Metsähallitus

Management plan for the habitats of Xyletinus tremulicola

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Ecology and distribution

Description

Xyletinus tremulicola (Y.Kangas, 1958) is a small black and brown beetle approx. 4 mm in length. Similarly to other wood-boring beetles (Anobiidae), it has a convex, hood-like pronotum and a spherical body. Its dark elytra have longitudinal spotted lines, and its legs and serrate antennae have a light reddish-brown colour. Based on external characteristics, the species is difficult to distinguish from others in the *Xyletinus* genus. However, *X. tremulicola* is the only one living inside the bark. The larvae are small and white with curved bodies. They have visible legs, unlike such species as bark beetles.

Life cycle

The length of the larval stage is two years, after which the larvae pupate inside the bark in early summer. Adult beetles are active in June and July.

Nutrition

Xyletinus tremulicola larvae feed on the bark of aspens and any fungi that may be living in it.

Habitats

The species lives on damaged aspen trunks that can be either live or dead. It has mostly been found on sturdy (> 20 cm) upright trunks, but it may also live on a log, especially if an aspen has died upright and fallen down later.

X. tremulicola larvae live inside aspen bark, often immediately underneath the hard surface of the bark. The larvae produce winding tunnels full of frass approx. 2 mm in diameter (Ehnström and Axelsson 2002). The occurrence is usually small in area, or no more than a few square decimetres.

The bark in areas used by *X. tremulicola* is typically rough and uneven due to damage caused by wood-decay fungi or other reasons. The aspen bracket (*Phellinus tremulae*), for example, may kill the bark locally, causing scarring in the tree. Occasionally, occurrences of this species have been associated with fungus-infested bark, but not enough is known about any obligate mutualism of the species with wood-decay or other fungi as yet.

Tunnels made by *Trypophloeus* beetles are very often seen in the same pieces of bark. It is possible that *Xyletinus* females use tunnels made by *Trypophloeus* larvae when laying their eggs inside the bark.

An occurrence of *X. tremulicola* can be identified by the round exit holes approx. 2 mm in diameter (Ehnström and Axelsson 2002). These holes are made as the adult beetles leave the bark. *Trypophloeus* exit holes are also round but clearly smaller, approx. one millimetre in diameter. Several successive *X. tremulicola* generations can live on the same trunk, and even in the same piece of bark.

The species favours the top part of the trunk and may also be found on thick branches. It has been observed both on warm and sunny sites (Rutanen 1994) and in closed-canopy forests (Eriksson 2007), and in valuable natural forests in protected areas and on suitable trees outside such areas alike. The species has been observed in aspen groves on the margins of felled areas, on individual dead aspens as well as on dead old aspens preserved as retention trees. Aspen stumps, including artificial snags, provide suitable habitat for it (Eriksson 2007).

As it can be caught in window traps, *X. tremulicola* is presumed to be an adept flier (Wikars and Hedenås 2010). It can consequently find its way to a suitable decaying tree even across a longer distance. However, suitable dying and dead aspens must be available continuously at the landscape level. Damaged trunks with thick bark and bracket fungi are particularly important for the occurrence of this species.

Distribution and status

Xyletinus tremulicola was described as a new species to science as late as 1958 based on individuals found in Northern Sweden. In Finland, this species was only found in 1991.

Observations have been made in Finland and Sweden up till the latitude of Rovaniemi. No observations of this species have been made in the westernmost parts of Finland. *X. tremulicola* also occurs in Estonia. While it has not been found elsewhere, it is likely to also occur in Russia, at least in areas close to the Finnish border. The southernmost observation in Finland was made in Lappeenranta, very close to the Russian border.

The most frequent observations of *X. tremulicola* in Sweden have been made in Uppland to the north of Stockholm, and it is classified as near threatened. In Finland, the species is classified as

Administrative status and legislation

EU Habitats Directive Annex II.

Animal species protected throughout the country (Nature Conservation Decree 160/1997, Annex 2a 471/2013)

Species under strict protection (Nature Conservation Decree 160/1997, Annex 4 471/2013)

Endangered species (Nature Conservation Decree 160/1997, Annex 4 471/2013)

Red List category in 2019: vulnerable VU

Hyvärinen et al. 2019

vulnerable (Hyvärinen et al. 2019). It is threatened by a changing tree species ratio in forests, decline in the number of old-growth forests and large trees as well as a reduced volume of decaying wood.

Habitat management in protected areas

Distribution of *Xyletinus tremulicola* in protected areas

X. tremulicola beetles have been found on the following Natura 2000 sites:

Kymenlaakso: Repovesi (Repovesi National Park),

Pirkanmaa: Isojärvi–Arvajanreitti (Isojärvi National Park) and Kärppäjärvi area,

Central Finland: Edessalo–Haukkasalo (partly in Pirkanmaa), Pyhä-Häkki area (Pyhä-Häkki National Park),

South Savo: Kakonsalo lake area,

North Karelia: Koli National Park,

North Ostrobothnia: Kiiminki fen area,

Lapland: Louevaara and Saariaapa–Hattuselkä.

The national parks contained in Natura sites are given in brackets. For more information on Natura sites, visit the Finnish Environment Institute's map services (Finnish Environment Institute 2018).

The species also occurs outside the Natura site of Jäppilä and Joroinen old-growth forests in Kivimäensalo Nature Reserve and in the protected forest of Tuiskukivalo, which is close to the Natura site of Tuiskukivalo spruce forest.

In the following sections, the distribution of *X. tremulicola* is discussed by Metsähallitus' Parks & Wildlife Finland units.

Lake Region

The topography of Repovesi area in Kokkola is highly variable due to several fracture lines running from northwest to southeast and northeast to southwest. Herb-rich forests beneath crags can be found in places, while the sites in this area are otherwise mostly relatively barren. The predominant tree is the pine. Deciduous trees, including aspens, also grow on slopes and in valleys. Young stands dominated by deciduous trees and also small stands of aspen can be found in places.

In Kuhmoinen on the western shore of Lake Päijänne, there are several nature reserves where *X. tremulicola* is known to occur. The Natura site of Isojärvi–Arvajanreitti has a variable topography characterised by long and narrow fissure valleys and forests on rocky terrain. Aspens are found as sturdy individual trees and groups in the old-growth forests of the area, and also in young mixed forests dominated by the spruce.

X. tremulicola was observed in Kärppäjärvi area in 1996. Most of the aspens in this area grow in the old-growth forest reserve of Kuoppa-aho. It comprises the most natural forests in the area, which include spruce-dominated mesic heath forests and herb-rich forests. They contain individual old deciduous trees, including sturdy aspens. The young and mature forests of Kärppäjärvi area are producing more aspen wood. *Cucujus cinnaberinus* is also found here. Both species live on aspens but, unlike *C. cinnaberinus*, *X. tremulicola* can be found on living trees, too.

Edessalo–Haukkasalo is located in the lake shore forests of Päijänne on the boundary between Jämsä and Kuhmoinen, to the northeast of Kärppäjärvi. Due to the prevalence of rocky terrain, the topography of the area contains small detail. While rocky terrains are dominated by pines, there also are mixed forests with spruces and deciduous trees. The ages of the forests vary from young seedling stands to old-growth forests. The area is protected partly under the Nature Conservation Act, and partly under the Water Act, the Land Use and Building Act and the Forest Act.

In Kakonsalo lake area on the boundary between Heinävesi and Savonlinna, there are private lands and forests in joint ownerships as well as Kakonsalo Nature Reserve. Similarly to the protected areas listed above, the topography of the terrain has small detail, including crags and exposed rock. The forests mainly are mixed spruce-dominated mesic heath forests of different ages. In the areas of Raatelamminsalo and Pieni-Pölläkkä as well as Haukiniemi, there are old-growth forests with sturdy aspens and decaying aspen wood.

Pyhä-Häkki area contains a larger continuous area of old-growth forest with sturdy old aspens growing in spruce forests individually and in small groups. In the northwest part of the National Park and the area outside the park, the forests are younger and, as a rule, pine dominated. There are little or no younger mixed forests with aspens.

The core of Koli National Park consists of a hill formation with herb-rich forests and their significant species. The area also has natural boreal forests. In Koli, aspen occurs everywhere from sapling stands to forests at regeneration age and even old-growth forests. Aspens are found on many types of sites. Herb-rich heath forests and herb-rich forests are in many places dominated by deciduous trees.

Ostrobothnia–Kainuu

Kiiminki fen area in Oulu is characterised by mire ecology, especially by fens and their vegetation. The fens are located in a mica schist zone in Kiiminki limestone area. The mixed heath forests of spruce and birch in the fragmented fen area contain aspens. These forests are mainly young or mature. The area of natural old boreal forests is low here. *X. tremulicola* individuals have been caught in a window trap from an aspen preserved as a retention tree in a clear felling outside a Nature site as well as in the border zone on a large damaged aspen.

Lapland

Saariaapa–Hattuselkä is located in the immediate vicinity of Runkaus Nature Reserve in Simo. In Saariaapa, forests are dotted around mires as islands of heath forest. In addition to spruces, deciduous trees also grow in the old pine forests of Hattuselkä, including very old aspens. In Runkaus area, too, there are not only mires but also old-growth forests with aspens.

The northernmost known occurrence of *X. tremulicola* is found in Louevaara hill formation, Rovaniemi, in the Triangle of Lapland. Old natural forests and strips of younger forest are found on the slopes of Louevaara hill. On the lower slopes, there are spruce forests with large aspens, whereas pine forests have taken over the higher slopes, and the top is dominated by supra-aquatic mixed spruce forests which include aspens. Three relatively large Natura sites are found in the vicinity: Pisavaara, Mustiaapa–Kaattasjärvi and Kilsiaapa–Ristivuoma. All of them have plenty of forest compartments with aspens.

Tuiskukivalo forest reserve, the area of which is over 100 hectares, is located at a distance of approx. 16 km from Saariaapa-Hattuselkä. Before the area was protected, clear felling had taken place in Tuiskukivalo, in which aspens had been spared as retention trees (Martikainen 2001). These clearings now have sapling stands which, in addition to retention trees, consist of aspen saplings. Sturdy old aspen trees are found in the old-growth forests of Tuiskukivalo.

It is likely that *X. tremulicola* occurs in other protected areas besides the ones listed here. Little is known about the distribution of the species in Ostrobothnia-Kainuu area, in particular. The species is protected, which should be taken into consideration in inventories. To look for the species on sites where it has been known to occur or in their vicinity, a derogation from the protection regulations concerning it must be obtained.

Decline of aspens

The aspen is vital for biodiversity. In commercial forests, it has declined due to historical forestry activities. This decline has been caused indirectly by favouring the spruce and the pine, and also directly by using mechanical and chemical means. Deciduous trees are cleared in young stands and young forests as they compete with the cultivated tree species for nutrients and light. At the final cut stage, old aspens may be felled.

The aspen reproduces from seeds but also asexually, mainly through root suckers. The suckers may be extremely prolific, especially if the felled tree was vigorous. Previously, efforts were made to prevent the growth of suckers by ring-barking aspens and by pouring herbicide (usually glyphosate) in grooves cut in the trunk with an axe. Deciduous tree saplings were sprayed on a larger scale between the 1960s and 1980s, as the aspen is an intermediate host of the pine shoot twist rust fungus *Melampsora pinitorqua*. The aspen produces numerous root suckers, especially when it is damaged or felled. In many places, signs of these old practices can still be seen in the forest structure, also in nature reserves. In an efficiently ring-barked forest, aspens cannot produce a new generation from root suckers, and almost all aspens may have died more or less at the same time. While the ring-barked aspens have formed decaying wood, decaying aspen wood gradually disappears in these forests as the trees rot.

The increased elk population also impacts the aspen continuum. Elk like to gnaw aspens and eat young aspen shoots. The grazing pressure from elk varies depending on the elk population in the area and the location of their winter grazing areas.

Natural early succession forests optimal for the development of a new aspen generation are very rare today. In closed-canopy forests, aspens usually are more or less of the same age. Aspens in old-growth forests are sturdy and old, and typically young aspens are missing, or there are only individual saplings or young trees growing in the forest. Clearings created by storm damage or

when individual trees die and fall down are ideal for the regeneration of aspens. In the past, forest fires created gaps in natural forest landscapes.

The reproduction of the aspen is tricky. Asexual reproduction is presumed to be the most effective on sites that have not burned or where the forest fire intensity has been low, whereas reproduction from seeds could be the most effective on sites of intensive fires (De Chantal et al. 2005). However, sexual reproduction from seeds is relatively common for the aspen, which is reflected in the genetic diversity of the species (Suvanto and Latva-Karjamaa 2005). The microclimate of the site results in variations in the germination of seeds and survival of seedlings. The best germination and growth are seen in humid but not wet low-lying areas on mineral soils (De Chantal et al. 2005). In old-growth forests, highly typical sites for aspens include the margins of different paludification sites and low-lying areas with spruces.

Several stages are critical for the development of old aspens. Firstly, the production of seeds and root suckers is slowed down by a lack of parent trees. Secondly, the development of aspen seedlings is prevented by a lack of suitable habitats in closed-canopy forests. Different disturbances favour deciduous trees. Thirdly, aspen seedlings are vulnerable to grazing herbivores. And finally, aspens are not always allowed to grow into old trees that would produce decaying wood when they die, especially in areas used for commercial forestry.

Whereas the importance of aspens for biodiversity is generally acknowledged, little information is available about the occurrence and age distribution of aspens at the landscape level. To fill in this information gap, some remote sensing projects have been conducted also in the Nordic countries (see Kivinen at al. 2020). These techniques offer some promising possibilities, and they can be combined with other data, including field survey results and ecological or genetic data. They also have their problems, however, including telling aspens from other deciduous trees. To identify individual aspens, such techniques as aerial laser scanning and hyperspectral imaging data have been used (Viinikka et al. 2020, Mäyrä et al. 2021). The results indicated that identifying aspens was possible, but wider use of the technique was restricted by its costs. The topic has also been studied using multispectral data collected using a drone, and the results are promising. More detailed information on the distribution of the aspen could help target actions especially at regions where aspens are not plentiful or where their age distribution is particularly unbalanced.

Research cooperation between the parties controlling protected areas and carrying out research should be stepped up to build a more accurate picture of the dynamics of the aspen and the significance of the factors that influence it.

Securing the aspen continuum

From the perspective of species that depend on this tree, the occurrence of aspens should be strengthened, both in terms of the spatial and temporal continuum. Aspens should be continuously available in a certain forest area to enable the population of a species dependent on it to survive

there. The forest should also have aspens of different ages to safeguard the continuity of this habitat over the long term. The size of the area in which the spatial and temporal continuum should be safeguarded depends on the characteristics of the species, including its ability to move between habitats. This scale is also being studied more extensively as part of conservation ecology research. The efforts to secure the aspen continuum should consequently comprise elements targeting both the spatial and the temporal aspect. In nature reserves where the age distribution of aspens is a problem because most of the trees are old, actions aiming to regenerate aspens should be prioritised. On commercial forestry land, actions that support the survival of aspens of different ages are the key.

Due to the natural dynamics and development of forests, the aspen continuum should be considered at landscape level. This means supporting the natural regeneration of aspens at the landscape level across a sufficiently large area, also in commercial forestry landscapes, and taking different actions simultaneously. Especially in small protected areas, securing the aspen continuum is not possible without actions in the landscape surrounding them.

Factors that support the reproduction of aspens include different disturbances that create optimal conditions for the growth of such pioneer tree species as the aspen. In protected areas, the most important ones of these are natural disturbances, including storms or, across smaller areas, the dynamics of small clearings. Of human actions, prescribed burning for restoration purposes is the most vital. Prescribed burning supports the regeneration of aspens by creating early succession habitats ideal for deciduous trees, which have low tolerance for competition and being overshadowed. Forest fires produce habitats suitable for *X. tremulicola* over the long term if aspens are allowed to grow into sturdy old trees.

In terms of securing the aspen continuum in protected areas, the most relevant sites are forests where forest management had been carried out before they were protected. Actions that support the regeneration of aspens include clearing space for aspens in young and mature managed forests by making small clearings. For the purposes of this document, this means making clearings with a small surface area where, as a rule, conifers are felled to reduce shadowing and competition and to promote the establishment of aspen seedlings. By felling trees and leaving the trunks lying around in a tangle, an effort can be made to prevent elks from accessing the site and grazing on it. Trees can also be removed from around the largest aspens if this does not put other significant ecological values at risk, such as impairing the living conditions of epiphytes. Novel habitats in protected areas could also be used for aspens. For example, sections of forest roads in protected areas that can be closed to traffic and allowed to overgrow could be suitable sites for testing the reproduction of aspens.

The elk cause the most damage to forests in their winter grazing areas, which typically feature sapling stands regenerated with pines. As a whole, the trends in the size of elk populations are a key factor. The elk density has declined in Finland since 2001 (Natural Resources Institute Finland

2021) which means that, presumably, the elk also cause less damage to aspen saplings. Seedling development can be supported locally by fencing the most critical sites, whereas large-scale fencing is not cost-effective.

In places, beavers may have an impact on the aspen continuum. The beaver population is the largest in western Finland, where the original European beaver is found. The significance of beavers to aspen groves is local and restricted to the immediate vicinity of watercourses (Salandre et al. 2017). Beavers mostly feed close by a watercourse, where they also feed on trees of all sizes, whereas further away they prefer smaller deciduous trees. However, the beaver may also fell relatively large aspens within a distance of a few dozen metres from a watercourse (Salandre et al. 2017).

A monitoring study of the North American beaver in Evo area found that beavers stayed on one site for less than three years on average, presumably because of a lack of food in the area (Hyvönen and Nummi 2008). On average, they returned to the same site after nine years. The same study also monitored the impacts the beavers had on the development of deciduous trees, noting that flooding benefited deciduous trees at the cost of conifers. The ecosystem impacts of the beaver should consequently be monitored over a longer period and with different animal densities to obtain a more accurate idea of how this species influences the aspen dynamics. When considering the disadvantages, the advantages to the ecosystem may be overlooked.

In acute situations, the survival of aspens can be secured by removing the North American beaver, which is an alien invasive species. Due to the distribution and population size of beavers, however, this will not be a permanent solution.

Recommendations for habitat management in protected areas

- Supporting the regeneration of aspens promotes the creation of habitats suitable for *X. tremulicola* over the long term. Making small clearings and clearing space for aspens in young and mature forests of an even structure. In this connection, the ground surface can be broken, revealing the mineral soil. This promotes the reproduction of the aspen. Suitable sites include ones where moisture conditions are likely to remain stable during dry spells of the summer.

Consideration for the species in forest management and safeguarding its habitats by ecological management

To secure the long-term preservation of *X. tremulicola* and other organisms dependent on the aspen over the long term, attention should also be paid to the occurrence of aspens in commercial forests. Other seminatural sites, including various margins and protective zones as well as gardens, may also be important as sites for old aspens.

In forest management, aspens should be taken into consideration across their entire life span from seedlings to decaying wood. When managing and thinning out sapling stands and young forests, this would mean retaining aspen seedlings and saplings, for example as game thickets. In regeneration fellings, groups of aspens and individual trees can be preserved as retention trees. Aspens as retention trees are particularly important for demanding species, including *X. tremulicola*. In permanently preserved tree groups, aspens have an opportunity to grow into old trees with thick bark and a trunk with hollows. As decaying wood, aspens should always be retained. Supporting the regeneration of and preserving aspens is particularly appropriate on sites where the cultivated tree species is something other than the pine.

In state-owned forests, valuable groups of aspens can be saved as nature attractions (Kaukonen et al. 2018). Guidelines on good forest management issued by Tapio recommend that sturdy aspens, in particular, should also be retained on sites regenerated with pines (Tapio Oy 2020). Aspens can also be cultivated, either for pulp or roundwood. Suitable sites include herb-rich and more nutrient-rich slopes with organic soils. Voles and the grazing pressure of elk need to be taken into consideration when cultivating aspens.

Recommendations for managing the habitats of the species on lands used for commercial forestry

- Supporting the regeneration of aspens by retaining game thickets with aspen seedlings in the young stand stage. Supporting the regeneration of aspens is particularly important in the vicinity of protected areas.
- Retaining aspens of different ages as a mix of deciduous trees and in retention tree groups.
- Retaining sturdy aspens (over 40 cm) in all forest management actions.
- When harvesting, leaving dead aspens in the forest. Care should be taken not to damage decaying wood on the ground when harvesting.
- Creating artificial aspen snags in connection with clear felling and continuous cover forestry.

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