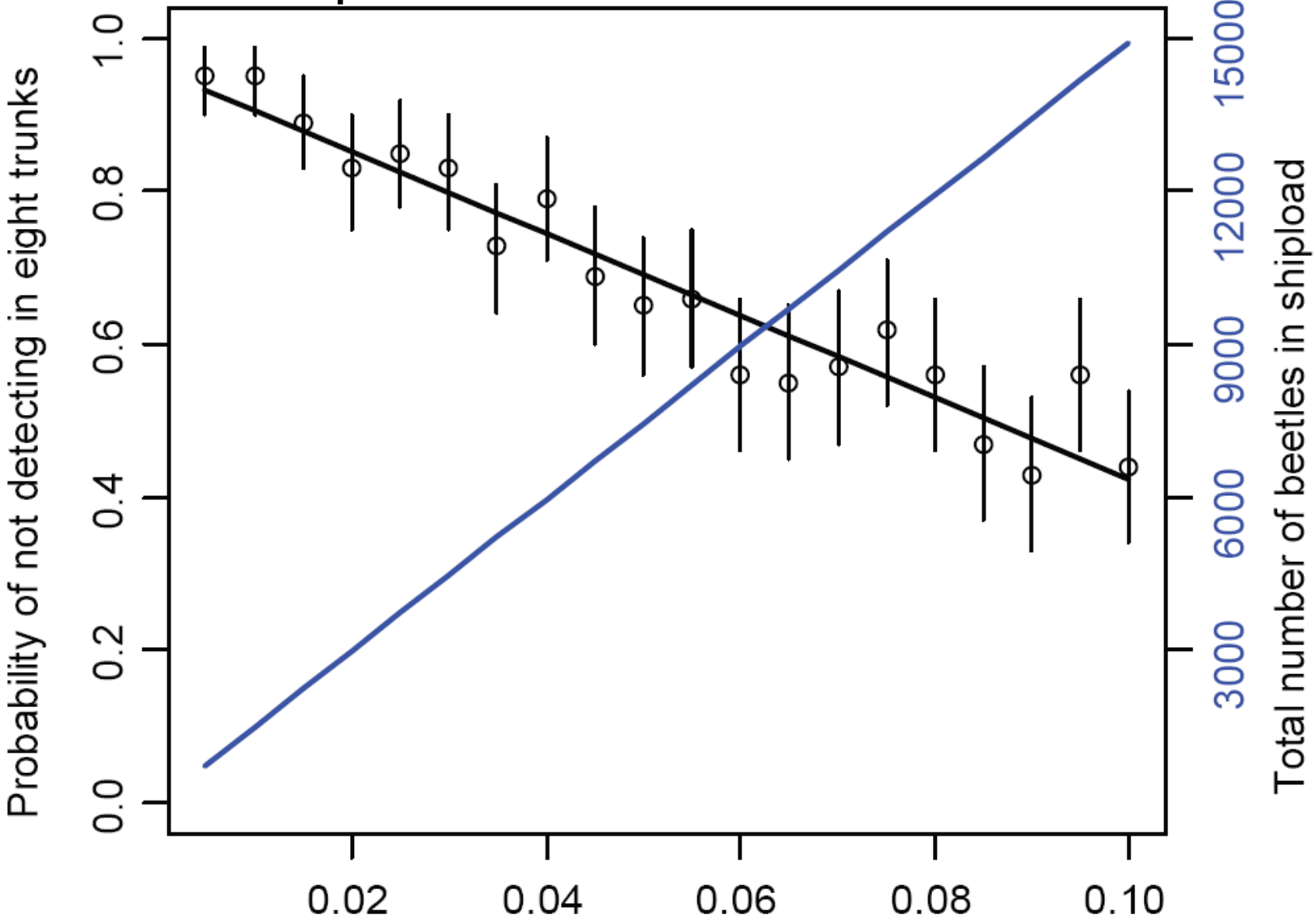
Survival uncertain

Survival EAB confirmed
(screen 10- × 10-cm hexagonal openings)

High risk to allow chips from 2.5 × 2.5 cm screen while finding out

	Trunks	Prepupae observed	Rate
*Screen 10 cm	4	8	1.0
*Screen 2.5 cm	4	0	0.01 - 0.1 ?
One shipload	149340	?	?

Simulation experiment:



True relative rate of beetles per tree in 2.5 cm chips

Økland, Haack, Wilhelmsen 2012. Detection probability of forest pests in current inspection ... Scand. J. For. Res.

Two dimensions not sufficient

A comparison of two "one inch" wood chips with adult Emerald Ash Borers. The smaller chip is about one inch square. The larger chip is about one inch on two sides and is, apparently, considered a non-regulated item under Michigan's Quarantine regulations. From Roberts and Kuchera (2006).

Roberts D. and Kuchera J. 2006. The Survival of EAB in Wood Chips: Does Size Matter? The Landsculptor: 19-21.

In practice:

Leftover material included in shiploads

Tree species composition did not match the declaration

Check of compliance:

- Checking each chip for insects – time consuming and tedious
- Tree taxa - microscopy work
- Tree genera - not tree species

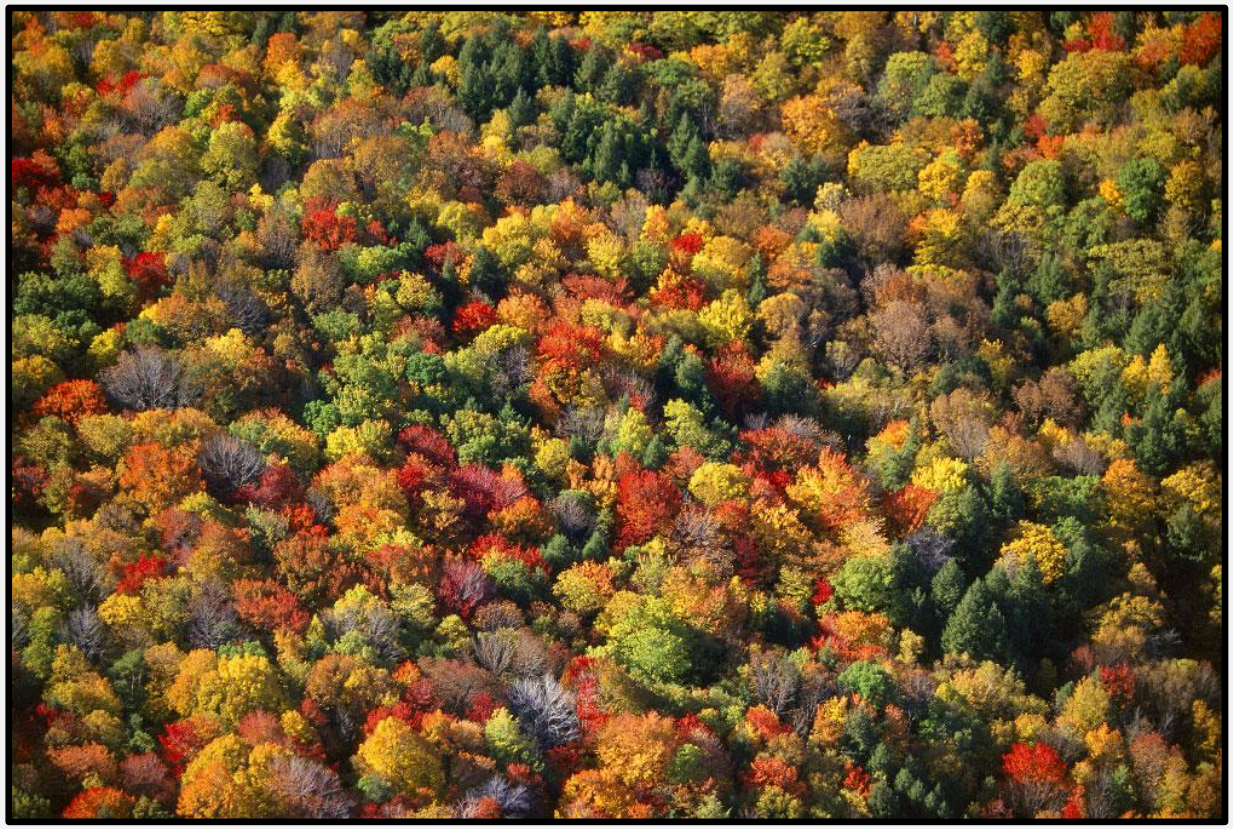
Declared:	*Also found:*
Acer rubrum, 70%	Wood chips of *Fraxinus*
Betula alleghaniensis, 25%	Tunnels and exit holes of *Agrilus*
Betula papyrifera, 5%	Coniferous wood chips (Picea)

Økland, B. 2010. Prosjekt om metoder for prøvetaking av flis. Oppdragsrapport fra Skog og landskap. 02/2011

Challenge due to mixtures of tree species

- Tenfold more tree species in North America than in Europe
- Careful and qualified logging necessary (possible?)
- Import control of tree species composition not feasible

⇨ Regulation of the commodity wood chips, rather than wood chips of individual tree species



Detection by traps or dogs in ports of entry?

- 72 – 76% detection for emerald ash borer
- detection level for bronze birch borer?

FOREST ENTOMOLOGY

Improving Detection Tools for Emerald Ash Borer (Coleoptera: Buprestidae): Comparison of Multifunnel Traps, Prism Traps, and Lure Types at Varying Population Densities

DAMON J. CROOK,[1,2] JOSEPH A. FRANCESE,[1] MICHAEL L. RIETZ,[3] DAVID R. LANCE,[1] HELEN M. HULL-SANDERS,[1] VICTOR C. MASTRO,[1] PETER J. SILK,[4] AND KRISTA L. RYALL[5]

J. Econ. Entomol. 107(4): 1496–1501 (2014); DOI: http://dx.doi.org/10.1603/EC14041

ABSTRACT The emerald ash borer, *Agrilus planipennis* Fairmaire (Coleoptera: Buprestidae), is a serious invasive pest of North American ash (*Fraxinus* spp.) that has caused devastating mortality since it was first identified in North America in 2002. In 2012, we conducted field trapping assays that tested the efficacy of purple prism and fluon-coated green multifunnel (Lindgren funnel) traps. Traps were baited with combinations of several lures that were previously shown to be attractive to *A. planipennis*: manuka oil—a sesquiterpene-rich oil, (3Z)-hexenol—a green leaf volatile, or (3Z)-dodecen-12-olide [= (3Z)-lactone], a sex pheromone. Eighty-nine blocks (trap lines) were tested throughout nine states along the outer edges of the currently known *A. planipennis* infestation in North America. Trap catch was highest on fluon-coated green multifunnel traps, and trap detections at sites with low *A. planipennis* population density ranged from 72 to 76% for all trap and lure types tested. (3Z)-hexenol and (3Z)-lactone baited traps functioned as well as (3Z)-hexenol and manuka oil-baited traps. Independent of the lure used, detection rates on green fluon-coated multifunnel traps were comparable with glued purple prism traps in areas with low *A. planipennis* population densities.

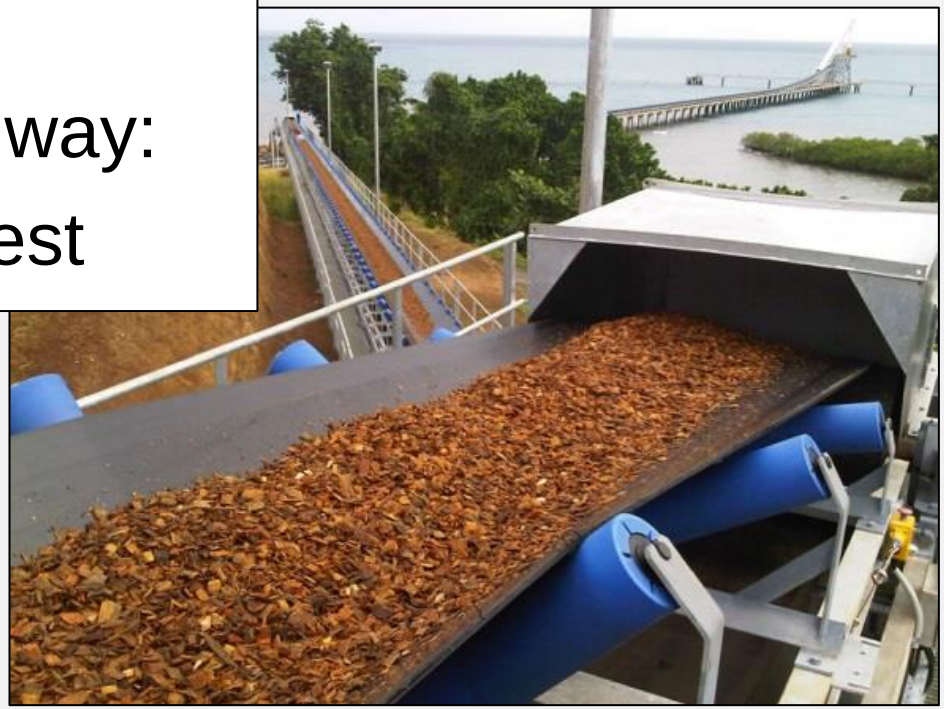
Depends on purpose

Inspection for return of individual consignments:

- Detection must be ~100%
- Return of ship too late

General survey of pathway:

- Verify presence of pest



Conclusion

- Hazards by overseas introduction – especially for BBB
- Overseas introduction can be stopped – expansion on the continent difficult to stop
- Measures: remove sap wood / heat treatment / irradiation - not plants for planting
- Wood-chipping not a safe measure – not accepted in UK and Norway for hosts of BBB and EAB
- Import control of wood chips – cannot stop arrivals of BBB and EAB and their tree hosts
- Commodity regulation – not by tree species
- Pellets trade up – wood chips trade slows down
- Pellets and pulp could replace all overseas trade by wood chips if regulated