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„Possible change in species diversity and species composition of nocturnal Lepidoptera in the Danubian floodplain after over ten years“

verfasst von / submitted by

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Abstract

The Marchfeld Dam separates the Danube Floodplains National Park into two parts. The part south of the dam is still flooded regularly, the northern part is no longer flooded. Due to this unique situation, the consequences of a draining of the floodplain as well as possible consequences of climate change on the moth community can be investigated in this area. In the periode 2006-2008, a survey of the moth fauna in this area was carried out as part of Christine Truxa's PhD thesis. In 2020, I repeated this survey and compare the changes in the moth fauna after 14 years.

Nocturnal Lepidoptera of the superfamilies Bombycoidea, Lasiocampoidea, Noctuoidea, Geometroidea and Pyraloidea were collected from March to November 2020. Ten traps were set monthly, five north and five south of the dam. 8109 moths from 359 species were collected. The sites north and south of the dam retained their individual character, as no alignment of fauna could be detected and the differences between sites were comparable to differences in the 2006-2009 period. As expected, the flood-prone sites were more diverse. This is particularly visible when species abundances are weighted more strongly in the assessment. No neozoa in relevant numbers were detected in the study. Likewise, no significant increase in termophilic species and no significant decrease in wetland species were detected. However, there was a detectable increase in the relative proportion of thermophilic species to total species numbers, but this was not robust. A significant species turnover was detected. However, this was caused by widespread generalists.

Thus, the study shows that the Danube Floodplain National Park has continued to maintain its unique character, which is shaped by the dam. The further desiccation of the floodplain and a termophilization of the moth fauna cannot yet be robustly stated on the basis of the results, but the tendencies are visible.

Abstract (deutsch)

Der Marchfeldschutzdamm teilt den Nationalpark Donau-Auen in zwei Teile. Der Teil südlich des Dammes ist nach wie vor durch regelmäßige Flutereignisse geprägt, während der nördliche Teil von dieser Dynamik abgeschnitten ist. Aufgrund dieser einzigartigen Ausgangslage können in diesem Gebiet die Auswirkungen der Austrocknung einer Au, sowie die möglichen Veränderungen durch den Klimawandeln auf die Mottengesellschaften untersucht werden. Christine Truxa untersuchte für ihre PHD-Arbeit. Im Zeitraum 2006-2008, die Mottenfauna. Im Jahr 2020 wiederholte ich diese Untersuchung um durch den Vergleich der Ergebenisse die Veränderung der Mottenfauna nach 14 Jahren zu untersuchen. Ich sammelte nachtaktive Lepidoptera der Superfamilien Bombycoidea, Lasiocampoidea, Noctuoidea, Geometroidea und Pyraloidea im Zeitraum März bis November 2020. Jeden Monat wurden zehn Fallen, jeweils fünf nördlich und fünf südlich des Dammes, aufgestellt. Insgesamt wurden 359 Arten mit insgesamt 8109 Individuen gefangen. Die Standorte nördlich und südlich des Damms behielten ihren individuellen Charakter, da keine Angleichung der Fauna festgestellt werden konnte und die Unterschiede zwischen den Standorten verlgeichbar war mit den Unterschieden in der vorhergehenden Studie. Wie erwartet waren die überflutungsgeprägten Standorte artenreicher. Das wurde besonders ersichtlich, wenn die Artabundanzen stärker gewichtet werden. Es wurden keine Neozoa in relevenaten Nummern festgestellt. Außerdem gab es keine signifikante Abnahme von Feuchtgebietsarten und keine signifikante Zunahme von thermophilen Arten. Es gab aber eine, nicht robuste, Zunahme des relativen Anteils von thermophilen Arten. Der feststellbare, signifikante, Species-Turnover wurde durch weiterverbreite Generalisten ausgelöst.

Es lässt sich daher sagen, dass der Nationalpark Donauauen nach wie vor seinen einzigartigen, durch den Damm geprägten, Charakter behält. Anhand der Ergebnisse lässt sich die Austrocknung der Au und die Thermophilisierung der Mottenfauna nicht robust belegen, aber die Tendenzen sind ersichtlich.

Introduction

Floodplains are among the rarest and most endangered ecosystems in Europe today (Hein et al., 2016; Mikac et al., 2018; Tockner and Stanford, 2002). In floodplains, diverse vegetation communities occur in a very confined space. Depending on the annual flood events, pioneer vegetation and older tree stands can be found in close proximity to each other (Ward et al., 2002). Floods repeatedly create pioneer sites and, as a result, the various successional communities (Schratt-Ehrendorfer, 2011). The individual characteristics of the floodplain vegetation depend on the water masses of the adjacent river and are therefore also influenced by the constructions along the river (Shilpakar et al., 2021). Due to centuries of river engineering, most are disturbed in their natural processes characterized by flooding (Erős et al., 2019; European Environment Agency., 2016). In recent years, there has been an increased interest in the ecosystem services provided by these habitats (such as flood protection, but also recreational value), creating an interest beyond conservation biology (Sanon et al., 2012; Schindler et al., 2016).

Arthropods in riparian areas must adapt to this alternation of extreme wetness and relative dryness. In the floodplains of the Lower Oder Auchenorrhyncha tend to be more submersion tolerant and overwinter in the floodplains, while Araneidae and Carabidae migrate back into the areas after flooding events. Submersion tolerant species tend to be wetland specialists and overwinter mainly as eggs (Rothenbücher and Schaefer, 2006). Floodplain forest species communities of the Araneidae are strongly influenced by flooding events and species with high dispersal ability have a particular advantage (Meriste et al., 2016). Riparian spiders avoid floods by actively migrating prior to the flood event, whereas flying carabids do not show proactive avoidance migrations and it is therefore assumed that they only retreat from the flood by flying when it arrives (Lambeets, 2009). Terrestrial bug communities are negatively impacted by flood duration and differ between different floodplain sites (Gratzer et al., 2013). On meadows in the Danube floodplain, highly dispersive butterflies were found to occur more dominantly, while philopatric species were more likely to occur on drier habitats (Fies et al., 2016). In riparian forests in eastern Austria, moth communities were more strongly influenced by the respective herb layer than by the flooding events, this was also the case for ground-layer moths (Truxa and Fiedler, 2012a). Wild bees were similarly less affected by the flood events than by the mowing of the meadows and thus the loss of their forage plants (Neumüller et al., 2018). Overall, ground-dwelling, non-flying arthropods are more affected by flooding, or exhibit corresponding avoidance behavior, while flying arthropods are less directly affected rather than by the specific vegetation characteristics of riparian vegetation. As a special site characterized by disturbance, riverine floodplains offer refuge (Shilpakar et al., 2021) and habitats for pioneer species (Lambeets, 2009).

The Danubian floodplain forest in the National Park Donau-Auen in Eastern Austria is an example of these highly endangered ecosystems (van Diggelen et al., 2006). This particular floodplain landscape is one of the largest of its kind to remain in Central Europe. It extends as kind of a "green belt" between Vienna and Bratislava (Nationalpark Donau-Auen GmbH, 2019a). The area is about 9500 hectares (Hohensinner et al., 2008). Since 1997 the area has been included in the IUCN protected area category II. Today, no silvicultural measures are undertaken in the forested areas except for occasional cutting of individual trees directly at public pathways when necessary for safety reasons. Accordingly, large amounts of dead wood have started to accumulate in the forests (Nationalpark Donau-Auen GmbH, 2019b). In addition, the increased infestation in the stands of *Fraxinus excelsior* with *Hymenoscyphus fraxineus* requires management measures (Schwanda et al., 2016). The various habitats within the national park are valuable laboratories for research on human driven impact on natural ecosystems. Drivers of change are for example climate change, the ongoing establishment of neobiota (Krebs et al., 2013; Lapin et al., 2019; Ließ and Drescher, 2008; Rak and Bergmann, 2013), the segregation in two flooding regimes through the Marchfeld-Schutzdamm (Weigelhofer et al., 2013) and the influence from intense farming practices on neighbouring agrarian land (Nationalpark Donau-Auen GmbH, 2019a; Vielberth, 2017).

The Marchfeld-Schutzdamm divides this valuable conservation area into two parts. Since the 1870ies, this levee prevents the near-annual flooding of parts of the forest, thus gradually changing its characteristics to a more xeric environment (Schratt-Ehrendorfer, 2011). Even though the Nationalpark Donau-Auen has to be topographically considered as a floodplain area, today the parts north of the dam are de facto more like a deciduous lowland forest on formerly flood-shaped soils (Schratt-Ehrendorfer and Rotter, 1999). Only the forest stands south of the levee still receive inundations in almost every year (Truxa, 2012). This separation into two different forest habitat types within a small area offers the opportunity to compare the change of their affiliated biota with ease.

Climate change, biodiversity loss and habitat segregation are amongst the most important topics of current conservation biology research (Ceballos et al., 2015; IPCC, 2014; Newbold et al., 2015). In recent years, reports on the decline of insect biomass (Hallmann et al., 2017) and species have received widespread coverage beyond the scientific community (Vogel, 2017). However, the relevance of particular drivers (Fox, 2013; Sánchez-Bayo and Wyckhuys, 2019) and the actual extent of the decline are still debated (Bell et al., 2020; Macgregor et al., 2019; Thomas et al., 2019). Arthropods, and especially the class of Insecta, as a widespread and well-studied tribe, have long been used as bioindicators for environmental change (da Rocha et al., 2010). Due to their close association with vegetation structure and composition, Lepidoptera (both moths and butterflies) have been used for years as indicators for ecological studies (Lomov et al., 2006; Summerville et al., 2004). Moths are the largest taxon for which considerable time-series abundance data exists, and because of their great species diversity and the many ecological niches they occupy, moths are a valuable model taxon for studying the effects of climate change and human impact on biodiversity (Wagner et al., 2021).

Because of the possibility to conduct cheap and easy quantitative ecological studies with moths (Truxa, 2012), this taxon allows to trace the ongoing habitat changes between the areas north and south of the Marchfeld dam in the Danube Floodplain National Park and also to analyse the effects of climate change on this valuable ecosystem. Earlier moth surveys revealed that (a) moth species diversity was higher in flood-prone than in non-flooded forest sections and (b) that the species composition of moth communities differed, but mostly with regard to variation in relative species abundances (Truxa and Fiedler, 2012a).

Based on earlier work of Truxa and Fiedler I strived to replicate part of their research with focus on the National Park Donauauen. The aim of the study was, by comparing the results obtained in the years 2006-2008 with mine (i.e. spring/summer 2020), to evaluate possible changes in species diversity and species composition of nocturnal moth assemblage. This present study is a chance to evaluate whether also in a lowland situation climate change and other drivers have left a signature in insect biodiversity after only a bit more than ten years in a vulnerable conservation area.

Based on earlier studies, I here set out to test the following specific hypotheses:

(1) Moth assemblages continue to be more species rich in flood-prone forest stands that still near annually experience riverine dynamics.
(2) Moth assemblages show signs of climate change and habitat change, i.e. novel species have arrived, while others have become rare or may even have even vanished locally.
(3) Some neobiota have established in the area in the meantime.
(4) Flood-prone and non-flooded forest stretches still differ in their moth species composition, but the extent of differentiation may have diminished over the past decade.
(5) Species composition has changed in both types of forest stands in the region, relative to the surveys over a decade ago.

Methods and study site

Study site

The study was conducted in the National Park Donauauen south of Orth an der Donau. Orth an der Donau is located 30km downstream from Vienna (Figure 1).

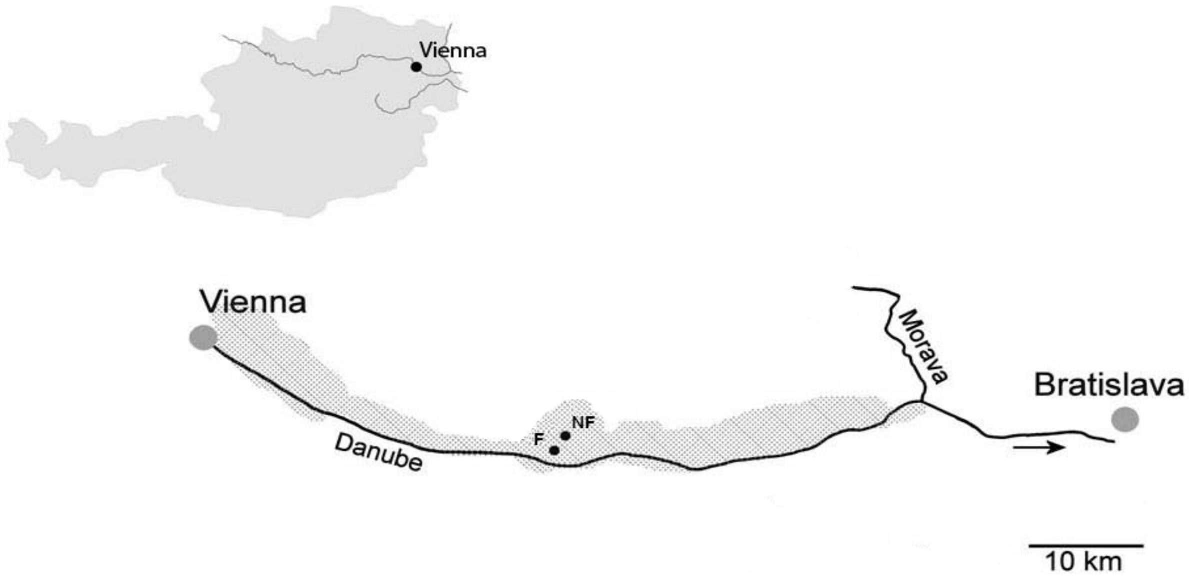


Figure 1: Location of the Nationalpark Donauauen with the study site. F = flood prone forest stands, i.e. south of the levee; NF = non-flooded forest stands, i.e. north of the levee (adapted from Truxa, 2012)

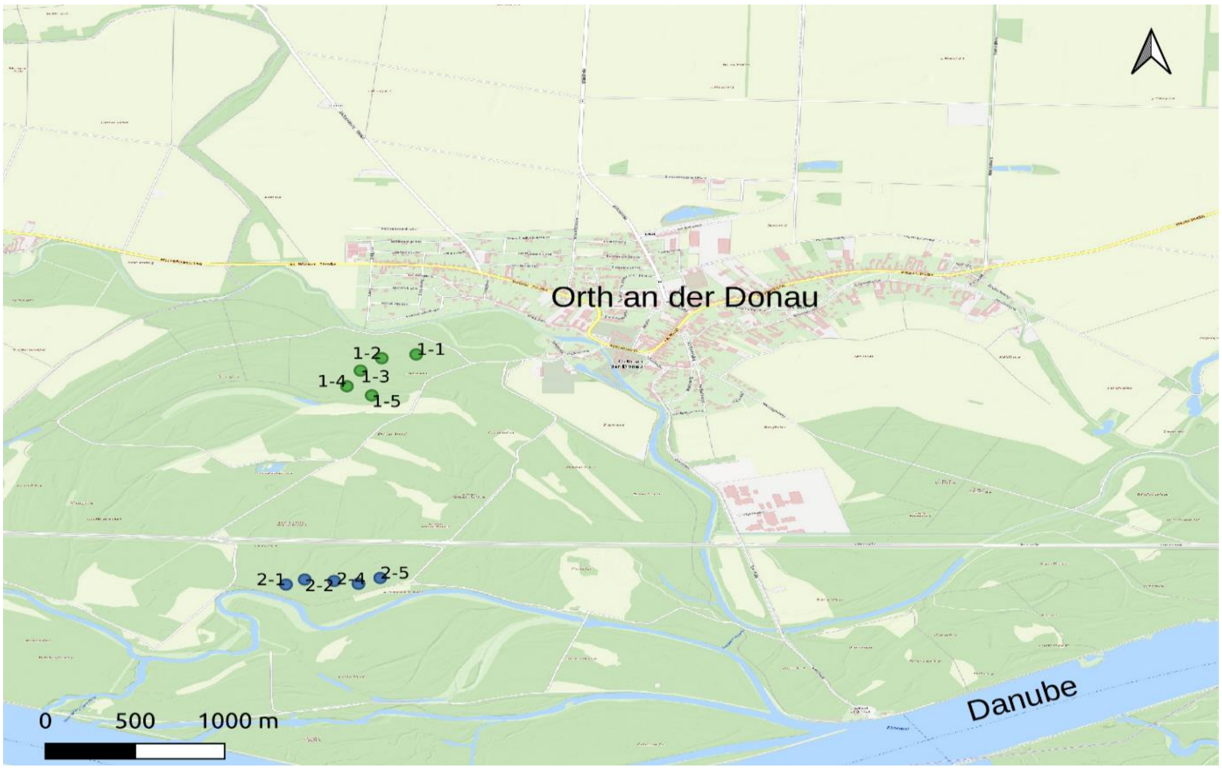


Figure 2: Map of the light trapping sites in the Nationalpark Donauauen. 1-1 - 1-5: sites north of the levee (non-flooded); 2-1 - 2-5: sites south of the levee (flood-prone). Data source: basemap.at

There were five light trapping sites north of the Marchfeld dam and five in the south (Figure 2). Only the southern part of the national park is still regularly flooded during episodes of high water levels in the river Danube. Accordingly, the two forest stands can also be characterized differently. To the north, maple, hornbeam and ash dominate the tree layer, while to the south mainly white poplars interspersed with single maple trees characterize the inventory. In the non-flooded areas, the herb layer contains plants that characterize the area throughout the year such as *Asarum europaeum* and *Hedera helix*, and in some places it is dominated by maple saplings. In the flood-prone zone, the herbaceous layer is much sparser and dominated by *Galium aparine*. Large stands of *Urtica dioica* are found especially at the transition zone to trails and clearings. The southern part still has the characteristics of a softwood floodplain forest. A species list of all plants recorded at the light trapping sites in the tree, shrub and herb layer can be found in Appendix I-IV and XI.

Methods

I sampled moths every month between late March 2020 and late November 2020 using automated LED-light traps (Brehm, 2017). The traps (Figure 3) consisted of two plexiglass discs, which are inserted into each other in the shape of a cross. In the middle of them is the light source. On the top were the battery and the timer, protected from rain by a plastic funnel. In the lower part hangs the catch tank. Inside the tank I placed a glass with some chloroform (Figure 3). The chloroform fumes numb the catches until the trap catch is being retrieved.

Figure 3: Light trap used in the study, in the early spring aspect at site 2-5.

The traps were placed at the same 10 spots over the whole sampling period in the year 2020. The first trap in each of the two forest stands (1-1 and 2-1, respectively) was placed at the same coordinates as Truxa stated for her surveys (2012). Distances between the remaining trap sites were roughly 100m within either of the two forest stands. Trap locations were chosen to be as far away from forest edges and trails as possible. In addition, I attempted to place them in as straight a line as possible. Therefore, for the flood-prone sites, the alignment resulted from the northern boundary by a forest road and a meadow and path located south of the forest patch. For the non-flooded sites, the margins resulted from trails to the north and east and a stream bed with dead wood to the south, which would have made setting and collecting the traps difficult. Due to the northeast - southwest orientation, the last trap site (1-5) had to be placed off line. Nevertheless, care was taken to ensure that the minimum distance was kept.

Trees with free-standing branches that had no shrubs in close proximity were selected for placing the traps. The light source was set close to chest height, i.e.

approximately 1.5 m above ground. Over the whole period no manipulation of the traps by wildlife (i.e. wild boars) or human passers-by was noticed.

Sampling occurred once a month from mid-March to mid-November. Best times for light-trapping are the phases around new moon (Appendix X), due to the more effective light trapping in darker nights (Truxa, 2012). Exact sampling dates were selected accordingly. The traps were placed only on dry days. If bad weather prevented the traps from being set, they were set on the next possible dry night. The traps were equipped with timers to switch the light on and off. Timers were set to start the LEDs half an hour after sunset and to shut them off half an hour before sunrise to adjust the trapping time to the main activity period of nocturnal Lepidoptera.

To sample all 10 sites, two days of fieldwork were needed, since per day five sites could be controlled (five north of the Marchfeld-Schutzdamm, or five in the south of it). Every month the temporal sequence of sites during sampling was reversed, i.e. starting in March with the northern part on the first day and the southern part on the second day. In April this procedure was reversed, and so on.

In the morning following a sampling night, trap content was retrieved and the traps were re-located or taken back into the lab. Afterwards, all sampled Lepidopterans were sorted out from the trap catch, transferred into glassine envelopes, and stored in a refrigerator at -20 °C in the laboratory until further analysis.

Focal taxa for this present study are all families of the Macrolepidoptera sensu (Mitter et al., 2017), i.e. basically the superfamilies Bombycoidea, Lasiocampoidea, Noctuoidea, Geometroidea and Pyraloidea. Specimens representing families of 'micro-moths' were retained, but not evaluated further for my thesis.

All Lepidoptera samples were identified to species level in the lab using faunal literature (Ebert and Rennwald, 1991; Fajčík, 2003; Fajčík and Slamka, 1996; Lepiforum e.V., 2002; Slamka, 2019, 2013, 2011, 2010, 2008). In 231 cases, when the specimens were in too bad condition, species identity was ascertained using the 'barcoding sequence' of the mitochondrial COI gene using the BOLD data base as reference. For this purpose, barcode sequences were generated through standard lab procedures and compared to reference data (Gottsberger et al., 2021; Rabl et al., 2020) (Appendix IX).

All moth records from the focal groups identified to species level were then entered into a spread-sheet software for further quantitative analysis.

Recorded moth species were categorized according to their preferred habitats based on literature (Ebert and Rennwald, 1991; Fajčík, 2003) as wetland species, thermophilic species, or neither. Pyraloidea were categorized in the same way using the works of Slamka (2019, 2013, 2011, 2010, 2008). For the purpose of my study, 'wetland species' means species that have their main distribution in floodplains, along streams, banks or in swamps. Those that occur both in floodplains and in other forests, parks or gardens were not considered for this purpose. Thermophilic species are those that occur mainly in warmer areas, especially if they are species with main distribution ranges in southern Europe.

For the classification of species as endangered, I used the list of threatened Lepidoptera published by the Federal Ministry of Agriculture, Forestry, Environment and Water Management (nowadays: Federal Ministry of Agriculture, Regions and Tourism) in the Grüne Reihe (Huemer, 2007). Neobiota were identified using the Environment Agency Austria list of neobiota in Austria (Huemer and Rabitsch, 2002).

Habitat structures at each trap site were characterized during vegetation surveys. In July all trees and shrubs with a DBH >1cm in a 10x10m square around the trap location were identified to species level, with the exact trap sites in the centre. Species identity and DBH of each tree and shrub individual was noted to allow for an estimate of basal area and thus above-ground biomass of the arboreal layer. Basal area was calculated as the sum of the cross-sectional areas of the trees at breast height in the 100m² square around each trap location.

The herb layer was surveyed twice (in April and July) during the vegetation period, because the herb layer vegetation shows a strong phenological turnover between spring and summer. For herb layer surveys, five plots of 2x2m² size were studied within the same radius around the trap as the trees. All vascular plant species and their approximate cover were noted, by performing Braun-Blanquet relevés (Pfeifer, 2016). The results were digitalised via Turboveg 2 (Hennekens and Schaminée, 2001). Plant species identification followed Exkursionsflora für Österreich, Liechtenstein und Südtirol (Fischer and Oberösterreichische Landesmuseen, 2008). For the ground cover at each trap site, the mean of the ground cover estimates of the respective five plots per trap site were calculated. The plant species lists of all plots per site were aggregated to obtain the total plant species count of each site.

Furthermore canopy density was analysed. At every site five pictures of the canopy were taken from the ground via a digital camera (Canon EOS 200D). Subsequently, the individual crown closure images were each colored using GIMP software (The GIMP Development Team, 2019). A blue tone was used for this purpose. The brightness and saturation were also reduced. Then the remaining colors were converted to grayscale using the "Desaturate" function. Finally, the images were posterized. For this, three channels were selected in the channel selection, since with two channels the overall image would be black. The images created in this way were further processed in PNG format with ImageJ (Schneider et al., 2012). For this purpose, they were formatted to 8-bit and the proportion of white areas was measured with the function "Analysis particles". Canopy closure was then defined as the fraction of black pixels per image. To characterize canopy cover at each light-trap site, the arithmetic mean of the five images taken per site was used.

Data analysis

From my list of moth records, I generated species-abundance matrices. Per site all sampling nights were summed up to gain one abundance-weighted list of all species. For characterizing local species diversity per trap site, I used Shannon's exponential diversity H' and Fisher's alpha (Fiedler and Truxa, 2012). To assess possible changes that might have occurred since the study of Truxa (2012), I also used the species data reported in her thesis, after adjustment in moth nomenclature to current standards. These diversity indices were then compared via two-way analysis of variance (ANOVA) between groups of sites representing the two flooding regimes and years of sampling.

Bray-Curtis similarity measures were used to express differences in species composition between the northern and southern sites and across the two survey periods. I used the sqrt-transformed variant to down-weigh the effects of a few over-abundant species. Based on this, beta-diversity patterns were graphically displayed via non-metric multidimensional scaling (NMDS). A two-way permutational analysis of variance (PERMANOVA) between flooding regimes and years of sampling was used to assess statistical significance of patterns visualized through the NMDS. Species with the greatest influence on site differences were identified using the SIMPER algorithm . Indicator species for the years and sites were determined with the IndVal function (Roberts, 2013).

Nestedness and species turnover were examined using the Jaccard index, i.e. disregarding species abundances. The aggregated beta-diversity among the individual sites was analyzed with the ‘betadisper’ function in the package Betapart (Baselga and Orme, 2012). An ANOVA was used to test for significance.

A Venn diagram with four sets was used to display the numbers of moth species shared between flood regimes and survey periods. It was generated with InteractiVenn (Heberle et al., 2015). Species accumulation curves and diversity profiles, again separated by sampling years and flood regimes, were generated with iNext Online (Chao et al., 2014).

Ground cover of the herb layer in spring and summer, number of species in the herb layer in spring and summer, canopy density, number of stems of woody plants, number of woody species, and DBH of living biomass were used as site descriptors. Sites north and south of the dam were compared using U-tests and t-tests.

I obtained weather data from the yearbooks of the Zentralanstalt für Meteorologie und Geodynamik for the nearest weather station situated in Groß-Enzersdorf (ZAMG, 2021).

For analyses, I used the programs R v4.04 (R Core Team, 2021) with the packages BiodiversityR 2.13-1 (Kindt and Coe, 2005), Vegan 2.5-7 (Oksanen et al., 2015), Betapart 1.5.4 (Baselga and Orme, 2012), Labdsv 2.0-1 (Roberts, 2013), RStudio Desktop v1.4.1106 (RStudio Team, 2020) and PAST v4.05 (Hammer et al., 2001). For graphic adjustment I used Gimp (The GIMP Development Team, 2019) and Inkscape (Inkscape Project, 2020).

Results

Characters of the light-trapping sites in the floodplain forest

I used a variety of structural characters of the forest around my 10 light-trapping sites to evaluate to what extent forest architecture and vegetation cover differed consistently between the flood-prone and non-flooded part of the forest near Orth/Donau. Plant species richness in the herb layer in summer proved to differ significantly between both fractions of the forest (see Table 1 for details on site descriptors and Table 2 for statistics). The results for number of woody species (p=0.053) and basal area (p=0.06) were just below significance. The same applies to the number of stems (p=0.06), but here the exclusion of *Corylus avellana* resulted in a p-value of 0.46.

There was a higher number of woody stems per unit area at the non-flooded sites, with higher numbers of hazel shrubs being the essential factor (Figure 4b). Likewise, there were more tree species growing in the drier forest area (Figure 4c) and more species in the herb layer in both spring and summer (Figure 4a). The average diameter of trees at breast height was higher south of the dam (Figure 4d). These data confirm that the vegetation of the forest ecosystems north and south of the dam differ from another in many relevant respects.

Table 1: Descriptors of forest structure at the 10 light-trapping sites near Orth/Donau. Non-flooded sites: 1-1 to 1-5; flood-prone sites: 2-1 to 2-5. For ground cover spring, summer and canopy density, the arithmetic mean of the five plots per site was used.

Site	ground cover (%) spring	ground cover (%) summer	species herb layer spring	species herb layer summer	total number of vascular plant species	canopy density (%)	stem number	woody species number	basal area in cm²
1-1	52.6	62	19	15	31	97	32	5	311
1-2	69	42	21	16	30	95.5	52	3	2782
1-3	70	79	25	18	33	97.4	46	6	656

1-4	45	57	12	12	27	95.4	49	7	3567
1-5	17	42	12	19	23	97.1	7	5	1900
2-1	73	43	14	8	17	93.2	5	2	7815
2-2	45	49	12	13	41	96.4	6	3	1577
2-3	91	58	15	15	40	95.8	17	3	6699
2-4	43	20.8	9	8	41	97.7	19	2	4537
2-5	36	18.4	11	10	43	96.6	31	5	5579

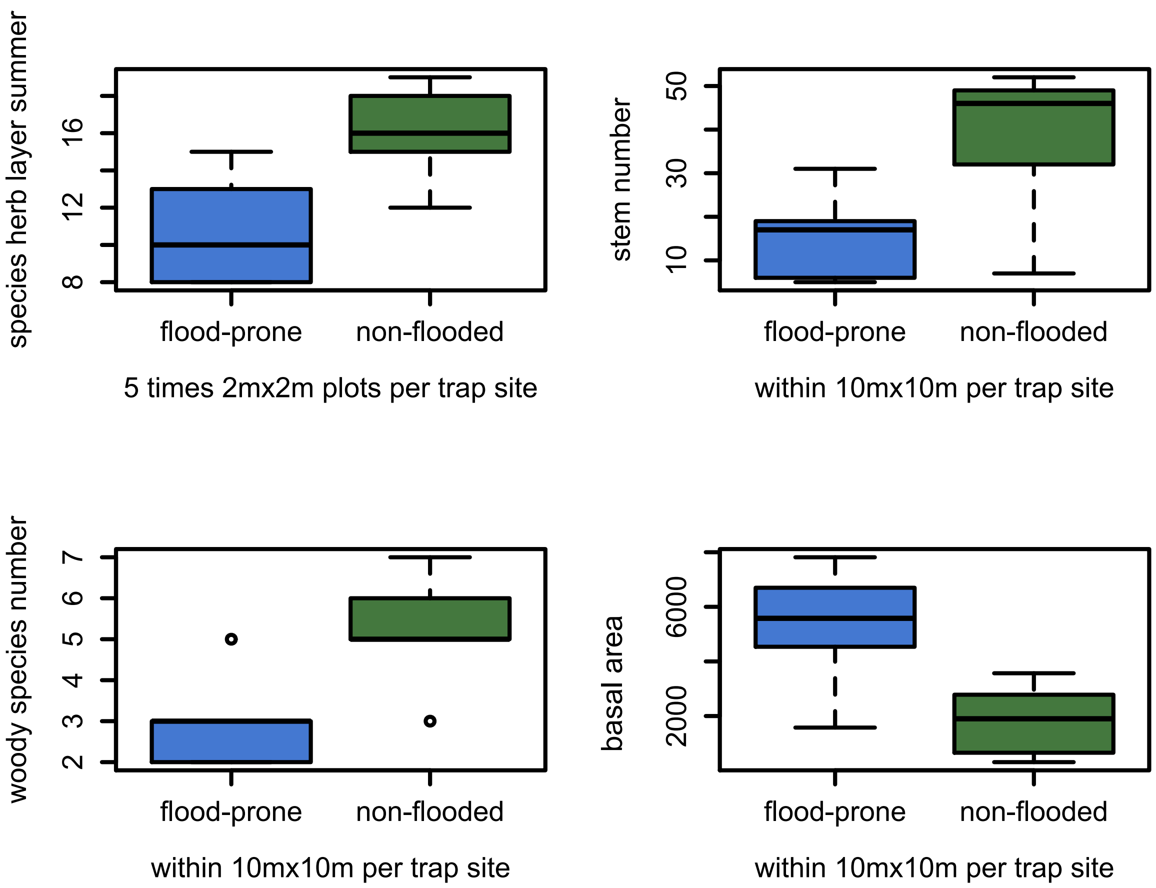


Figure 4: Boxplots of selected site characteristics in the year 2020: a) summed number of vascular plant species in the herb layer in summer within five 2mx2m squares at each trap site; b) stem number of living trees within a 10mx10m square around each trap site, including Corylus avellana; c) number of woody species within a 10mx10x square around each trap site; d) basal area in cm² within 10mx10m square around each trap site.

Table 2: p-values, z-scores, r-values of Mann-Whitney U-tests for site descriptors, comparing flood-prone with non-flooded forest stands.

	p-value	z-score	r-value
ground cover (%) spring	0.917	1.383	0.437
ground cover (%) summer	0.295	-0.539	-0.171
species herb layer spring	0.036	-1.8	-0.571
species herb layer summer	0.046	-1.686	-0.533
total number of vascular plant species	0.1425	-1.069	-0.338
canopy density (%)	0.835	0.972	0.307
stem number	0.06	-1.554	-0.491
woody species number	0.053	-1.6145	-0.029
basal area	0.06	-1.554	-0.491
stem number without Corylus avellana	0.463	-0.092	-0.029

General characterization of the moth samples

In total 8109 moths from 359 species were caught and identified during 19 light-trapping nights (Appendix X) the sampling campaign in 2020. The catches were composed of 3361 Geometridae (from 109 species), 1573 Noctudiae (117 species), 1235 Notontidae (21 species), 1022 Erebidae (37 species), 593 Crambidae (37 species), 120 Pyralidae (16 species), 58 Limacodidae (2 species), 47 Drepanidae (6 species), 39 Lasiocampidae (3 species), 36 Sphingidae (3 species), 15 Nolidae (5 species), 5 Saturniidae, 4 Cossidae, and 1 Hepialidae (1 species each). Geometridae accounted for 30% of all species (Figure 5a) and 41.4% of all individuals (Figure 5b), while Noctuidae contributed 32.6% of all captured species and 19.4% of all individuals .

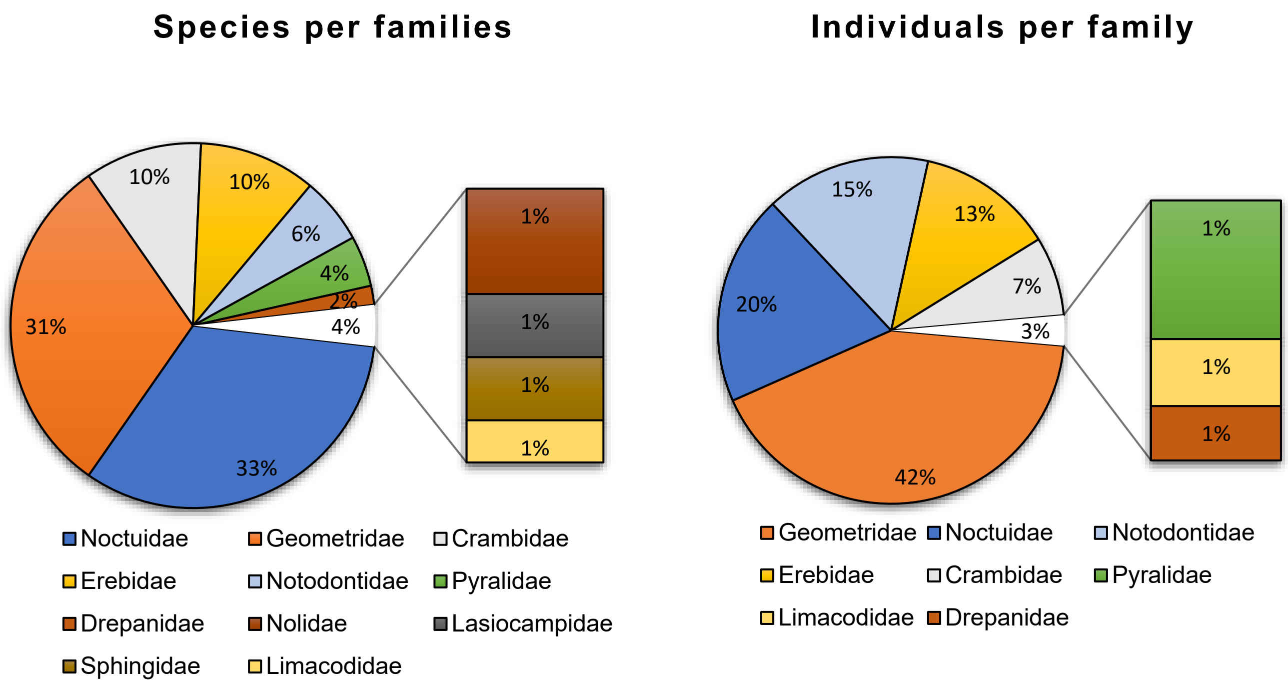


Figure 5: a) Affiliation of observed moth species to families in 2020 (n=359).; b) Affiliation of observed numbers of individuals to moth families in 2020 (n=8109).

Over the months, the lowest number of individuals was caught in October (117) and the highest in August (1972). The fewest species were counted in November (18) followed by March and October (21 each), and the highest number of species was reached in August (156) (Figure 6). Between October and November, there was a 1008% increase (from 117 to 1179) in individuals caught in the light-traps (Figure 7). This was mainly due to the mass emergence of one single species (756 individuals of the notodontid moth *Ptilophora plumigera*), but two geometrid species were also exceptionally common in November (*Erannis defoliaria, Colotois pennaria*). In the non-flooded areas, 14 species were captured in October. This was the lowest number. The largest number of catches was again in August (131). Accordingly, there were also the most individuals in August (1023) and the fewest in October and April, with 116 each. In the flood-prone area, August was the month with the highest number of individuals (949) and October the one with the lowest (50). However, June had the highest number of species (108) and November the lowest (12), followed by March and October (16 each) (Figure 8).

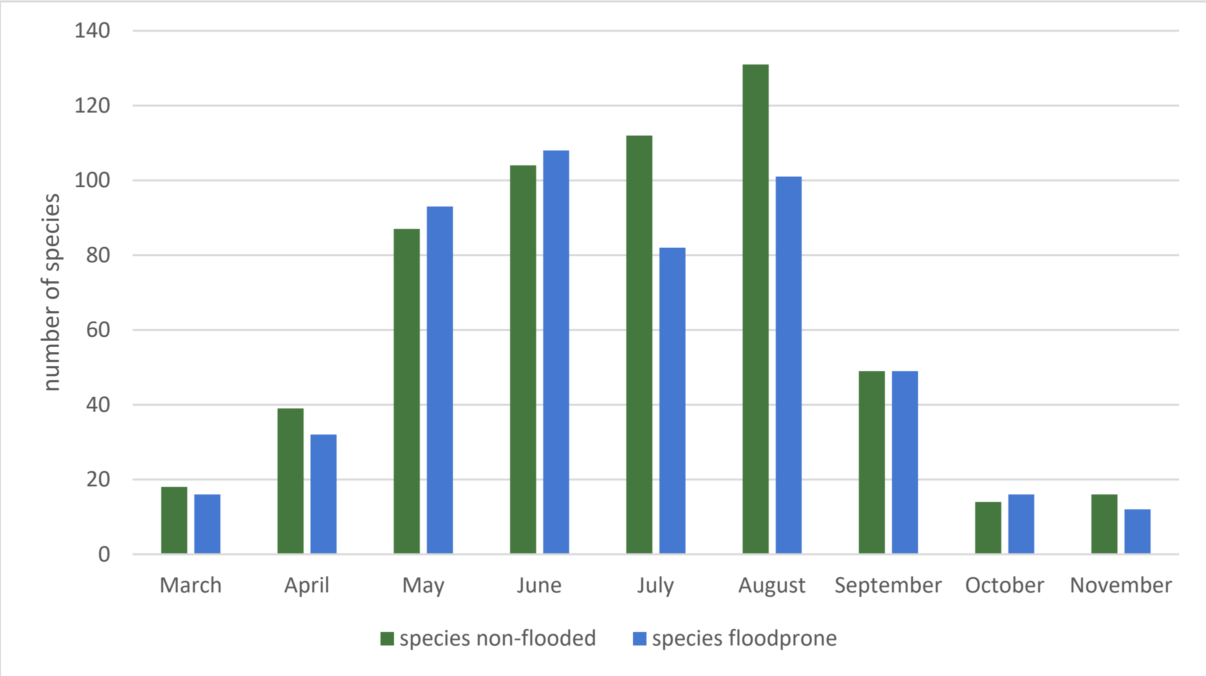


Figure 6: Number of moth species per month in 2020, separated between non-flooded and flood-prone forest stands.

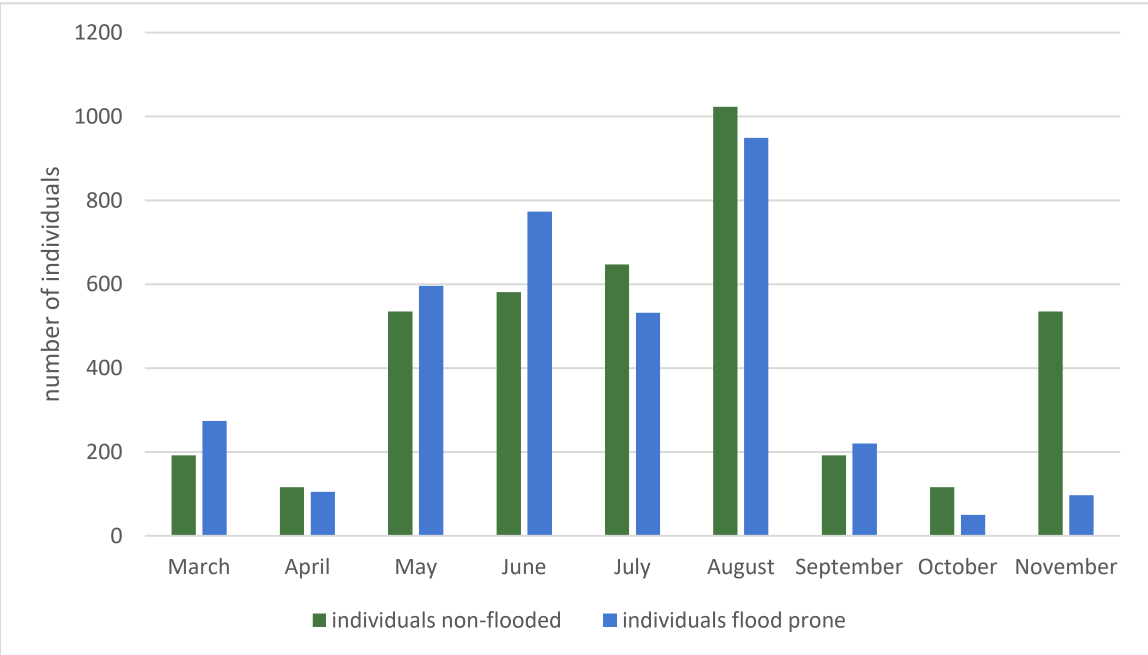


Figure 7: Number of moth individuals per month in 2020, separated between non-flooded and flood-prone forest stands.

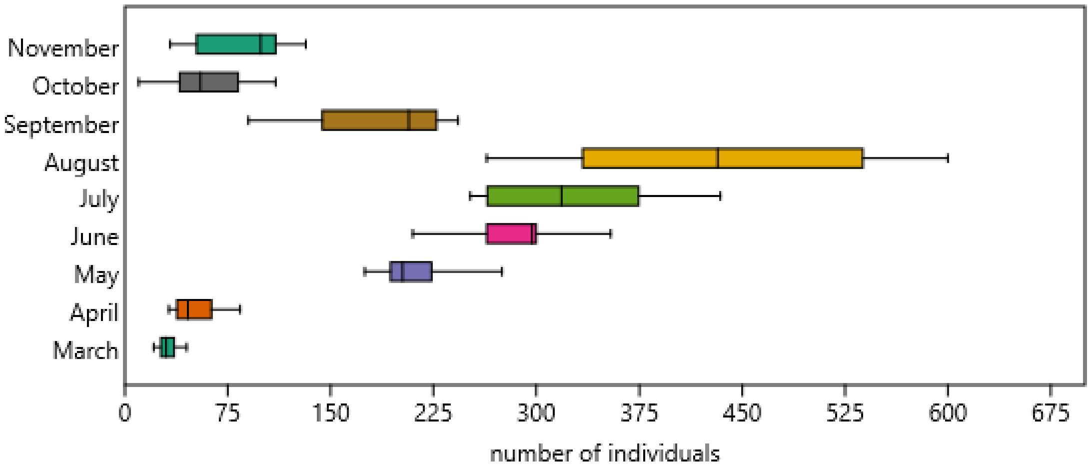


Figure 8: Number of individuals per catch night per month in 2020

Of the nocturnal Lepidoptera considered as neobiota in Austria, only *Cydalima perspectalis* and *Ephestia elutella* were captured, both were detected with just one individual in 2020.

In the non-flooded parts of the area 1 3 individuals of 30 species were caught, compared to 3 96 individuals (2 6 species) in the flood-prone areas. This means that . % of all individuals were caught in the northern (non-flooded) part of the area and .3% in the southern part. 3 of these species were found only in the north and 2 only in the south. 22 species (i.e. the clear majority) were shared between both forest areas (Figure 9).

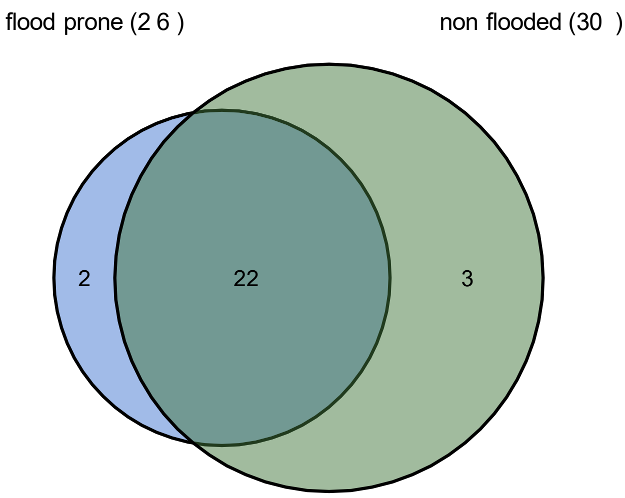


Figure 9: 2-set Venn diagram of shared and unique species in 2020 in the flood-prone and non-flooded forest area.

Mass emergences with more than 100 individuals per species occurred in 2020 only at the non-flooded sites. In trap 1-1 and 1-4 there were 155 *Ptilophora plumigera* each and in 1-5 206 moths of this same species, all in November.

The samples taken in 2020 by myself and those of Truxa together amounted to 424 recorded moth species. These two time periods had 242 species (57.1 % of the total) in common, while 115 species occurred only in my catches and 67 only in Truxa's (Figure 10). The non-flooded sites from the two trapping periods shared 189 species, while the flood-prone sites shared 131 species. This is a first indication of some turnover in moth community composition between the two time periods.

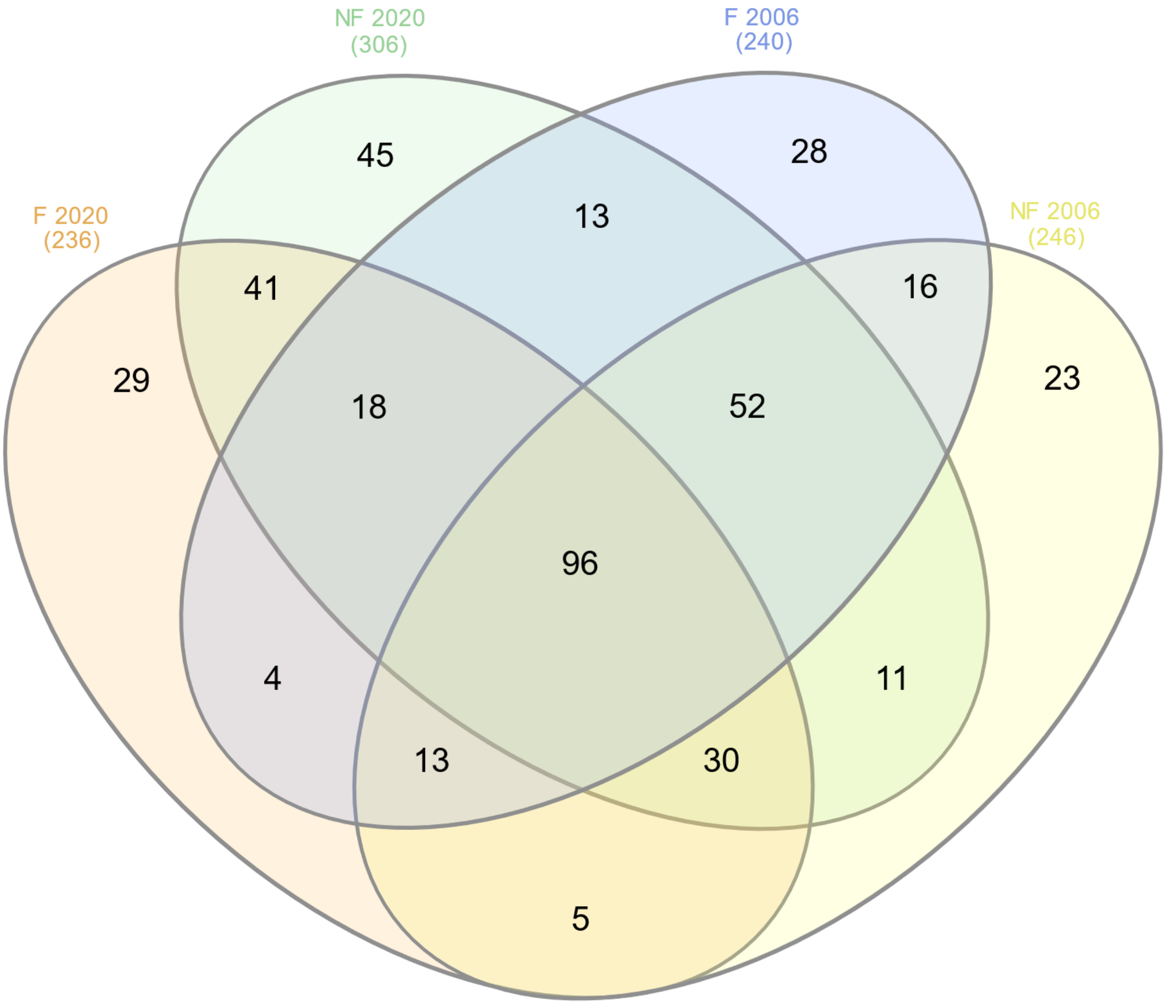


Figure 10: 4-set Venn diagram of the shared species, segregated by year and location. F 2020 = flood-prone area 2020; NF 2020 = non-flooded area 2020; F 2006 = flood-prone area 2006-2008; NF 2006 = non-flooded area 2006-2008.

Among the 115 moth species that were only recorded in 2020, 53 species were seen in just one single individual. Similarly, of the 66 species that did not occur in the 2020 samples, 39 species were represented with only one single specimen during the sampling campaign in 2006-2008. Therefore, much of the apparent species turnover between the two periods was due to singletons.

29 of the species seen only in 2020 occurred with more than 5 individuals, with 101 *Ennomos quercinaria* contributing the largest number (Table 3). These more common, newly recorded species are candidates for indicators of potential shifts in the moth communities over time. Of the species represented in the surveys of Truxa (2012), but missing in the 2020 samples, only 10 species were represented with more than 5 individuals, of which *Scopula immutata* had the largest share (Table 4).

Table 3: Individual numbers of exclusive moth species of the 2020 samples (i.e. species not recorded during the initial surveys in 2006-2008) represented by least 5 individuals.

Species	Non-flooded	Flood-prone	Total	Wetland (w)/ thermophilous (t)
Agrochola macilenta	*5*	*3*	*8*	
Anorthoa munda	*13*	*7*	*20*	
Apamea scolopacina	*2*	*6*	*8*	
Asthena anseraria	*0*	*5*	*5*	
Brachionycha nubeculosa	*17*	*11*	*28*	
Camptogramma bilineata	*8*	*2*	*10*	
Catocala fraxini	*2*	*6*	*8*	*w*
Cerastis leucographa	*2*	*3*	*5*	
Cirrhia ocellaris	*0*	*6*	*6*	*w*
Cosmia pyralina	*4*	*3*	*7*	
Crambus lathoniellus	*12*	*3*	*15*	
Cryphia fraudatricula	*1*	*6*	*7*	*t*
Dolicharthria punctalis	*3*	*2*	*5*	
Eccopisa effractella	*4*	*1*	*5*	
Eilema lurideola	*13*	*3*	*16*	
Endotricha flammealis	*43*	*4*	*47*	
Ennomos quercinaria	*86*	*15*	*101*	*t*
Lobophora halterata	*3*	*5*	*8*	*w*
Meganola albula	*7*	*4*	*11*	
Mimas tiliae	*11*	*7*	*18*	
Oligia latruncula	*1*	*12*	*13*	
Orthosia cruda	*2*	*5*	*7*	
Orthosia gracilis	*4*	*1*	*5*	
Paradarisa consonaria	*18*	*41*	*59*	
Peridea anceps	*6*	*2*	*8*	
Philereme transversata	*0*	*5*	*5*	
Polyphaenis sericata	*10*	*0*	*10*	
Saturnia pyri	*4*	*1*	*5*	*t*
Scoparia ambigualis	*5*	*2*	*7*	

Using an unpaired two-sample Wilcoxon test, no significant difference was detected between the occurrence of these exclusive species in 2020 between the northern and southern sites (z=0.200, p=0.579).

Table 4: Individual numbers of common moth species (n>5) that exclusively occurred in the samples of 2006-2008.

Species	**Non-flooded**	**Flood-prone**	**Total**	**Wetland (w)/ thermophilous (t)**
Agrotera nemoralis	4	1	5	
Agrotis ipsilon	6	0	6	
Evergestis pallidata	2	3	5	w
Ipimorpha retusa	1	6	7	w
Mythimna pallens	2	3	5	
Nycteola asiatica	2	8	10	w
Ochropacha duplaris	1	5	6	w
Oligia strigilis	7	0	7	
Scopula immutata	5	6	11	w
Trichiura crataegi	3	3	6	

Using the same method as above, no significant difference was found with regard to their individual numbers between the northern and southern sites in 2006 for Truxa's study either (z=1.334, p=0.909). These data show that among the more common species that were exclusive to either the earlier or the more recent sampling period there was no general difference between flood-prone and non-flooded forest sites.

In order to obtain a general overview over the concordance between relative abundances of recorded moth species between the two survey periods, I plotted the contribution of each species to the total catch (aggregated over all 10 light-trapping sites per survey period) in 2020 against the respective contribution in the years 2006-2008 (Figure 11). For visual clarity, I excluded all species that occurred only as a singleton. These singletons were also excluded from the calculation of the correlation coefficient. Overall, relative contributions of the 322 remaining shared species were significantly concordant between the two time periods (r=0.494, p<0.0001), but there was much variation, as evident from the moderate coefficient of determination (r^2=0.244). *Agrotis segetum* was overabundant in Truxa's samples and accounted for 7.11% of the catch in that year, while *Ptilophora plumigera* stood out in 2020 with contributing 9.32%. *Cyclophora annularia* had several hundred individuals in both periods (7.64% in 2006 and 2.98% in 2020). This analysis confirms that massive abundance fluctuations occurred between the two time periods that accrued to many different moth species.

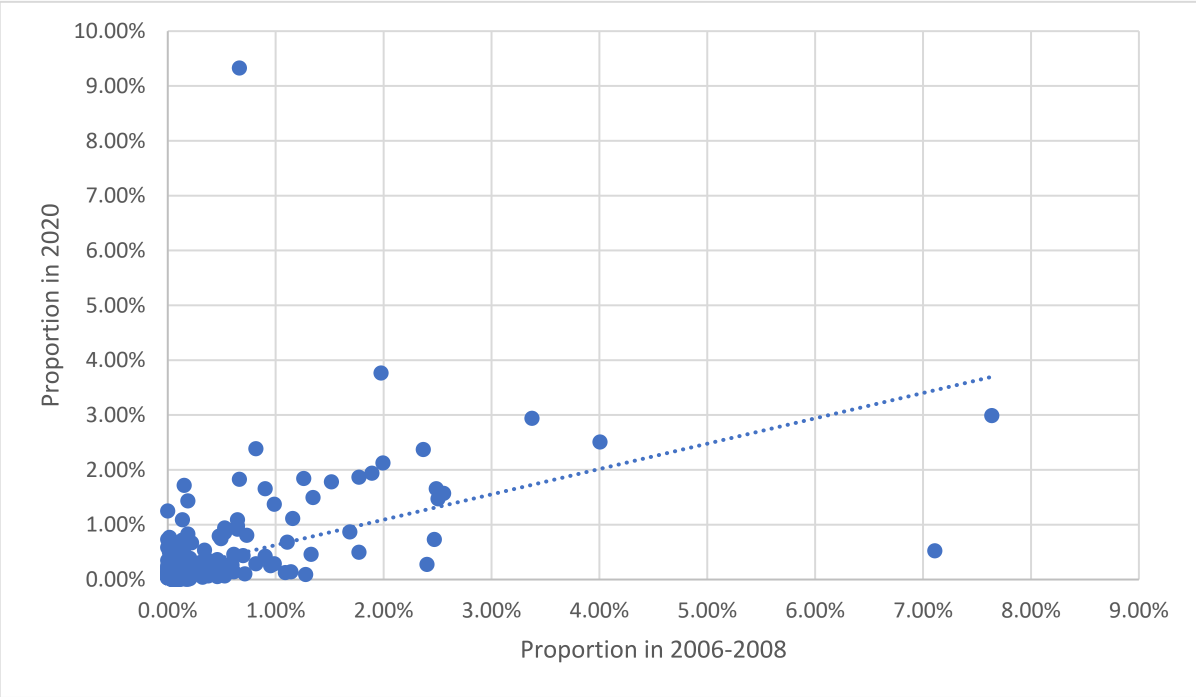


Figure 11: Scatter plot of relative contributions of 322 moth species to the total sample of the year 2020, against their respective contribution in the initial survey period (2006-2008); singleton species in either time period were excluded for visual clarity.

In 2006-2008, 94 individuals (1.6% of all individuals) belonged to a total of 33 species (10.68% of all species) with a distribution focus in warmer areas. In 2020, 228 individuals (2.8%) of 39 thermophilic species (10.9%) were caught. Of these thermophilic species, 11 species with 17 individuals occurred only in 2006-2008, while 15 species represented by 46 individuals were seen only in 2020.

In 2006, 951 individuals (16.2% of all individuals) belonged to a total of 45 species (14.6% of all species) with a distribution focus in wetland areas. In 2020, 999 individuals (12.3%) of 50 wetland species (13.9%) were caught. Of these wetland species, 11 species with 17 individuals occurred only in 2006, but 15 species with 46 individuals in 2020.

The relative proportion of wetland species decreased slightly from 17.1% to 14.5% over the 14 years at the flood-prone sites. In the non-flooded areas, in contrast, there was a very slight increase from 13% to 13.16% over this period. For thermophilic species, there was an increase in northern areas from 9.35% to 11.2% and a decrease in the south from 9.6% to 7.97%. In the samples from the northern areas taken in 2020, the relative proportion of wetland species decreased along trap sites (from 11.9% at 1-1 to 8.8% at 1-5).

A chi-square test for the wetland and thermophilic species and individuals of these species showed a significant value with one degree of freedom and a confidence interval of 95% (according to the distribution table for a value lower than 3.84) for both the wetland and the thermophilic species. There was no significance for the numbers of individuals (Table 5).

Table 5: Chi-Square-test for wetland individuals and species (shortend to wet) and thermophilous individuals and species (shortend to therm), displaying expected values and results for the chi-square calculations for the years 2006 and 2020.

Individuals

	wet	**rest**	**total**
2006	951	4914	5865
2020	999	7110	8109
total	1950	12024	13974
X²	43.0060474		

Species

	wet	**rest**	**total**
2006	45	264	309
2020	50	309	359
total	95	573	668
X²	0.05498238		

Individuals

	therm	**rest**	**total**
2006	94	5771	5865
2020	228	7881	8109
total	322	13652	13974
X²	117.429764		

Species

	therm	**rest**	**total**
2006	33	276	309
2020	39	320	359
total	72	596	668
X²	0.0058399		

I compared the logit-transformed relative numbers of individuals and species per site representing wetland and thermophilic moth species, respectively, with two way ANOVAs. Furthermore I compared these fractions with a t-test within my samples between the northern and southern sites, as well as the flood-prone sites of both sampling periods. The fraction of individuals representing wetland moths showed highly significant differences between the periods and flood regimes (Table 6, Figure 12, 13). There was no significant difference in the contribution of wetland moths between the flood-prone area samples of the year 2006/2008 and 2020 ($t= -0.695$, $p= 0.510$). However, I observed a highly significant difference in that regard between the samples from the northern and southern sites in my own survey data ($t= 8.664$, $p<0.0001$).

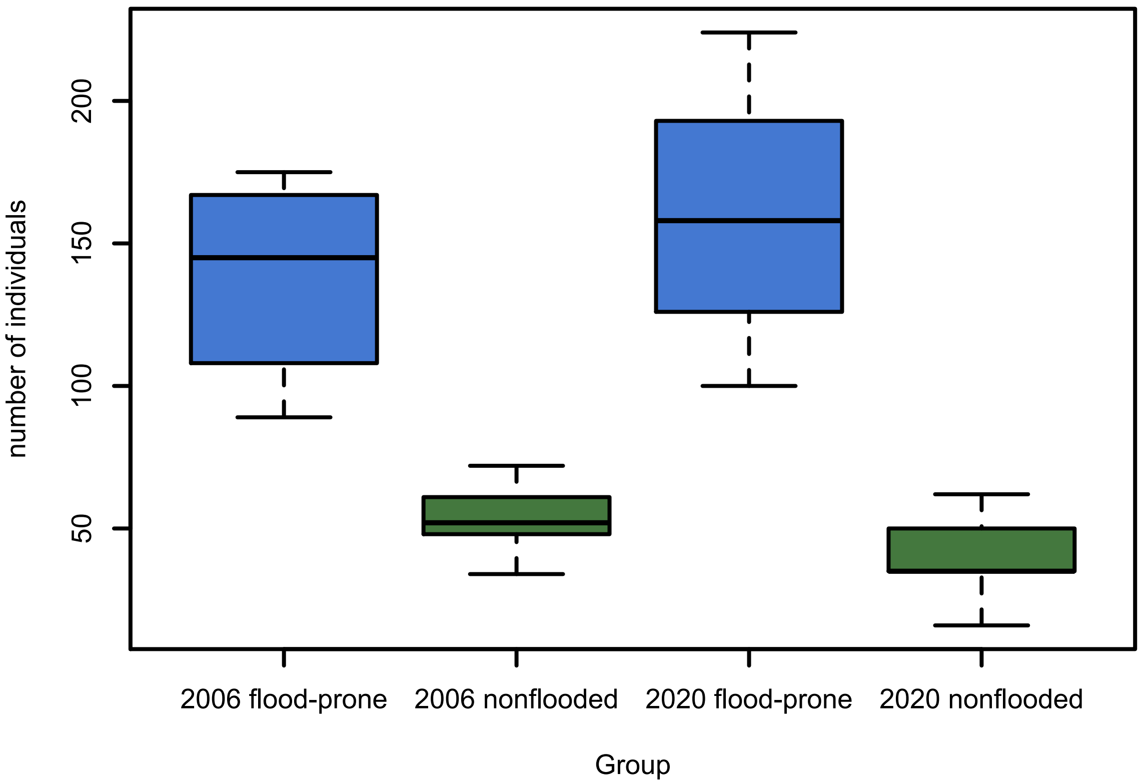


Figure 12 : Boxplot of number of wetland individuals per site, seperated by group

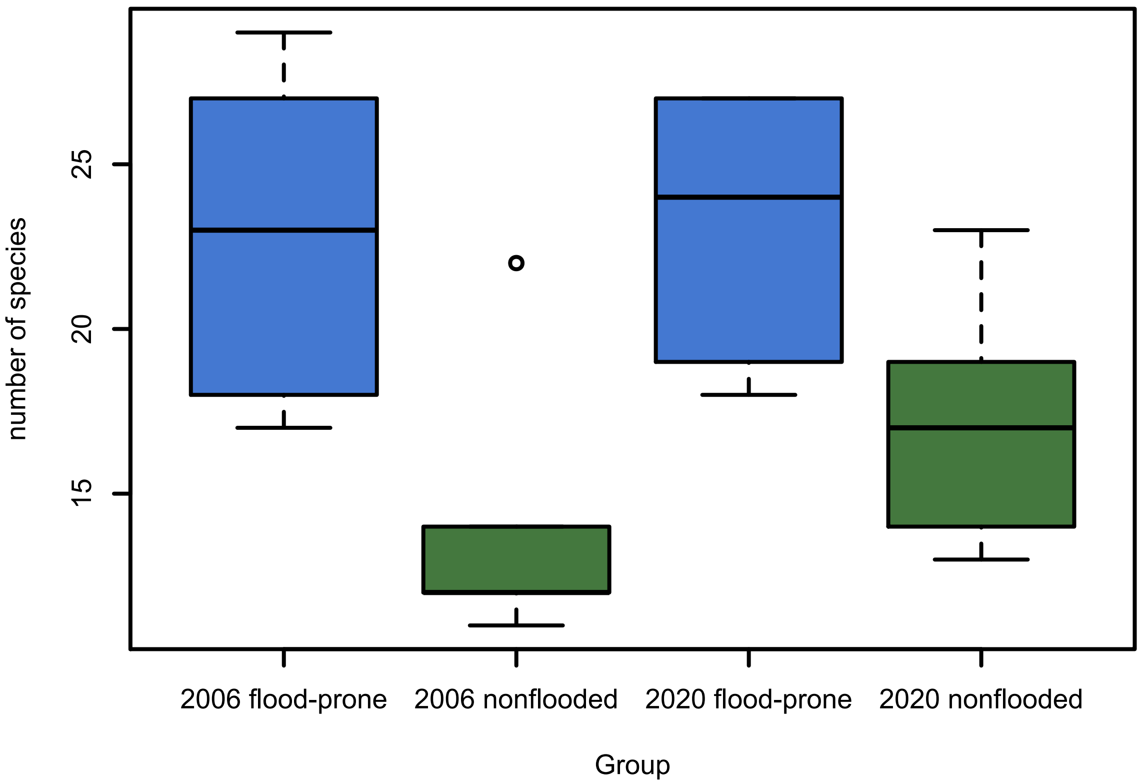


Figure 13: Number of wetland species per site, seperated by group

Table 6: Results of two-way ANOVA (F- and p-values) for the relative contribution of wetland moth individuals to light trap samples, compared between years and flood regimes.

Wetland individuals

	df	*F*	*P*
Year	1	15.34	0.001
Flood	1	162.13	<0.0001
Year:flood	1	7.98	0.012

An analogous comparison for the contribution of thermophilous species showed also significant differences between the years and flood regimes. The boxplot for the number of thermophilic species per site (Figure 15) showed that the non-flooded sites in the year 2020 had a higher share of thermophilous moths than all other sites (Table 7a) accordingly the number of thermophilous individuals was higher as well

(Figure 14). This was due to the high numbers of *Ennomos quercinaria* found at these sites. After excluding *Ennomos quercinaria,* no significance could be found any longer (Table 7b).

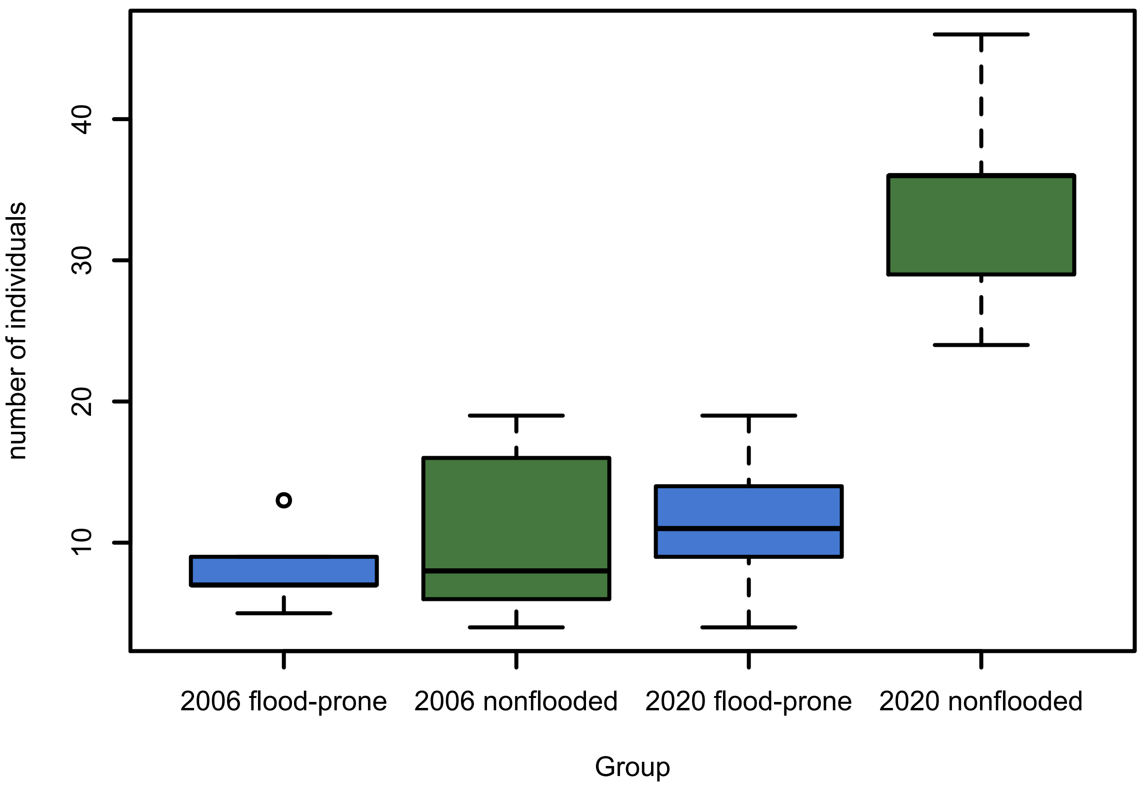


Figure 14: Boxplot of numbers of thermophilic individuals per site, seperated by groups.

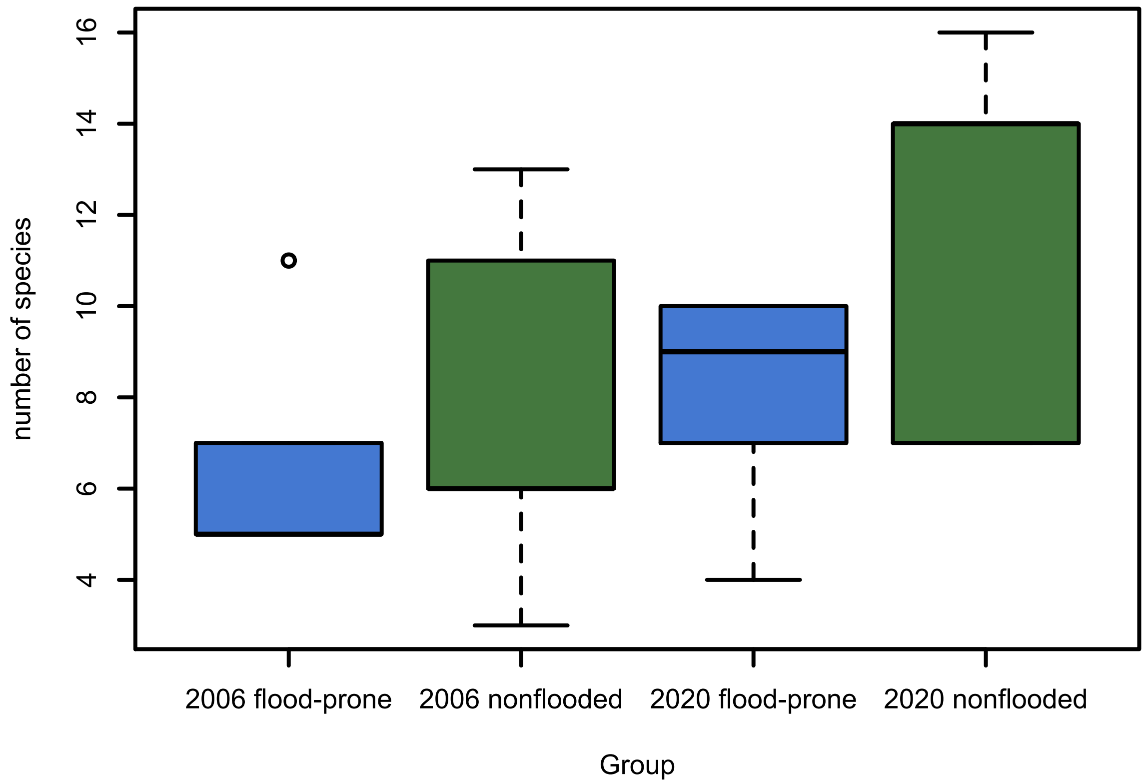


Figure 15: Boxplot of number of thermophilic species per site, separated by group

Table 7: Results of two-way ANOVA (F- and p-values) for the relative contribution of thermophilous moth individuals to light trap samples, compared between years and flood regimes. a) with Ennomos quercinariaincluded; b) without Ennomos quercinaria.

Thermophilous individuals

	df	*F*	*P*
Year	1	7.23	0.016
Flood	1	9.47	0.007
Year:flood	1	7.08	0.017

Thermophilous individuals (without *Ennomos quercinaria)*

	df	*F*	*P*
Year	1	0.212	0.652
Flood	1	2.338	0.146
Year:flood	1	1.342	0.264

The t-test also showed no significance for the fraction of thermophilous individuals, both with and without *Ennomos quercinaria* (with *Ennomos quercinara:* p=0.988; without: p=0.315). An apparent difference within the 2020 samples between the northern and southern sites (t= -3.8026 , p=0.0137) also proved to be entirely due to *Ennomos quercinaria* (t= -1.6567 , p=0.138 after exclusion of that species).
Compared with the relative individual numbers, the relative species number of wetland species showed no significant difference between the sampling periods, but again a clear pattern in relation to the flood regime (Table 8, Figure 16).

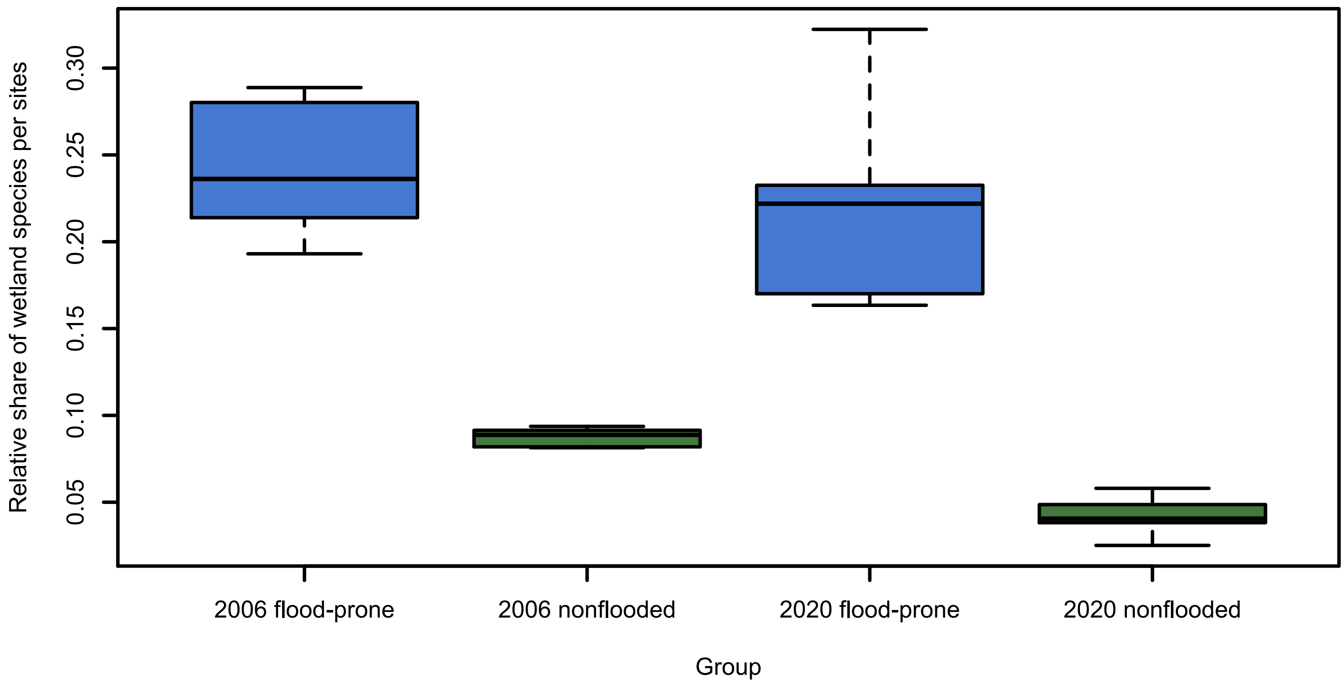


Figure 16: Relative share of wetland species per site seperated by groups

Table 8: Results of two-way ANOVA (F- and p-values) for the relative contribution of wetland moths to the species lists per site, compared between years and flood regimes.

Wetland species

	df	*F*	*P*
Year	1	3.147	0.095
Flood	1	36.39	<0.0001
Year:flood	1	0.262	0.616

In analogous comparisons of the relative species numbers of thermophilic moths, neither the ANOVA nor the t-test revealed any significant results (Table 9).

Table 9: Results of two-way ANOVA (F- and p-values) for the relative contribution of thermophilous moths to the species lists per site, compared between years and flood regimes.

Thermophilic species

	df	*F*	*P*
Year	1	0.276	0.606
Flood	1	1.047	0.321
Year:flood	1	0.226	0.641

Taken together over both study periods, there were 12 species of endangered moths recorded in the CR, EN and VU Red List categories. None of these species occurred in both periods. The only critically endangered species (*Euxoa distinguenda*) was present only in Truxa's catches. In 2006 there were 4 species from the Red List and in 2020 there were 8 species (Table 10). None of these species was recorded in substantial numbers.

Table 10: Red-List species recorded in the years 2006-2008 and 2020, with their categories given(critically endangerd, endangered and vulnerable).

Species	T1	T2	TF	TN	Sum per species	Category
Agrotis bigramma	0	0	1	3	4	EN
Arenostola phragmitidis	0	0	1	0	1	VU
Catephia alchymista	0	0	1	0	1	EN
Cosmia diffinis	1	0	0	0	1	EN
Cryphia fraudatricula	1	6	0	0	7	EN
Euproctis chrysorrhoea	3	1	0	0	4	VU
Euxoa distinguenda	0	0	0	2	2	CR
Meganephria bimaculosa	1	0	0	0	1	EN
Saturnia pyri	4	1	0	0	5	VU
Valeria oleagina	0	2	0	0	2	EN
Xanthia gilvago	0	1	0	0	1	EN
Xylena exsoleta	1	0	0	0	1	EN

Species diversity and assemblage composition

Both Fisher's alpha and the Shannon index revealed significant differences in species diversity between the years 2006/2008 and 2020 (Fisher's alpha: $p < 0.001$; Shannon index: $p = 0.012$), while the flooding regime had no significant effect (Table 11). Samples taken in 2020 generally indicated higher species richness. Using both diversity indices, it can be seen that the non-flooded trap sites sampled in 2020 were the sites with the highest moth biodiversity (Figures 17 and 18).

Table 11: ANOVA results for Fisher's alpha and Shannon's exp(H')

Fisher's Alpha

	df	*F*	*P*
Year	1	15.982	0.001
Flood	1	0.519	0.482
Year:flood	1	1.427	0.25

Shannon's exp(H')

	df	*F*	*P*
Year	1	7.793	0.013
Flood	1	1.165	0.296
Year:flood	1	0.864	0.366

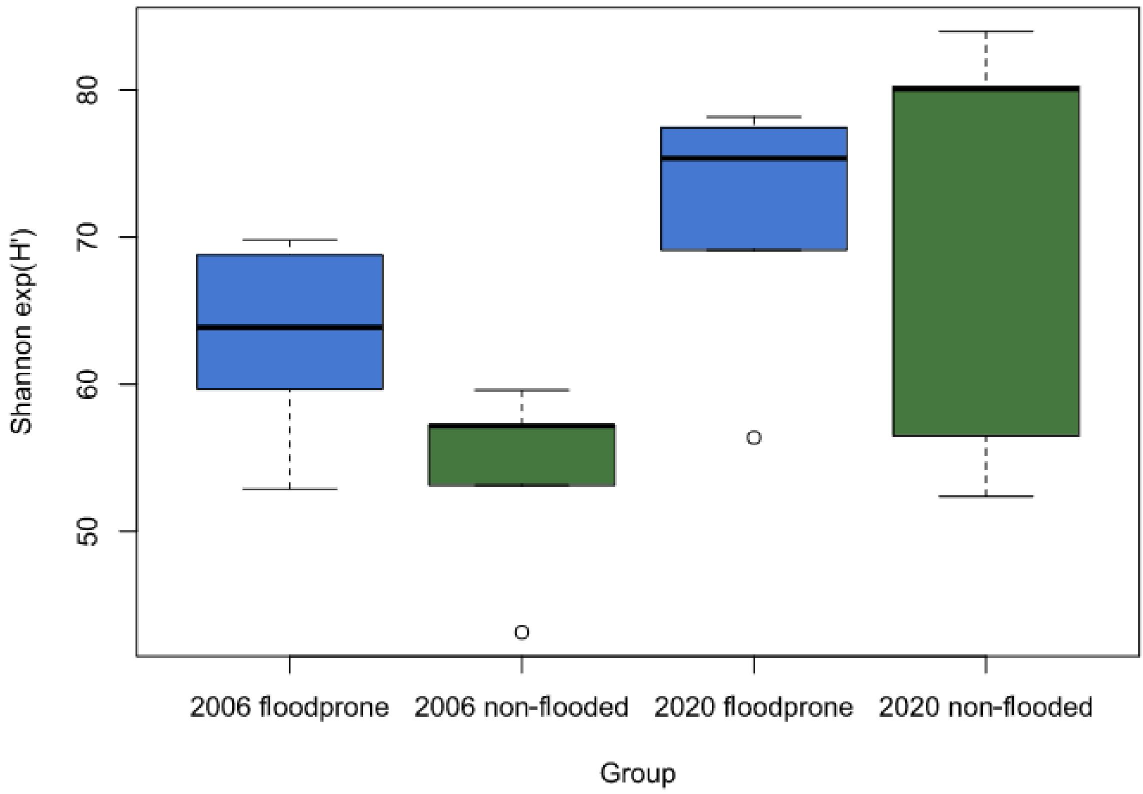


Figure 17: Boxplot of Shannon's exp(H') of moth assemblages by groups

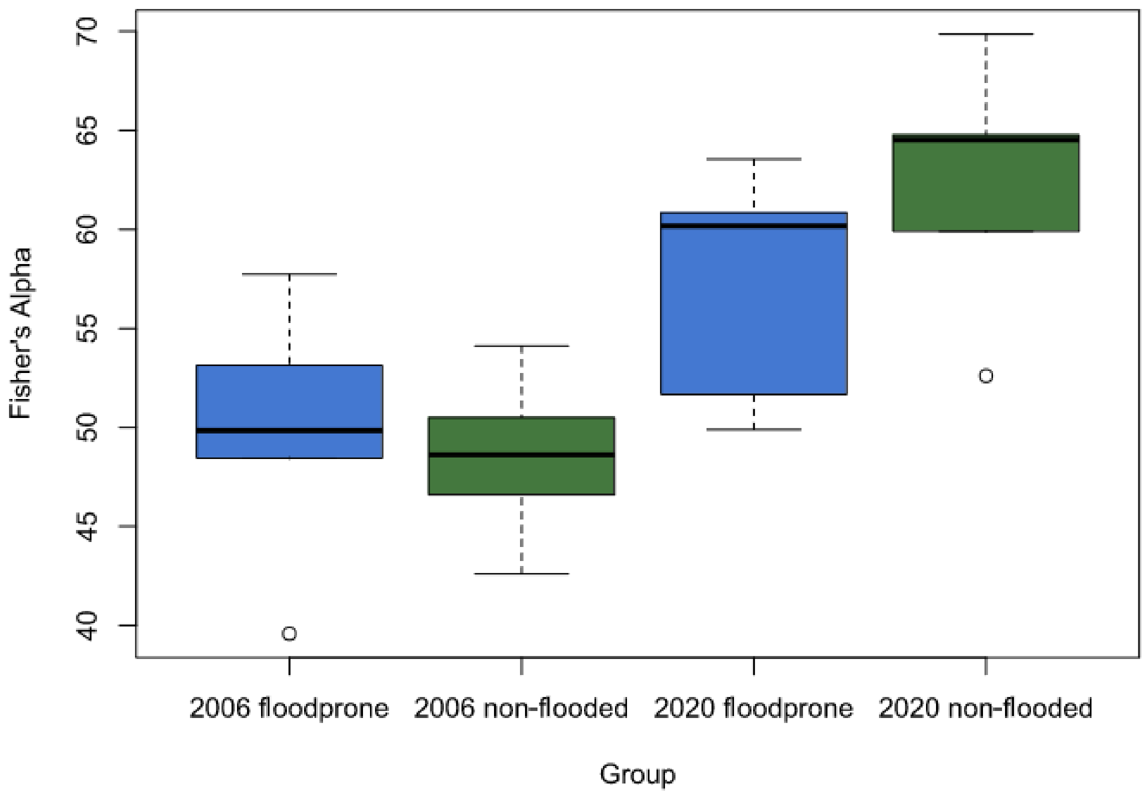


Figure 18: Boxplot of Fisher's alpha of moth assemblages by groups

Distances of local moth assemblages with regard to their species composition between the two survey periods and flood regimes appear to be approximately equal in reduced ordination space, i.e., the influences of these factors are equally important for the compositional differences between the sites (Figure 19). The high significance of differences was demonstrated with a PERMANOVA and also revealed a strong time × flood regime interaction (Table 12).

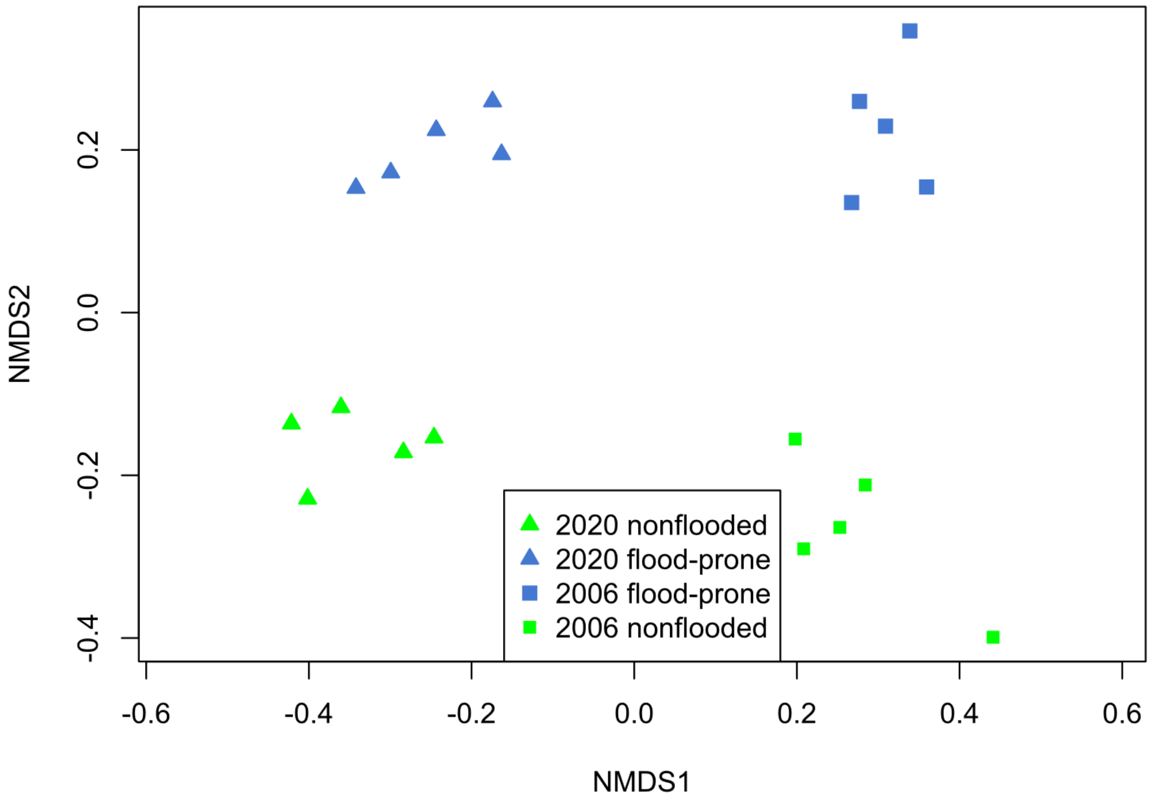


Figure 19: Unconstrained ordination plot of moth assemblages from the floodplain forest near Orth/Donau across two survey periods and two flood regimes, by means of an NMDS based on a Bray-Curtis distance matrix calculated from square root transformed catch numbers (stress value = 0.09).

Table 12: Results of a two-way PERMANOVA (with 999 permutations) on the Bray-Curtis matrix of moth assemblages, testing for the influence of survey period and flood regime on local species composition.

	df	*F*	*p*
Year	1	8.9552	0.001
flood	1	7.5257	0.001
Year:flood	1	3.2164	0.004

Betadiversity, nestedness, species turnover

Tests for species turnover and nestedness based on the Jaccard index did not reveal significant differences between years (Figure 20 a-d, Table 13) and forest plots (for the flood-prone plots see Figure 21 a-d and Table 14; for the non-flooded plots Figure 22 a-d and Table 15).

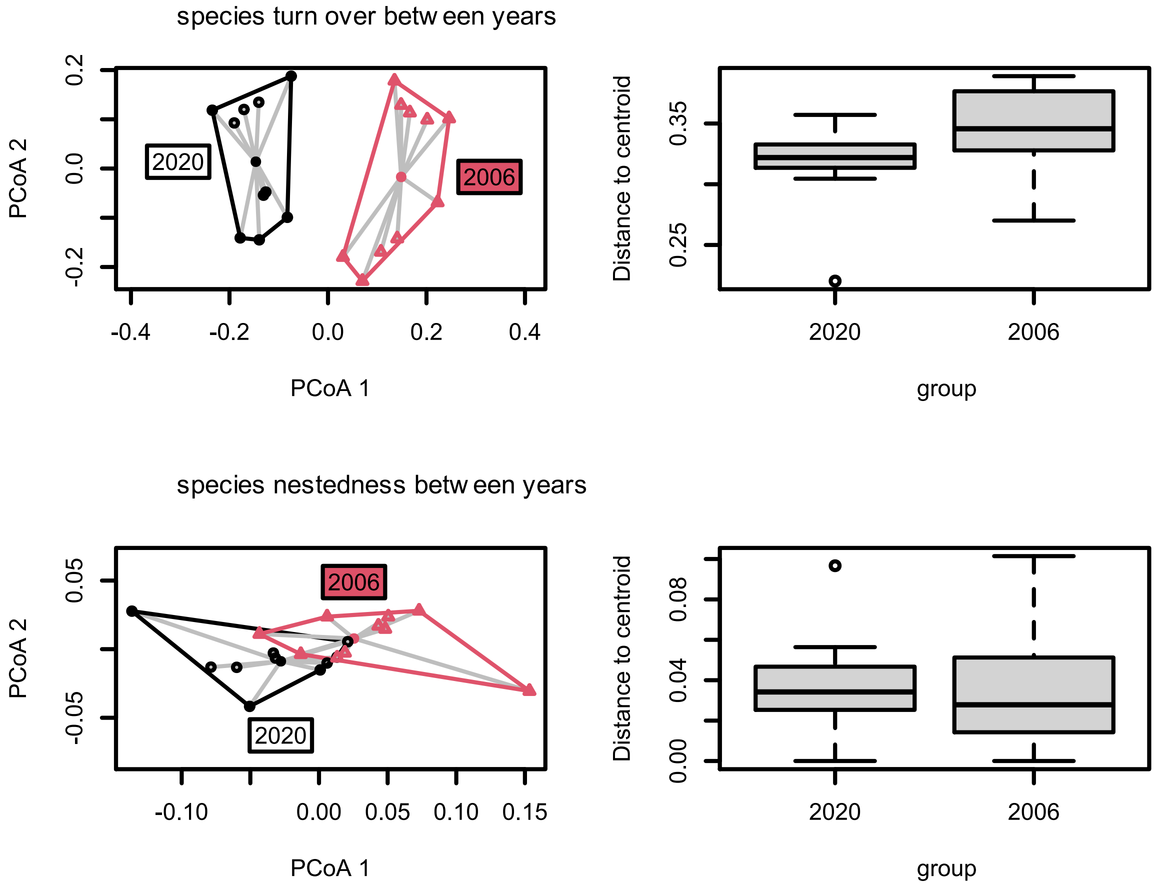


Figure 20 a) Betadisper plot for species turnover between the period 2006-2008 and the year 2020, based on the Jaccard index. b) Boxplot of the distance of the values of species turnover of each period in relation to their centroids. c) Betadisper plot for nestedness between the period 2006-2008 and the year 2020, based on the Jaccard index. d) Boxplot of the distance of the values of nestedness of each period in relation to their centroids.

Figure 13: Results of the ANOVAs for species turnover and nestedness components between moth samples from the years 2006-2008 and 2020.

Species turnover

	Df	F	P
Groups	1	2.904	0.106
Residuals	18		

Nestedness

	DF	F	P
Groups	1	0.009	0.926
Residuals	18		

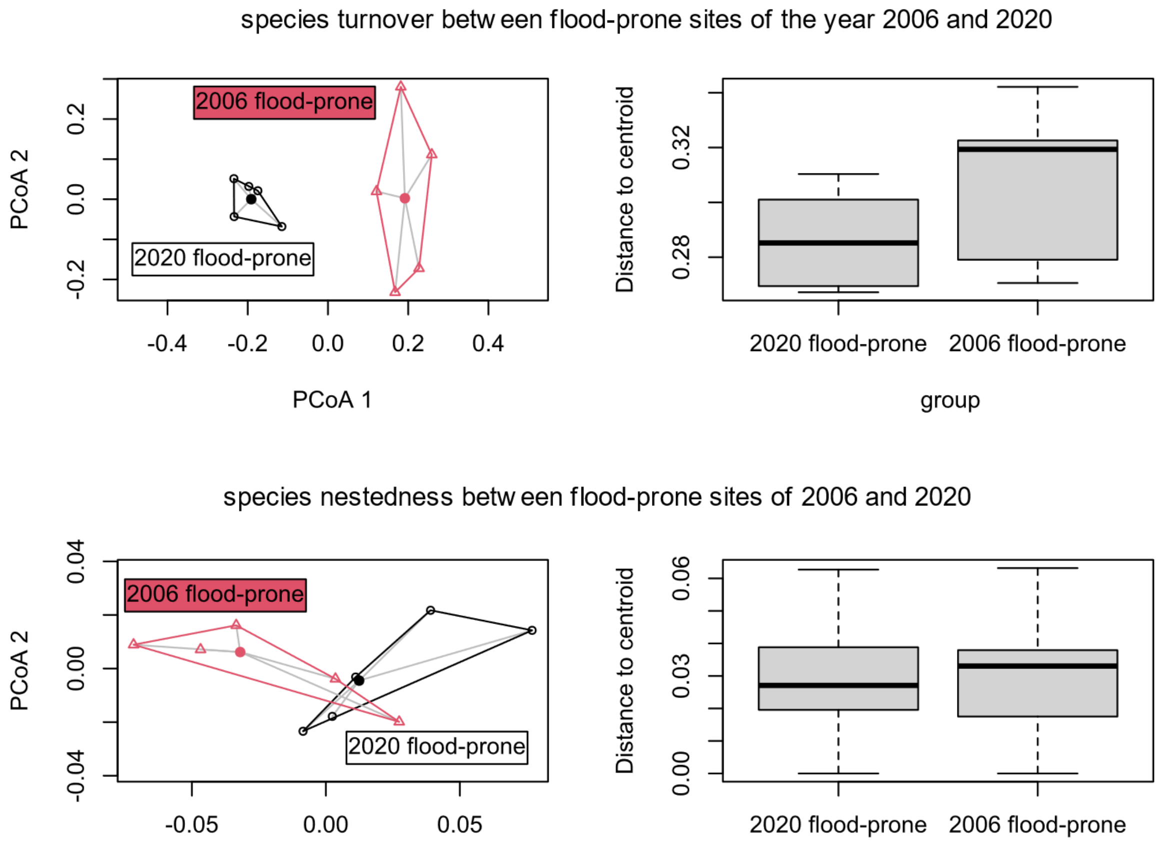


Figure 21 a) Betadisper plot for species turnover between the flood-prone sites of 2006-2008 and 2020, based on the Jaccard index. b) Boxplot of the distance of the values of species turnover between the flood-prone sites of 2006-2008 and 2020 in relation to their centroids. c) Betadisper plot for nestedness between the flood-prone sites of 2006-2008 and 2020, based on the Jaccard index. d) Boxplot of the distance of the values of nestedness between the floodprone sites of 2006-2008 and 2020 in relation to their centroids.

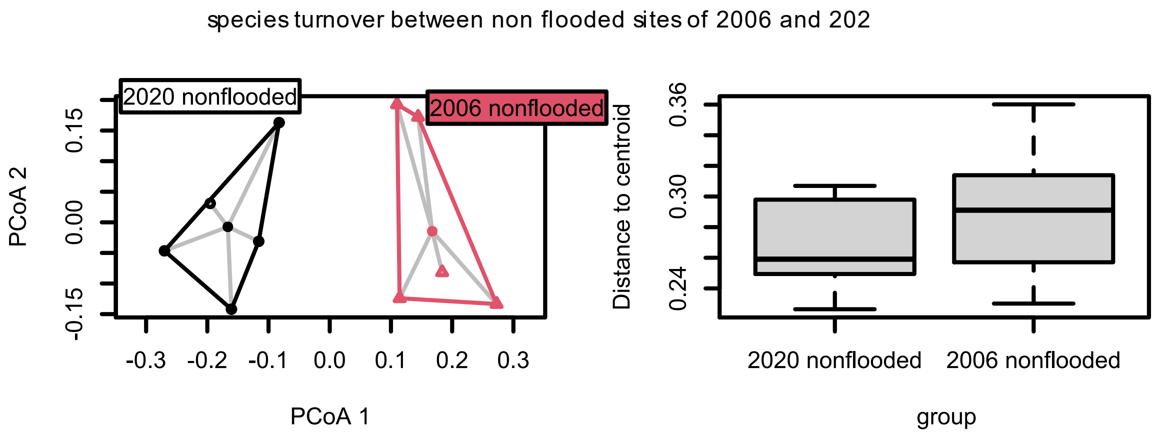
Table 14: Results of the ANOVAs for species turnover and nestedness between the floodprone sites of 2006-2008 and 2020

Species turnover

	Df	F	P
Groups	1	1.5603	0.247
Residuals	8		

Nestedness

	DF	F	P
Groups	1	0.0022	0.964
Residuals	8		



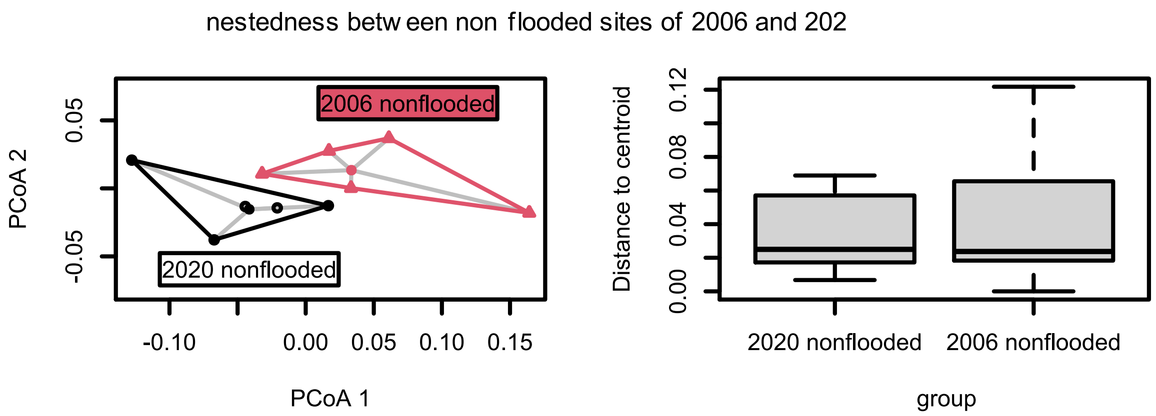


Figure 22: a) Betadisper plot for species turnover between the non-flooded sites of 2006-2008 and 2020 based on the Jaccard index. b) Boxplot of the distance of the values of species turnover between the non-flooded sites of 2006-2008 and 2020 in relation to their centroids. c) Betadisper plot for nestedness between the non-flooded sites of 2006-2008 and 2020 based on the Jaccard index. d) Boxplot of the distance of the values of nestedness between the non-flooded sites of 2006-2008 and 2020 in relation to their centroids.

Table 15: Results of the ANOVA's for species turnover and nestedness between the non-flooded sites of 2006-2008 and 2020

Species turnover

	Df	F	P
Groups	1	0.6877	0.431
Residuals	8		

Nestedness

	DF	F	P
Groups	1	0.1913	0.6734
Residuals			8

Species accumulation curves

The species accumulation curves (Figure 23) with 95% confidence intervals indicate that the samples drawn in 2020 were overall slightly more rich in species than those collected in the years 2006 to 2008. In both periods sampling success was high. The estimated sample coverage for the year 2006 was 98.7% and for the year 2020 98.9%. Evaluations with iNEXT for the two flood regimes separately revealed a sample coverage for the northern sites of 97.4% for 2006, and of 98.1% for 2020. For the forest areas south of the dam the respective results were 97.2% (2006) and 97.6% (2020) (Figure 24 and 25). Neither for the flood-prone nor for the flooded forest stands was there a significant difference in moth species richness, as indicated by the overlapping confidence intervals.

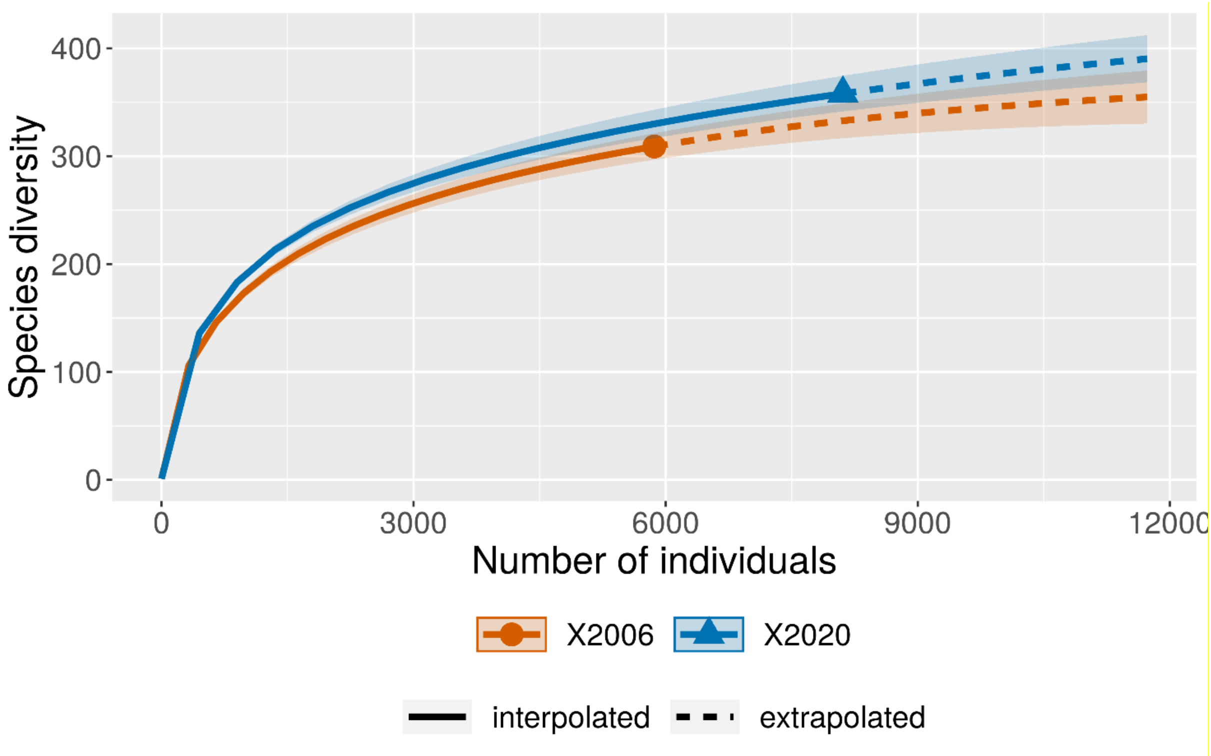


Figure 23: Species accumulation curve of moths for the year 2006/2008 and 2020. Shaded areas represent 95% confidence intervals.

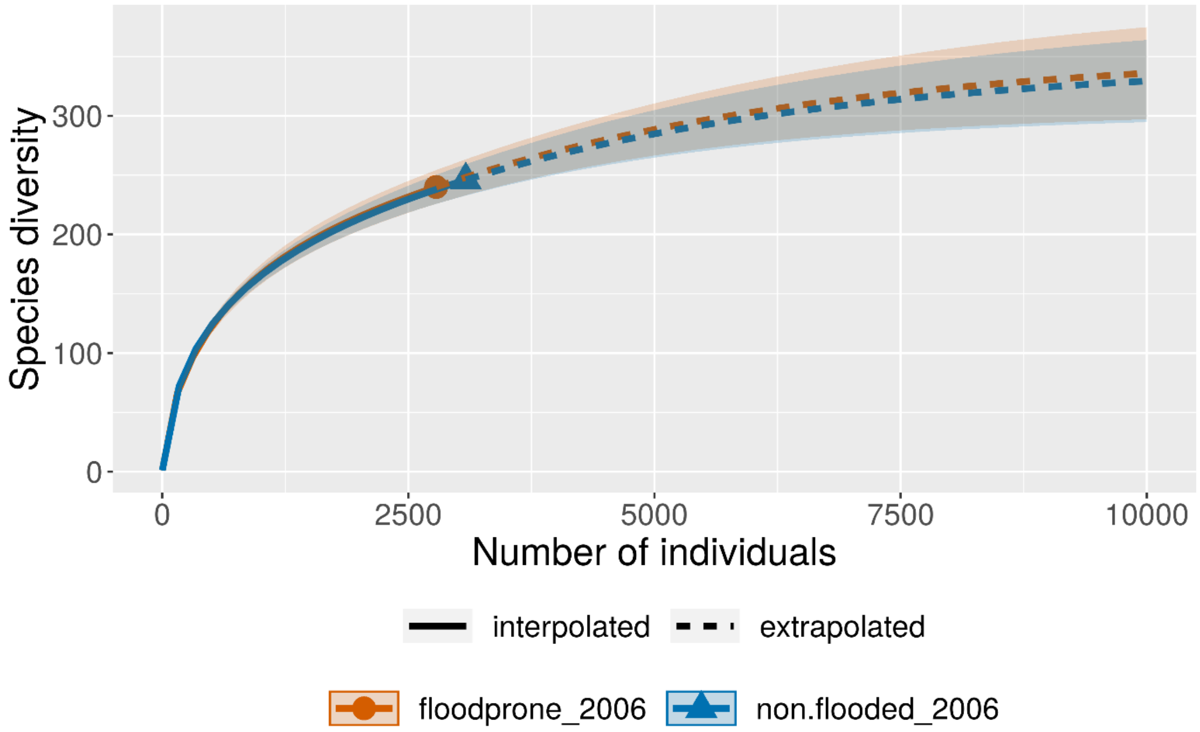


Figure 24: Species accumulation curve for the flood-prone and non-flooded sites in the years 2006-2008. Shaded areas represent 95% confidence intervals.

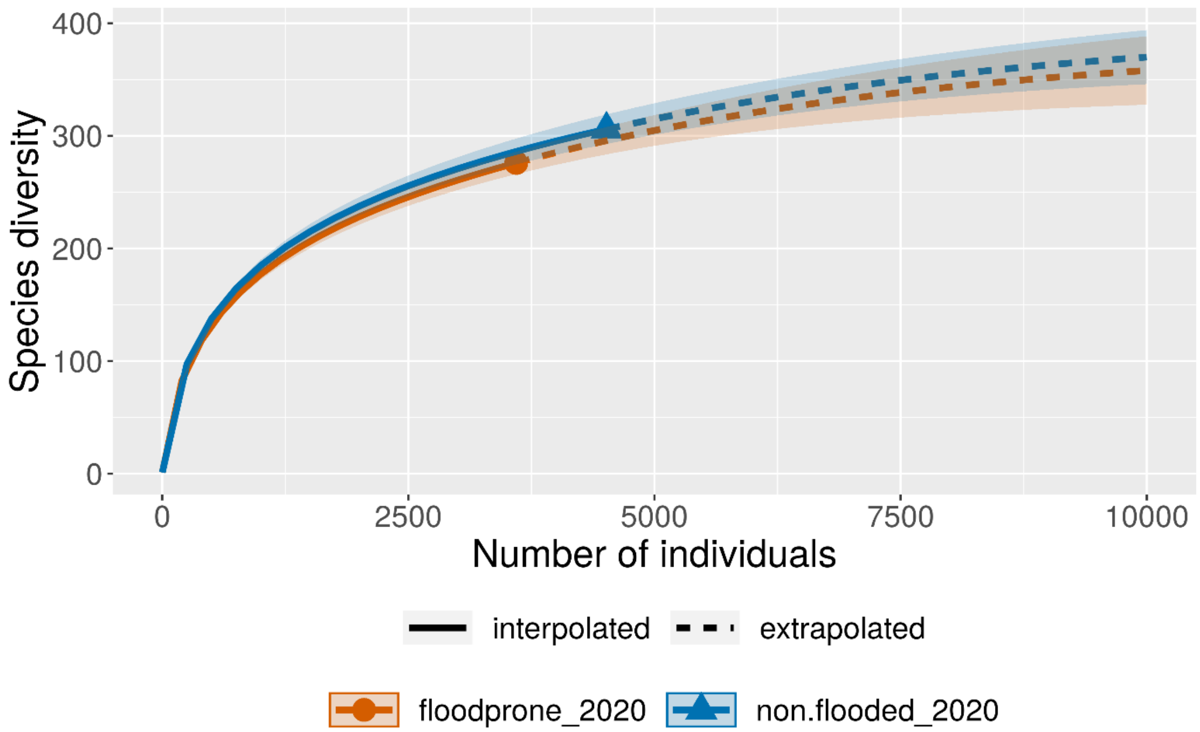


Figure 25: Species accumulation curves for the flood-prone and non-flooded sites in the year 2020. Shaded areas represent 95% confidence intervals.

The Hill number plot (Figure 26) shows that in both survey periods moth species diversity tended to be higher in the flood-prone part of the forest, if abundant moth species received higher weights (i.e. at a value of 2 and above for the alpha parameter of the Hill series, corresponding to Simpson's diversity measure). While in sum the 2020NF samples had the highest total observed number of species, at levels of the alpha parameter higher than 1.5 the combined 2006F and 2020F samples both exceeded the moth assemblages of the non-flooded forest part in species diversity. In contrast, in both parts of the forest diversity differences were negligible between the two survey periods at these higher levels of alpha, indicating a high similarity in community abundance patterns (Table 16).

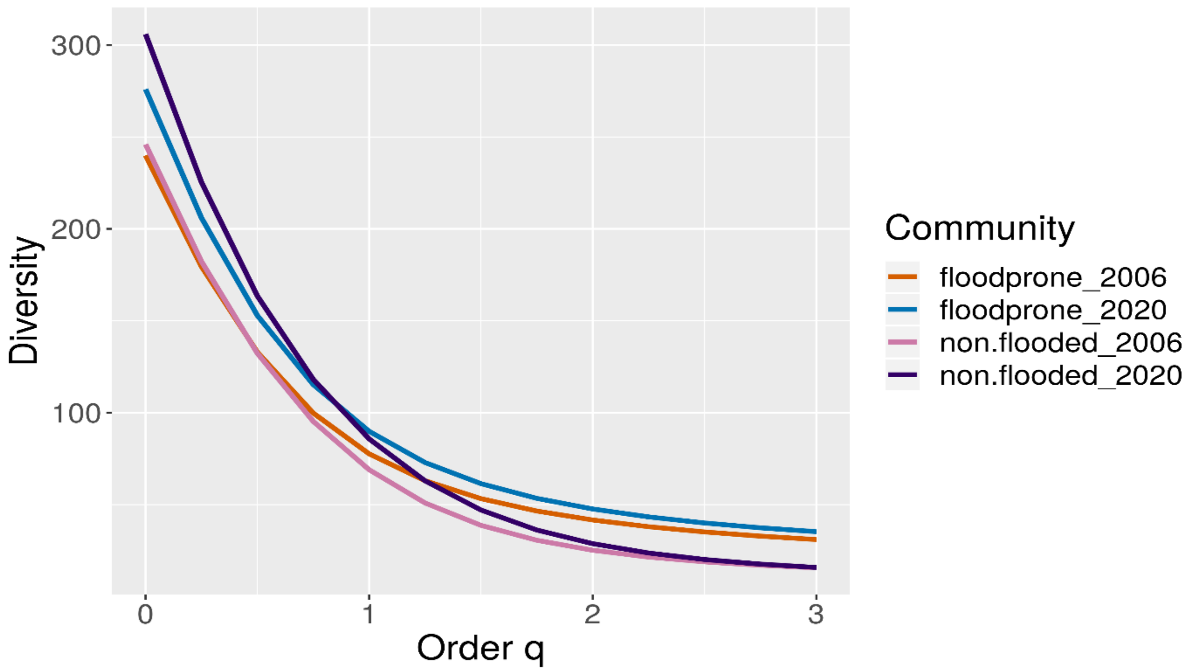


Figure 26: Diversity profiles (Hill number plot) of the 4 data partitions of moths in the Danube floodplain forest. q = 0: species richness; q = 1: exponential Shannon index; q = 2: Simpson index.

Table 16: Three selected values (at q = 0, 1 & 2) of Hill numbers for the species diversity of moth assemblages in two survey periods and two flood regimes in the floodplain forest near Orth/Donau. 95% confidence intervals in parentheses.

Order q	Diversity index	2020 non-flooded	2020 flood-prone	2006 non-flooded	2006 flood-prone
0	Species richness	306 (293-316)	276 (260-289)	246 (230-260)	240 (227-252)
1	Shannon index	85.8 (81.5-89.1)	89.9 (85.5-	69 (65.2-72.8)	77.6 (73.8-

			93.1)		82.4)
2	Simpson index	28.8 (26.4-30.7)	47.6 (45.3-49.9)	25.2 (23.3-27.1)	41.6 (39-44.7)

Using the SIMPER algorithm, I determined that the species with the greatest influence on site differences in species composition (expressed as Bray-Curtis similarities) was the autumnal notodontid *Ptilophora plumigera*. This species alone contributed 8.12% to the community differences between the years 2006/2008 and 2020. For the faunal differences between northern and southern sites (i.e., flood-prone and non-flooded), its contribution was even 13.48%. Tables 17 and 18 list those species that accounted for the largest share of differences in community composition. For ease of presentation, a cut-off of 25% cumulative differences was chosen. All these were common and widespread moth species, including some typical inhabitants of floodplain forests.

Table 17: Contributions of the top six moth species, collectively responsible for 25% difference in community composition, between the surveys 2006/2008 and 2020.

Taxon	Av. dissim.	Contrib. %	Cumulative %	Mean abundance 2020	Mean abundance 2006/ 2008
Ptilophora plumigera	4.965	8.124	8.1	75.6	3.9
Agrotis segetum	2.678	4.383	12.5	4.2	41.7
Cyclophora annularia	2.171	3.552	16.1	24.2	44.8
Pheosia tremula	1.795	2.937	19.0	23.8	19.8
Ecliptopera silaceata	1.532	2.507	21.5	30.5	11.6
Patania ruralis	1.385	2.266	23.8	20.3	23.5

Table 18: Contributions of the top four moth species, collectively responsible for 25% difference in community composition, between flood-prone (F) and non-flooded areas (NF).

Taxon	Av. dissim.	Contrib. %	Cum. %	Mean abundance NF	Mean abundance F
Ptilophora plumigera	8.034	13.48	13.5	140	11
Pheosia tremula	2.226	3.735	17.2	6.4	41.2

Erannis defoliaria	2.114	3.547	20.8	36.4	2.2
Pelosia muscerda	1.684	2.825	23.6	2.2	29.2

None of the species with the greatest influence on site differences in species composition had a similar position in the IndVal ranking (Table 19, Appendix XII).

Table 19: List of the five species with the highest IndVal value for the year 2020 and the years 2006-2008.

Species	**Year**	**Indval**	**p-value**	**Frequency**
Ennomos quercinaria	2020	1	0.001	10
Paradarisa consonaria	2020	1	0.001	10
Brachionycha nubeculosa	2020	1	0.001	10
Orthosia cerasi	2020	0.98412698	0.001	11
Eudonia mercurella	2020	0.96363636	0.001	12
Idaea dimidiata	2006-2008	0.91463415	0.001	15
Tethea or	2006-2008	0.86503067	0.001	18
Hemithea aestivaria	2006-2008	0.84	0.001	15
Hemistola chrysoprasaria	2006-2008	0.81481481	0.001	14
Atypha pulmonaris	2006-2008	0.78387097	0.008	13

To evaluate the effect of the few over-abundant species (n = 5) and singletons (n = 92 in both years) on differences in apparent community composition between survey years and flood regimes, all multivariate calculations were completed again without these species. It was evident that exclusion of these species had little to no effect on the overall site differences with regard to moth community composition. For example, the PERMANOVA results did not change at all after excluding singleton species

(Table 20); when omitting the over-abundant species, the p-value for the year × flood interaction changed marginally by 0.003, but still remained significant.

Table 20: Results of PERMANOVA comparisons (Bray-Curtis distance matrix, 999 permutations) between moth assemblages, after excluding 92 singleton species from the data set. Moth species were classified as 'strays' if they occurred with only one individual in each of the two years, or with one in only one year and not at all in the other.

	df	*F*	*p*
Year	1	8.24	0.001
Flood	1	6.86	0.001
Year:flood	1	2.83	0.007

Weather factors

The comparison of weather data of the last 20 years recorded at the station Groß-Enzersdorf showed no statistically significant differences of the year 2020 to the average of the last 20 years.

The year 2020 had only 12 days with minimum temperatures below 0°C, which is less than the average. No late frosts in May occurred at all. There was 79 mm/m² more annual precipitation in 2020, especially in June the difference was pronounced with 48mm/m². Conversely, spring was unusually dry, especially during April. Compared to the average, there were 4 fewer days with maximum temperatures above 30°C in 2020, but in July as well as August two distinct phases of summer heat occurred. Overall, mean annual temperature was 0.7°C higher than the mean of the last (already very warm) 20 years. Most remarkably, February 2020 deviated by +4.5°C from the 20-year average. Hence, the year when I did my moth sampling can be characterized as an unusually warm one, in particular with an exceptionally mild winter 2019/2020 preceding the onset of my sampling campaign (Figures for weather trends are listed in Appendix VII).

Discussion

Almost 15 years ago, the moth assemblages in flood-prone and non-flooded forest stands in the NP Donauauen had been the subject of an intense biodiversity study. Major outcomes of those initial analyses were that (a) species diversity tended to be higher in flood-prone forest stands; (b) species composition differed strongly between flood regimes, though mainly through abundance variation; and (c) multiple species traits reflected these ecological contrasts (Fiedler and Truxa, 2012; Guariento et al., 2020; Truxa and Fiedler, 2016, 2012a). Based on a repetition of these surveys in the year 2020, most of the formerly recognized patterns were corroborated, while also new facets emerged.

The species accumulation curves indicated a higher sample coverage of my catches, viz. 98.9% in the year 2020. Compared to the earlier surveys, I achieved higher coverages both at the sites north and south of the Marchfeld Dam, as well as overall. However, these differences were only in the range of 0.2-0.7%. Similarly, the numbers of individuals and species recorded were substantially higher in 2020 than those from 2006-2008. This is remarkable because Truxa sampled moths over two annual cycles (between August 2006 and August 2008), whereas I only did light-trapping from March to November 2020.

In comparison with the 2006-2008 trapping period, I used newer types of traps. While Truxa (2012, p. 98), used 15W fluorescent tubes (Sylvania Blacklight-Blue, F15W/BLB-T8; and Philips TLD, 15W/05) powered by a 12 V car battery, I was able to use the newer LEDs developed by Brehm (2017). These could also be run more efficiently with battery packs, resulting in longer average glow times. The new trap design may have had an impact on my catch numbers in that I may have attracted moths that are active in the early morning hours by allowing the traps to run longer. Truxa (2012, p. 98) reports her average trapping time as around 6 hours and turned her traps on automatically at dawn. I was able to run my traps (also automatically) from dusk to dawn. Because of the lighter weight of the traps, I was not as tied to good accessibility when selecting locations, but could focus on good trapping locations. Another possible reason could be an increased range of the LED lamps, since the fluorescent tubes showed only a limited attraction effect (Truxa and Fiedler, 2012b). In addition, the attraction effect may have been influenced by the different light frequencies emitted.

Effects of flood regime on moth assemblages

As also noted by Truxa in her study, the southern butterfly communities were more species-rich in my study (Truxa and Fiedler, 2012a). This can be seen especially in regard to the comparison of the respective Fisher's alpha values. Also the results of Guariento et al. (2020) showed this before. Larger differences that were detectable in regard to local alpha diversity occurred between the non-flooded areas in 2006/2008 and 2020, respectively. These results were supported by both diversity metrics considered, viz. the Shannon index and Fisher's alpha.

When comparing the species accumulation curves, it can be seen, if all samples are accumulated, that the gamma diversity in 2020 was just significantly higher than in 2006-2008, a possible explanation being the newer type of light traps. However, the gamma diversity between the flooding regimes of the years (Figs. 22 and 23) were not notably different. This means that there was a mostly equal sized species pool north and south of the dam. If the pure number of species is weighted less and the abundances of the species are weighted more, it becomes apparent that the more dynamic, southern sites had a more diverse moth fauna in both observation periods. A possible explanation for this observation is the high mobility of moths, whereby the pure species numbers are influenced by the occurrence of singletons (Fiedler and Truxa, 2012).

For other insect groups, a much stronger influence of flooding events on local species diversity was found. For example, Neumüller et al. (2018) hypothesized increased species turnover as the reason for higher species richness of bees south of the dam. He explained this by the emergence of different microhabitats due to recurrent flooding and concomitant changes in the plant communities. For butterflies, abundance and thus diversity was showen to be negatively affected by flooding (Fies et al., 2016). While soil-bound athropods are negatively influenced by flooding events (Gratzer et al., 2013) or show active migratory behavior (Lambeets, 2009), the imaginal stages of flying insects show little or no influence of floods (Lambeets, 2009; Neumüller et al., 2018; Truxa and Fiedler, 2012a). Ground-based moth caterpillars show escape tendencies from floods and retreat to higher ground or onto plants (Köppel, 1997). Yet ground layer species are more severely impacted than aroboral layer species (Truxa and Fiedler, 2012a). Species of the arboreal zone do not show this behavior (Köppel, 1997). The egg stages of Orthoptera in floodplains show a high tolerance to flooding and use the occurring winter and spring floods for passive dispersal by being drifted by water (Dziock et al., 2011). Lepidoptera eggs are also likely to withstand floods well (Köppel, 1997).

My data show that there were shifts in abundance compared to the previous study period. More common species were also affected. Studies on insect distribution and abundance showed that common, widespread species are subject to greater fluctuations in abundance than geographically restricted species (Gaston and Lawton, 1988). For insects, environmental stability is suggested to be the most important factor in maintaining stable populations (Wolda, 1978). Populations in dynamic landscapes or in areas with irregular weather events thus fluctuate more. In Norway, the interannual abundance fluctuation was found to be strongly dependent on summer and winter temperatures (Burner et al., 2021). One factor that explains the moth community compositions is the structural compositions of the plant community (Highland et al., 2013; Truxa and Fiedler, 2012a). An influence of the herb layer characterized by flooding in the southern parts of my study area can be assumed here.

Due to the Danube regulation, many oxbow lakes were cut off from the Danube and the existing wetlands are disturbed (Böttiger, 2011). Because of the missing connection of the oxbow lakes to the Danube and the deepening of the Danube bed, processes typical for floodplains no longer take place in large parts of the Danube floodplains (Reckendorfer, 2016). Another negative effect on the hydrodynamics of the floodplains is the increasing afforestation of the area (Böttiger, 2011). The interruption of natural dynamics along the river system allowed continuous plant cover to form on the now former riverbed. Former floodplain forest areas are transforming into drier sites (Schratt-Ehrendorfer and Rotter, 1999). The various separated oxbow lakes are characterized by sedimentation communities and are becoming increasingly forested (Skof, 2013).

Climate Change

There is a clear tendency towards warmer years in combination with increasingly unevenly distributed precipitation, depending on the season in Lower Austria (Hiebl et al., 2021). Even though climate change is assumed to be a driver of species loss, the exact impacts are not yet clear or difficult to determine. A measurement of a temperature increase in 2 meters height (standard height for temperature measurement) does not mean at the same time an increase of the temperature near the ground. This is mainly due to the microhabitats present there, which are for example caused by shading. Thus, different species are influenced very differently by climate change, because their habitat requirements, such as egg-laying sites or food plants, are influenced differently (Sage, 2017). Microclimates created by topographic conditions function as a kind of buffer to the effects of climate change, especially for more severely affected species. On the one hand, these microhabitats reduce the risk of extinction of threatened species due to climate change (Suggitt et al., 2018). On the other hand, microhabitats make it difficult to study the effects of climate change because they can make global trends harder to track at the local scale (Sage, 2017).

Seymour et al. (2020) showed in their long-term study that species richness of moths is strongly related to oscillations in temperature. Likewise, the stability of a species community is affected by these oscillations. Generalists are more stable than specialists and also more responsible for the ecosystem stability. Even though generalists are responsible for the stability of the moth community, generalists in particular tend to experience high abundance fluctuations (Gaston and Lawton, 1988). This tendency to fluctuation can explain the strong fluctuation of particularly abundant species that occurred between 2006-2008 and 2020.

Increased temperatures are associated with increased species diversity, which in turn enhances community stability (Seymour et al., 2020). Especially the species richness of nocturnal Lepidoptera in autumn seems to be dependent on temperature (Ruchin, 2021). The positive effect of elevated temperatures on increasing biodiversity is likely due to habitat shifts. More southerly species can migrate to more northerly latitudes and thus complement the established species pool. More northern species whose southern range is in the national park area may also disappear as a result of these niche shifts (Fox et al., 2014). In the lowlands, direct climate change impacts are less severe than in the mountains, but then lead to a stronger impact on the overall insect population because it is less easy for species to move to other temperature gradients due to habitat fragmentation in the lowlands (Halsch et al., 2021; Hülber et al., 2020; Vittoz et al., 2013) and reduced precipitation compared to montane regions (Vittoz et al., 2013). Climate change also alters successional communities by increasing the rate of vegetation growth, which in turn has negative effects on specialists in these habitats (Habel et al., 2019; Warren et al., 2021). For the Danube floodplain as an area dominated by disturbance, this could also mean a change in these habitats. Given the continuing increasing temperature trend, species turnover may be assumed as established species retreat along habitat boundaries (Chen et al., 2011). Assuming the advantages of thermophilic species in view of increasing temperatures, this should be detectable by a relevant increase of these species within the 14 years between my survey and the dissertation of Truxa. However, this was not the case, as there was neither a significant difference between the years studied, nor between the sites of my study. An observed increase in the number of individuals representing thermophilic species was caused by a single species that was over-abundant in 2020: *Ennomos quercinaria*. Even though not significant, there was a slight increase in thermophilic species relative to total species numbers. These observations might indicate that 'thermophilization' of the moth fauna is on its way in the study area, but the evidence for that is by no means robust yet.

Neobiota

I was able to detect only two neobiota, and these both only occurred with one individual each. Both of these are strictly bound to gardens and human households and do not really reach out into more natural ecosystems. Hence, invasive alien species are not yet of any significance amongst the moth assemblages in the NP Donauauen. This stands in stark contrast to the vegetation which has already been severely altered by the appearance of neophytes. The areas that still experience regular dynamics due to the Danube, such as gravel areas, are less populated by neophytes (Rak and Bergmann, 2013). In the Danube Floodplain National Park, 76 neophytes occur, 13 of which are considered a problem for nature conservation (Zsak, 2016). Many of these neophytes are being attempted to be kept under control through management measures. Invasive trees include *Populus × canadensis* (Dietrich, 2016) as well as *Ailanthus altissima, Acer negundo* and *Robinia pseudoacacia* (Zsak et al., 2015). All of these tree species are subject to active management measures. Furthermore, there are attempts to reduce *Solidago canadensis* (Zsak, 2016). *Robinia pseudacacia* occurs frequently in the area and leads to altered ground vegetation due to nitrogen enrichment in the soil and reduced shading in these stands (Kastler, 2013). According to the enemy release hypothesis, invasive plants have a fitness advantage, among other things, because they are subject to less pressure from herbivory or the like in their new habitats (Blossey, 2011). However, neophytes are also used as hosts by native fauna (Pearse and Altermatt, 2013). For insects, this depends on the host specificity of the insects, generalists therefore have an advantage, and the relatedness of the new species to existing species (Bertheau et al., 2010). For butterflies, it has been shown that the likelihood of adopting new, exotic plants as hosts is primarily related to the geographic distribution of the species. Another influence has the diet breadth. Widespread generalists are therefore more inclined to adopt new plants (Jahner et al., 2011). Even if native species integrate neophytes into their host network, replacing native species with neophytes results in a significant reduction in Lepidoptera caterpillar productivity, as well as species richness and individual numbers (Richard et al., 2019).

About 1% of the Lepidoptera species occurring in Austria are considered neozoa (Huemer and Rabitsch, 2002). Of the neobiotic Lepidoptera species expected in the Danube Floodplain National Park, some belong to the Gracillariidae family (Huemer and Rabitsch, 2002), which feed on *Robinia pseudoacacia* (Hellrigl, 2006) such as *Parectopa robiniella* or *Phyllonorycter robiniella* (Huemer and Rabitsch, 2002). This family was not covered within the framework of my research.

A neobiota that could have occurred is the Arctiidae member *Hyphantria cunea*. This moth is widespread worldwide and already occurs as a pest (Nakonechna et al., 2019). In Austria, the distribution is still limited to the southeast and only minor damage is recorded (Huemer and Rabitsch, 2002; Krehan and Steyrer, 2009; Schimitscheck, 1952). As a profiteer of climate change and the proven niche change (Tang et al., 2021) a north-west spread of the moth would be possible. Yet there was no occurrence in my trapping period.

The two neobiotic Lepidoptera species sampled were:

Cydalima perspectalis: The box tree moth was accidentally introduced into Europe in the mid-2000s and has been present in Austria since the end of this decade. It is a pest of *Buxus* and causes considerable damage to box plantings (Mally and Nuss, 2010).

Ephestia elutella: The cocoa moth is a stored products pest that occurs in all federal states of Austria and is considered established, but does hardly occur outside human settlements (Huemer and Rabitsch, 2002).

Since climate change favors the spread of neophytes (Nobis et al., 2009), it can be assumed that the species composition of Lepidoptera will continue to change in the coming years. This is made possible by the emergence of new niches, vacancies of existing niches (Heleno et al., 2009) or even the displacement by superiority in relation to changing climatic conditions (Lurgi et al., 2012). Species richness in particular might suffer in the future (McKinney and Lockwood, 1999).

Species composition

When comparing the two periods, the strong differences in species composition between the regularly flooded areas south of the dam and the areas north of the dam, that are no longer flooded, persisted. There was not only a detectable difference between sites, but also a clear shift in species composition between periods. This difference was not caused by outbreaks of a few individual over-abundant species. Therefore, a temporal species turn-over can be assumed.
The majority of the moths identified by the IndVal analysis as indicator species for 2020, as well as the moths that occurred only in 2020, are moths that are widespread, without specific habitat association in Central Europe. The same can be said about the indicator species for the 2006-2008 trapping period, as well about the species that occurred only at that time. However, the majority of the species occurring only in a single time horizon are species that occurred only in very small numbers of individuals in this time period. Thus, it may well be the case that these species were not caught in the other time period because they are inherently rare in the Nationalpark Donauauen and there might simply be a catch bias for these rare species (Venette et al., 2002).
Even if this local case study did not demonstrate a loss of biodiversity or an erosion of beta-diversity between the sites, multiple other studies show this trend. Specialists are particularly affected by climate change and landscape modification (Mangels et al., 2017). Floodplains as landscapes with their very special ecology, characterized

by flooding, are an example of specialist habitats. A change towards generalists should therefore be detectable (Roth et al., 2021), however, the change was not yet evident in the results, because the turnover was triggered by frequent, generalist species. As the Danube floodplains are dependent on flooding in summer after snowmelt in the Alps, the changed and more irregular snowfall in winter may have a future impact here.

Warm- and cold-adapted Lepidoptera are particularly affected by climate change. Together with land use change, this leads to a change in species composition and a decline in species richness (Filz et al., 2013). A 9-year study in Germany found an overall decrease in arthropod biomass and species numbers. This affected both forest and grassland habitats. However, the abundance of individual species was not affected. Specialists were again particularly affected (Seibold et al., 2019).

With regard to Red List species, all the few species detected in 2006-2008 could not be found again. Instead, completely different Red List moths were detected in 2020, so that there was no overlap. Since all these species occurred in low numbers of individuals, it is not possible to infer whether they have really disappeared or just could not be attracted to light traps and were thus under the detection threshold (Venette et al., 2002). In their study, Truxa and Fiedler (2012a) summarized that floodplains have only moderate moth diversity compared to other lowland forests and do not have high conservation value regarding endangered moths. Also, the available Red List for moths in Austria is already 14 years old, so it can only represent the current state of endangerment for nocturnal Lepidoptera to a limited extent (Huemer, 2007). In view of the general loss of biodiversity, rare species may often be particularly affected. Endangered species are particularly affected by this, as they usually not only occur in low numbers of individuals, but also have a smaller distribution range and are therefore subject to both the general trend of loss of insect biomass and diversity, but also to habitat loss and destruction (Seibold et al., 2019).

A study from England found that land-use intensity (LUI) is not the only factor influencing moth declines, as declines in semi-natural habitats are also evident. One suggested factor was climate change, as warm winters have a negative impact on moth abundance. However, other various, as yet unknown, causes for the observed declines are assumed (Blumgart, 2020).

Conservation aspects and general outlook

Even if this case study failed to identify any concrete evidence of climate change impacts on moth faunas in the Danube Floodplain National Park, this environmental pressure is becoming an increasing concern for this endangered area. Although the National Park is not affected by habitat fragmentation and intensification of land-use in its core area, these factors acting at the scale of the surrounding landscape are important drivers of the disappearance of moths (Mangels et al., 2017; Uhl et al., 2021a) and other wildlife (Collinge, 1996; Mullu, 2016). The lack of buffer zones and the direct proximity to human settlements and agricultural land can have a direct negative impact on habitat structure and diversity within protected areas (Uhl et al., 2021a). Furthermore may the lack of buffer zones, small extent, and fragmentation due to the dam well result in the national park having a less stable insect diversity in the long run, as it is primarily the quantity of existing habitats that suffers, and this is an important factor in addition to pure habitat quality (Uhl et al., 2021b). Due to the high host specificity of the larvae of many moths, complex diverse forest ecosystems are needed to maintain moth diversity (Roth et al., 2021). Because moth diversity is highest in older, more stable forest ecosystems, national parks are important refugia of stability (Fisher and Peterson, 2021). This is particularly evident in the fact that although the observed decline in insect abundance is also detectable in protected areas, it is occurring at lower rates in such conservation areas than in non-protected areas (van Klink et al., 2020).

In addition to the drying of the floodplain and possible future thermophilization, its particular location affects the national park. Without the possibility of an adequate buffer zone, the inflows from the surrounding intensively farmed areas directly affect the "core" zone. In degenerated landscapes, generalists have an advantage over specialists (Blumgart, 2020; Mangels et al., 2017). In nature reserves, which are insularly embedded in intensive agricultural landscapes, there are tendencies for sepcialists to be pushed back and replaced by generalists (both forest and meadow species) (Wölfling et al., 2019). Due to this qualitative change in moth diversity, external influences are difficult to capture by comparing species diversity, but are better captured by comparing species composition and functional diversity (Uhl et al., 2016). Due to the comparable situation of the Danube Floodplain National Park (isolation, succession), similar tendencies (displacement of species) can be expected. This is important, because protected areas are less affected by the triggers (land use intensity, habitat destruction, etc.) (Wagner et al., 2021) responsible for the reported "insect mortality" and, as shown in my study, the species diversity remained more or less the same, but no statement was made about the qualitative changes within the species community. However, the observed and demonstrated species turnover indicates major changes within communities.

One problem of repeating a study after 14 years is that the impact of single extreme weather events and, in the local case, the duration and extent of the floods cannot be assessed. As it is a snapshot of one year, especially the presence of rare species is difficult to prove, as the example of Red List species shows. Long-term studies show that there is a fluctuation in moth biomass at temporal scales over years to decades (Macgregor et al., 2019). Obviously, such decreases and increases cannot be thoroughly reflected by single inventories such as this one and may produce a biased or incomplete picture. Inclusion of moth assemblages comprising hundreds of species in annually replicated monitoring efforts is hardly conceivable, in view of the resources required for such an endeavor. Nevertheless, replications of local case studies at larger, though irregular time intervals offers the opportunity to assess whether gross patterns in the species assemblages have changed or remained robust. In this way, the present study contributes to the assessment of the status of biota in an important conservation area of eastern-most Austria.

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Appendix I Braun-Blanquet relevés, species list spring (non-flooded)

Site	1-1					1-2					1-3					1-4					1-5				
RelevÚ number	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
Acer sp	1	+		+	+	1	+	1	+	+	+		+	+	+	2	2	2	2	2	1	1	2	2	2
Aegopodium podagraria	1	1	1	1	1	1	+	2	+	1	2	2	2	2	2	1	1				+				
Allium ursinum	1	+		+																					
Anemone ranunculoides	2	2	2	1	1	2	2	2	2	2	1	2	2	2	1	2	2	2	1	2	+	+	+		+
Asarum europaeum	1		1	1	+	2	1	2	1	1	2	1	+	2			1								
Fraxinus excelsior	+		+		+	+	+	+			+	+	+									+			+
Galanthus nivalis	2	2	2	2	1	2	2	2	2	2	2	1	2	1	2	2	2	+	1	2	1	+		1	1
Geum urbanum	+	+	+	+	+	+		+		+						1									
Hedera helix	2	2	2	2	2	2	1	2	1	2	2	1	2	1	1								+	+	
Symphytum tuberosum	1				+				+					+											
Viola sp	r	+			r	+	1	1	+	+	1	2	1	2	1	+	+				1				
Paris quadrifolia		1	+	1		1	+	1	1	+	+	+		+	+		+								
Ficaria verna		2		2	1	2	1	2	+	2	1			+	+	1	2	2	1	2	+	+		+	1
Rubus sp		+									+										1	+	1	+	+
Sambucus nigra			+										+												
Mercurialis sp				1																					
Convallaria majalis						1					2														
Corylus avellana						+		+				+	+			+									
Polygonatum odoratum						+			+	1		2	+	2	2										
Pulmonaria officinalis						+	+	+	+																
Tilia sp							+			+												+			
Crataegus sp									+											r					+

Ligustrum vulgare										+															
Cornus mas											+	+												+	+
Hepatica nobilis												+	1	+											
Quercus robur												+													
Stachys sp													+												
Prunus sp															r										
Salvia glutinosa																+									
cover	55	65	50	60	33	90	80	60	55	60	70	60	80	55	85	75	65	25	25	35	25	5	15	25	15

Appendix II Braun-Blanquet relevés, species list spring (flood-prone)

Site	2-1					2-2					2-3					2-4					2-5				
RelevÚ number	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
Acer sp	1	+	+	1	+	+	+	+			+		+	+	+	1	1	+	1	1	1		1	1	+
Allium ursinum																	+	+					+		
Anemone ranunculoides	1	1	1	1	1	1	1	1	+	1	1	1	1	1	2	2	1	1	2	1	2	2	1	2	1
Galanthus nivalis	2	1		1	+	1	+	+	1	+	1	1	1	2	1	1	2	2	2	2	2	2	1	1	2
Geum urbanum												1		+	+										
Viola sp	+						1													+					
Paris quadrifolia											+	1		+					+	+		+			
Ficaria verna	2	2	3	2	2	2	2	2	1	3	2	3	2	3	2	2	2	2	2	2	1	2	2	2	2
Rubus sp										+		+	+	+	+										
Sambucus nigra		+							+		+	2	2	+	2										
Crataegus sp												+													
Cornus mas						+	+					1		+	2							1			
Galium aparine	+	1	3	4	3					+	2	2	2	2	1										
Veronica sp	1	2	2	1	2	+	+			1	+							+					1		+
Glechoma hederacea							+				2	1	2	+	1										
Urtica dioica											+	1	2												
Circaea lutetiana													1		1										
Euonymus europaeus																				+		+			+
Stellaria sp																						1		1	
Polygonatum latifolium																									+
cover	25	65	95	95	85	60	25	40	15	85	90	90	95	95	85	50	25	40	40	60	35	40	45	45	15

Appendix III Braun-Blanquet relevés, species list summer (non-flooded)

Site	1-1					1-2					1-3					1-4					1-5				
RelevÚ number	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
Acer sp	1	r		r	+	1	1	+	+	1	+	+	1	1	2	2	2	2	1	1	2	1	1	1	2
Aegopodium podagraria	+	+	+	1	+	+	+		+		2	1	2	2	1										
Asarum europaeum	+		1	+		1	2		1	+	1	+		1	+										
Fraxinus excelsior	1	1		+	+	+	+		r	+	+		+									r	+	+	
Geum urbanum	+												+			+	+				+				+
Glechoma hederacea	r																								
Hedera helix	5	3	3	3	3	2	2	2	2	2	2	1	2	2	+		+				1				+
Pulmonaria officinalis	r					+	+	r	+																
Paris quadrifolia		+	r	r		r	+				+														
Circaea lutetiana			1													+						+			
Rubus sp			r													+					+	+	1	+	+
Sambucus nigra			2									+	+	+	+										
Carex sylvatica				r																					
Corylus avellana					r	r	+			+		r	r	r		+									r
Viola sp						1	1	+	+	1	2	1	1	2	+	+	r				r	+			
Brachypodium sylvaticum								r		+											+				1
Impatiens parviflora								+								+	1				+				
Euonymus europaeus									r																
Ligustrum vulgare									+																
Populus alba										r															
Salvia glutinosa										+															
Carpinus betulus											r						r				r	+			
Cornus mas											2	+												+	2

Crataegus sp											r										r	r			
Polygonatum odoratum											+	2	+	1	2										
Hepatica nobilis												+	+	1											
Quercus sp												r													
Convallaria majalis															+										
Parietaria officinalis																+									
Solidago sp																						+			
Tilia cordata																									+
cover	90	60	50	60	50	45	50	20	50	45	50	75	90	90	90	40	70	35	75	65	40	50	30	25	65

Appendix IV Braun-Blanquet relevés, species list summer (flood-prone)

Site	2-1					2-2					2-3					2-4					2-5				
RelevÚ number	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
Acer sp	+	r			r	+	r	r	+	+	+	r	+	+	+	1	1		+	+	1	1		1	1
Geum urbanum									+			+	2	r	1										
Glechoma hederacea								r			2	2	2	2	+										
Hedera helix																								r	
Paris quadrifolia															r		r								
Circaea lutetiana	r										1	+	1	1	+									r	
Rubus sp									+	+		r													
Sambucus nigra	+	+			+	3		+			2	2	1	2											
Carex sylvatica												r	2		+										
Corylus avellana																						r			
Viola sp	+						r		+			+	+				r			r	r	r			
Brachypodium sylvaticum																									
Impatiens parviflora	1	1	2		1	2	+	3	2	2	+	+		r	+										
Euonymus europaeus						+	1	+	+	r							r			+				r	+
Populus alba					r													r							
Cornus mas	2					2					2	2	1	2	+									r	
Crataegus sp						+						+							r			r			
Impatiens sp	+		+					+	+	+	+														
Convolvulus arvensis						r																			
Stachys sp									+																
Urtica dioica											+	+													
Stachys sylvatica																								r	

cover	30	40	60	60	25	60	15	50	40	80	75	65	60	50	40	17	12	13	27	35	15	15	22	20	20

Appendix V Moth species in alphabetical order. Individual numbers recorded in 2020

Species	1-1	1-2	1-3	1-4	1-5	T1	2-1	2-2	2-3	2-4	2-5	T2
Abraxas grossulariata	0	1	0	0	0	**1**	0	0	0	0	0	**0**
Abrostola tripartita	0	0	0	0	0	**0**	0	0	0	1	0	**1**
Abrostola triplasia	2	0	2	0	1	**5**	1	1	1	0	3	**6**
Acasis viretata	0	0	0	0	0	**0**	0	0	0	1	0	**1**
Acrobasis advenella	0	7	0	0	1	**8**	6	2	1	2	2	**13**
Acronicta megacephala	0	0	0	0	0	**0**	3	11	3	0	2	**19**
Acronicta rumicis	1	1	0	1	1	**4**	0	0	0	0	1	**1**
Acronicta strigosa	1	0	0	0	0	**1**	0	0	0	0	0	**0**
Agriopis aurantiaria	6	2	2	2	2	**14**	0	0	1	0	0	**1**
Agriopis bajaria	0	2	0	0	0	**2**	0	0	0	0	0	**0**
Agriopis marginaria	0	0	1	0	0	**1**	0	0	0	0	0	**0**
Agriphila inquinatella	2	0	0	1	1	**4**	1	1	0	0	0	**2**
Agriphila straminella	0	0	0	0	0	**0**	0	0	1	0	1	**2**
Agriphila tolli	1	0	1	0	0	**2**	0	0	0	0	0	**0**
Agrochola laevis	0	0	1	0	0	**1**	0	0	0	0	0	**0**
Agrochola macilenta	0	0	0	1	4	**5**	0	1	2	0	0	**3**
Agrochola nitida	12	8	18	8	2	**48**	2	8	3	8	19	**40**
Agrotis exclamationis	0	1	3	2	2	**8**	0	0	1	0	0	**1**
Agrotis segetum	7	6	9	7	10	**39**	1	0	0	1	1	**3**
Alcis repandata	0	0	0	0	0	**0**	0	1	0	0	0	**1**
Allophyes oxyacanthae	1	0	1	3	2	**7**	0	1	4	1	0	**6**
Alsophila aescularia	9	11	10	4	6	**40**	0	1	0	3	3	**7**
Amphipyra berbera	0	0	1	0	0	**1**	0	0	0	0	0	**0**
Amphipyra pyramidea	2	4	7	1	0	**14**	0	1	1	4	1	**7**
Amphipyra tragopoginis	0	0	0	0	1	**1**	0	1	0	0	0	**1**
Anania coronata	3	0	4	0	2	**9**	1	1	2	2	2	**8**
Anania hortulata	2	1	1	0	0	**4**	13	7	7	2	8	**37**
Anania lancealis	3	0	1	0	0	**4**	1	3	3	5	5	**17**
Anania stachydalis	4	1	4	1	1	**11**	0	3	0	1	0	**4**
Anania terrealis	0	0	0	0	0	**0**	0	0	0	0	1	**1**
Anania verbascalis	2	0	0	0	0	**2**	0	1	0	1	0	**2**
Anarta trifolii	0	0	1	0	1	**2**	0	0	0	0	0	**0**
Angerona prunaria	11	2	6	3	4	**26**	1	1	12	1	2	**17**
Anorthoa munda	4	7	0	0	2	**13**	2	2	1	2	0	**7**
Apamea monoglypha	1	3	3	0	2	**9**	1	1	0	2	1	**5**
Apamea scolopacina	0	0	2	0	0	**2**	0	1	1	2	2	**6**
Apamea sublustris	0	0	0	0	0	**0**	0	1	0	0	0	**1**
Apeira syringaria	1	0	0	0	0	**1**	0	0	0	1	0	**1**
Aphomia sociella	0	0	0	0	1	**1**	0	0	0	0	0	**0**
Apocheima hispidaria	1	0	0	0	0	**1**	0	0	0	0	0	**0**

Apoda limacodes	20	3	10	2	22	**57**	0	0	0	0	0	**0**
Apterogenum ypsillon	0	1	0	0	0	**1**	0	1	0	0	0	**1**
Artiora evonymaria	0	1	0	0	0	**1**	0	0	0	1	0	**1**
Ascotis selenaria	0	2	0	0	1	**3**	1	0	0	0	0	**1**
Asteroscopus sphinx	2	7	4	1	1	**15**	2	0	2	0	0	**4**
Asthena anseraria	0	0	0	0	0	**0**	1	2	0	1	1	**5**
Atethmia centrago	0	0	0	0	0	**0**	0	0	0	0	1	**1**
Athetis gluteosa	0	1	1	0	0	**2**	0	1	1	0	0	**2**
Atolmis rubricollis	0	0	0	0	0	**0**	0	0	0	1	0	**1**
Atypha pulmonaris	0	0	1	0	0	**1**	1	0	1	1	0	**3**
Autographa gamma	0	0	1	0	1	**2**	0	0	0	0	0	**0**
Axylia putris	0	0	1	0	0	**1**	1	2	1	2	4	**10**
Biston betularia	3	1	0	0	0	**4**	1	0	1	1	2	**5**
Biston strataria	1	0	0	0	0	**1**	0	0	0	0	0	**0**
Brachionycha nubeculosa	1	8	1	6	1	**17**	3	2	2	2	2	**11**
Cabera exanthemata	4	4	1	1	2	**12**	3	2	1	1	1	**8**
Cabera pusaria	0	0	1	1	2	**4**	3	2	3	3	4	**15**
Cadra furcatella	0	0	0	0	0	**0**	0	0	0	0	1	**1**
Calliteara pudibunda	6	5	3	1	10	**25**	9	8	7	4	7	**35**
Campaea margaritaria	15	22	23	9	36	**105**	0	4	6	11	8	**29**
Camptogramma bilineata	2	2	1	1	2	**8**	0	0	0	2	0	**2**
Caradrina kadenii	5	2	6	3	3	**19**	1	2	0	1	1	**5**
Caradrina morpheus	0	1	1	0	1	**3**	1	0	0	1	2	**4**
Cataclysta lemnata	0	0	1	0	0	**1**	1	1	0	0	0	**2**
Catocala fraxini	0	0	1	0	1	**2**	1	1	2	1	1	**6**
Catocala fulminea	0	1	0	0	0	**1**	0	0	0	0	0	**0**
Catocala nupta	2	1	0	0	0	**3**	2	2	2	4	0	**10**
Catoptria falsella	0	2	0	1	1	**4**	2	5	0	0	0	**7**
Catoptria verellus	16	6	9	11	16	**58**	4	6	2	2	2	**16**
Cepphis advenaria	2	3	2	0	0	**7**	0	1	0	1	0	**2**
Cerastis leucographa	1	1	0	0	0	**2**	0	1	1	0	1	**3**
Cerura erminea	1	1	0	0	0	**2**	0	0	0	0	0	**0**
Charanyca trigrammica	0	4	10	0	5	**19**	0	0	0	0	1	**1**
Chiasmia clathrata	1	0	0	0	3	**4**	0	1	0	0	1	**2**
Chilo phragmitella	0	0	0	0	2	**2**	1	0	0	0	0	**1**
Chloroclysta siterata	0	2	0	0	0	**2**	0	0	1	0	0	**1**
Chloroclystis v-ata	2	1	2	0	1	**6**	1	2	0	1	3	**7**
Chrysoteuchia culmella	1	0	0	0	0	**1**	0	0	0	0	1	**1**
Cirrhia icteritia	1	0	0	0	0	**1**	1	0	1	0	0	**2**
Cirrhia ocellaris	0	0	0	0	0	**0**	2	2	1	1	0	**6**
Cleoceris scoriacea	0	1	0	0	0	**1**	0	0	0	0	0	**0**
Cleorodes lichenaria	0	0	0	0	0	**0**	0	0	0	1	0	**1**
Clostera curtula	1	2	1	0	2	**6**	3	1	3	1	1	**9**
Colobochyla salicalis	0	0	0	0	0	**0**	0	0	0	0	1	**1**
Colocasia coryli	12	11	12	5	14	**54**	1	3	7	3	2	**16**

Colostygia pectinataria	0	0	2	0	1	**3**	0	0	0	0	0	**0**
Colotois pennaria	34	33	12	11	23	**113**	0	0	2	1	0	**3**
Conistra erythrocephala	1	0	0	0	1	**2**	0	0	0	0	0	**0**
Conistra rubiginosa	0	0	0	1	0	**1**	0	0	0	0	0	**0**
Conistra vaccinii	2	2	5	5	5	**19**	0	2	0	0	2	**4**
Cosmia affinis	1	1	0	2	2	**6**	0	1	0	0	0	**1**
Cosmia diffinis	0	0	1	0	0	**1**	0	0	0	0	0	**0**
Cosmia pyralina	2	0	1	0	1	**4**	1	0	0	1	1	**3**
Cosmia trapezina	1	4	1	1	5	**12**	0	4	2	3	2	**11**
Cosmorhoe ocellata	0	1	0	1	0	**2**	0	0	0	0	0	**0**
Costaconvexa polygrammata	0	0	0	0	1	**1**	0	0	0	0	0	**0**
Crambus lathoniellus	5	1	3	0	3	**12**	0	1	0	1	1	**3**
Craniophora ligustri	1	2	4	1	4	**12**	0	0	1	0	2	**3**
Crocallis elinguaria	0	1	2	0	1	**4**	0	1	0	1	0	**2**
Cryphia algae	1	0	0	0	0	**1**	0	0	0	0	0	**0**
Cryphia fraudatricula	1	0	0	0	0	**1**	1	2	1	1	1	**6**
Cyclophora annularia	41	36	31	17	48	**173**	7	23	11	22	6	**69**
Cyclophora linearia	5	2	0	0	0	**7**	0	0	0	0	0	**0**
Cyclophora punctaria	1	0	1	1	1	**4**	0	0	0	0	2	**2**
Cydalima perspectalis	0	1	0	0	0	**1**	0	0	0	0	0	**0**
Delplanqueia inscriptella	0	0	2	0	0	**2**	0	0	0	0	0	**0**
Deltote pygarga	4	5	0	11	14	**34**	4	1	4	29	7	**45**
Diachrysia chrysitis	0	1	2	1	1	**5**	5	3	3	0	2	**13**
Diaphora mendica	1	0	0	1	0	**2**	0	0	1	0	0	**1**
Diarsia brunnea	0	0	1	0	0	**1**	0	0	0	1	2	**3**
Diloba caeruleocephala	0	2	0	2	4	**8**	4	0	4	3	0	**11**
Dolicharthria punctalis	0	1	2	0	0	**3**	0	0	0	1	1	**2**
Drymonia dodonaea	1	1	1	3	5	**11**	0	4	0	2	1	**7**
Dypterygia scabriuscula	1	1	3	0	0	**5**	0	0	2	0	0	**2**
Dysauxes ancilla	0	1	0	0	0	**1**	1	0	0	0	0	**1**
Eccopisa effractella	0	1	1	0	2	**4**	0	0	0	0	1	**1**
Ecliptopera silaceata	28	20	18	4	16	**86**	30	51	45	57	36	**219**
Ecpyrrhorrhoe rubiginalis	0	0	0	0	0	**0**	0	0	1	0	0	**1**
Ectropis crepuscularia	3	1	3	2	0	**9**	11	10	17	2	6	**46**
Egira conspicillaris	0	1	2	0	0	**3**	0	0	0	0	0	**0**
Eilema depressa	0	0	0	0	0	**0**	0	0	1	0	0	**1**
Eilema griseola	9	3	1	0	2	**15**	47	23	29	16	21	**136**
Eilema lurideola	5	2	4	0	2	**13**	0	1	0	0	2	**3**
Eilema sororcula	2	2	4	3	5	**16**	5	4	1	1	1	**12**
Elaphria venustula	0	0	0	0	0	**0**	0	1	0	0	0	**1**
Electrophaes corylata	0	0	0	0	1	**1**	0	0	0	0	0	**0**
Elophila nymphaeata	0	0	0	0	0	**0**	1	0	0	0	0	**1**
Ematurga atomaria	0	0	0	0	0	**0**	0	1	0	0	1	**2**
Endotricha flammealis	6	6	17	7	7	**43**	0	0	0	2	2	**4**
Ennomos autumnaria	5	4	3	3	2	**17**	1	4	2	3	2	**12**

Ennomos erosaria	0	1	1	1	0	**3**	0	0	0	0	0	**0**
Ennomos quercinaria	14	11	19	16	26	**86**	1	4	1	4	5	**15**
Ephestia elutella	0	0	0	0	1	**1**	0	0	0	0	0	**0**
Ephestia woodiella	4	2	0	2	1	**9**	1	0	0	0	0	**1**
Epione repandaria	1	0	0	0	0	**1**	0	0	0	0	0	**0**
Epirrhoe alternata	15	10	6	16	13	**60**	13	14	20	20	17	**84**
Epirrita dilutata	12	10	3	0	4	**29**	3	2	2	0	0	**7**
Erannis defoliaria	47	34	41	30	30	**182**	0	3	8	0	0	**11**
Etiella zinckenella	2	0	0	0	0	**2**	0	0	0	0	0	**0**
Euchoeca nebulata	1	1	3	0	0	**5**	0	0	1	7	4	**12**
Eudonia lacustrata	1	0	2	3	2	**8**	0	1	0	0	0	**1**
Eudonia mercurella	4	13	5	6	10	**38**	1	2	7	4	1	**15**
Eudonia pallida	0	0	0	0	0	**0**	0	0	2	1	0	**3**
Eudonia truncicolella	0	0	1	0	2	**3**	0	0	0	0	0	**0**
Eugnorisma depuncta	11	18	13	8	3	**53**	4	1	3	4	0	**12**
Eupithecia assimilata	0	0	0	0	1	**1**	0	1	0	0	0	**1**
Eupithecia dodoneata	1	1	0	0	0	**2**	0	0	0	0	0	**0**
Eupithecia egenaria	0	1	0	0	0	**1**	0	0	0	0	0	**0**
Eupithecia haworthiata	0	0	0	1	0	**1**	0	0	0	1	1	**2**
Eupithecia inturbata	2	6	0	4	1	**13**	1	7	5	5	0	**18**
Eupithecia plumbeolata	0	0	0	0	1	**1**	0	0	0	0	0	**0**
Eupithecia virgaureata	0	1	1	2	0	**4**	0	0	0	0	0	**0**
Euplagia quadripunctaria	1	0	0	1	0	**2**	0	0	0	0	0	**0**
Euplexia lucipara	1	1	1	0	0	**3**	0	3	2	0	3	**8**
Euproctis chrysorrhoea	0	0	3	0	0	**3**	0	0	0	0	1	**1**
Euproctis similis	1	0	0	0	0	**1**	7	2	4	2	4	**19**
Eupsilia transversa	2	6	4	1	2	**15**	5	8	6	3	2	**24**
Euthrix potatoria	1	1	0	0	2	**4**	0	1	0	1	1	**3**
Euxoa tritici agg.	0	0	0	1	1	**2**	0	0	0	0	0	**0**
Evergestis forficalis	0	0	0	0	0	**0**	0	0	0	1	0	**1**
Furcula bifida	0	0	0	0	0	**0**	0	1	0	0	0	**1**
Furcula furcula	1	0	0	0	0	**1**	0	0	0	0	0	**0**
Gandaritis pyraliata	1	0	0	1	0	**2**	3	2	2	1	0	**8**
Gluphisia crenata	1	0	0	1	0	**2**	2	2	0	0	0	**4**
Griposia aprilina	0	0	0	0	0	**0**	0	0	0	1	0	**1**
Gymnoscelis rufifasciata	0	0	0	0	0	**0**	0	2	0	0	0	**2**
Habrosyne pyritoides	0	0	0	1	0	**1**	0	0	0	3	0	**3**
Helicoverpa armigera	2	0	1	0	0	**3**	0	0	0	1	0	**1**
Hemistola chrysoprasaria	0	0	1	1	2	**4**	1	0	0	0	0	**1**
Hemithea aestivaria	0	0	3	0	0	**3**	1	0	2	1	1	**5**
Herminia grisealis	8	9	14	7	13	**51**	5	13	6	10	5	**39**
Herminia tarsicrinalis	16	10	22	3	23	**74**	21	23	18	14	22	**98**
Herminia tarsipennalis	0	1	1	4	0	**6**	0	2	3	0	2	**7**
Heterogenea asella	0	0	0	0	0	**0**	0	0	0	0	1	**1**
Hoplodrina ambigua	9	5	8	8	3	**33**	0	1	0	0	1	**2**

Hoplodrina blanda	1	0	2	0	0	**3**	3	0	1	18	0	**22**
Hoplodrina octogenaria	2	2	8	4	11	**27**	1	3	1	2	0	**7**
Hoplodrina respersa	0	0	0	0	2	**2**	0	0	0	2	0	**2**
Horisme corticata	0	0	2	0	0	**2**	0	0	0	0	0	**0**
Horisme tersata	1	0	0	0	0	**1**	0	0	0	0	0	**0**
Hydriomena impluviata	0	0	0	0	0	**0**	0	1	0	0	0	**1**
Hypena proboscidalis	3	2	4	3	3	**15**	19	29	9	32	7	**96**
Hypomecis punctinalis	4	2	11	4	11	**32**	6	18	14	5	13	**56**
Hypomecis roboraria	30	14	27	1	24	**96**	6	11	11	3	21	**52**
Hypsopygia glaucinalis	0	0	0	1	0	**1**	1	0	0	0	1	**2**
Idaea aversata	5	1	3	5	5	**19**	3	2	3	2	0	**10**
Idaea biselata	25	15	16	12	12	**80**	9	13	9	9	14	**54**
Idaea degeneraria	5	1	3	3	4	**16**	0	1	0	1	4	**6**
Idaea dimidiata	1	0	0	0	0	**1**	1	2	1	2	0	**6**
Idaea rusticata	3	1	2	2	4	**12**	0	0	0	0	1	**1**
Idaea subsericeata	0	0	0	0	0	**0**	0	0	0	0	1	**1**
Idaea sylvestraria	0	0	0	0	1	**1**	0	0	0	0	1	**1**
Idaea trigeminata	1	0	0	0	0	**1**	0	0	1	0	0	**1**
Idia calvaria	1	0	0	1	0	**2**	0	0	0	0	0	**0**
Ipimorpha subtusa	0	0	0	0	0	**0**	0	1	3	0	1	**5**
Jodis lactearia	1	0	0	1	1	**3**	0	0	0	1	0	**1**
Lacanobia oleracea	4	4	5	1	0	**14**	0	2	0	1	0	**3**
Lacanobia suasa	1	0	0	0	0	**1**	0	0	0	0	0	**0**
Lacanobia thalassina	1	0	0	0	0	**1**	0	0	0	0	0	**0**
Laodamia faecella	0	0	0	0	0	**0**	0	3	0	0	0	**3**
Laothoe populi	0	0	1	0	0	**1**	2	3	9	0	1	**15**
Laspeyria flexula	3	2	2	1	3	**11**	3	0	4	0	1	**8**
Lateroligia ophiogramma	0	0	0	1	0	**1**	0	0	0	0	0	**0**
Leucania comma	1	0	0	0	0	**1**	0	0	0	0	0	**0**
Leucania obsoleta	0	0	1	0	0	**1**	0	0	0	0	0	**0**
Leucoma salicis	0	0	0	1	0	**1**	2	5	1	4	2	**14**
Ligdia adustata	5	8	16	8	8	**45**	1	5	4	2	2	**14**
Lithophane furcifera	1	0	0	0	0	**1**	0	0	0	1	0	**1**
Lithophane ornitopus	1	0	1	0	0	**2**	0	1	0	0	0	**1**
Lithophane semibrunnea	1	0	0	0	0	**1**	0	0	0	0	0	**0**
Lithosia quadra	19	4	6	5	21	**55**	2	3	1	6	2	**14**
Lobophora halterata	1	1	0	1	0	**3**	0	4	0	1	0	**5**
Lomaspilis marginata	4	1	4	0	5	**14**	29	33	23	16	4	**105**
Lomographa bimaculata	12	7	5	4	16	**44**	20	16	12	11	18	**77**
Lomographa temerata	0	2	0	1	1	**4**	0	2	0	0	1	**3**
Lycia hirtaria	10	6	3	7	5	**31**	40	27	15	20	6	**108**
Lygephila pastinum	0	0	0	0	0	**0**	0	1	0	0	0	**1**
Lymantria dispar	1	3	0	0	1	**5**	0	2	0	0	2	**4**
Macaria alternata	2	0	2	0	1	**5**	0	1	1	1	0	**3**
Macaria notata	2	1	0	0	0	**3**	0	0	0	0	0	**0**

Mamestra brassicae	1	2	1	0	1	**5**	0	0	0	0	0	**0**
Meganephria bimaculosa	0	1	0	0	0	**1**	0	0	0	0	0	**0**
Meganola albula	1	1	0	2	3	**7**	0	0	2	1	1	**4**
Melanthia procellata	3	4	4	1	5	**17**	2	5	3	2	2	**14**
Mesapamea secalella	1	0	0	0	0	**1**	0	0	0	0	0	**0**
Mesapamea secalis	0	1	2	0	3	**6**	0	1	0	0	0	**1**
Mesoleuca albicillata	0	0	0	0	0	**0**	0	0	1	0	0	**1**
Mesoligia furuncula	0	1	0	0	0	**1**	0	0	0	0	0	**0**
Mimas tiliae	4	5	0	1	1	**11**	0	1	0	3	3	**7**
Mniotype satura	2	6	1	0	1	**10**	2	0	0	1	0	**3**
Mythimna albipuncta	7	0	3	2	1	**13**	1	0	0	1	0	**2**
Mythimna conigera	0	1	0	0	0	**1**	0	0	0	0	0	**0**
Mythimna l-album	1	0	1	0	2	**4**	0	0	0	0	0	**0**
Mythimna turca	9	8	7	3	4	**31**	2	2	1	5	13	**23**
Mythimna unipuncta	0	0	1	0	0	**1**	0	0	0	0	0	**0**
Mythimna vitellina	1	1	0	0	0	**2**	0	0	1	1	0	**2**
Nephopterix angustella	0	1	0	0	0	**1**	0	0	0	0	0	**0**
Noctua fimbriata	3	1	2	1	4	**11**	0	1	1	1	2	**5**
Noctua interposita	0	1	3	0	0	**4**	1	0	0	0	0	**1**
Noctua janthe	1	0	0	0	1	**2**	1	3	1	2	0	**7**
Noctua janthina	2	0	3	1	1	**7**	0	0	0	2	0	**2**
Noctua pronuba	12	13	12	6	4	**47**	1	9	2	10	7	**29**
Nola aerugula	0	0	0	0	0	**0**	0	1	0	0	0	**1**
Nola confusalis	0	0	0	1	0	**1**	0	0	0	0	0	**0**
Nola cucullatella	0	0	0	0	0	**0**	0	0	0	1	0	**1**
Notodonta dromedarius	0	1	0	0	0	**1**	0	0	0	0	0	**0**
Notodonta tritophus	0	0	0	0	0	**0**	1	0	0	0	0	**1**
Notodonta ziczac	0	0	0	0	0	**0**	0	1	0	0	0	**1**
Ochropleura plecta	1	0	6	1	0	**8**	2	3	4	5	1	**15**
Oligia latruncula	1	0	0	0	0	**1**	1	3	2	4	2	**12**
Oncocera semirubella	2	3	4	0	1	**10**	1	1	0	1	0	**3**
Operophtera brumata	7	5	6	2	6	**26**	1	0	0	0	0	**1**
Opigena polygona	0	0	0	0	0	**0**	0	1	0	0	0	**1**
Opisthograptis luteolata	0	0	0	1	0	**1**	0	0	0	0	0	**0**
Orgyia antiqua	0	0	0	0	1	**1**	0	1	1	0	0	**2**
Orthosia cerasi	11	7	2	4	4	**28**	12	6	6	5	5	**34**
Orthosia cruda	0	0	2	0	0	**2**	1	1	0	1	2	**5**
Orthosia gothica	8	6	4	10	7	**35**	4	10	8	7	3	**32**
Orthosia gracilis	0	0	3	1	0	**4**	0	0	0	1	0	**1**
Orthosia incerta	7	7	4	3	3	**24**	9	6	3	7	5	**30**
Orthosia populeti	0	0	0	0	0	**0**	1	1	0	0	1	**3**
Ostrinia nubilalis	1	1	0	0	0	**2**	0	0	1	2	0	**3**
Ourapteryx sambucaria	0	0	1	0	0	**1**	0	2	0	0	0	**2**
Palpita vitrealis	0	0	1	0	0	**1**	0	0	0	0	0	**0**
Paracolax tristalis	12	4	4	2	5	**27**	0	4	0	3	6	**13**

Paradarisa consonaria	3	5	3	3	4	**18**	8	9	7	12	5	**41**
Parapoynx stratiotata	1	3	0	0	0	**4**	2	0	0	1	2	**5**
Parascotia fuliginaria	1	1	0	0	0	**2**	0	0	0	0	0	**0**
Parastichtis suspecta	0	2	0	0	0	**2**	1	0	0	0	0	**1**
Paratalanta pandalis	0	0	0	1	0	**1**	0	0	0	0	0	**0**
Pasiphila rectangulata	0	2	0	0	0	**2**	1	1	1	0	2	**5**
Patania ruralis	10	8	12	3	4	**37**	33	35	43	25	30	**166**
Pechipogo strigilata	3	7	0	1	4	**15**	3	0	0	3	0	**6**
Pediasia contaminella	0	0	1	0	0	**1**	1	0	0	0	0	**1**
Pelosia muscerda	2	2	2	1	4	**11**	40	31	18	32	25	**146**
Peribatodes rhomboidaria	11	27	18	16	21	**93**	3	12	12	19	10	**56**
Peribatodes secundaria	3	0	2	0	1	**6**	0	0	0	0	0	**0**
Peridea anceps	0	0	3	3	0	**6**	0	1	0	1	0	**2**
Perizoma alchemillata	1	0	1	2	0	**4**	1	2	0	1	1	**5**
Phalera bucephala	0	1	0	1	1	**3**	1	0	3	2	3	**9**
Pheosia gnoma	0	0	0	0	0	**0**	1	0	0	0	0	**1**
Pheosia tremula	6	4	1	2	19	**32**	72	52	56	15	11	**206**
Philereme transversata	0	0	0	0	0	**0**	0	1	1	3	0	**5**
Philereme vetulata	0	0	0	1	0	**1**	0	0	0	0	0	**0**
Phlogophora meticulosa	1	2	0	0	0	**3**	0	0	1	0	0	**1**
Phragmataecia castaneae	0	0	0	1	0	**1**	1	1	0	1	0	**3**
Phragmatobia fuliginosa	0	0	0	0	2	**2**	0	1	0	0	1	**2**
Phycita roborella	0	0	1	1	0	**2**	0	0	0	0	0	**0**
Phyllodesma tremulifolia	1	0	1	0	0	**2**	0	0	0	0	0	**0**
Plagodis dolabraria	3	2	4	0	0	**9**	0	0	1	0	0	**1**
Plagodis pulveraria	6	7	8	1	11	**33**	2	1	2	1	1	**7**
Platytes cerussella	0	2	0	0	0	**2**	0	0	0	0	0	**0**
Plemyria rubiginata	0	0	1	0	0	**1**	0	0	0	0	0	**0**
Poecilocampa populi	5	1	1	1	5	**13**	6	2	6	2	1	**17**
Polyphaenis sericata	2	1	2	4	1	**10**	0	0	0	0	0	**0**
Polypogon tentacularia	3	0	0	0	1	**4**	1	0	0	1	1	**3**
Pseudeustrotia candidula	0	0	0	1	0	**1**	1	0	0	0	1	**2**
Pseudoips prasinanus	0	0	0	0	1	**1**	0	0	0	0	0	**0**
Pterostoma palpina	0	1	0	0	0	**1**	3	4	2	1	0	**10**
Ptilodon capucina	1	0	1	0	0	**2**	0	2	1	0	2	**5**
Ptilodon cucullina	8	5	6	6	18	**43**	1	0	8	5	7	**21**
Ptilophora plumigera	155	86	99	155	206	**701**	5	21	13	15	1	**55**
Pyralis farinalis	0	0	0	0	1	**1**	1	0	0	0	0	**1**
Pyrrhia umbra	0	0	1	1	0	**2**	0	0	0	0	0	**0**
Rhizedra lutosa	0	0	0	0	0	**0**	0	1	0	0	0	**1**
Rivula sericealis	3	4	7	1	2	**17**	4	5	5	3	3	**20**
Sabra harpagula	3	1	1	2	1	**8**	0	0	1	0	0	**1**
Saturnia pyri	2	0	1	1	0	**4**	0	1	0	0	0	**1**
Schoenobius gigantella	1	0	0	1	0	**2**	0	1	0	0	0	**1**
Schrankia costaestrigalis	0	1	0	0	0	**1**	0	1	0	0	0	**1**

Schrankia taenialis	0	0	1	0	0	**1**	0	0	0	0	0	**0**
Sciota fumella	1	0	0	0	0	**1**	0	0	0	0	0	**0**
Sciota rhenella	0	0	3	1	2	**6**	0	0	1	0	1	**2**
Scoparia ambigualis	3	1	0	0	1	**5**	0	0	0	0	2	**2**
Scoparia basistrigalis	2	3	5	5	2	**17**	6	6	12	12	5	**41**
Scopula floslactata	1	1	1	1	1	**5**	1	0	0	0	0	**1**
Scopula immorata	0	0	0	0	0	**0**	1	0	0	0	0	**1**
Scopula marginepunctata	0	1	0	0	0	**1**	0	0	0	0	0	**0**
Scopula nigropunctata	1	0	3	1	1	**6**	3	0	5	1	3	**12**
Scopula virgulata	1	0	0	0	0	**1**	1	3	0	0	0	**4**
Selenia dentaria	3	1	6	1	4	**15**	1	0	2	2	1	**6**
Selenia lunularia	4	7	0	4	0	**15**	0	2	0	1	1	**4**
Selenia tetralunaria	17	46	22	10	23	**118**	6	17	13	29	9	**74**
Spatalia argentina	2	0	1	0	1	**4**	0	0	0	0	1	**1**
Sphinx ligustri	0	0	1	0	0	**1**	0	0	0	1	0	**1**
Spilosoma lubricipeda	0	0	0	0	0	**0**	0	1	4	2	4	**11**
Spilosoma lutea	2	3	1	0	0	**6**	8	7	4	7	5	**31**
Stauropus fagi	3	3	2	2	2	**12**	2	2	0	0	0	**4**
Stegania cararia	0	0	0	0	0	**0**	1	0	0	0	0	**1**
Stegania dilectaria	0	1	0	0	0	**1**	1	0	0	0	0	**1**
Sunira circellaris	2	2	1	1	2	**8**	2	1	5	7	2	**17**
Tethea ocularis	0	0	0	1	0	**1**	0	0	0	0	0	**0**
Tethea or	3	1	0	1	0	**5**	1	5	5	5	1	**17**
Thalpophila matura	0	0	0	0	0	**0**	0	0	0	2	0	**2**
Thaumetopoea processionea	0	0	0	1	0	**1**	0	0	0	0	0	**0**
Tholera decimalis	0	0	1	0	0	**1**	0	0	0	0	0	**0**
Thyatira batis	0	2	1	1	2	**6**	0	1	3	0	0	**4**
Tiliacea aurago	1	0	0	0	0	**1**	0	0	0	0	0	**0**
Timandra comae	3	3	1	2	0	**9**	1	0	1	1	2	**5**
Trachea atriplicis	2	2	0	1	0	**5**	0	0	0	0	1	**1**
Triodia sylvina	0	0	0	0	0	**0**	0	0	0	1	0	**1**
Trisateles emortualis	9	0	2	1	1	**13**	0	1	0	0	0	**1**
Udea accolalis	0	0	0	0	0	**0**	0	0	2	0	0	**2**
Udea ferrugalis	1	1	0	1	0	**3**	2	0	0	0	0	**2**
Udea fulvalis	0	0	0	0	0	**0**	0	0	0	1	0	**1**
Valeria oleagina	0	0	0	0	0	**0**	0	1	0	1	0	**2**
Watsonalla binaria	1	0	0	0	0	**1**	0	0	0	0	0	**0**
Xanthia gilvago	0	0	0	0	0	**0**	0	1	0	0	0	**1**
Xanthorhoe biriviata	0	0	1	0	0	**1**	0	0	2	2	0	**4**
Xanthorhoe designata	0	0	0	0	0	**0**	0	1	0	0	0	**1**
Xanthorhoe ferrugata	1	0	0	0	0	**1**	1	1	0	0	0	**2**
Xanthorhoe fluctuata	1	0	0	0	1	**2**	0	1	0	0	0	**1**
Xanthorhoe spadicearia	0	0	0	0	0	**0**	0	1	0	0	0	**1**
Xestia c-nigrum	16	19	26	6	6	**73**	7	6	3	28	10	**54**
Xestia ditrapezium	0	0	0	0	0	**0**	0	1	0	0	0	**1**

Xestia triangulum	5	2	4	4	4	**19**	1	0	1	0	2	**4**
Xestia xanthographa	3	0	4	2	0	**9**	0	0	0	1	0	**1**
Xylena exsoleta	1	0	0	0	0	**1**	0	0	0	0	0	**0**
Total per site	1069	863	916	637	1028	**4513**	695	830	712	771	588	**3596**

Appendix VI Moth species in alphabetical order. Individual numbers recorded in 2006-2008 (Truxa, 2012)

Species	DF 1	DF2	DF3	DF4	DF5	TF	DN1	DN2	DN3	DN4	DN5	TN
Abrostola tripartita	0	0	0	1	1	**2**	0	0	0	0	0	**0**
Abrostola triplasia	1	0	0	0	3	**4**	0	2	3	0	2	**7**
Acontia trabealis	0	1	0	0	1	**2**	0	0	0	0	0	**0**
Acrobasis advenella	7	3	8	6	3	**27**	3	0	1	0	1	**5**
Acrobasis legatea	0	0	0	0	1	**1**	0	0	0	0	0	**0**
Acrobasis suavella	0	0	0	0	0	**0**	0	0	0	0	1	**1**
Acronicta alni	0	0	0	0	1	**1**	0	0	0	0	2	**2**
Acronicta auricoma	0	0	0	0	0	**0**	1	0	0	0	0	**1**
Acronicta cuspis	2	0	0	0	1	**3**	0	0	0	0	0	**0**
Acronicta megacephala	2	2	7	4	8	**23**	0	0	0	0	0	**0**
Acronicta rumicis	2	0	1	1	0	**4**	1	1	2	1	0	**5**
Acronicta strigosa	1	0	1	0	0	**2**	0	0	0	0	0	**0**
Agriopis aurantiaria	4	3	0	3	0	**10**	4	0	0	2	0	**6**
Agriopis bajaria	1	0	0	1	0	**2**	0	0	0	0	1	**1**
Agriphila inquinatella	1	3	1	0	0	**5**	1	0	1	0	1	**3**
Agriphila straminella	0	0	0	0	0	**0**	0	0	1	1	0	**2**
Agriphila tolli	0	0	0	0	2	**2**	0	0	0	0	1	**1**
Agrochola lychnidis	0	0	0	0	0	**0**	0	0	0	1	0	**1**
Agrochola nitida	0	0	0	0	0	**0**	3	1	3	0	1	**8**
Agrotera nemoralis	0	0	0	0	1	**1**	0	3	1	0	0	**4**
Agrotis bigramma	0	0	0	1	0	**1**	0	2	1	0	0	**3**
Agrotis exclamationis	0	0	0	0	0	**0**	5	4	5	2	3	**19**
Agrotis ipsilon	0	0	0	0	0	**0**	3	0	0	2	1	**6**
Agrotis segetum	1	2	0	1	2	**6**	211	15	70	13	102	**411**
Alcis repandata	0	0	0	0	1	**1**	1	0	0	0	0	**1**
Allophyes oxyacanthae	0	1	0	0	2	**3**	1	0	0	1	0	**2**
Alsophila aescularia	0	0	0	0	0	**0**	1	3	1	0	4	**9**
Ammoconia caecimacula	0	1	0	0	0	**1**	0	0	0	0	0	**0**
Amphipyra pyramidea	0	0	2	0	1	**3**	3	2	1	2	0	**8**
Amphipyra tragopoginis	0	0	0	0	0	**0**	0	1	0	0	0	**1**
Anania coronata	7	2	4	0	1	**14**	4	1	0	2	4	**11**
Anania hortulata	2	0	0	0	0	**2**	0	1	0	1	0	**2**
Anania lancealis	0	0	0	2	0	**2**	0	0	0	0	0	**0**
Anania stachydalis	1	1	0	1	1	**4**	0	0	0	0	0	**0**
Anania verbascalis	2	2	2	1	0	**7**	0	0	0	0	0	**0**
Anarta trifolii	0	0	0	0	0	**0**	0	0	1	2	0	**3**
Angerona prunaria	2	2	0	0	0	**4**	4	2	4	3	3	**16**
Anticollix sparsata	0	0	0	0	0	**0**	1	0	0	0	0	**1**
Apamea monoglypha	0	0	0	0	0	**0**	0	0	0	2	3	**5**
Apamea unanimis	0	0	0	0	1	**1**	0	0	0	0	0	**0**

Apeira syringaria	0	0	0	1	0	**1**	1	0	0	0	0	**1**
Aphomia sociella	1	0	0	0	0	**1**	2	0	0	0	0	**2**
Aplocera plagiata	0	1	0	0	0	**1**	0	0	0	0	0	**0**
Apoda limacodes	0	0	0	0	1	**1**	0	1	2	4	0	**7**
Apterogenum ypsillon	1	0	0	1	1	**3**	0	0	0	0	0	**0**
Arenostola phragmitidis	0	0	0	0	1	**1**	0	0	0	0	0	**0**
Artiora evonymaria	0	0	0	0	0	**0**	0	0	0	1	0	**1**
Ascotis selenaria	0	0	2	0	0	**2**	1	0	0	0	0	**1**
Asteroscopus sphinx	4	2	0	1	1	**8**	0	0	0	1	3	**4**
Atethmia centrago	0	0	0	0	0	**0**	1	1	0	1	2	**5**
Atypha pulmonaris	1	0	2	1	6	**10**	2	3	1	1	10	**17**
Autographa gamma	0	0	0	0	2	**2**	0	0	0	0	0	**0**
Axylia putris	0	4	6	6	3	**19**	15	0	7	6	20	**48**
Biston betularia	0	0	0	0	0	**0**	2	1	0	0	0	**3**
Cabera exanthemata	1	1	1	3	1	**7**	13	0	2	0	2	**17**
Cabera pusaria	1	1	2	0	0	**4**	2	0	1	0	0	**3**
Calliteara pudibunda	3	2	6	0	2	**13**	6	1	2	5	2	**16**
Campaea margaritaria	16	11	11	6	6	**50**	21	5	20	24	26	**96**
Caradrina clavipalpis	0	0	0	0	0	**0**	0	0	2	0	0	**2**
Caradrina kadenii	0	0	0	0	0	**0**	0	0	0	1	2	**3**
Caradrina morpheus	2	0	0	1	2	**5**	8	0	7	0	5	**20**
Cataclysta lemnata	1	1	2	0	1	**5**	0	0	1	2	0	**3**
Catephia alchymista	0	0	0	0	1	**1**	0	0	0	0	0	**0**
Catocala electa	1	0	0	0	0	**1**	0	0	0	0	0	**0**
Catocala nupta	0	0	0	0	0	**0**	1	0	0	0	0	**1**
Catoptria falsella	3	3	4	1	3	**14**	1	0	0	0	5	**6**
Catoptria verellus	0	2	9	5	11	**27**	1	1	7	2	0	**11**
Cepphis advenaria	0	0	1	0	2	**3**	0	3	0	1	6	**10**
Cerura erminea	0	2	0	0	0	**2**	0	0	0	0	0	**0**
Charanyca trigrammica	0	1	1	1	1	**4**	3	0	1	1	2	**7**
Chiasmia clathrata	2	0	0	3	4	**9**	1	0	0	0	2	**3**
Chilo phragmitella	0	1	0	1	1	**3**	0	0	1	2	0	**3**
Chloroclysta siterata	0	0	0	0	0	**0**	0	0	0	1	1	**2**
Chloroclystis v-ata	0	0	0	0	0	**0**	0	0	1	0	0	**1**
Chrysoteuchia culmella	0	0	1	0	0	**1**	0	0	0	0	0	**0**
Cilix glaucatus	0	0	1	0	0	**1**	0	0	0	0	0	**0**
Clostera curtula	1	1	2	3	1	**8**	1	1	0	0	0	**2**
Colocasia coryli	11	8	6	2	5	**32**	25	5	16	6	15	**67**
Colostygia pectinataria	1	1	3	0	2	**7**	0	0	0	1	0	**1**
Colotois pennaria	1	0	3	1	0	**5**	2	1	1	1	1	**6**
Comibaena bajularia	0	0	0	0	0	**0**	0	0	0	0	1	**1**
Conistra erythrocephala	0	0	0	2	1	**3**	0	0	0	0	0	**0**
Conistra vaccinii	0	0	0	0	1	**1**	0	2	1	1	0	**4**
Cosmia affinis	0	0	2	0	0	**2**	0	0	0	0	0	**0**
Cosmia trapezina	0	2	2	2	2	**8**	4	10	8	15	13	**50**

Cosmorhoe ocellata	0	0	0	0	1	**1**	0	1	0	0	0	**1**
Craniophora ligustri	3	0	2	0	0	**5**	2	3	4	2	14	**25**
Crocallis elinguaria	0	0	0	0	1	**1**	0	0	0	1	0	**1**
Cryphia algae	0	0	0	1	1	**2**	0	0	0	0	0	**0**
Cybosia mesomella	0	0	0	0	0	**0**	0	0	1	0	0	**1**
Cyclophora annularia	16	13	19	25	18	**91**	66	49	93	82	67	**357**
Cyclophora linearia	0	0	0	1	0	**1**	0	0	0	0	0	**0**
Cyclophora punctaria	0	0	0	0	0	**0**	0	0	1	1	2	**4**
Delplanqueia inscriptella	2	2	0	0	0	**4**	1	0	1	0	0	**2**
Deltote bankiana	1	0	0	0	0	**1**	0	0	0	0	0	**0**
Deltote pygarga	4	3	8	2	6	**23**	9	0	4	0	2	**15**
Diachrysia chrysitis	1	1	1	0	1	**4**	1	0	0	0	2	**3**
Diaphora mendica	1	0	0	0	0	**1**	0	0	0	0	0	**0**
Diloba caeruleocephala	1	0	0	0	2	**3**	1	0	0	2	0	**3**
Drepana falcataria	0	0	0	0	1	**1**	0	0	0	0	0	**0**
Drymonia dodonaea	3	0	1	1	3	**8**	6	1	5	4	3	**19**
Dypterygia scabriuscula	0	0	0	0	0	**0**	0	0	0	0	1	**1**
Dysstroma truncata	0	0	0	0	0	**0**	1	0	0	0	0	**1**
Ecliptopera silaceata	9	15	17	10	17	**68**	8	4	11	11	14	**48**
Ecpyrrhorrhoe rubiginalis	0	0	0	1	0	**1**	0	0	0	0	1	**1**
Ectropis crepuscularia	4	10	12	7	9	**42**	5	0	6	7	5	**23**
Egira conspicillaris	1	0	0	0	0	**1**	0	0	0	0	0	**0**
Eilema complana	0	0	0	0	0	**0**	0	0	1	0	0	**1**
Eilema griseola	17	4	5	10	9	**45**	16	11	6	12	14	**59**
Eilema sororcula	1	0	0	0	1	**2**	2	1	2	0	1	**6**
Elaphria venustula	0	0	0	0	0	**0**	1	0	0	0	0	**1**
Electrophaes corylata	0	0	0	0	0	**0**	0	0	1	1	1	**3**
Elophila nymphaeata	1	0	0	2	0	**3**	1	0	1	1	2	**5**
Ennomos autumnaria	1	2	2	0	0	**5**	0	0	0	0	0	**0**
Ephestia woodiella	0	1	0	0	0	**1**	0	1	0	0	0	**1**
Epirrhoe alternata	14	7	19	17	17	**74**	1	4	1	2	7	**15**
Epirrita dilutata	0	0	0	0	0	**0**	2	1	0	2	0	**5**
Erannis defoliaria	16	8	5	6	6	**41**	3	0	3	0	1	**7**
Euchoeca nebulata	5	1	2	2	1	**11**	1	0	0	0	0	**1**
Eudonia lacustrata	0	0	0	2	1	**3**	0	1	0	0	0	**1**
Eudonia laetella	1	0	0	3	0	**4**	0	0	0	0	0	**0**
Eudonia mercurella	0	0	1	0	0	**1**	0	0	0	0	1	**1**
Eudonia pallida	1	1	1	1	2	**6**	0	0	0	0	0	**0**
Eudonia truncicolella	0	0	0	0	0	**0**	0	1	0	0	2	**3**
Eugnorisma depuncta	1	2	0	1	1	**5**	6	3	6	9	14	**38**
Eupithecia absinthiata	0	0	1	0	0	**1**	0	0	1	0	0	**1**
Eupithecia assimilata	0	0	1	0	0	**1**	0	0	1	0	0	**1**
Eupithecia centaureata	0	1	0	0	1	**2**	0	0	0	1	1	**2**
Eupithecia haworthiata	0	0	0	0	0	**0**	1	0	0	0	0	**1**
Eupithecia inturbata	1	2	0	0	0	**3**	2	1	1	1	1	**6**

Eupithecia satyrata	0	0	0	0	0	**0**	0	0	0	0	1	**1**
Eupithecia virgaureata	0	3	0	1	0	**4**	0	0	0	1	1	**2**
Euplagia quadripunctaria	0	0	0	0	0	**0**	2	0	2	0	2	**6**
Euplexia lucipara	1	1	1	2	1	**6**	0	0	5	0	2	**7**
Euproctis similis	8	8	6	0	10	**32**	5	1	5	2	11	**24**
Eupsilia transversa	1	0	0	0	0	**1**	2	0	1	0	0	**3**
Euthrix potatoria	1	0	0	0	0	**1**	0	1	0	0	0	**1**
Euxoa distinguenda	0	0	0	0	0	**0**	0	0	2	0	0	**2**
Evergestis extimalis	1	0	0	0	0	**1**	0	0	1	0	1	**2**
Evergestis limbata	0	1	0	0	0	**1**	0	0	0	1	0	**1**
Evergestis pallidata	0	0	0	1	2	**3**	0	0	0	2	0	**2**
Furcula bifida	0	0	0	0	1	**1**	1	0	0	0	0	**1**
Galleria mellonella	0	1	0	0	0	**1**	0	1	0	0	0	**1**
Gandaritis pyraliata	12	9	11	7	13	**52**	5	3	0	2	2	**12**
Gluphisia crenata	1	0	1	0	0	**2**	3	0	0	0	0	**3**
Habrosyne pyritoides	0	1	0	0	0	**1**	1	0	0	0	1	**2**
Hadena perplexa	0	0	0	1	0	**1**	0	0	0	0	0	**0**
Helicoverpa armigera	1	0	0	0	0	**1**	0	0	0	0	1	**1**
Heliomata glarearia	0	0	0	0	0	**0**	1	0	0	0	0	**1**
Hemistola chrysoprasaria	3	2	3	3	1	**12**	3	1	2	1	3	**10**
Hemithea aestivaria	2	4	2	1	1	**10**	3	8	5	8	8	**32**
Herminia grisealis	7	7	8	2	2	**26**	7	8	8	5	14	**42**
Herminia tarsicrinalis	17	10	20	15	22	**84**	9	4	4	7	9	**33**
Herminia tarsipennalis	0	2	0	1	0	**3**	0	0	0	0	0	**0**
Hoplodrina ambigua	1	1	1	1	1	**5**	3	3	6	7	17	**36**
Hoplodrina blanda	0	0	1	0	0	**1**	0	5	3	3	6	**17**
Hoplodrina octogenaria	0	0	0	0	1	**1**	11	7	9	19	6	**52**
Horisme corticata	0	0	0	0	1	**1**	1	0	0	0	0	**1**
Horisme tersata	0	0	0	0	0	**0**	1	1	0	0	0	**2**
Horisme vitalbata	0	0	0	1	0	**1**	0	0	0	0	0	**0**
Hydraecia micacea	1	0	0	0	2	**3**	0	0	0	0	0	**0**
Hydriomena impluviata	3	2	0	1	0	**6**	1	0	0	0	0	**1**
Hypena proboscidalis	4	8	14	14	6	**46**	1	0	5	4	2	**12**
Hypomecis punctinalis	5	2	4	4	5	**20**	5	8	2	0	3	**18**
Hypomecis roboraria	3	3	3	2	1	**12**	7	5	8	3	4	**27**
Hypsopygia glaucinalis	0	0	0	0	1	**1**	0	0	0	0	0	**0**
Idaea aversata	0	0	0	1	0	**1**	4	2	12	3	5	**26**
Idaea biselata	2	4	2	3	2	**13**	8	6	5	9	12	**40**
Idaea degeneraria	0	0	0	0	0	**0**	0	0	0	0	4	**4**
Idaea dimidiata	11	17	11	12	11	**62**	2	1	1	3	6	**13**
Idaea rubraria	0	0	0	0	0	**0**	0	0	1	0	1	**2**
Idaea rusticata	1	0	0	0	0	**1**	1	0	1	0	0	**2**
Idaea subsericeata	0	0	0	0	0	**0**	1	0	0	0	0	**1**
Idaea trigeminata	0	0	0	0	0	**0**	0	0	0	0	2	**2**
Ipimorpha retusa	0	2	1	2	1	**6**	0	1	0	0	0	**1**

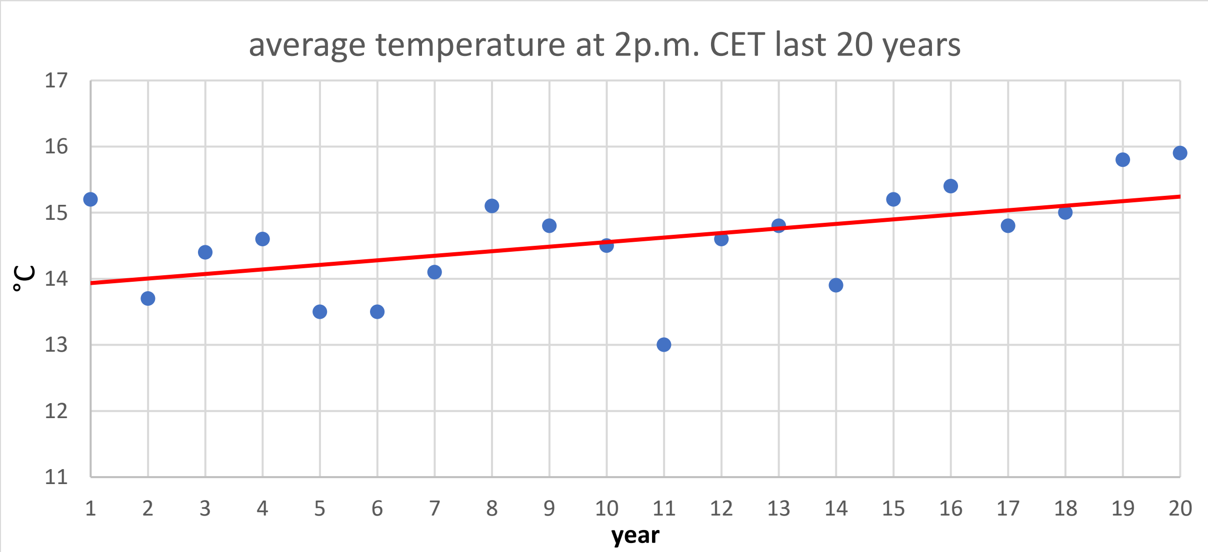
Ipimorpha subtusa	0	1	0	0	0	**1**	0	1	1	1	0	**3**
Jodis lactearia	0	0	0	0	0	**0**	0	0	0	0	1	**1**
Lacanobia oleracea	0	0	1	1	0	**2**	4	0	10	5	4	**23**
Lacanobia suasa	0	0	0	0	0	**0**	1	0	0	0	0	**1**
Lacanobia thalassina	0	0	2	1	1	**4**	0	0	1	2	5	**8**
Laodamia faecella	0	0	0	0	1	**1**	0	0	0	0	0	**0**
Laothoe populi	2	0	0	0	0	**2**	0	0	0	0	0	**0**
Laspeyria flexula	1	0	1	2	0	**4**	0	1	0	0	1	**2**
Leucania obsoleta	0	0	0	1	0	**1**	4	0	3	0	0	**7**
Leucoma salicis	0	0	1	1	3	**5**	0	3	1	0	0	**4**
Ligdia adustata	17	21	21	13	17	**89**	7	9	11	18	11	**56**
Lithosia quadra	0	0	2	2	1	**5**	1	9	5	11	0	**26**
Litoligia literosa	0	0	0	0	0	**0**	1	0	0	0	0	**1**
Lomaspilis marginata	17	21	21	13	17	**89**	7	9	11	18	13	**58**
Lomographa bimaculata	10	11	10	3	6	**40**	7	8	9	7	8	**39**
Lomographa temerata	0	2	0	1	2	**5**	1	0	1	0	1	**3**
Lycia hirtaria	2	0	0	2	2	**6**	1	0	1	0	1	**3**
Lygephila pastinum	0	0	1	0	0	**1**	1	0	0	1	1	**3**
Lymantria dispar	2	2	1	0	1	**6**	0	0	0	0	0	**0**
Macaria alternata	1	1	0	0	0	**2**	2	1	1	1	5	**10**
Macdunnoughia confusa	0	0	1	0	0	**1**	0	0	0	0	0	**0**
Malacosoma neustria	0	1	0	0	2	**3**	0	0	0	0	0	**0**
Mamestra brassicae	1	1	0	0	1	**3**	8	1	7	2	10	**28**
Melanthia procellata	1	0	2	2	2	**7**	1	0	1	3	0	**5**
Mesapamea secalis	0	0	0	0	0	**0**	0	0	0	1	0	**1**
Mesoleuca albicillata	0	0	0	0	1	**1**	2	0	0	0	0	**2**
Mesoligia furuncula	0	0	0	0	0	**0**	0	0	0	0	1	**1**
Mniotype satura	0	0	0	0	0	**0**	1	0	1	0	0	**2**
Mythimna albipuncta	1	0	2	1	1	**5**	0	4	3	1	1	**9**
Mythimna l-album	0	0	0	0	1	**1**	2	0	0	0	2	**4**
Mythimna pallens	1	0	1	1	0	**3**	0	0	2	0	0	**2**
Mythimna turca	2	0	1	4	4	**11**	1	0	0	1	0	**2**
Mythimna vitellina	0	0	0	0	0	**0**	0	0	1	0	0	**1**
Nephopterix angustella	0	0	0	0	0	**0**	0	0	0	0	1	**1**
Noctua comes	0	0	0	0	0	**0**	0	0	0	1	3	**4**
Noctua fimbriata	1	0	0	0	2	**3**	0	0	1	0	0	**1**
Noctua interposita	0	0	1	0	0	**1**	0	0	1	0	0	**1**
Noctua janthe	0	0	0	0	1	**1**	0	0	0	1	0	**1**
Noctua janthina	0	1	0	0	0	**1**	0	0	0	0	0	**0**
Noctua orbona	0	0	0	1	0	**1**	0	0	0	0	0	**0**
Noctua pronuba	6	1	0	0	1	**8**	5	4	4	6	4	**23**
Nola cucullatella	0	2	0	0	1	**3**	0	0	2	3	0	**5**
Notodonta dromedarius	1	0	0	0	0	**1**	0	0	0	0	0	**0**
Notodonta tritophus	0	0	1	0	1	**2**	0	0	0	0	0	**0**
Nycteola asiatica	1	0	0	0	7	**8**	1	0	1	0	0	**2**

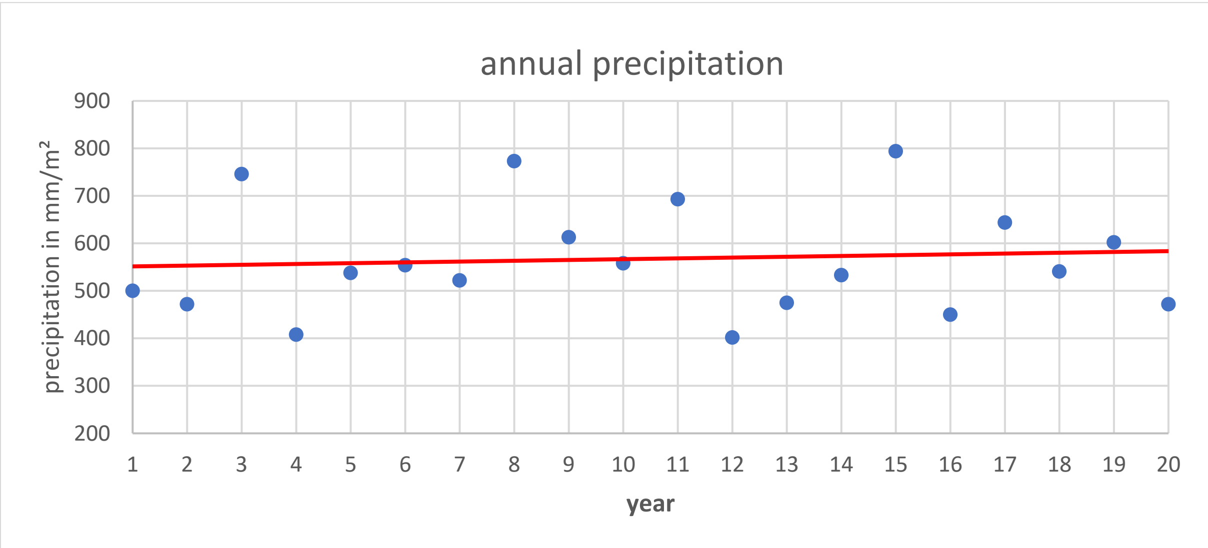
Ochropacha duplaris	1	0	2	0	2	**5**	0	0	0	0	1	**1**
Ochropleura plecta	3	4	2	3	5	**17**	7	3	13	0	8	**31**
Oligia strigilis	0	0	0	0	0	**0**	1	3	2	1	0	**7**
Oncocera semirubella	1	1	1	1	1	**5**	4	1	1	0	0	**6**
Operophtera brumata	5	3	0	5	2	**15**	1	1	3	2	1	**8**
Orgyia antiqua	0	0	0	1	0	**1**	0	0	0	0	0	**0**
Orthonama obstipata	0	0	0	1	0	**1**	0	0	0	0	0	**0**
Orthosia cerasi	0	0	0	0	1	**1**	0	0	0	0	0	**0**
Orthosia gothica	0	0	0	4	2	**6**	2	1	1	1	0	**5**
Orthosia incerta	0	0	0	1	1	**2**	0	0	0	0	1	**1**
Ostrinia nubilalis	2	0	0	0	0	**2**	1	2	0	0	0	**3**
Ourapteryx sambucaria	1	1	1	2	1	**6**	1	1	1	1	0	**4**
Paracolax tristalis	0	0	0	0	0	**0**	0	0	0	1	0	**1**
Parapoynx stratiotata	0	1	2	0	1	**4**	2	1	0	0	0	**3**
Parastichtis suspecta	0	0	0	0	0	**0**	1	0	0	0	0	**1**
Paratalanta pandalis	0	0	0	0	0	**0**	0	0	1	0	0	**1**
Parectropis similaria	0	0	0	0	0	**0**	0	0	1	0	0	**1**
Pasiphila rectangulata	1	3	0	0	1	**5**	1	0	2	0	2	**5**
Patania ruralis	45	18	67	35	34	**199**	7	6	6	10	7	**36**
Pechipogo strigilata	0	0	0	0	0	**0**	3	8	19	3	2	**35**
Pelosia muscerda	26	15	18	15	21	**95**	3	1	6	5	1	**16**
Peribatodes rhomboidaria	8	3	5	1	21	**38**	6	10	8	3	9	**36**
Peribatodes secundaria	0	0	3	0	0	**3**	0	0	0	0	0	**0**
Perizoma alchemillata	0	1	0	0	0	**1**	0	0	0	0	0	**0**
Phalera bucephala	0	2	1	1	0	**4**	0	0	1	0	0	**1**
Pheosia tremula	46	17	55	19	45	**182**	6	2	2	0	6	**16**
Philereme vetulata	1	0	0	0	0	**1**	0	0	3	0	0	**3**
Phragmatobia fuliginosa	0	1	0	0	0	**1**	1	0	0	0	0	**1**
Plagodis dolabraria	0	0	0	0	0	**0**	1	0	0	0	0	**1**
Plagodis pulveraria	11	8	8	9	7	**43**	20	10	12	10	9	**61**
Plemyria rubiginata	1	1	0	0	4	**6**	1	2	0	1	0	**4**
Poecilocampa populi	1	0	0	1	0	**2**	0	0	0	1	1	**2**
Polia nebulosa	0	0	0	0	0	**0**	0	0	0	1	0	**1**
Polypogon tentacularia	0	0	0	0	0	**0**	0	0	0	0	1	**1**
Pterostoma palpina	0	0	3	4	5	**12**	1	1	0	0	0	**2**
Ptilodon capucina	2	3	2	0	4	**11**	1	0	0	1	0	**2**
Ptilodon cucullina	0	2	3	0	7	**12**	6	1	4	1	4	**16**
Ptilophora plumigera	5	4	9	10	8	**36**	0	0	2	0	1	**3**
Pyrausta aurata	0	1	0	0	0	**1**	0	0	0	0	0	**0**
Rivula sericealis	14	9	10	10	8	**51**	3	4	6	3	11	**27**
Sabra harpagula	0	0	0	0	0	**0**	0	1	0	0	0	**1**
Sciota rhenella	0	0	0	0	1	**1**	0	0	0	0	1	**1**
Scoparia basistrigalis	0	2	1	0	0	**3**	1	0	1	3	0	**5**
Scopula floslactata	0	0	0	0	0	**0**	2	0	0	0	0	**2**
Scopula immorata	0	0	2	1	1	**4**	0	0	1	0	0	**1**

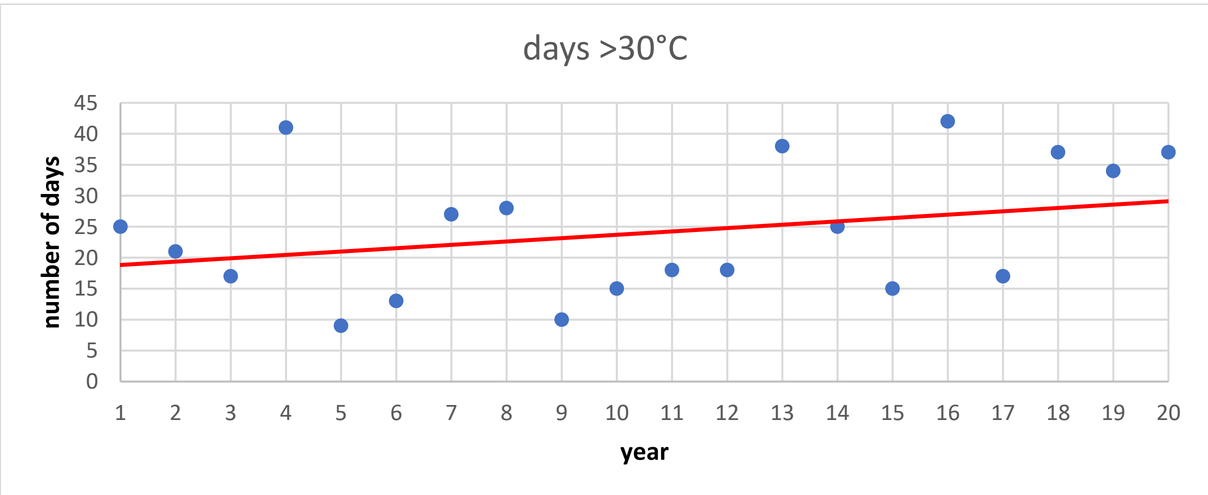
Scopula immutata	1	0	1	1	3	**6**	2	1	2	0	0	**5**
Scopula marginepunctata	0	0	0	1	0	**1**	0	0	0	0	0	**0**
Scopula nigropunctata	1	0	0	0	0	**1**	0	0	0	1	0	**1**
Scopula virgulata	2	2	2	0	0	**6**	2	0	0	1	2	**5**
Selenia dentaria	0	1	0	1	1	**3**	1	1	2	3	2	**9**
Selenia lunularia	0	0	0	0	0	**0**	0	0	0	1	0	**1**
Selenia tetralunaria	21	20	20	42	6	**109**	3	5	1	11	10	**30**
Sideridis rivularis	1	1	0	0	0	**2**	0	1	0	0	0	**1**
Siona lineata	1	0	0	0	0	**1**	0	0	0	0	0	**0**
Smerinthus ocellata	1	0	0	0	0	**1**	0	0	0	0	0	**0**
Spatalia argentina	0	0	0	0	1	**1**	0	0	0	1	0	**1**
Spilosoma lubricipeda	6	3	1	8	6	**24**	2	1	1	5	3	**12**
Spilosoma lutea	0	3	2	4	4	**13**	4	0	4	8	7	**23**
Stauropus fagi	2	1	1	1	0	**5**	5	0	3	2	2	**12**
Stegania dilectaria	0	0	0	1	0	**1**	1	0	0	0	0	**1**
Sunira circellaris	2	3	2	5	1	**13**	0	0	0	0	0	**0**
Synaphe punctalis	0	0	0	0	0	**0**	1	0	0	0	0	**1**
Tethea ocularis	2	0	0	0	0	**2**	1	0	0	0	0	**1**
Tethea or	20	15	20	23	33	**111**	6	1	9	1	13	**30**
Thalpophila matura	0	0	0	0	0	**0**	1	0	0	1	0	**2**
Thaumetopoea processionea	0	0	0	0	0	**0**	1	0	0	0	1	**2**
Thera juniperata	0	0	0	0	0	**0**	0	0	0	0	1	**1**
Therapis flavicaria	0	0	0	0	1	**1**	0	0	0	0	0	**0**
Thyatira batis	1	0	3	1	1	**6**	1	0	1	1	1	**4**
Tiliacea aurago	0	0	0	1	0	**1**	0	0	0	0	0	**0**
Timandra comae	3	1	2	2	1	**9**	1	0	0	4	3	**8**
Trachea atriplicis	1	1	0	0	0	**2**	3	0	0	0	5	**8**
Trachonitis cristella	0	0	0	1	0	**1**	0	0	0	0	0	**0**
Trichiura crataegi	2	1	0	0	0	**3**	0	0	0	2	1	**3**
Triodia sylvina	1	1	0	0	0	**2**	1	0	0	0	0	**1**
Trisateles emortualis	1	1	0	0	0	**2**	1	2	3	1	2	**9**
Tyta luctuosa	0	1	0	0	0	**1**	0	0	0	0	0	**0**
Udea ferrugalis	0	2	1	0	0	**3**	0	0	0	0	0	**0**
Watsonalla binaria	1	0	0	0	0	**1**	0	0	0	0	0	**0**
Xanthorhoe biriviata	1	0	0	0	0	**1**	0	0	0	0	0	**0**
Xanthorhoe designata	0	0	1	0	0	**1**	0	0	1	0	0	**1**
Xanthorhoe ferrugata	1	3	3	0	4	**11**	1	0	4	1	2	**8**
Xanthorhoe fluctuata	0	0	0	0	0	**0**	0	0	0	0	1	**1**
Xestia baja	0	0	0	1	0	**1**	0	0	0	0	0	**0**
Xestia c-nigrum	5	8	9	7	8	**37**	41	21	16	14	21	**113**
Xestia rhomboidea	0	0	0	0	0	**0**	0	0	1	0	0	**1**
Xestia sexstrigata	0	0	0	0	0	**0**	1	0	0	0	0	**1**
Xestia triangulum	0	0	2	2	0	**4**	6	0	2	5	0	**13**
Xestia xanthographa	0	0	0	0	0	**0**	0	0	0	0	1	**1**

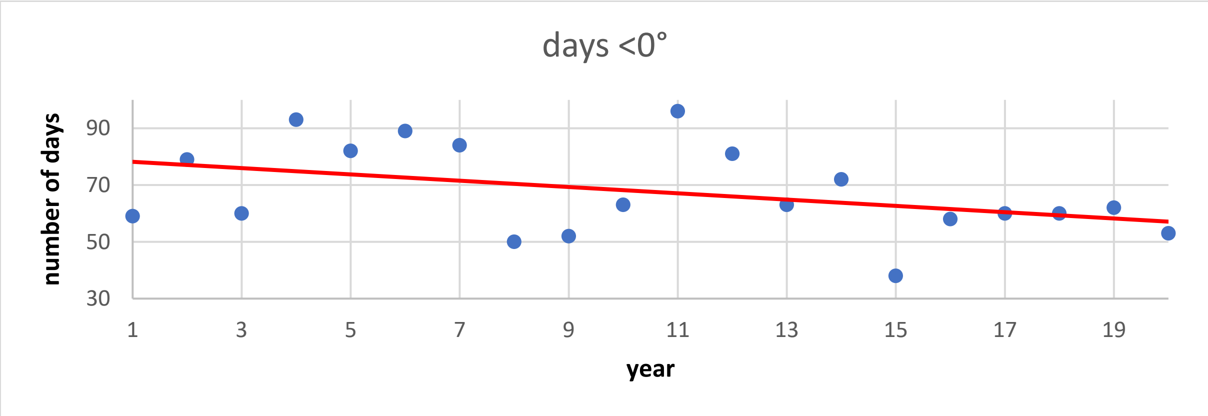
Total per site	596	461	614	505	606	**2782**	811	363	639	525	745	**3083**

Appendix VII: Climate trends based on weather data from the ZAMG station Groß-Enzersdorf (ZAMG, 2021)

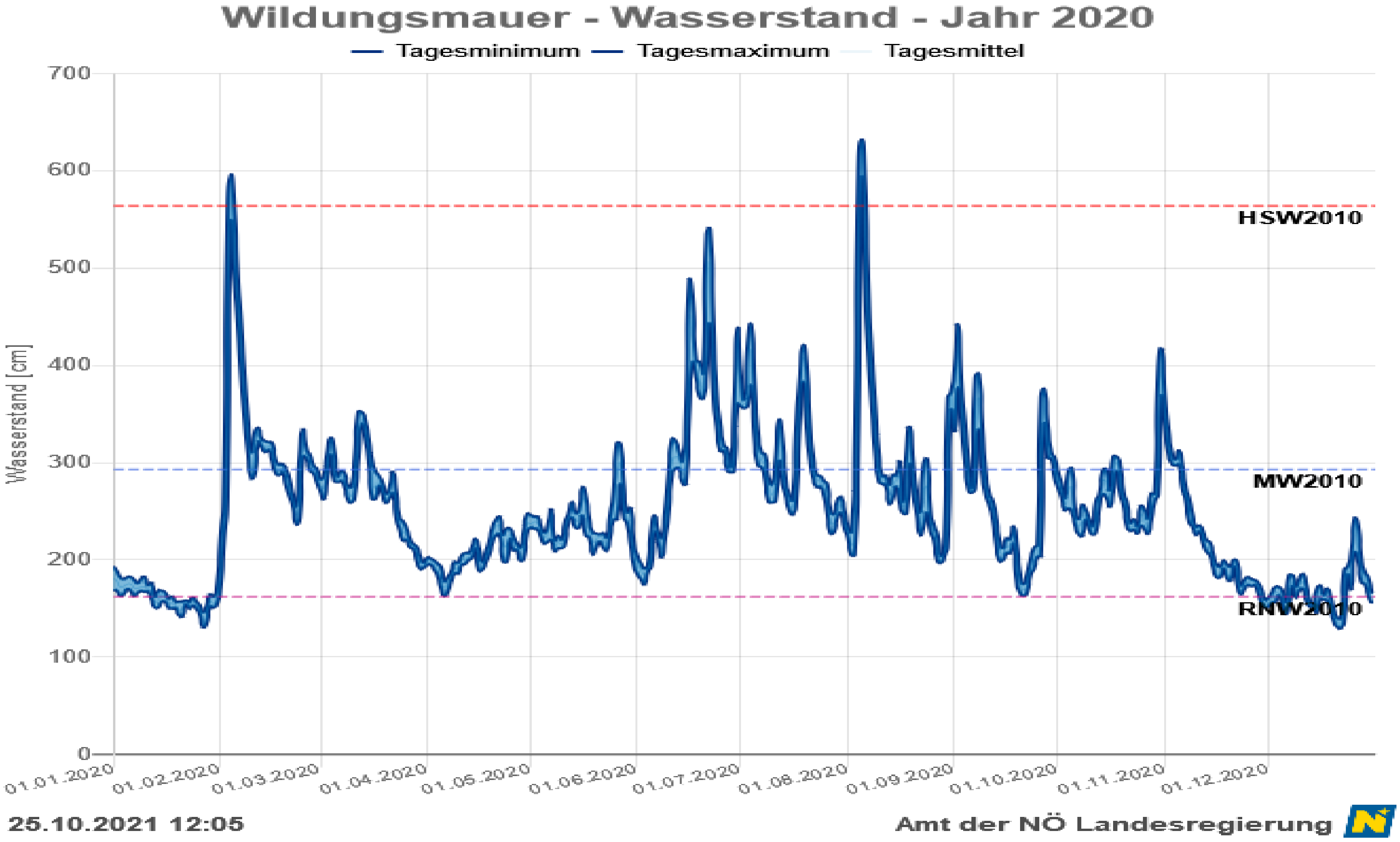







days <0°
number of days
90
70
50
30
1
3
5
7
9
11
13
15
17
19
year

Appendix VIII: Danube water levels in 2020 - Wildungsmauer monitoring station (Land Niederösterreich, 2021)



Appendix IX: DNA Barcoding ((Rabl et al., 2020)– supporting information)

A 658 bp long fragment of the COI gene, known as the barcode region, was obtained by extracting DNA from the legs of the butterfly specimen according to Analytik Jena innuPREP DNA Micro Kit (https://www.analytik-jena.de/). PCR reactions were done with the Thermo Scientific PCR system as following: 2.5 µl of 10× $(NH_4)_2SO_4$ PCR buffer, 2.5 µl $MgCl_2$ (25 mM/l), 0.5 µl dNTPs (10 mM/µl), 0.5 µl of each primer (10 pg/µl), 0.2 µl BSA, 1-2 µl template DNA, 0.2 µl Taq DNA polymerase and filled to 10 µl with PCR-grade H_2O (https://www.thermofisher.com). The primers were LepF1 (TTCAACCAATCATAAAGATATTGG) and LepR1 (AACTTCTGGATGTCCAAAAAAT CA). PCR was done with a split program with the following cycles: 1x: 94 °C 04:00 min; 5x: 94 °C 01:00 min, 44 °C 01:30 min, 72 °C 01:30 min; 35x: 94 °C 01:00 min, 49 °C 01:15 min, 72 °C 01:15 min; 1x: 72 °C 07:00 min. PCR reactions were purified by digestion with shrimp alkaline phosphatase and exonuclease for 30 min at 37°C followed by 15 min at 80°C. Sequencing reactions were set up with 0.5 µl ABI BigDye 3.1 (Applied Biosystems, Carlsbad, CA, USA), 0.4 µl primer, 1.75 µl sequencing buffer, 2 µl Trehalose, 1-3 µl template DNA and filled to 10 µl with PCR grade H_2O. Sanger sequencing was carried out using a ABI PRISM 3730 Genetic Analyzer. All gene fragments were sequenced in both directions and were edited and assembled using DNASTAR Lasergene SeqMan 7.1.0 (DNASTAR Inc.).

Appendix X: Light trapping dates in 2020

1-1	1-2	1-3	1-4	1-5	2-1	2-2	2-3	2-4	2-5
27.03.	27.03.	27.03.	27.03.	27.03.	28.03.	28.03.	28.03.	28.03.	28.03.
23.04.	23.04.	23.04.	23.04.	23.04.	22.04.	22.04.	22.04.	22.04.	22.04.
21.05.	21.05.	21.05.	21.05.	21.05.	22.05.	22.05.	22.05.	22.05.	22.05.
30.06.	30.06.	30.06.	30.06.	30.06.	27.06.	27.06.	27.06.	27.06.	27.06.
20.07.	20.07.	20.07.	20.07.	20.07.	21.07.	21.07.	21.07.	21.07.	21.07.
19.08.	19.08.	19.08.	19.08.	19.08.	18.08	18.08	18.08	20.08.	18.08
16.09.	16.09.	16.09.	16.09.	16.09.	17.09	17.09	17.09	17.09	17.09
21.10.	21.10.	21.10.	21.10.	21.10.	20.10.	20.10.	20.10.	20.10.	20.10.
18.11.	18.11.	18.11.	18.11.	18.11.	19.11.	19.11.	19.11.	19.11.	19.11.

Appendix XI: Number of stems per tree species and tree species within a 10m × 10m square with each trap in the center.

Number of stems	1-1	1-2	1-3	1-4	1-5	2-1	2-2	2-3	2-4	2-5
Acer campestre				1	1	3	1			1
Acer pseudoplatanus	4	2	3		3					6
Alnus sp.				1						
Carpinus betulus				1						
Cornus mas			2		1			11		
Corylus avellana	14	48		37					15	
Crataegus sp.					1		4			1
Fraxinus excelsior		2	8	5					4	2
Juglans regia	9		2	3						
Populus alba						2	1	5		
Prunus padus	4									
Sambucus nigra	1									
Tilia cordata				1	1					

Number of trees	1-1	1-2	1-3	1-4	1-5	2-1	2-2	2-3	2-4	2-5
Acer campestre				1	1	3	1			1
Acer pseudoplatanus	4	2	3		3					6
Alnus sp.				1						
Carpinus betulus				1						
Cornus mas			2		1			6		
Corylus avellana	2	9		5					4	
Crataegus sp.					1		3			1
Fraxinus excelsior		2	8	5					3	2
Juglans regia	7		2	3						
Populus alba						2	1	5		
Prunus padus	4									
Sambucus nigra	1									
Tilia cordata				1	1					

Appendix XII: List of indicatorspecies for the difference between time periodes

species	year	indval	p-value	frequency
Ennomos quercinaria	2020	1	0.001	10
Paradarisa consonaria	2020	1	0.001	10
Brachionycha nubeculosa	2020	1	0.001	10
Orthosia cerasi	2020	0.98412698	0.001	11
Eudonia mercurella	2020	0.96363636	0.001	12
Ptilophora plumigera	2020	0.9509434	0.001	17
Orthosia incerta	2020	0.94736842	0.001	13
Lycia hirtaria	2020	0.93918919	0.001	16
Agrochola nitida	2020	0.91666667	0.001	14
Eupsilia transversa	2020	0.90697674	0.002	13
Poecilocampa populi	2020	0.88235294	0.001	14
Scoparia basistrigalis	2020	0.87878788	0.001	15
Orthosia gothica	2020	0.85897436	0.001	16
Ennomos autumnaria	2020	0.85294118	0.001	13
Mythimna turca	2020	0.80597015	0.003	16
Caradrina kadenii	2020	0.8	0.002	11
Hypomecis roboraria	2020	0.79144385	0.005	20
Paracolax tristalis	2020	0.7804878	0.001	9
Eilema sororcula	2020	0.77777778	0.003	16
Chloroclystis v-ata	2020	0.74285714	0.002	9
Anania hortulata	2020	0.72888889	0.013	11
Ecliptopera silaceata	2020	0.72446556	0.004	20
Melanthia procellata	2020	0.72093023	0.007	17
Noctua fimbriata	2020	0.72	0.014	12
Scopula nigropunctata	2020	0.72	0.005	10
Idaea biselata	2020	0.71657754	0.001	20
Noctua pronuba	2020	0.71028037	0.009	18
Endotricha flammealis	2020	0.7	0.001	7
Anorthoa munda	2020	0.7	0.001	7
Mimas tiliae	2020	0.7	0.004	7
Crambus lathoniellus	2020	0.7	0.002	7
Meganola albula	2020	0.7	0.003	7
Catocala fraxini	2020	0.7	0.004	7
Hypomecis punctinalis	2020	0.6984127	0.007	19
Idaea degeneraria	2020	0.67692308	0.008	9
Calliteara pudibunda	2020	0.6741573	0.02	19
Alsophila aescularia	2020	0.67142857	0.015	12
Peribatodes rhomboidaria	2020	0.66816143	0.015	20
Sunira circellaris	2020	0.65789474	0.045	15
Anania lancealis	2020	0.63913043	0.01	8
Perizoma alchemillata	2020	0.63	0.017	8

Epirrita dilutata	2020	0.61463415	0.02	10
Lomographa bimaculata	2020	0.605	0.048	20
Eilema lurideola	2020	0.6	0.013	6
Oligia latruncula	2020	0.6	0.008	6
Camptogramma bilineata	2020	0.6	0.008	6
Cosmia pyralina	2020	0.6	0.011	6
Cryphia fraudatricula	2020	0.6	0.011	6
Apamea monoglypha	2020	0.58947368	0.026	10
Conistra vaccinii	2020	0.575	0.043	11
Selenia lunularia	2020	0.57	0.031	7
Catocala nupta	2020	0.55714286	0.023	7
Sabra harpagula	2020	0.54	0.031	7
Polyphaenis sericata	2020	0.5	0.038	5
Apamea scolopacina	2020	0.5	0.038	5
Lobophora halterata	2020	0.5	0.03	5
Orthosia cruda	2020	0.5	0.03	5
Cerastis leucographa	2020	0.5	0.032	5
Idaea dimidiata	2006-2008	0.91463415	0.001	15
Tethea or	2006-2008	0.86503067	0.001	18
Hemithea aestivaria	2006-2008	0.84	0.001	15
Hemistola chrysoprasaria	2006-2008	0.81481481	0.001	14
Atypha pulmonaris	2006-2008	0.78387097	0.008	13
Gandaritis pyraliata	2006-2008	0.77837838	0.008	15
Spilosoma lubricipeda	2006-2008	0.76595745	0.007	14
Plagodis pulveraria	2006-2008	0.72222222	0.002	20
Ligdia adustata	2006-2008	0.71078431	0.002	20
Scopula immutata	2006-2008	0.7	0.006	7
Ourapteryx sambucaria	2006-2008	0.69230769	0.006	11
Xanthorhoe ferrugata	2006-2008	0.69090909	0.021	11
Mamestra brassicae	2006-2008	0.68888889	0.047	12
Axylia putris	2006-2008	0.68717949	0.035	14
Rivula sericealis	2006-2008	0.67826087	0.006	20
Euproctis similis	2006-2008	0.66315789	0.034	15
Lacanobia thalassina	2006-2008	0.55384615	0.042	7
Plemyria rubiginata	2006-2008	0.54545455	0.047	7
Elophila nymphaeata	2006-2008	0.53333333	0.04	7
Ipimorpha retusa	2006-2008	0.5	0.03	5