An Inventory of the Moths Found at Finca Las Piedras in the Peruvian Amazon

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Abstract

Lepidoptera form the second largest order of insects with over 180,000 species worldwide. Because of this great species richness and diversity, they are an important food source for a wide range of taxa. As the Amazon rainforest is rapidly being confronted with deforestation and land use changes, it is of high priority to create inventories of the plants and animals found within there. Throughout this research, an inventory of the moths in and around Finca las Piedras (in the Peruvian Amazon) was created using light trapping, opportunistic surveys and light sheet surveys. Over 19 surveying days, a total of 12 moth families were found. Within these families, 18 subfamilies, 39 genera, and 26 species were identified. The data presented in this research will contribute to a wider catalogue of the taxa recorded at Finca las Piedras, providing an opportunity to view changes in species composition over time. Should a change in diversity occur over time, further research should be carried out to determine the cause and conservation efforts should be put in place as needed.

Introduction

The Amazon rainforest is being deforested at unsustainable rates. The World Wide Fund (WWF) (2022) predicts that 17% of the Amazon's forests have already been lost and that a further 17% are degraded. With the Amazon rainforest being an important carbon sink (Phillips et al., 2008), it is critical that this deforestation is reduced and reversed if we are to minimise the effects of climate change. The largest drivers of deforestation in the Amazon include agricultural land use, timber extraction, mining and the expansion of settlements (Gallice, Larrea-Gallegos and Vázquez-Rowe, 2017; Dos Santos et. al, 2021). This destruction of primary rainforest not only reduces resilience against the effects of climate change but also leads to loss of habitat, resulting in extinctions and therefore a loss of biodiversity (Vieira et al., 2008).

Lepidoptera play a critical role in the functioning of ecosystems via pollination, herbivory and by acting as prey (Summerville et al., 2004). As well as indicating habitat quality (Kitching et al., 2000), Lepidoptera can be used to predict bird (Blair, 1999) and Hymenoptera diversity (Kerr et al., 2000). As such, moths can be used as indicators of biodiversity in a given habitat (Dar and Jamal, 2021; Braga and Diniz, 2018). By recording the moth families and species found in three different habitats, I was able to create an inventory. In the future, these results could be compiled with inventories of moths from over multiple years and combined with inventories of different taxa in order to create a wider image of the effects of habitat change on biodiversity. As many new species of Lepidoptera are still being discovered in the Amazon rainforest (Lamarre et al. 2016), it is important that more research is carried out on this group before these species face extinction due to habitat loss and climate change.

By using a LED light trap, opportunistic surveying and a light sheet, I aim to record the different moth families, subfamilies, genera and species that are present in primary rainforest, secondary rainforest and agricultural land. By combining the moths found using these three surveying techniques, a more complete list of the moths that are present at Finca Las Piedras can be created. By viewing this inventory in the context of the wider ecology at Finca Las Piedras, general trends in species richness could be observed in the long term. As this site has areas that have recently been transformed from agricultural land to secondary rainforest, it is of conservation importance that any changes in species richness observed over the years are used to promote other habitat transformations that will benefit wildlife.

Methods

Study Sites

This research was based in and around the Finca Las Piedras Research Station in the East of the Madre de Dios region of Peru. The Finca sits within the Amazon rainforest and holds a mixture of primary *Terra Firme* forest and secondary *Terra Firme* forest that was reforested from agricultural land. Approximately 1.5km North-West of the Finca sits the Interoceanic Highway that connects Peru to Brazil. Just outside the property, to the North and South, there is agricultural land. This land is used to grow a mixture of crops including papaya, yuca and corn. For this study, data was collected from agricultural land, secondary rainforest and primary rainforest. Light traps were placed at 3 study sites. My first study site was within the agricultural land that was used to grow corn. The land within the Finca that was previously used for agricultural purposes was in the past largely a monoculture of a non-native and invasive species of cattle grass (*Brachiaria sp.*) (Barbosa et al., 2008). Since 2017, much of this land has been actively reforested with fast growing native tree species (including *Inga sp*. trees) that provide shade and inhibit the growth of the invasive grass. This area of reforested land was used as my second study site. The third trapping site was within primary rainforest. This area of rainforest in the Finca has received some disturbance through the loss of some large animal species (such as black-faced black spider monkeys (*Ateles chamek*)) and the loss of some high-value hardwood species such as big leaf mahogany (*Swietenia macrophylla*) (J. Duran, personal communication, 2024). However, the forest is largely intact and is connected to vast areas of Amazonian rainforest, with the next major road lying approximately 52km to the East. The rainforest at the Finca also connects to vast areas of Brazil nut concessions. These concessions consist of about 1 million ha of closed canopy rainforest that are used for the sustainable harvesting of Brazil nuts by local people (Willem, H.V., Ingram, V.J. and Guariguata, 2019). These forests are protected from hunting and timber extraction by federal law; however, these activities do still occur at a small scale due to a lack of law enforcement.

Within these study sites, random points in which to put my light trap were selected. At each of the three habitats, a 50m-by-50m area was selected that had a vegetation structure that was representative of the surrounding habitat. Within this area, 3 random points were selected using QGIS 3.38.1 (QGIS Development Team, 2024). This produced the coordinates in which the moth trap was placed.

As well as the moth light trapping that was carried out, opportunistic surveys were done to find moths. These surveys were carried out largely in the secondary and primary rainforest at Finca Las Piedras. As this surveying method simply involved photographing any moths I found, this method benefitted from night walks, the attractive feature of artificial lights to moths and the fact that moths frequently get trapped inside buildings. A large amount of the moths found via opportunistic surveying were located inside the dining room at Finca Las Piedras. This was likely due to the presence of artificial light and net screens that allowed much of this light to be seen from outside

The last surveying method used was light sheeting. This was carried out within the camp at Finca Las Piedras, in the secondary rainforest. This area was more open than other sections of the secondary rainforest, allowing the light to be seen from a great distance.

Equipment

The moth trap used in this study was a variation of the traditional Heath moth trap (Heath, 1965). The trap was comprised of a 20 litre non-transparent white plastic bucket, a fitted lid, a funnel and an LED moth light. Metal meshes with 12mm and 2mm holes was shaped to form a funnel that had a 300mm diameter opening at the top, a 60mm diameter hole at the bottom and was 140mm in height. The entire funnel was then wrapped in soft plastic, leaving the entrance and exit holes open. This allowed for a smoother surface for the attracted moths to fall against, thereby facilitating in them falling through the funnel and into the bucket. The funnel was placed at the top of the bucket and the lid was placed on top. A 300mm hole was cut into the lid to allow moths to fall through to the funnel. The LED light used was a Goodden Gemlight Super which emits green, blue and ultraviolet light and has a daylight sensor built in. The light was attached to the lid of the bucket, facing up, by drilling a piece of wood to the lid and tying the light to it. This light was powered via a USB cable using a 20,000mAh power bank. The light and power bank were sealed in a zip-lock bag to prevent moisture damage. Drainage holes of a 4mm diameter were drilled into the base of the bucket. The final part of the trap construction was to place egg boxes inside the bucket so that the moths had somewhere to hide, making them more likely to settle in the trap and less likely to fly out.

Light sheeting required the use of two wooden posts set in the ground 360cm apart with two sets of rope hanging horizontally between them and tied 210cm apart. A large white sheet was also required to place over the rope frame. The light used was a LepiLED Maxi light and was powered by a Honda EG1000 portable generator.

The moths found via light trapping, opportunistic surveys and light sheeting were photographed using the camera of a Samsung Galaxy Note10 mobile phone. Other equipment used during surveying included disposable latex gloves for handling moths and a Bedee 1500 lumens head torch for navigation and finding moths whilst on night walks.

Light Trapping

I aimed to carry out light trapping for a total of 9 days (3 nights each week) between the 11th and 27th September. This would allow me to survey one point per day in the chosen habitat and all three habitats would be surveyed each week. Each study site was visited in the same order each week. The light trap was set at 5pm, before sunset and attended the next morning at 5:30am, before sunrise. Using the randomly generated coordinates, the moth trap was placed in one of the study sites. The mobile phone app Geo Tracker (Geo Tracker - GPS Tracker, 2024) was used to locate each point. If the location was deemed to be inappropriate for placing the trap (e.g. due to uneven ground or dense vegetation) the trap was moved to a more suitable location within 2m of the original point. If no suitable ground was available within this range, a new randomly generated point would be used.

Once the trap had been placed, the light was put into standby mode by plugging it into the power bank. As this light has a built-in daylight sensor, it turned on automatically once it was dark outside. Once the lid had been fitted and the trap was fully set as described in the equipment section, the trap was left over night.

In the morning, the light turned off prior to inspection, once there was enough light to trigger the daylight sensor. Upon approaching the trap, the entrance in the funnel was blocked with some vegetation to prevent moths exiting prior to inspection. Next, the outside of the trap and a 2m diameter around the trap was checked to see if any moths that were attracted to the light landed outside the trap. These moths were photographed. The inside of the trap was then checked, inspecting each egg box for moths. Again, these moths were photographed. This process was then repeated in the same week for the other two habitat sites on the following two days.

Opportunistic and Light Sheet Surveys

For opportunistic surveys, four night walks were carried out, each around one to two hours long from 7:30pm. These night walks were carried out in primary and secondary forest. Any moths found in this time were photographed. Any other moths found around the camp at Finca Las Piedras were also photographed, both inside and outside buildings. During mornings, moths could often be found on the mesh screen walls of the dining hall due to getting trapped there after being attracted to artificial lights in the previous night. Again, these moths were photographed to contribute to the inventory.

The light sheet survey was carried out on the 4th of October, when the moon phase was near a new moon. At 5:30pm, a white sheet was placed over the rope frame and secured using clips. The LepiLED Maxi light was hung 60cm away from the sheet from another piece of rope and connected to the generator and turned on. Between 7:35pm and 8:50pm, the sheet was checked for moths and any that were found were photographed. At 9pm, the light was turned off.

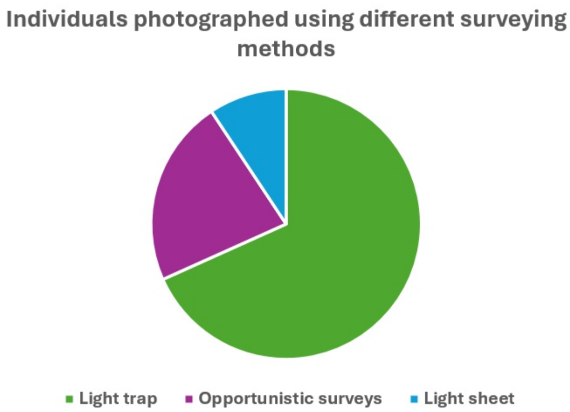
Identification

Identification of moths was carried out to the lowest level possible. The book *'Polillas de Colombia: Guía de Campo*' (Bernal and Martínez, 2023) was largely used to identify moths to family, subfamily, genus or species level. To view more species within a particular group of moths or to double check an identification, iNaturalist (2024) would be used. Features such as the size of the moth, shape of wings, position the wings are held in and wing patterning facilitated the identification of these moths.

Results

A total of 19 days were spent surveying between 22nd August and 4th October 2024. Opportunistic surveying was carried out over 13 days, 8 days were spent doing light trap surveys and a light sheet survey was carried out on 1 day. Of the eight days of light trap surveys, the trap was fully functioning for only three of these days. For the other five days, the LED light turned off part way through the night, reducing the number of moths found in the trap by morning. Using a combination of surveying techniques, 15 days of surveying were carried out in secondary rainforest, 5 days of surveying were carried out in primary rainforest and just 1 day of surveying was done in agricultural land. Overall, 268 individuals were photographed, and the highest number of individuals were found using light traps (183 individuals). Additionally, 60 and 25 individuals were found and photographed using opportunistic and light sheet surveys respectively (Figure 1).

Figure 1: The proportion of individuals found and photographed using light trapping surveys, opportunistic surveys and light sheet surveys.



Of the 268 individuals photographed, 108 were identified to family level or lower (see Appendix A). The remaining 160 individuals were left unidentified due to time constraints. Of the moths photographed in secondary rainforest, 100 were identified to varying levels. In primary rainforest and agricultural land, six and two individuals were identified respectively (Figure 2). Of the 108 individuals identified to family level, 83, 65 and 31 individuals were identified further to subfamily, genus and species level respectively. A total of 12 different moth families were identified. The greatest number of individuals were recorded in the families *Erebidae, Geometridae, Notodontidae* and *Saturniidae* (see Table 1). The greatest number of families identified in a habitat was 12 families in the secondary forest. This was followed by primary rainforest with three identified families and the agricultural land with two identified families. A total of 39 different genera and 26 species were also identified across all habitats.

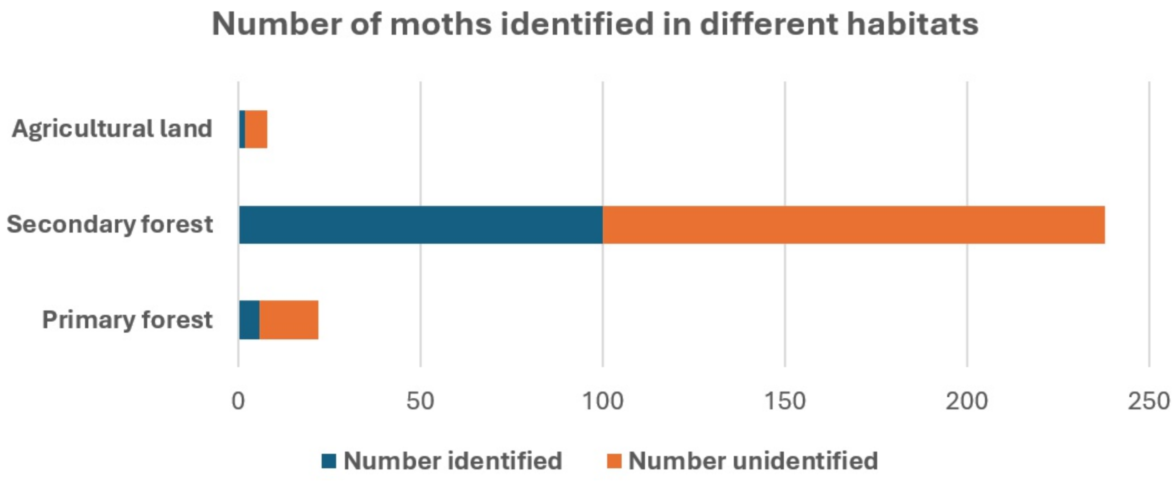
Table 1: The number of individuals identified in each family across primary rainforest, secondary rainforest and agricultural land.

	Primary rainforest	Secondary rainforest	Agricultural land
Bombycidae	0	2	0
Crambidae	0	5	1
Erebidae	3	37	0
Geometridae	0	22	1
Lasiocampidae	0	1	0
Noctuidae	0	2	0
Notodontidae	0	10	0
Pyralidae	0	4	0
Saturniiadae	1	9	0
Sphingidae	1	6	0
Tortricidae	1	1	0
Uraniidae	0	1	0
Total	**6**	**100**	**2**

Discussion

The data presented above should be viewed as preliminary results which will contribute to the existing moth inventory at Finca Las Piedras which is managed by The Alliance for a Sustainable Amazon (ASA). The number of individuals found in each habitat are more of a reflection of the time spent surveying in those areas than a true representation of abundance. As such, comparisons in the number of families and species should not be made between the habitats using these results. If differences in family or species presence are to be viewed across habitats, this should be done through analysing the records from a more complete inventory. Any differences observed

Figure 2: The number of moths that were identified and not identified to family level or higher.



through this are likely to come from varying distributions in host plants leading to varying distributions of the moth species that rely on those plants (Smart et al. 2000).

Limitations

Using a LED moth light has many advantages such as the fact that they can be powered via a power bank rather than a generator or mains electricity and can therefore be used in more remote locations. However, LED lights are usually outperformed in the number of moths they attract as compared to more powerful moth lights such as mercury vapour lights (White et al., 2016). However, modern LED moth lights, like the Goodden Gemlight Super that was used in this study, use multiple types of light (UV, green and blue) in order to maximise the number of moths that can be attracted to a LED light. Also, it has been shown that high numbers of moths will come to LED lights in tropical regions, including Peru (Brehm, 2017). However, it is likely that a greater abundance of moths and perhaps a greater diversity of moths could have been attracted to my light trap if a mercury vapour light had been used. For an area like Finca Las Piedras, where it was necessary to carry the light trap to the study site, it was much more practical to use the lighter set up of an LED light and power bank than a fragile mercury vapour light and a heavy generator.

The greatest challenge faced during data collection was the LED light in the moth trap failing. On five of the eight nights that the moth trap was set, the light failed part way through the night. By sunrise, the light had already turned off one or more hours prior to observation. As it was dark at that time with the light turned off, the moths would have been more active, and it is likely that many moths left the trap prior to inspection. Initially, this project had been designed to compare moth abundance and diversity between primary rainforest, secondary rainforest and agricultural land. Due to the light failure, the results were no longer comparable to each other as on the nights when the light failed, the moth abundance and diversity was no longer representative of the area. This, however, provided the opportunity to change the project to an inventory. Any moths that had been photographed previously during moth trapping and any more photographed from then on would provide data for the inventory.

Due to a change in methodology, the parameters for which moths were to be photographed changed. At the beginning of my initial project, only moths that were suspected to be from four families (*Erebidae, Geometridae, Sphingidae* and *Saturniidae*) were photographed. If a moth could be identified to one of these families in the field, it would not always be photographed. This has reduced the number and diversity of moths that could have been photographed for the inventory. After this period, however, all moths that were observed were photographed, producing a more representative overview of the moths found at Finca Las Piedras.

This change in projects also resulted in variation in the number of days that each habitat was surveyed. The habitat with the highest number of surveying days was the secondary forest; this was due to the fact that I was attempting to get the LED light trap working again, close to camp. This means that more of the moths presented in this inventory will be linked with secondary rainforest and fewer will be characteristic of primary rainforest or the surrounding agricultural land. One paper suggests that whilst secondary rainforest holds a significantly distinct assemblage of moth communities from primary rainforest, secondary rainforest can hold a substantial level of moth diversity (Hawes et al., 2009). This could mean that whilst more species could have been recorded by spending more days surveying the primary forest, a significant proportion of the moths in the area could have been identified solely from surveying secondary rainforest.

Another limitation in this research was that, due to time constraints, only 108 individuals were identified out of 268. This could mean that within the unidentified individuals, there could be moth families and species that were not represented in this inventory. However, this inventory was designed to contribute to a larger moth inventory created by ASA. In this larger inventory, more time could be spent presenting a more complete representation of the moths present at Finca Las Piedras. The level to which these moths were identified was also dependant on my prior knowledge of moth identification and on the identification resources that were available. If more time was available for identification or if more identification guides were available, it is likely that more or the photographed individuals would have been identified and of those identified, they could have been identified to a higher level.

Future Recommendations

As this study was designed to contribute to a wider inventory, it is suggested that these moth surveys are continued in order to create a more complete inventory for Finca Las Piedras. Greater variation in surveying techniques could also be used in the future. For example, a mercury vapour bulb could be used for light trapping or pheromone traps could be used. This could potentially attract a greater variety of moths and therefore contribute further to making a more complete inventory list for Finca Las Piedras. In the future, more time should also be designated to the identification phase to make an inventory that has a more representative family and species composition. To facilitate moth identification, online moth forums, more written guides and the knowledge of Lepidoptera experts (such as those in ASA's Lepidoptera Team) could be relied upon. This could allow for more moth species to be identified. If someone wishes to study moths in the Peruvian Amazon in the future but has little knowledge of moth identification, I suggest that they focus more on abundance or only identify moths to family level for families that are easily recognised (e.g. *Sphingidae*). This is due to the fact that moth identification can take a long time due to similarities between families and species.

As my LED moth light failed and my initial project was not carried out, a comparison of the abundance and diversity of moths was not observed. For this reason, it would be beneficial to see this research carried out in the future. By studying the differences in moths in primary rainforest, secondary rainforest and agricultural land, the effects of land use change on moths could be observed. For example, it has already been suggested that there is a higher biodiversity of a range of taxa in primary rainforest than in agricultural land (Montero et al., 2021; Delzeit et al., 2017). Little research, however, has been carried out to compare moths in these habitats. By viewing the results of such a study in the context of multiple taxa, a wider scale view of the effects of deforestation and land use change could be seen. This would then inform where conservation efforts are required most.

Conclusion

This inventory has provided an insight into some of the moth families and species that are present at Finca Las Piedras. The moths observed will contribute to a larger inventory which as well as Lepidoptera, includes a wider range of taxa such as birds, mammals, and other insects. By recording the diversity of wildlife found at sites such as Finca Las Piedras in the Amazon rainforest, the effects of land use change can be more closely monitored over time. As it is predicted that there are many moth species still to be discovered, it is also possible that by continuing to survey for moths, new species could be found. It is of ecological importance that these new species are documented before they are threatened with extinction due to land use changes, disturbance and climate change. As the number of moths recorded in the inventory of Finca Las Piedras increases over time, it will highlight the diversity of wildlife there and show the importance of protecting such areas and of reversing the effects of deforestation elsewhere.

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Appendix

Appendix A. Table of all identified moths in agricultural land, secondary rainforest and primary rainforest. Trap = Light trap surveys, Opportunistic = Opportunistic surveys and Sheet = Light sheet surveys. Any moths that could not be identified to a particular level were filled as 'Unknown' for that level

Habitat	Date	Method	Family	Subfamily	Genus	Species
Agricultural land	16/09/2024	Trap	*Crambidae*	*Spilomelinae*	*Desmia*	*bajulalis*
Agricultural land	16/09/2024	Trap	*Geometridae*	*Geometrinae*	Unknown	Unknown
Secondary	22/08/2024	Opportunistic	*Erebidae*	*Erebinae*	*Ronania*	*marmorides*
Secondary	27/08/2024	Opportunistic	*Uraniidae*	*Uraniidae*	*Urania*	*leilus*
Secondary	08/09/2024	Trap	*Notodontidae*	*Hemiceratinae*	*Hemiceras*	Unknown
Secondary	08/09/2024	Trap	*Notodontidae*	*Hemiceratinae*	*Hemiceras*	Unknown
Secondary	08/09/2024	Trap	*Notodontidae*	*Dioptinae*	*Scotura*	*bugabensis*
Secondary	08/09/2024	Trap	*Notodontidae*	*Hemiceratinae*	*Hemiceras*	Unknown
Secondary	08/09/2024	Trap	*Erebidae*	*Arctiinae*	Unknown	Unknown
Secondary	08/09/2024	Trap	*Geometridae*	Unknown	Unknown	Unknown
Secondary	08/09/2024	Trap	*Geometridae*	*Ennominae*	*Sericoptera*	Unknown
Secondary	08/09/2024	Trap	*Geometridae*	*Geometrinae*	*Nemoria*	Unknown
Secondary	08/09/2024	Trap	*Notodontidae*	*Hemiceratinae*	*Hemiceras*	Unknown
Secondary	08/09/2024	Trap	*Erebidae*	*Arctiinae*	*Opharus*	Unknown
Secondary	08/09/2024	Trap	*Erebidae*	*Arctiinae*	*Opharus*	Unknown
Secondary	08/09/2024	Trap	*Erebidae*	*Arctiinae*	*Episcepsis*	Unknown
Secondary	08/09/2024	Trap	*Notodontidae*	*Hemiceratinae*	*Hemiceras*	Unknown
Secondary	08/09/2024	Trap	*Erebidae*	*Arctiinae*	*Trichromia*	Unknown
Secondary	08/09/2024	Trap	*Notodontidae*	*Hemiceratinae*	*Hemiceras*	Unknown
Secondary	08/09/2024	Trap	*Erebidae*	*Arctiinae*	*Episcepsis*	*hypoleuca*
Secondary	08/09/2024	Trap	*Erebidae*	*Arctiinae*	*Loxophlebia*	*imitata*
Secondary	08/09/2024	Trap	*Notodontidae*	*Hemiceratinae*	*Hemiceras*	Unknown
Secondary	08/09/2024	Trap	*Notodontidae*	Unknown	Unknown	Unknown
Secondary	08/09/2024	Trap	*Erebidae*	*Arctiinae*	Unknown	Unknown
Secondary	08/09/2024	Trap	*Noctuidae*	*Amphipyrinae*	*Emarginea*	*combusta*
Secondary	08/09/2024	Trap	*Geometridae*	Unknown	Unknown	Unknown
Secondary	08/09/2024	Trap	*Saturniidae*	Unknown	Unknown	Unknown
Secondary	08/09/2024	Trap	*Erebidae*	*Arctiinae*	*Trichromia*	Unknown
Secondary	08/09/2024	Trap	*Saturniidae*	Unknown	Unknown	Unknown
Secondary	08/09/2024	Trap	*Erebidae*	*Erebinae*	*Mocis*	*dyndyma*
Secondary	08/09/2024	Trap	*Crambidae*	*Spilomelinae*	Unknown	Unknown
Secondary	08/09/2024	Trap	*Erebidae*	*Arctiinae*	*Calodesma*	*dioptis*
Secondary	08/09/2024	Trap	*Erebidae*	*Arctiinae*	Unknown	Unknown
Secondary	08/09/2024	Trap	*Bombycidae*	Unknown	Unknown	Unknown
Secondary	08/09/2024	Trap	*Erebidae*	*Arctiinae*	*Episcepsis*	*hypoleuca*
Secondary	08/09/2024	Trap	*Erebidae*	*Arctiinae*	*Homoeocera*	*trizona*
Secondary	08/09/2024	Trap	*Erebidae*	*Arctiinae*	*Psoloptera*	*thoracica*
Secondary	08/09/2024	Trap	*Erebidae*	*Arctiinae*	Unknown	Unknown
Secondary	08/09/2024	Trap	*Geometridae*	*Ennominae*	*Leuciris*	Unknown

Habitat	Date	Method	Family	Subfamily	Genus	Species
Secondary	08/09/2024	Trap	*Geometridae*	*Geometrinae*	Unknown	Unknown
Secondary	08/09/2024	Trap	*Geometridae*	*Geometrinae*	*Synchlora*	*gerularia*
Secondary	08/09/2024	Trap	*Geometridae*	*Geometrinae*	Unknown	Unknown
Secondary	08/09/2024	Trap	*Sphingidae*	Unknown	Unknown	Unknown
Secondary	11/09/2024	Trap	*Erebidae*	*Arctiinae*	*Prepiella*	Unknown
Secondary	11/09/2024	Trap	*Erebidae*	*Arctiinae*	*Prepiella*	Unknown
Secondary	11/09/2024	Trap	*Saturniidae*	Unknown	Unknown	Unknown
Secondary	11/09/2024	Trap	*Saturniidae*	Unknown	Unknown	Unknown
Secondary	11/09/2024	Trap	*Saturniidae*	Ceratocampinae	Syssphinx	molina
Secondary	11/09/2024	Trap	*Tortricidae*	Unknown	Unknown	Unknown
Secondary	18/09/2024	Trap	*Pyralidae*	Unknown	Unknown	Unknown
Secondary	18/09/2024	Trap	*Pyralidae*	Unknown	Unknown	Unknown
Secondary	18/09/2024	Trap	*Pyralidae*	Unknown	Unknown	Unknown
Secondary	18/09/2024	Trap	*Pyralidae*	Unknown	Unknown	Unknown
Secondary	20/09/2024	Opportunistic	*Crambidae*	Unknown	Unknown	Unknown
Secondary	20/09/2024	Opportunistic	*Crambidae*	Unknown	Unknown	Unknown
Secondary	20/09/2024	Opportunistic	*Geometridae*	*Ennominae*	Unknown	Unknown
Secondary	20/09/2024	Opportunistic	*Geometridae*	*Sterrhinae*	*Semaeopus*	*illimitata*
Secondary	21/09/2024	Trap	*Saturniidae*	*Ceratocampinae*	*Syssphinx*	*molina*
Secondary	21/09/2024	Trap	*Erebidae*	*Arctiinae*	*Correbia*	Unknown
Secondary	21/09/2024	Opportunistic	*Geometridae*	Unknown	Unknown	Unknown
Secondary	21/09/2024	Opportunistic	*Erebidae*	*Eulepidotinae*	*Eulepidotis*	Unknown
Secondary	22/09/2024	Opportunistic	*Geometridae*	*Geometrinae*	*Oospila*	*albicoma*
Secondary	22/09/2024	Opportunistic	*Sphingidae*	*Macroglossinae*	*Callionima*	Unknown
Secondary	22/09/2024	Opportunistic	*Sphingidae*	Unknown	Unknown	Unknown
Secondary	22/09/2024	Opportunistic	*Erebidae*	*Eulepidotinae*	*Eulepidotis*	*perlata*
Secondary	22/09/2024	Opportunistic	*Crambidae*	*Spilomelinae*	*Omiodes*	Unknown
Secondary	23/09/2024	Opportunistic	*Sphingidae*	*Macroglossinae*	*Callionima*	Unknown
Secondary	23/09/2024	Opportunistic	*Sphingidae*	*Macroglossinae*	*Xylophanes*	Unknown
Secondary	23/09/2024	Opportunistic	*Erebidae*	*Eulepidotinae*	Unknown	Unknown
Secondary	25/09/2024	Trap	*Saturniidae*	*Ceratocampinae*	*Syssphinx*	*molina*
Secondary	26/09/2024	Opportunistic	*Erebidae*	*Erebinae*	*Ascalapha*	*odorata*
Secondary	26/09/2024	Opportunistic	*Erebidae*	*Arctiinae*	*Elysius*	Unknown
Secondary	26/09/2024	Opportunistic	*Erebidae*	*Eulepidotinae*	*Dyomyx*	Unknown
Secondary	26/09/2024	Opportunistic	*Erebidae*	*Spilomelinae*	Unknown	Unknown
Secondary	26/09/2024	Opportunistic	*Geometridae*	*Geometrinae*	Unknown	Unknown
Secondary	26/09/2024	Opportunistic	*Sphingidae*	Unknown	Unknown	Unknown
Secondary	26/09/2024	Opportunistic	*Erebidae*	*Arctiinae*	*Heliura*	Unknown
Secondary	26/09/2024	Opportunistic	*Erebidae*	*Eulepidotinae*	*Eulepidotis*	Unknown
Secondary	27/09/2024	Opportunistic	*Erebidae*	*Eulepidotinae*	*Eulepidotis*	Unknown

Habitat	Date	Method	Family	Subfamily	Genus	Species
Secondary	27/09/2024	Opportunistic	*Erebidae*	*Eulepidotinae*	*Eulepidotis*	Unknown
Secondary	28/09/2024	Opportunistic	*Notodontidae*	*Heterocampinae*	*Colax*	*apulus*
Secondary	28/09/2024	Opportunistic	*Erebidae*	*Arctiinae*	*Hypocrita*	*hystaspes*
Secondary	03/10/2024	Opportunistic	*Geometridae*	*Geometrinae*	Unknown	Unknown
Secondary	03/10/2024	Opportunistic	*Erebidae*	*Eulepidotinae*	*Eulepidotis*	*alabastraria*
Secondary	04/10/2024	Sheet	*Geometridae*	*Ennominae*	*Sphacelodes*	*vulneraria*
Secondary	04/10/2024	Sheet	*Bombycidae*	*Epiinae*	*Colla*	Unknown
Secondary	04/10/2024	Sheet	*Erebidae*	*Eulepidotinae*	*Eulepidotis*	*guttata*
Secondary	04/10/2024	Sheet	*Erebidae*	*Arctiinae*	*Dinia*	Unknown
Secondary	04/10/2024	Sheet	*Geometridae*	*Geometrinae*	Unknown	Unknown
Secondary	04/10/2024	Sheet	*Erebidae*	*Arctiinae*	*Trichromia*	*albicollis*
Secondary	04/10/2024	Sheet	*Saturniidae*	*Ceratocampinae*	*Syssphinx*	*molina*
Secondary	04/10/2024	Sheet	*Geometridae*	*Geometrinae*	*Oospila*	*rufilimes*
Secondary	04/10/2024	Sheet	*Saturniidae*	*Ceratocampinae*	*Syssphinx*	*molina*
Secondary	04/10/2024	Sheet	*Lasiocampidae*	*Poecilocampinae*	*Euglyphis*	*putrida*
Secondary	04/10/2024	Sheet	*Erebidae*	*Arctiinae*	*Saurita*	*tipulina*
Secondary	04/10/2024	Sheet	*Geometridae*	Unknown	Unknown	Unknown
Secondary	04/10/2024	Sheet	*Geometridae*	Unknown	Unknown	Unknown
Secondary	04/10/2024	Sheet	*Crambidae*	*Spilomelinae*	Unknown	Unknown
Secondary	04/10/2024	Sheet	*Noctuidae*	*Noctuinae*	Unknown	Unknown
Secondary	04/10/2024	Sheet	*Geometridae*	*Ennominae*	Unknown	Unknown
Secondary	04/10/2024	Sheet	*Geometridae*	Unknown	Unknown	Unknown
Secondary	04/10/2024	Sheet	*Geometridae*	Unknown	Unknown	Unknown
Primary	12/09/2024	Trap	*Erebidae*	*Arctiinae*	*Correbia*	Unknown
Primary	12/09/2024	Trap	*Erebidae*	*Arctiinae*	*Prepiella*	Unknown
Primary	25/09/2024	Opportunistic	*Tortricidae*	Unknown	Unknown	Unknown
Primary	25/09/2024	Opportunistic	*Sphingidae*	Unknown	Unknown	Unknown
Primary	25/09/2024	Opportunistic	*Saturniidae*	*Hemileucinae*	Unknown	Unknown
Primary	02/10/2024	Opportunistic	*Erebidae*	*Arctiinae*	*Calonotes*	Unknown

