Alien species in Belgium: a fact sheet for

Anoplophora glabripennis

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This fact sheet was created as part of the project *Alien Alert*, which aims at developing an integrated quick-screening tool for emerging pests and invasive species in Belgium. This BELSPO-funded project involves eight scientific institutions. Coordination is provided through the Belgian Biodiversity Platform.

The objective of this fact sheet is to support the identification of potentially invasive non-native species for Belgium and neighbouring areas. Organisms that qualify for this fact sheet are species that are not present in Belgium but likely to become so in the near future, or that are present but not widely distributed, and are likely to cause environmental and/or socio-economic harm.

The scheme of this risk assessment is based upon the International Standards for Phytosanitary Measures, which are endorsed by the Food and Agriculture Organization of the United Nations (FAO 2004). It consecutively assesses the stages of entry, establishment, spread & ecological and/or economic impacts.

(Reference: FAO (2004) International Standard for Phytosanitary Measures No. 11: *Pest risk analysis for quarantine pests including analysis of environmental risks and living modified organisms.*)

(Cover picture taken from http://commons.wikimedia.org.)

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1 ORGANISM IDENTITY AND DISTRIBUTION

1.1 ORGANISM IDENTITY

Scientific name:	*Anoplophora glabripennis* (Motschulsky 1853)
Synonyms:	*Anoplophora lævigator, Melanauster glabripennis, Melanauster lævigator, Melanauster nankineus, Melanauster nobilis, Cerosterna glabripennis, Cerosterna lævigator*
Common names:	Loofhoutboktor (Dutch), Aziatische boktor (Dutch), Asian longhorn beetle (English), Basicosta white-spotted longicorn beetle (English), Starry sky beetle (English), Capricorne asiatique (French), Longicorne asiatique (French), coléoptère de ciel étoilé (French), Asiatische Laubholzbockkäfer (German)
Taxonomic position:	Arthropoda > Insecta > Coleoptera > Cerambycidae

Note : *A. glabripennis* is part of the *glabripennis* complex, comprising *A. glabripennis*, *A. freyi*, *A. flavomaculata* and *A. coeruleoantennatus* (the latter being doubtful, taxonomically). The EPPO (1999) datasheet reports that in China, Wu and Jiang (1998) considered as possible the existence of different races of *A. glabripennis*. For example, there is debate in China whether *A. glabripennis* from northern China and *A. glabripennis* from southern China are actually two separate species (Chen 1989, in EPPO 1999).

Morphologically, *A. glabripennis* can be confounded with other *Anoplophora* species like the potentially invasive species *A. chinensis*.

1.2 SHORT DESCRIPTION

The Asian long-horn beetle is a large insect attacking several species of broadleaved tree species and characterized by the following stages:

eggs - About 5-7 mm, off-white, oblong. The ends of the eggs are slightly concave (Peng and Liu 1992, in EPPO 1999). Just before hatching, eggs turn yellowish-brown.

larvae - The larvae are legless with a maximal length of 5 cm, creamy white, with an indurated prothorax that appears brown.

adults - Typical shape of a Cerambycid with long antennae, body-size ranging from 2.5 cm (male) to 3.5 cm (female). Antennae are 2.5 times body length in males or 1.3 times body length in females. Adults are black with about 20 irregular white spots on the each elytra. The antennae have 11 segments, each with a light steel blue colour at the base (EPPO 1999, Cavey 2000).

1.3 ORGANISM DISTRIBUTION

A/ Native range

The native range is located in Far-east Asia, but the exact delimitation is unknown. Its presence was confirmed in China (Anhui, Fujian, Gansu, Guangdong, Guangxi, Guizhou, Hebei, Heilongjiang, Henan, Hubei, Hunan, Jiangsu, Jiangxi, Jilin, Liaonang, Neimenggu, Ningxia, Shaanxi, Shandong, Shanxi, Sichuan, Yunnan, Zhejiang), Korea Democratic People's Republic, Korea Republic and Taiwan (EPPO 1999). The Asian long-horn beetle is not present in the most western provinces of Qinghe, Xinjiang and Xizang (Tibet) and Hong Kong (Anonymous 1999).

B/ Introduced range

Belgium

The species is not established in Belgium (David Michelante, AFSCA, pers. comm.).

Rest of Europe

The species is established in several parts of Western Europe:

-in three Landers of Germany (Bayern since 2004 (OEPP 2008/095); Nordrhein-Westfalen since 2005 (LWK, 2012) and Baden Württemberg since 2012 (Katrin Kaminski, JKI, pers. comm.)),

-in three regions of France (Région Centre since 2003; Basse Normandie since 2004 and Alsace since 2008) (OEPP 2004/163, 2005/003, 2006/096, 2008/094, 2009/094,OEPP 2009/045),

-in two regions of Italy (with only a few plants attacked in the city of Corbetta in Lombardia region, since 2007) (OEPP 2009/046; Benianimo Cavagna, Regione Lombardia, pers. comm.) and with a large outbreak in Cornuda in Veneto region since 2009 (Matteo Maspero, MINOPRIO, pers. comm.)),

-in at least 4 counties of Switzerland (Fribourg since 2011; Thurgau since 2012; Zurich since 2012; Basel-Landschaft since 2012) (Beat Forster, LWF, pers. comm.)

-in one region of the United-Kingdom (near Kent since 2012) (Justin Dixon, FERA, pers. comm.).

Note: the species had also been present in Austria near the border with Germany since 2001, but thanks to control and regulatory measures, the species is currently under eradication. No occurrence has been observed since 2009 (Ute Hoyer-Tomiczek, BFW, pers. comm.). Early detection in the Netherlands also permitted to eradicate the species in 2008 (Anonymous 2012). The species was also intercepted in Denmark in Holstebro with a wooden pallet (in 2008; Scheel 2009), but not established. The species was also mentioned in Poland (Białooki 2003) but this record was never confirmed by the National Plant Protection Organization and is considered as unreliable by the EPPO Secretariat.

Other continents

In Asia, the species invaded the city of Yokohama in the Honshu province of Japan in 2002, but is now eradicated (OEPP 2006/100). In North America, the species is established in Canada and the United States of America. In Canada, the species is restricted to two cities of Ontario: Toronto (introduction in 2003) and Vaughan. The pest is currently established in 5 states of the U.S.: New York (since 1996), California, New Jersey (Middlesex and Union counties, since 2002), Massachusetts (Worcester county, since 2008; Suffolk County, since 2010) and Ohio (Clermont County). The species was also present in Illinois (Chicago, probably since 1993) and Hudson County (since 2002) in New Jersey, but after the completion of control and regulatory programs, and following confirmation surveys, the pest is now considered as eradicated (EPPO 1999 and USDA website).

2 RISK ASSESSMENT

2.1 PROBABILITY OF ESTABLISHMENT AND SPREAD

2.1.1 Present status in Belgium

The species is currently absent. In 2008, the species never established in Belgium but was intercepted in a private garden in Courtrai (3°15'52.06"E; 50°49'49.91"N) (D. Michelante, AFSCA, pers. comm.).

2.1.2 Present status in neighbouring countries

France - Present, under control in Région Centre (since 2003), Basse-Normandie (since 2004) and Alsace (since 2008; OEPP 2004/163, 2005/003, 2006/096, 2008/094, 2009/094, OEPP 2009/045).

Luxembourg - Absent (retrieved from EPPO PQR; EPPO 2007).

The Netherlands - Eradicated (Anonymous 2012).

Germany - Present, under control in Baden Württemberg (since 2012) (Katrin Kaminski, JKI, pers. comm.), Bayern (since 2004) (OEPP 2008/095), Nordrhein-Westfalen (since 2005) (LWK, 2012).

United Kingdom - Present, under control in Kent (since 2012) (Justin Dixon, FERA, pers. comm.).

2.1.3 Introduction in Belgium

The main pathway of introduction to Belgium is presumed unintentional, by transport with wood packing originating from the native range or from already infested countries. A very few reports of *A. glabripennis* with plants for planting (bonsai) also exist (Hérard et al. 2006, Rigaux, ISEFOR, pers. comm.), but it is unclear if the species was not confounded with *A. chinensis*.

Since the end of the 1990s, the Asian long-horn beetle was introduced in several parts of the world (Canada, US, Japan and several countries in Europe) with wood packing material and particularly with granite stones imported in wooden crates from China. Outbreaks seem preferentially located along canals or near ports by which wood packing material transits, e.g. outbreaks near Bornheim (Germany), Weil am Rhein (Germany) or Naka-ku, in Kanagawa Prefecture (Japan).

To prevent the international transport of insects with wood packing material, the International Standard for Phytosanitary Measures implement the ISPM 15 norm which requires that wood used as packing material are debarked prior to a heat treatment at

56°C for at least 30 min (FAO 2008). Implementation of ISPM 15, contribute to reduce the propagule pressure, they did not totally prevent Europe from new introductions of *A. glabripennis*.

Only a few individuals are released from wood packing material, but with the possibility of already mated females among them. The newly escaped beetles may rapidly establish stable populations at the proximity of the release point, due to their high reproductive potential. Moreover, the cryptic life of the immature stages under the bark of healthy trees makes early detection difficult.

The number of arrivals per year in Belgium is estimated regular. Two confirmed interceptions were recorded in the country, one time at a port of entry, arrived with wood package material from China (2004) and the second one in a private garden of Courtrai (2008). Moreover, the species is regularly intercepted in other countries e.g. from 2008 to 2010, there were two confirmed interceptions in the Netherlands and four in Germany (Rigaux ISEFOR pers. comm.) and several interceptions also occurred throughout the U.S.: Alabama, California, Florida, Illinois, Indiana, Michigan, New Jersey, New York, North Carolina, Ohio, Pennsylvania, South Carolina, Texas, Washington, and Wisconsin (Smith et al. 2001).

As the species is also established in most of neighbouring countries (France, United-Kingdom and Germany), internal movements within the European Union have also to be considered as a potential pathway of introduction to Belgium. Natural dispersal is quite low with a mean spread of less than 1 km per year (Bancroft and Smith 2005) but human-mediated spread may occur through the unintentional dispersal of infested wood packing material by car. Such movements were occasionally reported, for example, the pest was intercepted on a truck travelling from Bremen to Sachsen (Germany) in 2001 (OEPP 2001/136). However when identified, infested sites are under strict control that limit such movements.

Intentional introductions are presumed very low because of little interest as captive animal or low entomological interest.

2.1.4 Establishment capacity and endangered area

A/ Life-cycle and reproduction

In contrast with mainland eastern China where the whole life cycle can be completed in only 1 year, 2 years are requested in Europe. The difference is probably due to most frequent sunny days in China. However, due to particularly hot temperatures in the summer 2003, a shortened life cycle of 1.5 years was reported in Europe (Appendix of Robinet et al. 2012).

B/ Climatic requirements

In its native range, the distribution of the Asian long-horn beetle covers a number of climatic zones, from the arid temperate region in the north to the border of tropical regions in the south. It does not occur at altitudes above 1000 m and seems most abundant below 200 m (MacLeod et al. 2002). The threshold temperature for egg development is fixed at 7,8°C (Li and Wu 1993). With a 10,2°C threshold, around 1264 accumulated degree day are requested to complete the biological cycle (Yang et al. 2000). Based on ecoclimatic data (temperature, moisture, etc), a Climex analysis was built by MacLeod et al. (2002): see figure below.

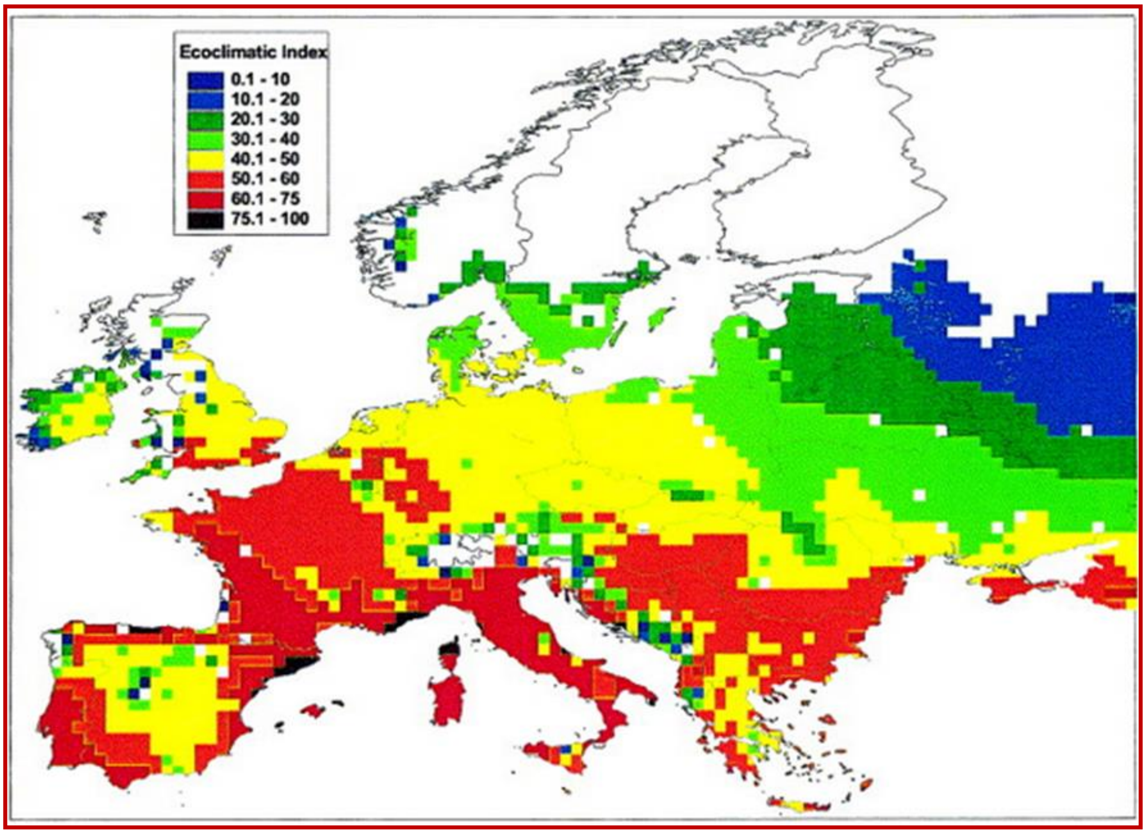


Figure - CLIMEX map of Europe with Ecoclimatic Index (with climatological data 1961-1990) interpolated to 0.5° latitude x 0.5° longitude gridded data. Higer values of Ecoclimatic Index represent more favourable climatic conditions (retrieved from MacLeod et al. 2002)

C/ Habitat preferences

Host range is particularly broad; the Asian longhorn beetle can feed and develop on many deciduous trees. In Asia, North America and Europe various species from many different families have been reported (Hérard et al. 2006, Sawyer 2008). In Europe, the life-cycle may be completed on *Acer*, *Aesculus*, *Alnus*, *Betula*, *Carpinus*, *Fagus*, *Fraxinus*, *Platanus*, *Populus*, *Prunus*, *Salix* and *Sorbus*. The most commonly attacked species belong to the *Acer* genus followed by *Betula*, *Salix*, *Aesculus* and *Populus* (Hérard et al. 2006, 2009). Some authors estimate that all deciduous trees (including fruit trees) may serve as potential hosts (Schröder et al. 2006). Data on the proportion of broadleafed forsts in Europe is available in the Figure below.

The species is mainly found in urban areas (Poland et al. 2001), which supposed that ornamental or shade trees are first colonized.

D/ Feeding habits

The Asian long-horn beetle is polyphagous and its major hosts are present widely in many European countries in the natural and urban environments.The most obvious symptoms are the circular exit holes of 1 cm diameter observed on trunks and branches. They are made by the adults when they emerged at a new generation. Adults feed on leaves, petioles and young barks. After mating, females scrap bark to lay eggs, a behaviour that can cause dropping of sapwood. Larvae feed in the cambium and wood leading to loss of turgor pressure, yellowing and dropping of leaves (MacLeod et al. 2002).

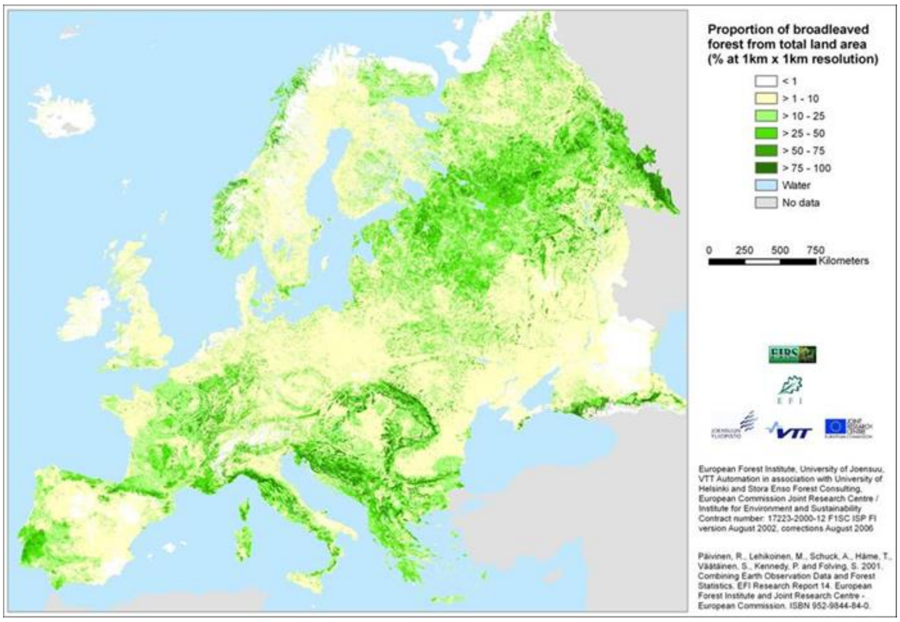


Figure - Proportion of broadleaved forest from total land area (% at 1 km x1 km resolution) Päivinen et al. (2001), retrieved from supplementary material of Robinet et al. (2012).

E/ Control agents

In China, several parasitoids from Hymenoptera families (Encyrtidae, Ichneumonidae, Braconidae, Bethylidae and Eulophidae) and Diptera family (Tachinidae) attack eggs or larvae of the Asian longhorn beetle (Smith et al. 1999).

In Europe, potential enemies of *A. glabripennis* are probably among natural enemies of the cerambycids *Saperda populnea* and *S. carcharias*, two species colonizing *Salix* and *Populus* spp. Among them are cited the parasitoids *Euderus albitarsis* (Hymenoptera: Eulophidae), *Dolichomitus populneus* (Diptera: Tachinidae), *Billaea irrorata* (Hymenoptera: Ichneumonidae) and predators *Odinia xanthocera* (Diptera: Odiniidae), *Lasiambia baliola* (Diptera: Chloropidae), and *Thaumatomyia elongatula* (Diptera: Chloropidae) (Hérard et al. 2003). We conclude that a pool of potential control agents is present in Europe but further developments should be requested to characterize their effectiveness on controlling *A. glabripennis* populations.

Generalist predators, like predatory beetles and birds, could also impact populations of the Asian longhorn beetle, but as the higher larval stages enter deep into the wood, the time interval for predation is quite low.

F/ Establishment capacity in Belgium

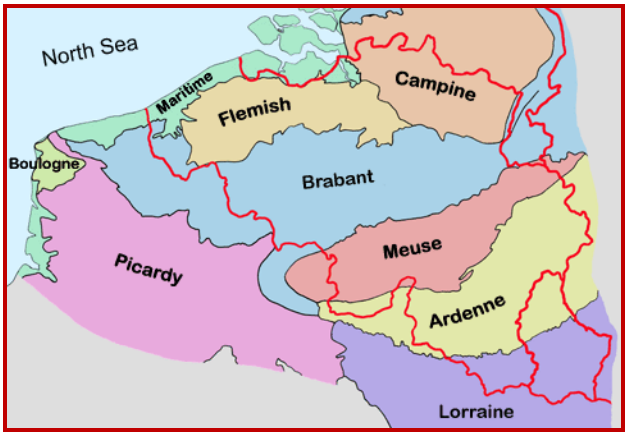
Potential for future establishment of the longhorn beetle is considered to be very likely in Belgium because of suitable climatic conditions and no host suitability limitations.

G/ Endangered areas in Belgium

Ecoclimatic index and density of host trees suggest a slightly inferior probability of suitable biotic factors in the northern districts; with an ecoclimatic index of 40,1-50 in the North (East), versus an index of 50,1-60 in the South (West). But the difference in ecoclimatic suitability between North and South is estimated low. Broadleaved species are particularly abundant in the southern districts with a proportion of broadleaved area superior to 10% (Päivinen et al. 2001). In the northern districts, despite broadleaved species are present in a low proportion with only 1-10% of the areas covered (Päivinen et al. 2001), patches of suitable habitat exist in urban areas with shade and ornamental broadleaved trees (e.g. *Prunus* spp.), therefore habitat suitability is estimated high in every district.

The privileged pathway of introduction is the import of commodities with woody packages. Considering that the risk of entry is particularly higher for the northern districts, via the Antwerp port or the Zeebrugge port and also considering probability of establishment decreasing with the distance from the potential port of entry, we consider the establishment probability higher in the northern districts.

The establishment capacity for the different Belgian geographic districts is deemed as follows:



Districts	Establishment conditions
Maritime	Optimal
Flandrian	Optimal
Brabant	Optimal
Kempen	Optimal
Meuse	Suboptimal
Ardenne	Suboptimal
Lorraine	Suboptimal

Map taken from Diederich & Ries, lichenology.info

2.1.5 Dispersal capacity

A/ Natural spread

Flight capacities are not considered particularly high with an asymptotic spread rate estimated to 0.12 km/year in modelling approach (Bancroft and Smith 2005) but a few individuals are able to disperse further and increase the global spread rate.

On flight mills, insects were able to flight over 1 km (Smith et al. 2001).

Mark-release-recapture experiments have shown that adults of the Asian longhorn beetle can disperse 1 to 3 km during their life span, although most remain near the tree where they emerge when the host density is high, because 98% of the marked beetles were recaptured at less than 1km from the release point (Smith et al. 2001).

Radial spread rate observed from historical data of damage in North America (New York and New Jersey) is also quite low, with a medium range of 0,4 km per year (Sawyer and Panagakos, 2008). Values of a similar order of magnitude were observed in Europe at the end of 2004 (Hérard et al. 2005).

The body size of the species is quite high and disadvantageous for passive wind transport over long distances.

B/ Human assistance

Human-mediated spread is probably the most important vector for long distance dispersal of the Asian longhorn beetle. Human transports occur accidentally as a contaminant of commodities (wood-packing material) or as occasional accidental transports with vehicles e.g. the pest was intercepted on a truck travelling from Bremen to Sachsen (Germany) in 2001 (OEPP 2001/136).

2.2 EFFECTS OF ESTABLISHMENT

2.2.1 Environmental impacts

A/ Competition [Low to Moderate]

A number of other cerambycids are present in Europe and competition could take place at high density. For example, *Saperda populnea* colonizes poplar trees (Eken et al. 2006), but for this species no evidence of competition with the Asian longhorn beetle exist from the native area (Pang and Zhao 1986 in MacLeod et al. 2002).

B/ Predation/herbivory [Medium]

Because of its polygophagous regime, the Asian longhorn beetle may cause significant impact to native broadleaved species. Despite death of a host is not systematic, a cumulative impact of *A. glabripennis* with other disease should probably contribute to decline of some broadleaved species. The larvae feed undetected inside trees leaving them weakened and susceptible to further pest or disease damage (FERA 2012).

C/ Genetic effects and hybridization [Low]

No hybridization between *Anoplophora glabripennis* and a European cerambycid species has been reported.

D/ Pathogen pollution [Low]

Anoplophora glabripennis may transport microorganisms such as entomopathogenic fungi (Shimazu et al. 2002) susceptible to be transmitted to native insects. However such a transmission has never been reported so far.

E/ Effects on ecosystem functions [Medium]

The Asian longhorn beetle may impact native forest dynamics but to a limited extent.

2.2.2 Animal health impacts [Very low]

No impact on animal health identified.

2.2.3 Plant health impacts [High]

The Asian longhorn beetle can cause serious damage to fruit, forestry and ornamental trees.

Larvae should affect *Populus* plantation economy. *Populus* is used in plywood manufacture (MacLeod et al. 2002). For example, it was estimated that up to 89% of the wood of an attacked poplar tree grown for commercial use can lose 46% of its value (Gao et al. 1993 in EPPO 1999).

Damages to fruit trees give rise to economic losses, both by adults feeding on shoots and larvae boring into cambium and wood, sometimes resulting in the death of trees (Haack et al. 1997).

2.2.4 **Human health impacts** [Very low]

No significant impact reported on human health.

2.2.5 **Other impacts** [High]

In urban regions, weakening of trees by the larval tunnels can cause a danger to pedestrians and vehicles from broken branches and death of trees.

Costs of the eradication campaign in New York, which include publicity, tree removal, education and tree replacement, exceeded 2,5 million euro annually (MacLeod et al. 2002).

The landscape value of street and parkland without tree due to eradication will also be reduced drastically.

3 SUMMARY: *ANOPLOPHORA GLABRIPENNIS* IN BELGIUM

ENTRY – *High* - The risk of introduction of the Asian longhorn beetle is estimated to be from moderate to high, with low uncertainty, because of regular arrivals with wood packing material from Asia in ports (e.g. the port of Antwerp in Belgium). Occasional movements by car or boat from already infested neighbouring countries may also be a source of introduction of wood packing material.

ESTABLISHMENT – *High* - The risk of the Asian longhorn beetle establishing self-sustaining populations in Belgium and neighbouring areas is high because appropriate climatic conditions and a large continuum of suitable host plants are encountered. The uncertainty is low.

SPREAD – *Low to Moderate* - The natural spread capacities are low. Occasional human-mediated spread may drastically increase the rate of spread. The global spread rate is estimated from low to moderate with medium uncertainty linked to the frequency and conditions of human-mediated spread.

IMPACTS – *Moderate to High* - Based on impacts observed in Europe, it is likely that the establishment of population of *Anoplophora glabripennis* will contribute to the decline of broadleaved trees in Belgium and neighbouring countries, already affected by climate changes and other diseases. Economic impacts may be also significant for horticultural and plywood manufacture sectors.

4 LIST OF REFERENCES

Anonymous (1999) Commission decision of 26 May 1999 on emergency measures against the dissemination of *Anoplophora glabripennis* (Motschulsky) as regards China (except Hong Kong). Off. J. Euro. Commun. L137: 45–46

Anonymous (2012) Solidarity dossier on *Anoplophora glabripennis* (Almere) SL/NL/2011/01. http://www.ersa.fvg.it/istituzionale/servizio-fitosanitario-chimico/circa/organismo-nocivo/insetti/anoplophora-chinensis/solidarity-nl/NL%20SOL%20Dossier%20ALB%202011.pdf accessed 01/02/2012

Bancroft & Smith (2005) Dispersal and influences on movement for *Anoplophora glabripennis* calculated from individual mark-recapture. Entomologia Experimentalis et Applicata 116: 83–92

Białooki (2003) [*Anoplophora glabripennis* – first confirmation in Poland.]. Ochrona Roślin 47: 34-35. In: Review of Agricultural Entomology 92(9), April 2004, abst. 8621, p 1333.

Cavey (2000) Pest Reports—EXFOR Database: *Anoplophora glabripennis*. http://spfnic.fs.fed.us/exfor/data/pestreports.cfm?pestidval=53&langdisplay=english

Eken et al. (2006) Pathogenicity of *Beauveria bassiana* (Deuteromycotina: Hypomycete) to larvae of the small poplar longhorn beetle, *Saperda populnea* (Coleoptera: Cerambycidae). Mycopathologia 162: 69-71

EPPO (1999) data sheets on quarantine pests. EPPO Bulletin 29: 497–501. doi: 10.1111/j.1365-2338.1999.tb01426.x

EPPO (2007) Plant Quarantine Data Retrieval System PQR Version 4.6. http://www.eppo.org/DATABASES/pqr/pqr.htm, accessed on 2013-01-15

FAO (2008) International standards for phytosanitary measures: Revision of ISPM No15, Regulating wood packaging material in international trade, Draft Publ. No. 15. Food and Agriculture Organization of the United Nations, Rome, Italy

FERA (2012) Asian longhorn beetle http://www.fera.defra.gov.uk/plants/plantHealth/pestsDiseases/asianLonghornBeetle/index.cfm, accessed 01/02/2012

Haack et al. (1997) New York's battle with the Asian long-horned beetle. J. For. 95: 11-15

Hérard et al. (2003) Natural enemies of *Saperda* spp. (Col. Cerambycidae, Lamiinae) in Europe, envisioned as potential agents in biological control of *Anoplophora* spp. in Europe and the USA – Proceedings of the United States Department of Agriculture interagency research forum on gypsy moth and other invasive species, Annapolis, MD, USA, 15-18 January 2002: 36-37

Hérard et al. (2005) *Anoplophora* in Europe : Infestations and Management Responses. pp. 55–61. In SLC Fosbroke and KW Gotts

Li & Wu (1993) Integrated management of longhorn beetles damaging poplar trees. Beijing: China Forestry Press, 290 pp

LWK (2012) Asiatischer Laubholzbockkäfer in NRW gefunden. http://www.landwirtschaftskammer.de/landwirtschaft/pflanzenschutz/psd/asiatischer-laubholzbockkaefer.htm, accessed 01/02/2012

MacLeod et al. (2002) An analysis of pest risk from an Asian longhorn beetle (*Anoplophora glabripennis*) to hardwood trees in the European community. Crop Protection 21:635–645

Päivinen et al. (2001) Combining Earth Observation Data and Forest Statistics. EFI Research Report 14. European Forest Institute, Joint Research Centre - European Commission. EUR 19911 EN. 101p.

Poland et al. (2001) Be on the lookout for Asian longhorned beetles. Arborist News 10: 55-57

Robinet et al. (2012) A Suite of Models to Support the Quantitative Assessment of Spread in Pest Risk Analysis. PLoS ONE 7: e43366. doi:10.1371/journal.pone.0043366

Sawyer & Panagakos (2009) Spatial dynamics of the Asian longhorned beetle: Carteret, NJ to Staten Island, NY in nine years? In: McManus KA, Gottschalk KW (eds) Proceedings of 19th US Department of Agriculture Interagency Research Forum on Invasive Species 2008. USDA For Serv Gen Tech Rpt

Scheel (2009) *Anoplophora glabripennis* first finding in wood packaging material in Denmark. EPPO Bulletin 39: 153–154. doi: 10.1111/j.1365-2338.2009.02281.x

Shimazu et al. (2002) Fungal pathogens of *Anoplophora glabripennis* (Coleoptera: Cerambycidae) and their virulences. Bulletin of the Forestry and Forest Products Research Institute 1: 123-130

Smith et al. (2001) Dispersal of *Anoplophora glabripennis* (Cerambycidae). Environmental Entomology 30: 1036-1040

Smith et al. (1999) *Anoplophora glabripennis* (Motschulsky): Field behavior and natural enemies in China, pp. 60-61. In: S.L.C. Fosbroke and K.W. Gottschalk (eds.), Proceedings U.S. Department of Agriculture Interagency Research Forum on Gypsy Moth and other Invasive Species. Annapolis, MD

Yang et al. (2000) Generation differentiation and effective accumulated temperature of *Anoplophora glabripennis* (Motsch). Forest Pest Dis. 19: 12-14