

Butterbur Hoverfly

(*Neoascia unifasciata*)

A Conservation Action Plan for Luxembourg 2025-2030

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LE GOUVERNEMENT
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Contents

Introduction	4
Status review	5
Species description	5
Systematics / taxonomy	5
Biology and ecology.....	5
Functions and values	6
Past and current distribution and demography.....	6
Habitat and resource assessment	9
Threat analysis	9
Conservation Action Plan	11
Vision	11
Goal 1 Governance and protection	11
Objective 1.1: Governance	11
Objective 1.2: Protection	13
Objective 1.3: Integration in existing plans.....	14
Goal 2 Research	16
Objective 2.1: Distribution & Habitat preferences	16
Objective 2.2: Interactions with other species	18
Objective 2.3: Host plant properties	19
Objective 2.4: Monitoring method	20
Goal 3 Conservation Action.....	21
Objective 3.1 Population management and expansion.....	21
Objective 3.2 Backup population in restored habitats	24
Objective 3.3 Invasive species control.....	26
Goal 4 Public Awareness.....	28
Objective 4.1 Public awareness	28
Objective 4.2 Stakeholder engagement	29
Distribution map references	33
References.....	36

Introduction

Biodiversity is in peril, but the majority of species, particularly invertebrates, are still neglected in global conservation efforts (Hochkirch et al., 2021). The percentage of threatened species in Europe is even higher among invertebrates (24%) than among vertebrates (18%) (Hochkirch et al., 2021, Hochkirch et al., 2023). Therefore, it is crucial to start conservation efforts for such neglected groups, particularly for invertebrates providing important ecosystem services, such as pollination.

Species belonging to the hoverfly family *Syrphidae* are considered the second most important pollinators after Hymenoptera, visiting 72% of globally important crops (Doyle et al., 2020; Radner et al., 2020). As opposed to most bee species, many hoverflies migrate in order to complete their life-cycles. Following warm temperatures, up to 4 billion hoverflies migrate across Europe every year (Wotton et al., 2019; Hawkes et al., 2024). This movement of ~80 tons of biomass strengthens the genetic diversity of plants, brings food resources for hoverfly predators and spreads biological control of pests over cultivated lands (Wotton et al., 2019; Pekas et al., 2020; Hawkes et al., 2024; Reynolds et al., 2024). However, similar to other insect groups, many hoverfly species are threatened by extinction (Vujic et al. 2022). Agricultural intensification and the disappearance of flower rich meadows threaten the persistence of many hoverfly species' populations.

Until now, the conservation status of 893 hoverfly species has been assessed for the European Red List, with 35% (314) of those being classified as "Threatened" with extinction (Vujic et al. 2022).

One threatened hoverfly species is *Neoascia unifasciata*, which has been classified as "Endangered" on the IUCN Red List of Threatened Species (van der Ent et al., 2021), highlighting the need for conservation action. Throughout its geographic range, this species has only been found in association with *P. hybridus* (butterbur), with the larvae feeding on its decaying stems (Treiber, 1991; Stuke, 2001). The loss of large and old butterbur stands may have contributed to the population declines of this species. Conservation action plans can be used to tailor interventions towards the needs of specialist species such as *Neoascia unifasciata*. The following document contains the first action plan for a threatened pollinator in Luxembourg. It includes a status review of *Neoascia unifasciata* in Luxembourg, as well as a detailed conservation action plan. The status review aims to summarize all information known about this species (taxonomy, ecology, distribution, threats etc.) that forms the basis of the planning elements (Vision, Goals, Objectives and Actions). The implementation of this plan will not only benefit *Neoascia unifasciata*, but also other species associated with butterbur and living in alluvial forest habitats.

Status review

Species description

Systematics / taxonomy

Neoascia unifasciata was described by Strobl (1898) as a variety of *Neoascia podagrica*, until it was recognized as a valid species by Barkemeyer & Claussen (1986). Doesburg (1953) described *N. obliqua ab. imperfecta* as a new variety of *obliqua*, which were later identified as *N. unifasciata*. However, these names were not synonymized as the name *imperfecta* is not valid (see Barkemeyer & Claussen, 1986). It is a small (3.5-6.5 mm), saprophagous mostly black hoverfly (Syrphidae) species (Fig. 1) (Thompson 1981; Reemer & Hippa, 2005). It belongs to the genus *Neoascia* (fan flies) which has ten extant species distributed throughout the Holarctic region with some species known from the Oriental region (Thompson, 1981, Reemer & Hippa, 2005, Skevington et al 2019). The main distribution in the Palaearctic region is in the temperate part on continental Europe and the Middle and Far East (Stackelberg, 1955). They are recognisable by a petiolate abdomen and thickened hind femur. The species exhibits sexual dimorphism, such that the female is characterised by a “club” like waisted abdomen that is wider at the end and thin around the waist (Van Veen, 2004). Furthermore, the abdomen of the males is marked by a complete whitish band (Fig. 1).

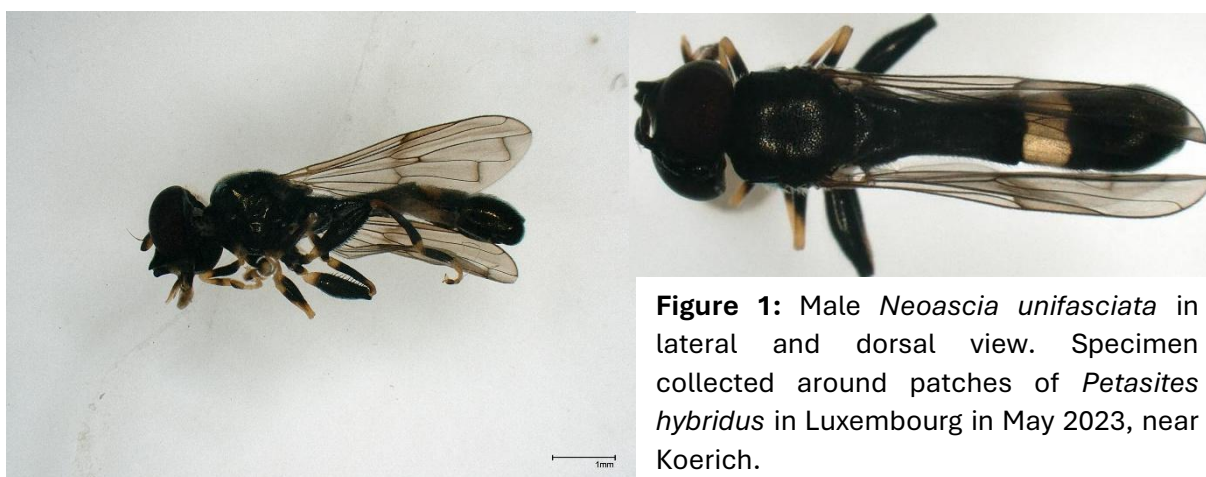


Figure 1: Male *Neoascia unifasciata* in lateral and dorsal view. Specimen collected around patches of *Petasites hybridus* in Luxembourg in May 2023, near Koerich.

Biology and ecology

N. unifasciata is associated with large, thick patches of butterbur (*Petasites hybridus*) plants. Its larvae are considered saprophagous, consuming its decaying stems (Treiber, 1991; Stuke, 2001; Kłasa & Soszynski, 2010). Eggs may be laid in other decaying matter found under *Petasites* cover such as *Populus* twigs (Couvreur, 2009). Individuals bask on the leaves of *Petasites hybridus* in

the morning. Later in the day, they can be observed flying above the *Petasites* alongside various other *Neoascia* sp. such as *N. obliqua* and *N. podagrica* (Jassat, 1998, Treiber, 1991). They have been observed resting on the stalks of *P. hybridus* during the hottest hours of the day (personal obs.). They occasionally leave the *Petasites* dominated patches to feed on the pollen/nectar of adjacent flowers.

The flight period of *Neoascia unifasciata* is reported to range from May to August (Krpáč, 2001; Klasa & Soszynski, 2010; Speight et al., 2017), but in Luxembourg it has been observed flying as early as April (B. Andrasi, personal obs.). Similar to other *Neoascia* species, *N. unifasciata* is a non-migratory species (Hawkes et al., 2024; Reynolds et al., 2024). Therefore, large patches of *Petasites hybridus* together with flower-rich meadows in the vicinity are important for the survival of the species (Speight 1988; Treiber, 1991; and personal obs.).

Flower visits by the adults are not well documented, but the existing observations suggest that it is not specialized in diet. Reported food plants vary across the species' geographic range from *Apiaceae*, *Euphorbia cyparissias*, *Caltha palustris* and *Stellaria* spp. in the Mediterranean (Krpáč et al., 2001; Vujić et al., 2020), as well as *Arrhenatherum elatius* and *Vernalis aestivalis* in Central Europe (Klasa & Soszynski, 2010; Tóth, 2011). In Luxembourg, it has been observed landing and flying around *Veronica chamaedrys* in two of the four known sites (B. Andrasi, personal obs.).

Functions and values

Detailed information about its functions and values within the ecosystem is lacking. While it is a pollinator, the efficiency of the species in pollination remains unknown. The species may play a role as pollinator of small flowers which are not often pollinated by larger bees or butterflies. It may serve as a good habitat quality indicator of non-polluted streams which are not disturbed and/or canalised. In its larval form, it may play a role in decomposing decaying *Petasites* stems, thus contributing to nutrient cycling.

Past and current distribution and demography

The existing records indicate a distribution from the Caucasus region to Central Europe and the Baltic states, from Iran and Georgia in the southeast to southern Netherlands and northern Germany in the northwest and Latvia in the northeast (Fig. 2). The southernmost occurrence of this species is in Bulgaria, while the Northernmost is Latvia (Fig. 2). They occur at moderate altitudes mostly between 228-560 meters (Treiber 1991). Occasionally, they may be found above 1,000 meters, e.g. in the eastern Alps or on Mount Epirus in Greece (Mazánek, 2006; Vujić et al., 2020; Kočić et al., 2023). In Luxembourg, the species was classified as “possibly extant” by van der Ent et al. (2021). Based upon this classification, a targeted search for the species was

conducted in 2023 in *Petasites hybridus* stands in Luxembourg and the species was found at two sites in the Eisch valley near Koerich (Bernhardi, 2023). Two further sites were found in 2024 during the preparation of this document. The species is known to have usually very small populations, and the overall population trend is considered negative (van der Ent 2021) as a consequence of the decline of alluvial forests. These alluvial forests are also under severe threat in Luxembourg.

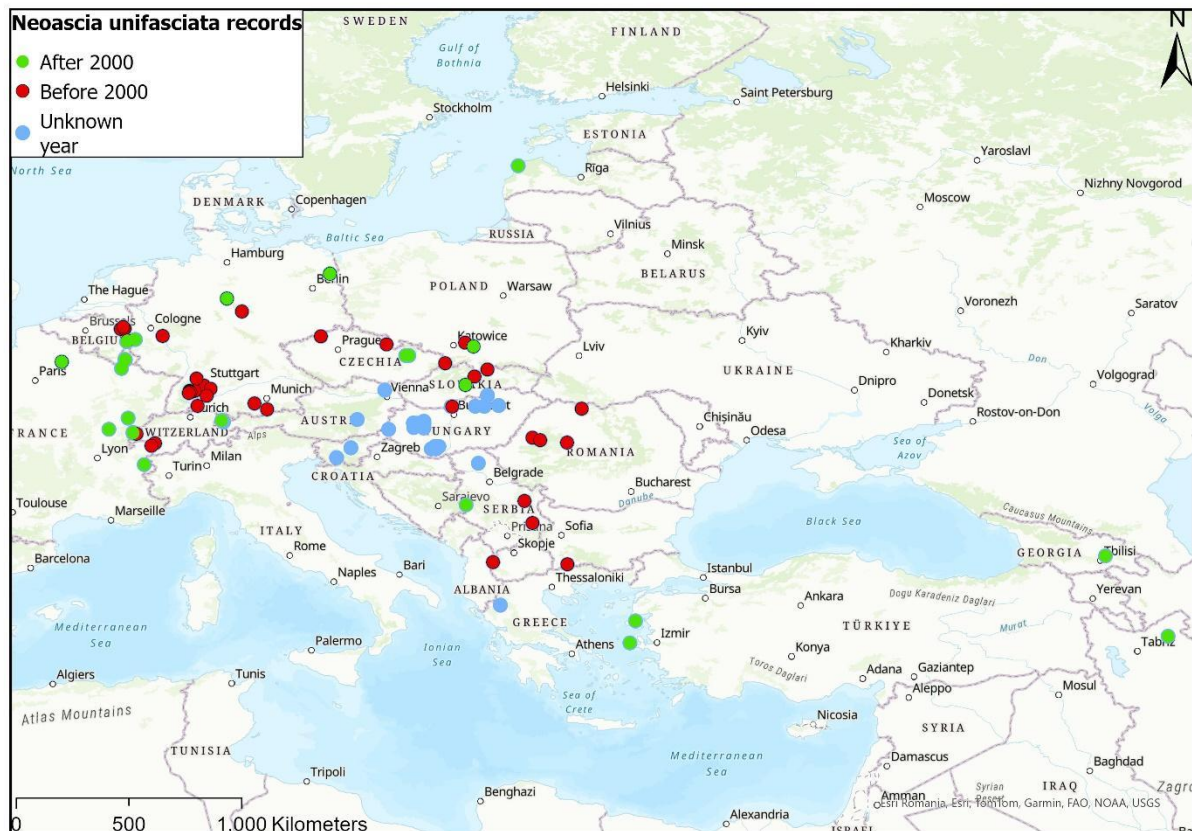


Figure 2: Geographical distribution of *Neoscia unifasciata* based on records published in the literature, on GBIF.com, Observation.org and museum/private collections.

N. unifasciata is currently listed as Endangered on the European Red List (Van der Ent et al 2021). Its disappearance has been reported from the Netherlands (Reemer et al., 2023). Currently, *Neoscia unifasciata* is known from four sites in Luxembourg with a maximum distance of 3.5 km between the sites furthest away (Fig. 3). It is assumed that the species was more widespread in the past but has lost habitat due to increasing development in stream valleys as well as canalization of streams.

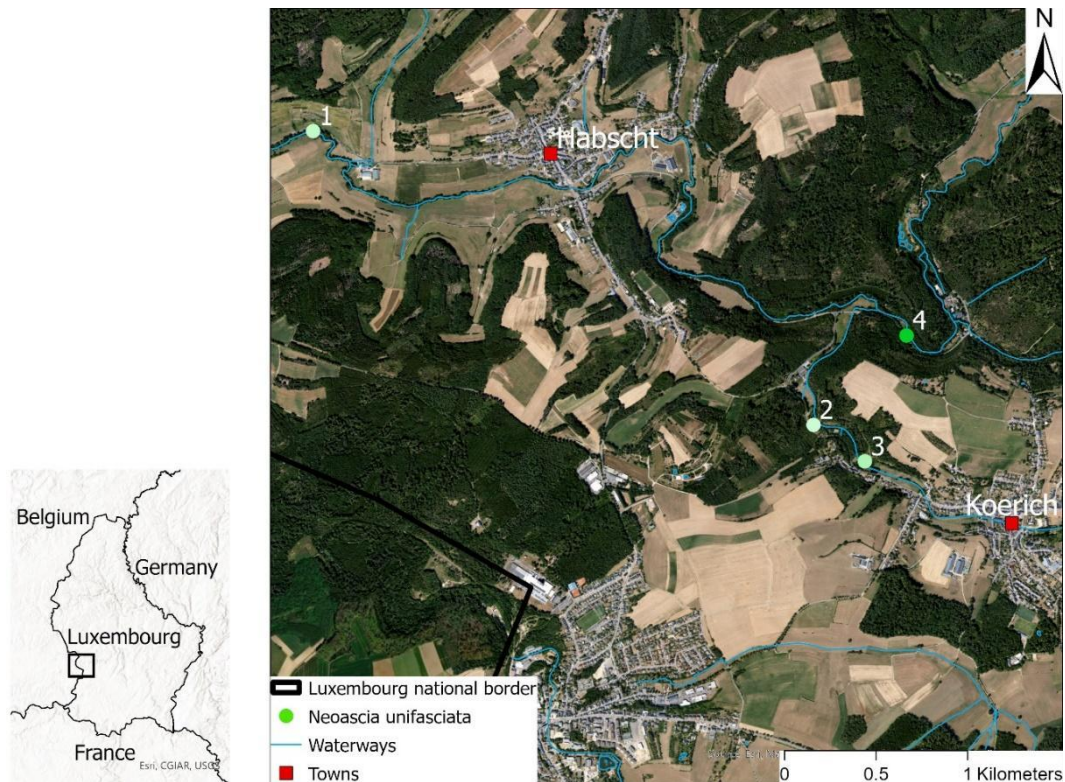


Figure 3: Map of the four sites (numbered green circles) of *Neoascia unifasciata* in Luxembourg. All specimens were found close to the Belgium border, near the villages Habscht and Koerich. Different shadings of green represent differences in the sum of all individuals of *N. unifasciata* recorded so far – Site 1: 3; Site 2: 1; Site 3: 8; Site 4: 63.



Figure 4. Photos of the four sites with occurrence of *N. unifasciata* (taken in October 2024)

Habitat and resource assessment

The typical habitat of *N. unifasciata* are wet meadows, tall herb stands with *Petasites* in alluvial situations, for example on moist gravel beds near upland streams and forest edges, often in valleys (Treiber, 1991; Klasa & Soszynski, 2010; Speight et al., 2017; Vujić et al., 2020, Van de Meutter et al., 2023). The current habitats are rather small and fragmented. Conservation interventions aimed at habitat management should focus on maintaining *Petasites hybridus* patches along with adjacent wildflowers, such as *Veronica chameadrys*. Critical resource thresholds are not yet known for this species.

Threat analysis

The threats to *Neoascia unifasciata* populations have not been investigated in detail, yet. According to van der Ent et al. (2021), the major threat to the European populations is overgrazing of alluvial gallery forests by livestock, pollution, nitrification and changes in the hydrology of river systems. Based on our knowledge of its ecology, populations of this species are vulnerable to any factors leading to a loss of large *Petasites hybridus* patches. In Luxembourg, overgrazing can be largely excluded as a threat to the species. Instead, some of the sites are affected by abandonment and subsequent shrub encroachment, which leads to overshadowing of *Petasites* stands, preventing them from developing larger stands in the future. Changes of the hydrology are probably an important threat to the species as many smaller streams have been regulated or are adjacent to farmland. The spread of invasive alien species, such as Japanese knotweed (*Reynoutria spec.*) and Indian balsam (*Impatiens glandulifera*), is another important threat. *N. unifasciata* may also be affected by spill-over of pesticides and pollutant run-offs from adjacent roads. Larvae of *N. unifasciata* may be negatively affected by nitrification. In the past, the Eisch has also been contaminated by long-term phenol spillovers.

Table 1: Potential threats that the recently discovered Luxembourgish populations of *Neoascia unifasciata* face, including their timing and severity. To view the sites to which the numbers refer, see Figure 3 above.

Site	Threats				
	Shrub Encroachment	Pollution	Nitrification	Land conversion	Invasive sp.
1	✓	✓	x	x	x

2	✓	✓	x	x	✓
3	✓	✓	✓	x	x
4	✓	✓	✓	x	x
Timing	Present	Past	Present	Past	Future
Severity	high	low	low	low	high

Abbreviations

AEV	Administration de l'environnement
AGE	Administration de la gestion de l'eau
ANF	Administration de la Nature et des Forêts
ASTA	Administration des Services Techniques de l'Agriculture
FFF	Fondation faune et flore
HfN	Fondation Hëllef fir d'Natur
LIFE	L'Instrument Financier pour l'Environnement
MECB	Ministère de l'Environnement, du Climat et de la Biodiversité
MNHNL	Musée national de l'histoire naturelle de Luxembourg
N&E	Nature & Ëmwelt
SICONA	Syndicat intercommunal du Centre pour la conservation de la nature

Conservation Action Plan

Vision

Luxembourg maintains well-connected unconfined stream valleys with periodically flooded areas that host larger stands of butterbur (*Petasites hybridus*), providing sustainable habitat for specialist insects, such as the Butterbur hoverfly, *Neoascia unifasciata*. This hoverfly species has self-sustaining, viable populations, so that its role in the ecosystem is ensured. Authorities, foresters, conservationists and local communities are aware of the importance of butterbur stands for maintaining populations of specialized insects. Sustainable management valuing and preserving these special habitats is in place.

Goal 1 Governance and protection

Governance and protection established and secured for *Neoascia unifasciata* and its habitat, providing leadership and implementation of the conservation plan; as well as protection via recognition in plans for associated protected habitats and pollinators.

Objective 1.1: Governance

To establish a steering group by 2025 in order to guide and facilitate implementation of the plan and review progress regularly.

Actions

1.1.1 Creation of a steering group

Purpose: To ensure the implementation of all actions

Note: Regular meetings each year to review progress (more often during the first year)

Who: MNHN / SICONA / ANF / N&E / MECB

By when: Action completed in 2025

Indicator: Regular meetings

Resources: staff time

1.1.2 Facilitate implementation of the action plan

How: MECB - FPE / LIFE funding (?)

Note: Consider involving Belgian organizations (e.g. Natagora), N&E might lack capacity for in-depth involvement

Who: SICONA / N&E / MNHN

By when: 2026

Indicator: Funding raised

Resources: staff time for proposal

*1.1.3 Ensure consent of private owners of areas with populations of *N. unifasciata**

Note: Sites 1 and 4 as well as parts of site 3 are private property; consent and in favourable situations conventions with private owners are needed to implement actions; ownership of surrounding areas should be checked

How: Contact private owners to seek their consent

Who: ANF-Arrondissement Centre-Ouest

By when: 2026

Indicator: Conventions signed

Resources: staff time

*1.1.4 Explore options for acquiring land with habitats of *N. unifasciata* from private owners*

Note: Sites 1 and 4 as well as parts of site 3 are private property; ownership of surrounding areas should be checked

Who: SICONA (acquiring land on open areas) / Natur & Umwelt / ANF-Arrondissement Centre-Ouest (acquiring land on forested areas)

By when: 2027

Indicator: report with overview of willingness of landowners to sell

Resources: staff time

Objective 1.2: Protection

To ensure that *Neoascia unifasciata* is added to the list of national protected species, and effectively protect all habitats of *N. unifasciata* by 2028.

Actions

*1.2.1 Add *Neoascia unifasciata* to the list of national protected species*

How: List recently submitted

Who: MNHN / MECB

By when: 2025

Indicator: species listed

Resources: staff time

Status: proposal was submitted in October 2024

*1.2.2 Ensure that the habitats of *N. unifasciata* are listed in as protected biotopes*

Note: Site 4 is currently correctly listed as a combination of 6430 (hydrophilous tall herb fringe communities), 6510 (lowland hay meadow) and BK10 (Calthion meadow); site 1 is currently listed as BK11 (marsh), and adjacent parts as BK10 (Calthion meadow), BK04 (sedge reed), BK06 (reed); focus on sites 2 and 3 (currently not listed)

Who: ANF-Service nature

By when: 2027

Indicator: habitats in list of protected biotopes

Resources: staff time

1.2.3 Ensure consideration of *Neoascia unifasciata* and its habitat in new or planned protected areas

Note: ZPIN 87 (Léisbech) is planned adjacent to the area, its borders may need to be adapted to include *N. unifasciata* sites. info ANF: the planning of this nature reserve has not yet been started and it is being designated by the water administration. ANF will contact AGE and MECB via its COPIL network when the process is being started.

How: Provide input to management plan (e.g. integrate flattening of Eisch and restoration of *Petasites* stands; removal of IAS)

Who: AGE / MECB / COPIL Natura 2000 Mamer-Äischdall-Gréngewald

Indicator: *Petasites* stands considered in management plan of ZPIN 87

Resources: staff time

1.2.4 Inclusion of the *Neoascia unifasciata* population near Koerich (site 2 and 3) in the existing Natura 2000 site

How: Reach out to MECB about options to expand Natura 2000 site

Who: COPIL Natura 2000 Mamer-Äischdall-Gréngewald

by when: 2029

Indicator: Current Natura 2000 site is expanded to include Site 2 and 3

Resources: staff time

Objective 1.3: Integration in existing plans

To ensure that *Neoascia unifasciata* and its habitat are considered in existing planning approaches by 2030.

Actions

1.3.1 Integrate *Neoascia unifasciata* conservation in the update of the Natura 2000 action plan

Note: Next plan will start in 2030, based on actions refined in 2025/6. Current Plan available here: <https://data.legilux.public.lu/file/eli-etat-adm-amin-2021-11-22-b4594-jo-fr-pdf.pdf>

How: Liaise with MECB to work on the revision of the plan
Who: MECB / ANF / COPIL Natura 2000 Mamer-Äischdall-Gréngewald
By when: 2026-28.
Indicator: Natura 2000 plan updated
Resources: staff time

*1.3.2 Ensure consideration of *Neofiber zibeticus* conservation in the implementation of the beaver action plan*

Note: Ask ANF-Service Faune sauvage et chasse about beaver family sites (spatially explicit) in the area. Beaver Action Plan available here: <https://environnement.public.lu/fr/publications/chasse/bt6.html>
How: Beaver management in habitats of *Neofiber zibeticus* should consider preservation of *Petasites* stands
Who: MNHN
By when: 2025-2030
Indicator: Beaver managers are aware of *Neofiber zibeticus*
Resources: staff time

*1.3.3 Integrate *Neofiber zibeticus* conservation into the National Newt Action Plan and other action plans*

Note: Site 1 (Habscht) is Natura 2000 site; Site 2 is owned by the commune, SICONA have planned a stream action on the site; Site 3 is (at least partly) owned by the commune as well, SICONA had planned stream restoration action; Site 4 is privately owned, but Natura 2000 site (and under biodiversity contract). SICONA tried to buy the site 4 land during a LIFE project. Integration in the national Calthion Action Plan should also be considered: https://environnement.public.lu/dam-assets/documents/natur/plan_action_especes/calthion.pdf
How: Measures to create new ponds at the *Neofiber zibeticus* sites are combined with those increasing *Petasites* stands.
Who: SICONA

By when: 2027/2028

Indicator: *Neoascia* action plan consulted and integrated

Resources: staff time / machines

*1.3.4 Ensure consideration of *Neoascia unifasciata* conservation in the implementation of the water framework directive*

Note: Restoration of Eisch is planned (3rd plan of water framework directive 2021-2027), hydromorphological measure (HY MO06), evaluation currently underway, new plan being developed

How: Reach out to AGE to contribute to implementation of restoration plan

Who: AGE

By when: 2028

Indicator: Management plan of water framework directive adapted

Resources: staff time

*1.3.5 Ensure consideration of *Neoascia unifasciata* conservation in the restoration of alluvial forests*

Note: Alluvial forest restoration is currently ongoing

How: Reach out to ANF

Who: ANF / Biological Stations / Natur & Umwelt

By when: 2027

Indicator: Alluvial forest restoration plan adapted

Resources: staff time

Goal 2 Research

Spatial and ecological requirements of self-sustaining *Neoascia unifasciata* populations as well as their interactions with other species understood and a standardized monitoring method developed.

Objective 2.1: Distribution & Habitat preferences

To improve knowledge of the distribution and habitat requirements of *Neoascia unifasciata* by 2028.

Actions

*2.1.1 Survey of distribution of *Neoascia unifasciata**

How: Search in *Petasites* stands along other streams/rivers (LIDAR or other sources); use biotope cadastre (shapefiles are downloadable); include citizen science

Note: e.g. Manternach (Syr), Redange

Who: FFF / MNHN / AGE

by when: **Completed in 2025**

Indicator: All potential sites surveyed 2x

Resources: staff time / travel costs

*2.1.2 Study life history, oviposition sites and larval habitat preferences of *Neoascia unifasciata**

How: field observations

Who: FFF / MNHN

by when: 2026

Indicator: Paper on life history, oviposition sites and larval habitat preferences published

Resources: staff time / travel costs

*2.1.3 Study importance of open canopy cover for *Neoascia unifasciata**

How: LAI analysis / GIS analysis (intersect with LIDAR data)

Note: currently underway, but more sites are needed to increase sample size

Who: FFF / MNHN

by when: 2025

Indicator: analysis completed

Resources: staff time / travel costs

*2.1.4 Study minimum area of *Petasites* stands for maintaining a self-sustaining population of *Neoascia unifasciata**

How: Analyse data gathered through field observations

Note: Include sites in Belgium to increase sample size

Who: FFF / MNHN

by when: 2026

Indicator: Minimum resource threshold estimate available

Resources: staff time / travel costs

2.1.5 Study adult food preferences, distance to flowering plants and abundance of flowers

How: Analyse data gathered through field observations, microhabitat analysis

Who: FFF / MNHN

by when: 2028

Indicator: Paper on habitat preferences published

Resources: staff time / travel costs

*2.1.6 Study importance of soil moisture and wind exposure for *Neoascia unifasciata**

How: Soil moisture measurement over the year and across site (grid approach)

Note: Distinguish foraging habitat from oviposition habitat etc.

Who: MNHN

by when: 2028

Indicator: Paper on habitat preferences published

Resources: staff time / travel costs

Objective 2.2: Interactions with other species

To improve knowledge of the ecological interactions of *Neoascia unifasciata* with other species in the habitat, including other *Neoascia* species as well as mammals by 2030.

Actions

*2.2.1 Study interactions with other *Neoascia* species*

How: Study resource partitioning between *Neoascia unifasciata* and other *Neoascia* species.

Note: Particularly competition with *N. obliqua* / *N. annexa* should be studied / Record habitat parameters and oviposition sites for all three species to analyse for potential competition

Who: FFF / MNHN

by when: 2030

Indicator: Paper on resource partitioning published

Resources: staff time / travel costs

2.2.2 Study effect of beaver and wild boar activities on the habitat

How: Camera traps to check if Beaver uses *Petasites* stand and potentially reduces *Petasites* densities. study potential threat by flooding or digging activities

Who: FFF / MNHN

by when: 2030

Indicator: Report or paper on effects of beaver and wild boar activities on the populations of *Neoascia unifasciata*.

Resources: staff time / camera traps / travel costs

2.2.3 Study the arthropod communities associated with butterbur

How: Field observations/collections of arthropods found within butterbur stands

Who: FFF / MNHN

by when: 2030

Indicator: Publication on arthropod communities

Resources: staff time / metabarcoding / travel costs

Objective 2.3: Management Effectiveness

To close knowledge gaps regarding the effects of habitat management and most efficient methods to promote the host plant and habitat of *Neoascia unifasciata* by 2028.

Actions

2.3.1 Study effects of management of adjacent meadows on *Neoascia unifasciata*

Note: On site 4, the area next to a large *Petasites* stand with *Neoascia unifasciata* is mown regularly. How does this affect the hoverfly? When is the best time for mowing? What is the best mowing height? Is mowing problematic? Which type of mowing to be used? Which adult food plants are on the meadow and how can they be promoted?

Who: FFF / MNHN / SICONA?

by when: 2027

Indicator: Effects of mowing understood

Resources: staff time / travel costs

*2.3.2 Study reproductive strategy of *Petasites hybridus* in order to optimize restoration protocols*

Note: It is unknown whether sexual reproduction or clonal reproduction are more important in the population dynamics of *Petasites hybridus*. This knowledge is needed to optimize restoration protocols.

How: Microsatellite analysis

Who: FFF / MNHN

by when: 2028

Indicator: Results from genetic study

Resources: staff time

Objective 2.4: Monitoring method

To develop and implement population monitoring for *Neoascia unifasciata* and its habitat as well as monitoring of the effects of conservation measures.

Actions

*2.4.1 Developing a standardized monitoring method for *Neoascia unifasciata**

How: probably something like timed counts / transect counts (visual) / test during the whole season at different times of the day and different weather conditions

Who: FFF / MNHN

by when: 2025/26: testing method, 2027-2030 implementation

Indicator: Monitoring protocol for *N. unifasciata* published

Resources: staff time / travel costs

*2.4.2 Integration of the monitoring protocol for *Neoascia unifasciata* into the Monitoring scheme for Rare and Threatened Pollinator species (RaTS).*

Note: A priority list for RaTS monitoring is currently being compiled by MNHN

Who: FFF / MNHN

by when: 2026

Indicator: Monitoring scheme integrated

Resources: staff time

*2.4.3 Establishing a monitoring scheme for *Petasites* stands that maintain *Neoascia unifasciata**

How: Simple measurement of area covered by *P. hybridus* (by GPS, photographs, drones...).

Who: FFF / MNHN

by when: 2026

Indicator: Monitoring method available

Resources: staff time

*2.4.4 Establishing a monitoring scheme for effectiveness of conservation actions for *Neoascia unifasciata**

How: Analyse data from population and habitat monitoring on sites with different measures

Who: FFF / MNHN

by when: 2030

Indicator: Monitoring method available

Resources: staff time

Goal 3 Conservation Action

Habitats of *Neoascia unifasciata* secured and expanded and its population(s) reconnected by habitat restoration

Objective 3.1 Population management and expansion

To manage the population(s) of *Neoascia unifasciata* and expand or (re)connect them by removing shrubs, trees and invasive alien species, and expand existing butterbur stands as well as floral resources

Actions

3.1.1 Remove fallen trees in existing butterbur stands

Note: particularly on site 4 there is a risk of falling trees as a result of beaver activity; take care not to impact the *Petasites* stand; needs consent of private owners

Purpose: To ensure the size and health of the *Petasites* stand is not compromised

Who: ANF – Arrondissement Centre-Ouest

by when: when the trees have fallen over (2025-2030)

Indicator: Trees are removed

Resources: staff time/ equipment

3.1.2 Vegetation map for spatially-explicit management plan

How: Map of butterbur, shrubs, trees, ponds, knotweed, streams, springs

Note: According to the biodiversity contract, mowing is only allowed after 15 June on site 4.

Who: FFF / MNHN / SICONA

by when: 2028

Indicator: Vegetation map exists

Resources: staff time / GPS / GIS

3.1.3 Hydrological map for spatially-explicit management plan

How: Map of existing drainages, ditches etc., use LIDAR

Who: ASTA / ANF / MNHN / land owners

by when: 2028

Indicator: Hydrological map exists

Resources: staff time / GIS

3.1.4 Study phenol contamination in sediments of Eisch

Note: Past phenol spillovers have led to a contamination of the Eisch; sediments should be analysed to avoid negative effects of any restoration measures of the stream bed

Who: AEV

by when: 2027

Indicator: report on sediment contamination

Resources: staff time / consumables

3.1.5 Spatially explicit management plan to expand Neoascia habitat

How: Spatial-explicit GIS plan where to remove shrubs, where to remove knotweed, where to restore streams, where to change agricultural management

Note: Workshop with all actors to ensure that all management measures are being implemented

Who: MNHN / ANF

by when: 2027

Indicator: Spatial plan exists

Resources: staff time / GIS

3.1.6 Implementation of the management plan

How: Remove shrubs & trees, remove knotweed, close drainage ditch.

Note: Small strips with butterbur exist along roads, which need to be expanded; sites 1, 3 and 4 by SICONA, site 2 by ANF. Management of woody structures need to follow the national law on nature conservation i.e. authorisations need to be asked in advance.

Who: ANF – Arrondissement Centre-Ouest / AEG

by when: 2026-2030

Indicator: Strips cleared / expanded

Resources: staff time / machines / permits

3.1.7 Monitoring vegetation development (focus on butterbur trends)

How: Annual vegetation mapping

Note: monitor also effects of beavers

Who: MNHN / ecotop

by when: 2026 - 2030

Indicator: Annual vegetation maps exist

Resources: staff time / GPS / GIS

3.1.8 Explore options for increasing the flooded area in the area of Eisch and Giewelerbaach

How: Are there options for flattening the stream beds? Could more wetlands be restored

Note: Perhaps in new planned protected area (Léisbech),

Who: AGE / ANF / SICONA

by when: 2028

Indicator: Assessment in place

Resources: staff time

Objective 3.2 Backup population in restored habitats

Initiate stream valley restoration in a second valley for long term establishment of a second (meta)population of *N. unifasciata*

Actions

3.2.1 Petasites survey across Luxembourg

How: Map butterbur distribution in valleys of Luxembourg, as well as other parameters (shrub encroachment, flowering plants, canopy cover, slope, soil)

Note: Combine with search for *Neoascia*; ask Biological stations if they know larger butterbur stands

Who: FFF / MNHN / ecotop

by when: Completed in 2025

Indicator: Map with parameters exists

Resources: staff time / GPS / GIS

3.2.2 Prioritization of potential restoration sites

How: based upon likelihood of *Neoascia* establishment (parameters above & distance to known populations)

Note: Need information from research on habitat preferences

Who: FFF / MNHN

by when: 2026

Indicator: Priority list exists

Resources: staff time

3.2.3 Spatial restoration planning to expand *Petasites* stands

How: Spatial-explicit GIS plan

Who: MNHN / SICONA / ANF

by when: 2027/28

Indicator: Spatial plan exists

Resources: staff time, GIS

3.2.4 Develop methods to improve *Petasites* colonization

How: Assisted colonization / seeds or rhizomes? first trials at uncolonized sites or on site after *Reynoutria* removal

Who: MNHN

by when: 2028

Indicator: Translocation method developed

Resources: staff time / travel costs

3.2.5 Implementation of the restoration plan

How: Removal of shrubs & trees / sowing *Petasites* seeds (or planting) / stream restoration

Who: ANF / SICONA / HfN

by when: 2029 - 2030

Indicator: Restoration measures have been implemented

Resources: staff time / machines

3.2.6 Monitoring vegetation development (focus on butterbur expansion)

How: Annual vegetation mapping

Who: FFF / MNHN / SICONA

by when: 2028 - 2035

Indicator: Annual vegetation maps exist

Resources: staff time / GPS / GIS

3.2.7 Assessment of optimal colonization strategy of *N. unifasciata*

How: Depending on distance to next population: translocation?

Note: Is natural colonization possible / translocation needed? Captive breeding possible?

Who: Steering group

by when: 2029

Indicator: Assessment completed

Resources: staff time

3.2.8 Promote buffer zones along streams and rivers

How: Encourage farmers to extend unused buffer zones along streams and rivers; e.g. via biodiversity contracts (but in this case the site needs to be used by farmers); other types of contracts might be useful in cases of abandoned sites

Purpose: natural restoration of *Petasites* stands

Who: SICONA, ANF, N&E

by when: 2027-2030

Indicator: Increase in buffer zones along streams and rivers

Resources: staff time

Objective 3.3 Invasive species control

Control invasive plant species (*Impatiens glandulifera*, *Reynoutria* spp., *Helianthus tuberosus*) in the catchment areas of the Eisch and Giewelerbaach

Actions

3.3.1 Remove knotweed (Reynoutria spp.) in areas close to habitats of Neoascia unifasciata

Note: Immediate action is particularly needed near site 2; the site is privately owned (first contact owners); removal needs good supervision (take care not to spread rhizomes), over several years; contact Colabor (Bertrange); sow or plant *Petasites* after removal.

Who: ANF – Arrondissement Centre-Ouest

by when: 2025 (repeat annually until eradicated)

Indicator: Knotweed removed

Resources: staff time / equipment

3.3.2 Map distribution of Impatiens glandulifera, Reynoutria spp., Helianthus tuberosus in the catchment of Eisch and Giewelerbaach

How: First use mData - field survey

Note: Make sure to include Belgium!

Who: MNHN / Efor-ersa

by when: **Mapping Completed in 2025** (repeat annually until eradicated)

Indicator: distribution map completed

Resources: staff time / GPS

3.3.3 Use upstream-downstream control approach for Impatiens glandulifera

How: Cut *Impatiens* before seed development (2 x per year)

Note: LIFE RIPARIAS project may support this

Who: ANF – Arrondissement Centre-Ouest / COPIL Natura 2000 Mamer-Äischdall-Gréngewald

by when: 2027

Indicator: *Impatiens* distribution decreased

Resources: staff time / mowing equipment / travel costs

3.3.4 Use upstream-downstream control approach for Reynoutria spp.

How: Complete digging of rhizomes, careful removal

Note: Immediate removal at Giewelerbaach

Who: ANF – Arrondissement Centre-Ouest
by when: 2028
Indicator: *Reynoutria* distribution decreased
Resources: staff time / machines / travel costs

3.3.5 Liaise with Belgian colleagues to control invasive species in Belgian catchment area

How: Organize meetings with Belgian stakeholders
Note: Interaction with GC - EEE would be useful as the ministry and ANF regularly conduct meetings with the Greater Region.
Who: MNHN
by when: 2025-2030
Indicator: Belgian stakeholders are informed and cooperating on the control of invasive species for the benefit of *N. unifasciata* populations (and beyond)
Resources: staff time

Goal 4 Public Awareness

Awareness of the importance of butterbur stands and natural stream valleys as a habitat for threatened insects increased and local stakeholders actively engaged in their conservation

Objective 4.1 Public awareness

To increase awareness of butterbur stands and their associated insect species among the general public and local stakeholders.

Actions

4.1.1 Information sign along hiking trail at Eisch

How: Develop a sign explaining the importance of the habitat, the ecology of the hoverfly and the measures being undertaken to preserve it
Note: must be weather resistant; authorisation required?
Who: MNHN / ANF / SICONA
by when: 2027

Indicator: Sign completed/in place

Resources: staff time / designer / budget for production

4.1.2 Provide information about the project on Luxembourg's pollinator website

How: Include a short text, a link to this action plan and some photos on <https://www.planpollinisateurs.lu/>

Who: MNHN / MECB / Naturpark Our

by when: 2026

Indicator: Website information available

Resources: staff time

4.1.3 Excursion with stakeholders

How: Organize an excursion with important stakeholders to visit the site and inform about the species, the habitat and threats

Who: SICONA / MNHN

by when: 2025-2030

Indicator: excursion conducted

Resources: staff time / travel costs

4.1.4 Produce a short video on the project

How: footage from camera traps, drones...

Who: MNHN

by when: 2028

Indicator: video available

Resources: staff time / drone / camera

Objective 4.2 Stakeholder engagement

To provide means for citizens, communities and other stakeholders to engage in the conservation of *N. unifasciata* and its habitat by improving management and contributing to monitoring of threats

Actions

4.2.1 Monitoring of invasive plants and butterbur

How: Use iNaturalist/observation.org to call for data and manage data

Who: MNHN

by when: 2025 - 2030

Indicator: Citizen Science data available

Resources: staff time

4.2.2 Organize a hoverfly identification course

How: Invite a hoverfly expert (e.g. from the Netherlands)

Who: MNHN / SICONA / SNL

by when: 2028

Indicator: identification course conducted

Resources: staff time / travel costs / honorary

Table 2. Timeline of actions for the *Neoascia unifasciata* conservation plan (light grey boxes indicate the duration of the actions, the dark grey boxes indicate milestones in the action).

Goal	Objective	Action	Name of action	2024	2025	2026	2027	2028	2029	2030
1	1.1	1.1.1	Creation of a steering group	x	x	x	x	x	x	x
1	1.1	1.1.2	Facilitate implementation of the action plan		x	x	x	x	x	x
1	1.1	1.1.3	Consent of private owners			x	x	x	x	x
1	1.1	1.1.4	Land acquisition			x	x	x	x	x
1	1.2	1.2.1	Add to list of protected species	x	x	x	x	x	x	x
1	1.2	1.2.2	Protect habitats as "biotope"		x	x	x			
1	1.2	1.2.3	Consideration in new planned nature reserve (ZPIN 87)		x	x	x	x	x	x
1	1.2	1.2.4	Inclusion in existing Natura 2000 site		x	x	x	x	x	x
1	1.3	1.3.1	Integration in Natura 2000 Action plan		x	x	x	x	x	x
1	1.3	1.3.2	Consideration in Beaver action plan		x	x	x	x	x	x
1	1.3	1.3.3	Consideration in Newt action plan		x	x	x	x	x	x
1	1.3	1.3.4	Consideration in Water framework directive		x	x	x	x	x	x
1	1.3	1.3.5	Consideration in plans to restore alluvial forests		x	x	x	x	x	x
2	2.1	2.1.1	Survey of distribution		x	x				
2	2.1	2.1.2	Larval habitat preferences & life history		x	x	x	x		
2	2.1	2.1.3	Importance of open canopy cover		x	x				
2	2.1	2.1.4	Minimum area of <i>Petasites</i> stands		x	x				
2	2.1	2.1.5	Importance of flowers for adults			x	x	x		
2	2.1	2.1.6	Importance of soil moisture & wind exposure			x	x	x		
2	2.2	2.2.1	Interactions with other <i>Neoascia</i> species			x	x	x	x	x
2	2.2	2.2.2	Effects of mammals			x	x	x	x	x
2	2.2	2.2.3	Arthropod communities in <i>Petasites</i>						x	
2	2.3	2.3.1	Effects of meadow management		x	x	x			

2	2.3	2.3.2	Study on reproductive strategy of <i>Petasites</i>			x	x	x		
2	2.4	2.4.1	Standardized monitoring protocol		x	x	x	x	x	x
2	2.4	2.4.2	Integration in RaTS monitoring			x	x	x	x	x
2	2.4	2.4.3	Petasites monitoring			x	x	x	x	x
2	2.4	2.4.4	Monitoring effectiveness of conservation action			x	x	x	x	x
3	3.1	3.1.1	Remove fallen trees		x	x	x	x	x	x
3	3.1	3.1.2	Vegetation map			x	x	x	x	x
3	3.1	3.1.3	Hydrological map			x	x	x		
3	3.1	3.1.4	Phenole contamination				x			
3	3.1	3.1.5	Spatially explicit management plan			x	x	x	x	x
3	3.1	3.1.6	Implementation of management plan			x	x	x	x	x
3	3.1	3.1.7	Vegetation monitoring			x	x	x	x	x
3	3.1	3.1.8	Explore options for increasing flooded area		x	x	x	x		
3	3.2	3.2.1	<i>Petasites</i> survey across Luxembourg		x	x				
3	3.2	3.2.2	Prioritization of restoration sites			x	x			
3	3.2	3.2.3	Spatially explicit restoration plan				x	x		
3	3.2	3.2.4	Test methods to improve <i>Petasites</i> colonization			x	x	x	x	x
3	3.2	3.2.5	Implement restoration plan					x	x	x
3	3.2	3.2.6	Monitoring of vegetation development in restored sites					x	x	x
3	3.2	3.2.7	Assessment of <i>Neoascia</i> colonization strategy					x	x	
3	3.2	3.2.8	Promote buffer zones along streams			x	x	x	x	x
3	3.3	3.3.1	Remove knotweed close to habitats of <i>N. unifasciata</i>		x	x	x	x	x	x
3	3.3	3.3.2	Map distribution of IAS		x	x	x	x	x	x
3	3.3	3.3.3	Upstream-downstream control for <i>I. glandulifera</i>			x	x	x	x	x
3	3.3	3.3.4	Upstream-downstream control for <i>Reynoutria</i> spp.			x	x	x	x	x
3	3.3	3.3.5	Collaborate with Belgian colleagues on control measures		x	x	x	x	x	x

4	4.1	4.1.1	Information sign			x	x	x		
4	4.1	4.1.2	Provide information on pollinator website			x	x	x	x	x
4	4.1	4.1.3	Stakeholder excursion			x	x	x	x	x
4	4.1	4.1.4	Video on project			x	x	x	x	x
4	4.2	4.2.1	Citizen Science monitoring		x	x	x	x	x	x
4	4.2	4.2.2	Hoverfly Identification course					x	x	x

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Supplementary material

Distribution map references

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