

Metsähallitus

*Management plan for
the habitats of
Stephanopachys
linearis and
Stephanopachys
substriatus*



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Management plan for the habitats of *Stephanopachys linearis* and *Stephanopachys* *substriatus*

Ecology and distribution



Stephanopachys linearis



Stephanopachys substriatus

Description

Stephanopachys linearis

Stephanopachys linearis (Kugelann, 1792), is a dark brown or black beetle 4 to 6 mm in length. Its body shape is cylindrical. The pronotum is rough and the elytra have a shiny surface and relatively dense pitting. In its appearance, this beetle closely resembles bark beetles, which live in recently dead trees and feed on the phloem layer. The distinguishing features between these species include the shape of the antennae: bark beetles have antennae with spherical tips, whereas

Stephanopachys antennae widen evenly towards the tip. The best way of seeing this difference is using a magnifying glass. *S. linearis* has backward pointing spines on its pronotum.

Stephanopachys substriatus

Stephanopachys substriatus (Paykull, 1800), has a rough surface and spherical body shape, and it is 4 to 6 mm in length. Its pronotum and elytra have tubercles, pits and brown hairs, which make the beetle look rough and dim in colour. In other respects, it is similar to *S. linearis* in shape and colour.

Larvae and feeding traces

The larvae of the two beetle species are similar. They resemble the larvae of bark beetles and certain woodboring beetles (Anobidae) living on similar trees. *Stephanopachys* larvae have three pairs of legs, while bark beetle larvae have none. The distinguishing feature between *Stephanopachys* and Anobidae larvae can be found in their mouth parts. They can only be seen at high magnifications (Ehnström and Axelsson 2002, Wikars 2015). *Stephanopachys* larvae mainly bore into the bark, whereas bark beetles' mother tunnels are mainly found in the wood, and the larvae mainly bore into the phloem.

Life cycle

Stephanopachys adults are active for most of the summer (Ehnström and Axelsson 2002). The larvae live inside the bark for one to two years and pupate in an oval pupation chamber in spring. Adult beetles emerge from the pupation chambers in late June or early July (Wikars 2015). Newly hatched adults look for new scorched trees to reproduce on.

Nutrition

Stephanopachys larvae live and bore tunnels in the bark of scorched trees. In particular, their tunnels are found in the inner bark. Sometimes the tunnels may also reach into the phloem layer.

Habitats

Stephanopachys linearis and *S. substriatus* live on standing spruces and pines that have been damaged by fire. Observations made in Sweden indicate that to some extent, *S. substriatus* favours spruces, while *S. linearis* prefers pines (Wikars 2006, Ranius et al. 2014). The trees in which these species live usually have a diameter at breast height of over 10 cm (Wikars 2006, Ranius et al. 2014), but they can be found on trunks clearly thinner than this.

These species usually lay their eggs in living trees on a burned site, usually very soon after the fire. The species are typically found in the base of the trunk, and the occurrences are limited to charred sections of the bark where the heat of the forest fire has damaged the phloem layer (Ilmonen et al. 2001, Ehnström and Axelsson 2002, Borowski et al. 2018). A *Stephanopachys* occurrence may be

discovered when the adult beetle bores through the charred bark and reddish frass can be seen at the mouth of the tunnel on the surface of the scorched wood. The tunnels of the larvae are found in the layer between the living and dead part of the wood (Wikars 2015). Both species may occur on a trunk simultaneously. Bark beetle tunnels can also be found in similar areas.

Several consecutive generations of *Stephanopachys* beetles may live on the same trunk. This means that the occurrence may continue for several years after the fire. The probability of *S. linearis* occurrences has been found to decline when eight years have passed since the fire (Ranius et al. 2014).

Stephanopachys beetles typically colonise living trees (Borowski et al. 2018). On occasion, they have also been found on fully burned trees, or trees that are dead and dry with loose bark (Wikars 2006). However, the most efficient reproduction of these species takes place on live trees damaged across a smaller area. If the fire is too intense, it will kill the trees rapidly and more or less simultaneously.

While a less intense ground fire burns the mor, it only causes minor damage to the lower parts of tree trunks and does little to create suitable habitat. In fires that are optimal for these beetles, larger conifers survive with slight or moderate damage, which means that some of them will die slowly over the following years. Some trees survive as the damage stops spreading and heals over.

Stephanopachys beetles are early succession species that arrive soon after the fire and settle on damaged trees together with bark beetles. Finding the sites of forest fires as soon as possible is vital for them. Some species living in similar habitats can sense components of the smoke created by a forest fire even in very small concentrations. This means that the species must sense the smoke while the fire is burning or soon afterwards while these compounds still float in the air. The mechanism used by *Stephanopachys* beetles is not yet known. Adult *S. substriatus* individuals have also been observed on sites used for storing timber and log piles. These beetles are believed to have been "attracted by the smell of wood" (Ilmonen et al. 2001). This would indicate that the substance that draws the species is a volatile compound secreted by the tree.

The occurrence of *Stephanopachys* beetles is influenced by the number of suitable trunks on the burned site and landscape connectivity, or the sizes of the burned sites and distances between them (Ranius et al. 2014). Where the number of suitable host trees is higher, the species is more likely to find the site, and the site is more likely to be inhabited at a certain moment in time. The site of a larger forest fire is likely to have more suitable trees. If the site has a larger number of suitable host trees and if the trees are dying at different times, this increases the length of the period during which the site is suitable for the species. It is unlikely that the species can immediately colonise all suitable areas on the trunks. This means that there will be suitable habitats for the beetles on the burned site for a longer period. If the trees dying at different times are suitable for *Stephanopachys* beetles in different years, this will have a similar effect.

In an area with recurring forest fires, the species have better preconditions for being preserved over the long term. It is potentially worthwhile concentrating prescribed burning to certain areas of fire disturbance sites on which the species occurs.

Distribution and status

Stephanopachys beetles are species of the boreal zone and coniferous forests in mountainous regions. In Finland, they are found in the southern parts of the country and Lapland, mostly in eastern areas. The westernmost observation in Southern Finland in the 2000s was made in Janakkala for *S. linearis* and in Salamajärvi National Park in Perho for *S. substriatus*. Similarly, the northernmost observations were made in Savukoski in Urho Kekkonen National Park and around Lake Inarijärvi in Inari. Northern areas appear to be emphasised in the current distribution of *S. substriatus* in Finland when compared to *S. linearis*.

More recent observations of *S. linearis* have been made in the 2000s than of *S. substriatus* (Suomen kovakuoriaisatlas 2020). In addition to their breeding habitats, *S. substriatus* adults were observed on log piles and walls of buildings (Ilmonen et al. 2001) and on old waned pine planks with the bark partly left on stored in the loft of a cowshed in Oulu; additionally, they were caught by netting among grasses and bushes in the timber storage area of a sawmill in Savukoski.

S. linearis is a palearctic species of the boreal zone. It occurs in the Nordic and Baltic countries, Poland, Belarus and Ukraine. Its range extends all the way to the Far East. In addition, separate occurrences have been found in mountainous regions of Central and Southern Europe (Borowski et al. 2018).

S. substriatus is a holarctic species found not only in Eurasia but also in Northern America. In Europe, its distribution is similar to that of *S. linearis*. The species is found in conifer forests in the Nordic and Baltic countries and in the Alps.

Both species have been classified as near threatened in Finland. Factors believed to put them at risk include a decline in the volume of decaying wood and old-growth heath forests as well as the reduced number of burned sites and other early succession sites.

Administrative status and legislation

EU Habitats Directive Annex II.

Protected under the Finnish Nature Conservation Act. (Nature Conservation Decree 160/1997, Annex 2a 471/2013)

Red List category in 2019: near threatened

Hyvärinen et al. 2019

Habitat management in protected areas

Distribution of *Stephanopachys linearis* and *Stephanopachys substriatus* in protected areas

S. linearis beetles have been found on the following Natura sites in the 2000s:

Kymenlaakso: Repovesi (Repovesi National Park),

Päijät-Häme, partly in Kymenlaakso: Kujjärvi–Sonnanen,

North Karelia: Petkeljärvi–Putkelanharju (Petkeljärvi National Park), Koitajoki area (Koivusuo Nature Reserve), Koli (Koli National Park), Patvinsuo (Patvinsuo National Park), Pönttövaara-Pahkavaara and Jäkäläkangas,

Kainuu: Elimyssalo area and the old-growth forests of southern Kuusamo,

Lapland: UKK National Park–Sompio–Kemihaara (Urho Kekkonen National Park and Sompio Nature Reserve).

In the vicinity of Natura sites, an observation was made in the forest reserve of Ukonsärkkä area (Suolaminvaara–Tervasuo/old-growth forests of Ukonsärkkä area). Additionally, observations of the species have been made in commercial forests in the vicinity of the following Natura sites on private and state-owned lands: Suurisuo in Janakkala, Metsäkoulu retention forest, old-growth forests of Jäppilä and Joroinen, Ruunaa and Näätävuoma–Sotkavuoma.

S. substriatus beetles have been observed on the following Natura sites:

on the boundary between Central Ostrobothnia and Central Finland: Salamajärvi (Salamajärvi National Park and Salamanperä Nature Reserve),

North Karelia: Patvinsuo (Patvinsuo National Park) and Jäkäläkangas,

Lapland: Pallas–Ounastunturi (Pallas–Yllästunturi National Park), UKK National Park–Sompio–Kemihaara (Urho Kekkonen National Park and Sompio Nature Reserve) and Lake Inarijärvi. The observations on Lake Inarijärvi were made on the wall of an outdoor toilet. Similarly to *S. linearis*, observations of *S. substriatus* have also been made in Ukonsärkkä forest reserve.

S. substriatus has been found in the vicinity of the following Natura sites: the old-growth forests of Jäppilä and Joroinen, Koitajoki area, Ruunaa, Elimyssalo area, Näätävuoja–Sotkavuoma. In eastern parts of Lieksa municipality, several observations have also been made on prescribed burning sites in commercial forests on state-owned land.

In Oulanka, both species were the most recently observed in the 1980s. In Tuiskukivalo spruce forest in Rovaniemi, the most recent observation of *S. substriatus* was made in 1996.

Following the name of each listed Natura site, the national parks and nature reserves contained in the site are given in brackets. For more information on Natura sites, visit the Finnish Environment Institute's map services (Finnish Environment Institute 2018).

Fire continuum sites and restoration burning in protected areas

The fire continuum sites maintained by Metsähallitus (Päivinen & Aapala 2007, Hyvärinen & Aapala 2009) and prescribed burning for restoration purposes outside these sites play a key role in safeguarding the occurrences of the *Stephanopachys* beetles. On fire continuum sites, prescribed burning of forest takes place every three to five years in the protected areas as well as in the multiple-use forest areas in between them. The total number of fire continuum sites is 52 (Hyvärinen & Aapala 2009). The southernmost one of these sites is Sundalen in Hankoniemi (shooting and training range of the Finnish Defence Forces) and the northernmost one is Vätsäri Wilderness Area in Inari. Over the ten-year period 2009–2019, Metsähallitus Parks & Wildlife Finland has burned on average 76 hectares of forest every year. On average, ten sites were burned per year, most of them in Southern Finland. In 2018, for example, Metsähallitus Parks & Wildlife Finland burned 132 hectares of forest on 15 sites, and in 2020 a total of 57 hectares on ten sites. In 1989–2020, the average area burned has been around seven hectares.

In terms of maintaining pyrophilous species, prescribed burning of commercial forests for ecological management purposes as well as the burning of protected areas with a homogeneous forest structure produce suitable habitats for *Stephanopachys* beetles. Prescribed burning of natural boreal forests which are significantly or fairly representative regarding *Stephanopachys* beetles living on burned sites may be considered mainly where there are larger areas of natural forests.

The following sections describe the distribution of *Stephanopachys* beetles by Metsähallitus Parks & Wildlife Finland regional units as well as the status of fire continuums on Natura sites with known occurrences of these species.

Lake Region

Repovesi Natura site in Kouvola belongs to the fire continuum site bearing the same name (Hyvärinen and Aapala 2009). Kujjärvi–Sonnanen in Heinola is located at the approximate distance of 20 km from Repovesi. Prescribed burning of forests for restoration and ecological management purposes has been carried out in both areas since 2006. In Kujjärvi–Sonnanen area, sunlit habitats have also been managed by means of prescribed burning. In Repovesi, prescribed burning has been carried out regularly every two to five years, and the total area burned by the end of 2020 was around 55 hectares. This area is highly important for the vitality of the southernmost population of *S. linearis* beetles. The fire continuum site in Evo is also a potentially important area for them. In 2006, the species was found on a pine trunk on a burned site near Suurisuo in Janakkala at a distance of less than 30 km from Evo.

On Salamajärvi fire continuum site in Perho municipality in Suomenselkä, prescribed burning and restoration burning of forests have already been carried out every two to six years since 1997. The Salamajärvi site plays a key role for forest species in the watershed area where mires make up a significant part of protected areas. A fire continuum plan was prepared for this area in the Light & Fire LIFE project (Metsähallitus 2017).

The fire continuum site of Sorsavesi–Kivimäensalo includes the Sorsavesi archipelago and Kivimäensalo area in the old-growth forests of Jäppilä and Joroinen. Prescribed burning has taken place in Sorsavesi in 2017, 2018 and 2020. Kivimäensalo is an important site for the occurrence of threatened forest species in the municipality of Joroinen. The species found here have included *Phryganophilus ruficollis*, *Cossonus cylindricus* and *Protaetia marmorata*. However, the burned site where *Stephanopachys* beetles were found in 2004–2006 is located in state-owned commercial forests outside the protected area.

The strongest populations of pyrophilous insect species in North Karelia are found in the protected areas of Lieksa and Ilomantsi. Patvinsuo fire continuum site includes not only Patvinsuo but also Koitajoki area and Ruunaa. Of these sites, prescribed burning was carried out the most recently in Ruunaa in 2020. However, burning also takes place on suitable sites outside protected areas in the region. Such sites between protected areas include Pönttövaara–Pahkavaara, Jäkäläkangas and the old-growth forests of Ukonsärkkä. A significant part of Jäkäläkangas is included in the extensive burned site of Kitsi. Prescribed burning in Pönttövaara–Pahkavaara took place for the first time in 2009.

Petkeljärvi–Putkelanharju is located in southern parts of Ilomantsi. Prescribed burning for restoration purposes was carried out in Petkeljärvi for the first time in 2005, and a *S. linearis* was caught in a window trap the following year. The second time burning was carried out in the area was in 2018.

The slash-and-burn area of Koli comprises a separate fire continuum site. Slash-and-burn techniques have been used in Koli National Park every one to two years since 1994, most recently in 2021. Koli National Park is located at a distance of around 30 km from Patvinsuo. It is likely that the fire continuum on the eastern border maintains a viable population of *S. linearis* beetles, and some individuals find their way to the burned sites in Koli.

Ostrobothnia–Kainuu

In the Metsähallitus Parks & Wildlife Finland districts of Ostrobothnia and Kainuu, data available on the occurrence of *Stephanopachys* beetles or other pyrophilous species is scant, considering the maintained fire continuum sites and the quality of the old-growth forests in the area. This is more likely to stem from a lack of beetle research and monitoring by experts rather than the distribution of the species.

Elimyssalo fire continuum site in Kuhmo consists of not only the Natura site from which it derives its name but also the areas of Iso Palonen-Maariansärkät and Lentua. The fire continuum site was initially started as part of the Green Belt LIFE project in 2005. After an interval of one decade, prescribed burning continued in the Fire & Light LIFE project in 2018 in 2019, which included the preparation of a fire continuum plan (Heikura 2016a). Prescribed burning will also take place as part of the Beetles Life project, which is currently being carried out in the area.

Prescribed burning in the old-growth forests of southern Kuusamo took place for the first time as part of the Green Belt LIFE project in 2005 (Siekkinen 2007). Restoration burning was carried out in the area for a second time in 2015. The fire continuum site also includes Pahamaailma and Vieremänsuo area. Burning took place in Pahamaailma in 2006 and in Vieremänsuo area in 2011.

A fire continuum site has been maintained in Oulanka. Until recent years, however, burning intervals have been long (Heikura 2016b).

Lapland

Tuiskukivalo spruce forest is not part of a fire continuum site.

On the Natura site consisting of Urho Kekkonen National Park, Sompio and Kemihaara, prescribed burning of forest for ecological management purposes took place in Kemihaara in 2018. Natural forest fires blazed in Urho Kekkonen National Park in 2013 and 2018. A fire continuum plan was prepared for this area in the Light & Fire LIFE project (Puustinen 2016).

No prescribed burning for restoration purposes has been carried out in Näätävuoma–Sotkavuoma area in Kittilä. A fire continuum site in Näätävuoma–Sotkavuoma has been identified here (Hyvärinen and Aapala 2009), and a fire continuum plan is to be prepared for it in the course of a project that is under preparation.

The location of the observation site in Pallas–Ounastunturi is uncertain. The Natura site of Pallas–Ounastunturi is included in a fire continuum plan that covers Pallas–Yllästunturi National Park (Välimäki 2005). Prescribed burning has taken place once in Ylläs–Aakenus area in 2008. The plan is to be updated in a near future as part of a pending project. Burning is also being planned on the Natura site of Kuortano–Saivinvuoma–Launijärvi to the east of Pallas–Ounastunturi National Park.

It is likely that *S. linearis* and *substriatus* beetles also occur on the burned sites of other protected areas besides the ones listed. The distribution of these species is particularly poorly known in Ostrobothnia and Kainuu. Both species are protected, and a derogation from the protection regulations is always needed to look for the species in the vicinity of known occurrences. Trees suitable for the species must always be examined judiciously and with as light a touch as possible, as detaching bark damages the beetles' habitat. The search on the site must be called off immediately if the species is observed on it, or its occurrence is suspected.

Recommendations for habitat management in protected areas

- Maintaining fire continuums in protected areas. Forest must be burned every three to five years on each fire continuum site following the plan (Hyvärinen & Aapala 2009, Appendix 7). Maintaining fire continuums in Salamajärvi, Repovesi area, North Karelia, Peräpohjola and Forest Lapland is particularly crucial for the two species. These continuums can also be supported by prescribed burning elsewhere, in protected areas outside the fire continuum sites and on lands used for commercial forestry.
- The distribution of the species on restoration burning sites should be examined in closer detail in the area of Ostrobothnia and Kainuu.

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

The safeguarding of habitats suitable for *S. linearis* and *substriatus* beetles can also be supported in forests outside protected areas. These species depend on scorched conifers. Saving charred trees and producing them under controlled circumstances are key measures. These measures are also beneficial in areas with no known occurrences of either species in their vicinity, as a large number of other pyrophilous species live in Finland, not only insects but also fungi, for example.

The prescribed burning of forest regeneration sites improves the thermal and nutrient conditions of the site. Felling residue left on the prescribed burning site may benefit some pyrophilous species. *Stephanopachys* beetles need fire-damaged upright spruces or pines that are at least 10

cm in diameter. Such habitats can be created by the prescribed burning of retention tree groups. A precondition for prescribed burning is making a prescribed burning notification referred to in section 8 of the Rescue Act (379/2011) to the rescue services.

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

- In connection with a natural forest fire, not harvesting fire-damaged sturdy or relatively sturdy spruces or pines (diameter at breast height > 15 cm). Under the Forest Damages Prevention Act, at most 10 cubic metres of damaged spruces with a butt diameter of over 10 cm and at most 20 cubic metres of pines per hectare may be left in the forest.
- Leaving retention trees on sites to be burned.
- Prescribed burning of felled areas and retention tree groups for ecological management purposes. The retention tree group/burning site should have sturdy or relatively sturdy spruces or pines.

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