Scientific name	*Vespa velutina*
Common name	Asian hornet
Broad group	Invertebrate
Number of and countries wherein the species is currently established	4: ES, FR, IT, PT
Risk Assessment Method	GB NNRA
Links	https://secure.fera.defra.gov.uk/nonnativespecies/downloadDocument.cfm?id=643
1. Description (Taxonomy, invasion history, distribution range (native and introduced), geographic scope, socio-economic benefits)	Socio-economic benefits: None known.
6. Can broadly assess environmental impact with respect to ecosystem services	*Vespa velutina* predates managed honey bees, which provide pollination services to commercial crops and natural landscapes. This hornet also predates a wide variety of other beneficial insect species, including unmanaged pollinators (e.g. other Hymenoptera, hoverflies) (Rome *et al.*, 2011, Villemant *et al.*, 2011a). Provisioning services: The possible negative effect on pollination (primary service) may translate into loss of crop/fruit production and honey yields (secondary service). Regulating services: The Asian hornet preys on honeybees and other wild pollinators such as bumble bees, which can have a negative impact on production. Cultural services: Although hornets usually are defensive, they may be considered a nuisance to recreational activities, cause mental and physical health issues.
8. Includes status	Honeybees are protected in several European countries and covered by

(threatened or protected) of species or habitat under threat	different legislation (e.g. legislation on animal health certification and requirements for the movement of bees between Member States, Directive 92/65/EEC; including also other invasive alien species, *Aethina tumida, Varroa destructor*). The Asian hornet colonizes urban, sub-urban, agricultural and wooded areas, but rarely also can be found in unmanaged environments (e.g. marshlands), which may include protected habitats.
	Unpredictable. However, could expect that northern parts of Europe might become more susceptible to establishment. Although the native range of *V. velutina* is within NE India, S. China and Taiwan and Indonesia, even in such tropical regions this species nests in cooler highland regions, which are climatically similar to Southern Europe (Martin, 1995, Starr, 1992). *Vespa* species are very effective at regulating the temperature within their nests, protecting adults and brood from ambient temperature extremes (Martin, 1995); they can maintain a constant nest temperature around 30℃, even if temperatures outside the hive may be 20℃ lower. Under laboratory conditions, *V. velutina* has been shown to complete its lifecycle under a wide range of conditions (14-25℃) (Dong & Wang, 1989).
9. Includes possible effects of climate change in the foreseeable future	Models predict that large parts of Europe are climatically suitable for the species (Barbet-Massin *et al.*, 2013, Rome *et al.*, 2009, Villemant *et al.*, 2011a), and an increase in the climatic suitability for the species in the Northern hemisphere is predicted, especially close to the already invaded range in Europe, in Spain and in Central and Eastern Europe – from Switzerland to Hungary up to Southern Sweden. Standard deviations of the results obtained from the 13 different climate scenarios confirmed the low uncertainty of models to predict an increase in invasion risk across Central and Eastern Europe, close to the already invaded European range. These regions hold among the highest densities of bee-hives in Europe, and could suffer from the potential predation of the putative invading hornet on pollinators. When considering all known occurrences of *V. v. nigrithorax* in the native and invaded ranges, models revealed that many countries of Western Europe exhibit a high probability of being invaded with a higher risk along the Atlantic and northern Mediterranean coasts. Coastal areas of the Balkan Peninsula, Turkey and Near East appear also suitable and could potentially be colonised later.
11. Documents information sources	**Barbet-Massin M, Rome Q, Muller F, Perrard A, Villemant C, Jiguet F. 2013.** Climate change increases the risk of invasion by the yellow-

	legged hornet. *Biological Conservation* **157:** 4-10. **Choi MB, Martin SJ, Lee JW. 2011.** Distribution, spread and impact of the invasive hornet *Vespa velutina* in South Korea. *Entomological Research* **41:** 276-276. **Dong D, Wang W. 1989.** A preliminary study on the biology of wasps *Vespa velutina auraria* Smith and *Vespa tropica ducalis* Smith. . **Ibáñez-Justicia A, Loomans A. 2011.** Mapping the potential occurrence of an invasive species by using CLIMEX: case of the Asian hornet (*Vespa velutina nigrithorax*) in The Netherlands. *Proc Neth Entomol Soc Meet* **22:** 39-46. **Martin SJ. 1995.** Hornets (Hymenoptera: Vespidae) of Malaysia. . *Malayan Nature Journal* **49:** 71-82. **Monceau K, Bonnard O, Thiéry D. 2014.** *Vespa velutina*: a new invasive predator of honeybees in Europe. *Journal of Pest Science* **87:** 1-16. **Rome Q, Gargominy O, Jiguet F, Muller F, Villemant C. 2009.** Using maximum entropy (MAXENT) models to predict the expansion of the invasive alien species *Vespa velutina* var. *nigrithorax* Du Buysson, 1905 (Hym.: Vespidae), the Asian hornet. *Europe. In: Apimondia***:** 15-20. **Rome Q, Perrard A, Muller F, Villemant C. 2011.** Monitoring and control modalities of a honeybee predator, the yellow-legged hornet *Vespa velutina nigrithorax* (Hymenoptera: Vespidae). *Aliens: The Invasive Species Bulletin* **31:** 7-15. **Starr CK. 1992.** The social wasps (Hymenoptera: Vespidae) of Taiwan. *Bulletin of the National Museum of Natural Science* **3:** 93-138. **Villemant C, Barbet-Massin M, Perrard A, Muller F, Gargominy O, Jiguet F, Rome Q. 2011a.** Predicting the invasion risk by the alien bee-hawking Yellow-legged hornet *Vespa velutina nigrithorax* across Europe and other continents with niche models. *Biological Conservation* **144:** 2142-2150. **Villemant C, Muller F, Haubois S, Perrard A, Darrouzet E, Rome Q. 2011b.** Bilan des travaux (MNHN et IRBI) sur l'invasion en France de *Vespa velutina*, le frelon asiatique prédateur d'abeilles. *Proceedings of the Journée Scientifique Apicole–11 February***:** 3-12. **Villemant C, Perrard A, Rome Q, Gargominy O, Haxaire J, Darrouzet E, Rortais A. 2008.** A new enemy of honeybees in Europe: the invasive Asian hornet *Vespa velutina*. XXth International Congress of Zoology – Paris, 26-29 August 2008. http://inpn.mnhn.fr/gargo/Vespa%20velutina%20ICZ%202008.pdf.
Main experts	Wolfgang Rabitsch Piero Genovesi
Other contributing experts	Olaf Booy Belinda Gallardo

Notes	In how many EU member states has this species been recorded? List them. 6 member states (MS): France (since 2003/2004), Spain (since 2010), Belgium (2011), Portugal (since 2012), Italy (since 2013), Germany (2014) In how many EU member states has this species currently established populations? List them. Certain establishment in 4 MS: France, Spain, Portugal, Italy Establishment in 2 MS uncertain: flying male recorded present in Belgium in 2011 but not reported in 2012 - not believed established; only recently recorded present in Germany (August/September 2014) – no data on establishment available yet. In how many EU member states has this species shown signs of invasiveness? List them. Certain spread in 4 MS (highly invasive): France, Spain, Portugal, Italy Spread in 2 MS uncertain: observed in Belgium in 2011 but not in 2012 therefore not believed to have spread; only recently recorded present in Germany (August/September 2014) – no data on invasiveness available yet. In which EU Biogeographic areas could this species establish? The GB risk assessment (overall conclusion Medium Risk and Medium Uncertainty) is validated. Missing information was added. *Vespa velutina* has established in urban and rural environments. Shows a preference for peri urban/urban locations: Based on observations of invasive populations of this species in both France and south Korea, mature nests are distributed in the environment as follows: *Habitat type in France: Urban/periurban - 49% (of nests) Agricultural areas - 43% Forest - 7% “Milieu humides” (i.e. wetlands?) e.g. estuaries, marshes - 1%

	**Habitat type S. Korea: Forest (only 'green'; no urbanisation) - 20% (of hornet community on wing) Forest edge (green:urbanisation 3:1) – 29% Large urban parks (green:urbanisation 1:1) – 40% Local urban parks (green:urbanisation 1:3) – 65% Urban centre (only urbanised; no 'green') – 92% *Nest heights: >10m above ground - 75% (of nests) Between 2-10m above ground - 21% <2m above ground - 3% ***Substrate: Trees - 90% (of nests) Buildings (verandas, terraces, barns, municipal buildings etc) – 10% underground rarely - <1%? ***Types of tree: Oaks 25% (of nests) Poplars 19% Acacias 13% Conifers 11% Birch ?% Bushes (Laurel) 1% Fruit trees (Plum, Pear, Sour cherry) 1% Proximity to water: Strong correlation between hornet presence and proximity to hydrographic network (water = a requirement for nest building). *French population, based on 4,107 nests (Villemant *et al.*, 2011b) **South Korean population (Choi *et al.*, 2011) ***French population, based on studies of 550 nests (Villemant *et al.*, 2008) In how many EU Member States could this species establish in the future [given current climate] (including those where it is already established)? List them. Unknown. However, it has been stated (Monceau *et al.*, 2014) that "different simulations based on climatic similarities of locations in France

	and Asia predicted an expansion to most parts of France and neighbouring European countries" (Ibáñez-Justicia & Loomans, 2011, Villemant *et al.*, 2011a). The comparison between native and invaded areas shows that they differ in their level of precipitation during the driest month of the year, the invaded areas receiving more precipitation than the native area. It has been stated that: "Eight climatic suitability models have been used to predict the potential invasion risk of *V. v. nigrithorax* based on eight climatic data from WorldClim at 5 arc-minutes grid. We used occurrence data in the models from the invaded range as well as from the native range of this particular variety, gathering information from museum collections, published records and recent field sampling in its native range. The consensus map obtained from the models shows that *V. v. nigrithorax*could successfully invade many other parts of the world since the scenario of introductions through international trade - as it occurred in France - could well be repeated." (Rome *et al.*, 2009) Map: Limoges (France) Match Climate Europe. Green triangles indicate locations of *V. velutina* nests until 2009 (INPN 2010), blue dots indicate stations where the Climate Matching Index (CMI) >0.7, and crosses indicate stations where CMI <0.7. (Ibáñez-Justicia & Loomans, 2011) Map from Rome et al. (2011). Predicted potential invasion risk of *V. v. nigrithorax* based on ensemble forecast models using eight climatic data from WorldClim. Verified data only. In how many EU member states could this species become invasive in the future [given current climate] (where it is not already established)? List them. As above. INPN (2010) Inventaire National du Patrimoine Naturel. http://inpn.mnhn.fr.
Outcome	Compliant