Report: Establishment of a plot designed with agro-nature measures in function of functional agrobiodiversity

Status up to 2023

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Figure 1: Drone Image (September 2022) providing an overview of the plot.

1. Table of content

2. Objectives of the plot

The agro-nature demonstration plot has multiple objectives:

1) The agro-nature measures implemented on the plot create an environment necessary to support ecosystem services related to pest control, pollination, and nutrient cycling. The combination of perennial grass-flower strips with mixed hedgerows ensures continuous blooming (and thus a food source) from early spring to late autumn. In addition to nectar and pollen, the numerous insects present also serve as a food source for many other animals (e.g., plant-specific aphids that provide a ready feast for pest controllers like ladybugs, parasitic wasps, hoverflies, etc., when prey is scarce in the crops themselves). The permanent ecological structures not only provide food but also offer shelter and nesting opportunities, both above and below ground. These serve as refuges and buffers against disturbances that inevitably occur in the crop areas of the plot. This objective thus focuses on housing a "standing army" of biodiversity that plays a role in ecosystem services (="functional agrobiodiversity").

2) Establishing and maintaining agro-nature measures on Inagro's own land allows us to gain practical experience and identify challenges. This enables communication based on practical experience, rather than solely on theoretical knowledge.

3) In addition to experimenting with more conventional agro-nature measures, such as field borders, the plot also offers space to test crops or farming practices that show potential for both biodiversity and farmers. For example, the plot provides room for trials related to integrated pest management and pollination, in an environment designed for these purposes. Similarly, it can be used to test the crop management of alternative crops.

4) The plot serves as a platform to demonstrate topics related to agro-nature, integrated pest management, and pollination.

5) A final objective is to map the biodiversity present over the years. This brings with it a sub-objective: testing and refining a set of monitoring techniques that are easy to use and reproducible. The methods used and tested are highlighted in this report, while the monitoring results will be presented in a separate report. For example, several pilot tests were conducted using innovative monitoring techniques.

3. Layout of the plot

Several agro-nature measures have been implemented on the plot. The image below shows the spatial arrangement of the different elements present. Each of these elements is discussed individually later in this report.

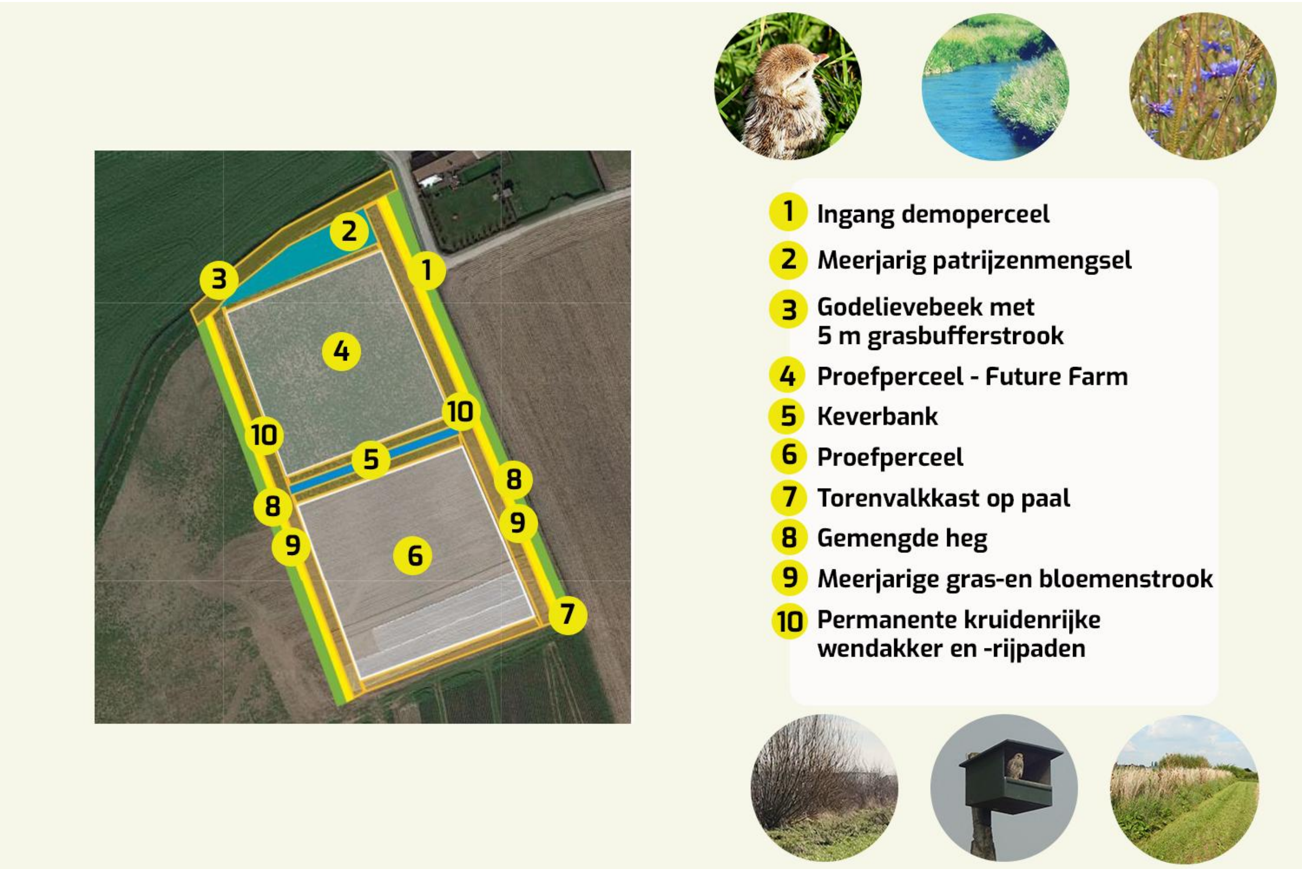

Figure 2: Schematic representation of the agro-nature measures implemented on the plot.

Below is a chronological overview of the plot's development and the crops present over the various years.

3.1. 2016

1) Crop
   a) In 2016, the plot was a grazed grassland.
2) Agro-nature measures
   a) None

3.2. 2017

1) Crop
   a) In 2017, summer wheat was sown.
   b) In the winter of 2017-2018, a cover crop with phacelia was planted.Agro-nature measures
2) Agro-nature measures
   a) None

3.3. 2018

1) Crop
   a) Various trials with cabbage crops.
   b) Grass-clover as a cover crop on parts of the plot where cabbage was no longer present at the end of the season.
2) Agro-nature measures
   a) In the spring of 2018, the eastern mixed hedge was planted.
   b) In the fall of 2018, soil was brought in to create a beetle bank. The soil was left to settle over the following months.(Beetle banks were designed to be created using a plow, but since earthworks were already being done on-site, the beetle bank in Beitem was constructed with imported soil).

3.4. 2019

1) Crop
   a) Grass-clover as a balancing crop across the entire plot.
   b) Grass-clover was maintained as a cover crop during the winter.
2) Agro-nature measures
   a) During the winter of 2018-2019, the eastern hedge was cut back to about 15 cm above the ground to encourage a dense hedge branching from low down.
   b) In the spring, a temporary annual flower mix (Inagro's own mix) was sown on the beetle bank. (The sowing of the final beetle bank mix was planned for the fall of 2018 but could not take place).
   c) The eastern flower strip was also sown in the spring of 2019 (an annual FAB mix from Advanta, designed for IPM in orchards).

d) In the spring of 2019, a kestrel nest box was installed on a pole in the field.

e) The final beetle bank mix was sown in the fall.

3.5. 2020

From 2020, the plot was split into two blocks, separated by the beetle bank: Plot 19A to the north of the beetle bank and Plot 19B to the south.

1) Crop
    a) 19A
        i) Partly zucchini, and partly onion (an IPM trial on intercropping with sugar peas for thrip control).
        ii) Grass-clover was maintained in the spray/harvest tracks.
        iii) No cover crop (the crop remained on the plot).
    b) 19B
2) Onion (an IPM trial on intercropping with sugar pea for thrips control). Grass clover maintained in the spray paths/harvest paths.
        i) No green cover crop (crop remained present on the plot)
3) Agro-nature measures
    a) In the winter of 2019-2020, the western hedge was planted for the first time. Due to extreme drought in 2020, all plant material died.
    b) In the spring, a temporary annual mixture (Inagro's own mixture) was sown in the eastern flower strip, and now also in the western flower strip.
    c) The beetle bank mixture was exceptionally mowed once in the spring of 2020 due to a strong emergence of flowering annual herbs from the temporary annual mixture in 2019.

3.6. 2021

1. Crop
    a) 19A
        i) Japanese oats as the main crop, maintained as a cover crop (variety trial for the seed-bearing potential of Japanese oats for farmland birds).
    b) 19B
        i) Fennel (IPM trial: intercropping with a "banker field" of nasturtium and phacelia for thrip control).
        ii) Winter wheat (trial with under-sowing of flowering herbs to support functional agro-biodiversity), sown as both cover crop and subsequent crop.

2. Agro-nature measures

a) In the winter of 2020-2021, the western mixed hedge was replanted, this time successfully.

b) In the spring, the final perennial mix (Inagro's own) was sown in both the eastern and western flower strips.

3.7. 2022

1) Crop
   a) 19A
      i) Spinach and fennel (IPM trial on banker fields), followed by onion.
      ii) The crop remained on the plot over the winter
   b) 19B
      i) Winter wheat, followed by bird's-foot trefoil (trial on the added value of this innovative mowing crop for breeding farmland birds and pollinators).
      ii) Fall 2022: Bird's-foot trefoil was sown. This is a perennial crop that remains over the winter.
2) Agro-nature measures
   a) In the spring of 2022, a partridge mix was sown on the sloping tip of Plot 19A. Previously, various herb mixes had been trialed in this location.

3.8. 2023

1) Crop
   a) 19A
      i) Partly leek, partly Brussels sprouts (trial on the effects of the beetle bank on cabbage fly control).
      ii) The crop remained on the plot over the winter.
   b) 19B
      i) Bird's-foot trefoil (continuation of the 2022 trial).
      ii) The crop was maintained through the winter.
2) Agro-nature measures
   a) By 2023, all planned agro-nature measures were in place, with no new ones added.
   b) In the spring of 2023, there was a significant pressure of creeping thistle and curly dock in the western flower strip, leading to the decision to destroy the strip and manage it as a false seedbed for a season.
   c) In the fall of 2023, the strip was reseeded with a perennial grass-herb mix.

3.9. 2024

1) Crop

a) 19A

   i) After harvesting the leeks and Brussels sprouts, the plot lay fallow until late August. Starting in late August, bird's-foot trefoil was sown as part of a trial on the effect of sowing time.

b) 19B

   i) Continuation of the bird's-foot trefoil trial until month X, followed by winter wheat.

2) Agro-nature measures

   a) The sown flower mix in the western flower strip did not establish well. The strip was left untreated and developed spontaneously into a strip dominated by white clover, with various other herbs interspersed.

   b) The beetle bank continued to perform well without further management, except for mowing a localized patch of thistles.

   c) The eastern mixed hedge was pruned on one side: the outer row of plants along the perimeter was cut back to 1.5 meters in height, and long, overhanging branches were removed (not a typical flat prune).

   d) Half of the partridge mix was mowed in the spring, with the clippings removed.

4. Existing Agro-Nature Measures

4.1. MIXED HEDGE

Structural woody elements like hedges or tree lines are essential for biodiversity in agricultural areas. Perennial green infrastructure provides a habitat for a variety of species and contributes to the preservation of functional agro-biodiversity.

Hedges are a valuable complement to flower strips, as they offer complementary features. In addition to supporting biodiversity, hedges can also create a more favorable microclimate for adjacent flower strips.For these reasons, mixed hedges were planted alongside both flower strips: one along the eastern flower strip and one along the western flower strip.

Grass herb strips bloom profusely for a fairly long period. However, in early spring and autumn, there is either no bloom or it is becoming less present. Various types of shrubs, on the other hand, bloom much earlier than the species in the flower border in spring, or much later in autumn. Moreover, a number of shrub species produce extra food for farmland birds in winter.

The eastern hedge was successfully planted in the winter of 2017-2018. The shrubs were pruned in the following winter to about 15 cm above the ground, encouraging dense branching from the base. This results in a sturdy, well-branched hedge that grows densely from the bottom.

The western hedge was successfully replanted in the winter of 2020-2021. In this hedge, the shrubs were not pruned back as was done in the eastern hedge.

The eastern and western hedges were planted at different times, and their composition differs slightly.

Composition of the eastern mixed hedge (planted in winter 2017-2018):

Cornelian cherry, Red dogwood, Hornbeam, Privet, Alder buckthorn, Elder, Hazel, Osier willow, and some ivy plants (a non-climbing form).

Although goat willow is preferred (very early bloom), it proved difficult to obtain planting stock. Additionally, successfully planting this species is challenging. Therefore, goat willow was replaced by osier willow.

Composition of the western mixed hedge (planted in winter 2020-2021):

Red dogwood, Hornbeam, Privet, Alder buckthorn, Elder, Hazel, Field maple, Woolly snowball, White willow, and an early blooming willow (stock from plants present elsewhere on the site of Inagro. No conclusive identification of the species).

4.2. PERENNIAL GRASS AND FLOWER STRIP

On both sides of the plot, there is a perennial grass-herb strip.

Generally, it is assumed that the effects of flower edges on pest control in the adjacent crop extend about 50 meters into the plot. The demo plot agro-nature is 95m wide, so it was decided to create a flower edge along both sides of the plot.

The grass-herb strips consist largely of tuft-forming grasses, supplemented with perennial native herbs. They are not seas of flowers, but structures that provide food as well as shelter or nesting opportunities for various species groups throughout the year, both above and below ground.

In the spring of 2023, it became clear that there was strong pressure from thistle and dock in the western flower edge. Therefore, it was decided to destroy the strip and manage it as a false seedbed for a season. In the autumn, the strip was resown. Thistles are also present in the eastern flower edge, but in lower numbers than in the western hedge. The thistles in the eastern hedge were manually/mechanically managed in 2023, and their presence will be further monitored. We strive to always have blooming vegetation in at least one of the two edges.

As a rule of thumb for mowing the grass-herb edges, we aim to mow twice a year with removal, but mowing is adjusted based on the estimated need (the cut material is always removed).

Composition of the sown mixture (sown in spring 2021):
Cocksfoot, red fescue, meadow grass, wild chamomile, yarrow, borage, caraway, cornflower, common knapweed, coriander, large hawkweed, large teasel, buckwheat, meadow cranesbill, scabious, rough hawkweed, common daisy, musk mallow, hop clover, alfalfa, common parsnip, evening primrose, red clover, and white clover.

Figure 3: View of the combined mixed hedge and perennial grass-herb strip on the eastern side of the plot (summer 2021).

4.3. BEETLE BANK

A beetle bank is a raised, minimally managed grass strip that lies as an island in a field.

It helps natural pest controllers and supports partridges: ground beetles like to overwinter at the base of the grass tufts, and the elevation ensures that the structure dries and warms up faster in the spring, making the beetles active early in the year. These beneficial insects provide pest control in the plot around the beetle bank, and they also form an important food source for partridge chicks that shelter on the beetle bank.

If the vegetation installation is successful, a beetle bank normally does not need to be mowed further.

Composition of the sown mixture (sown in spring 2021):
Reed fescue, red fescue, cocksfoot, meadow foxtail, timothy, cornflower, knapweed, common yarrow, common clover, large poppy, musk mallow, wild carrot, large teasel, borage.

The mixture mainly consists of tuft-forming grasses, supplemented with a small proportion of flowering herbs. The structure becomes even more interesting on very long beetle banks if a group of shrubs is planted here and there. On the plot in Beitem, this is not necessary as there are already sufficient shrubs present, in combination with a beetle bank that is not very long (+/-70m).

Figure 4: View over the beetle bank (photo taken from the top of the beetle bank in the summer of 2021).

4.4. GRASS BUFFER STRIP

The plot slopes towards the Goddelievebeek that flows along the northern edge of the plot.

Between the plot and the stream, a grass buffer strip was provided that serves multiple functions: within the strip falls the fertilization and cultivation-free zone, the strip also serves as a fixed driving path and allows easy cleaning of the stream. Moreover, the grass buffer strip retains nutrients and soil particles that could wash off the plot.

4.5. PARTRIDGE MIXTURE

The plot also made room to experiment with a mixture specially designed for the needs of partridges, taking into account the common crops in the region. For example, there are no cabbage-like species in the mixture.

It is a perennial structure, of which half of the area is worked and resown each year. This way, there is always a part of the area that is rougher (overgrown) with more structure, and a part that is younger (resown), with more bloom.

It is therefore a measure that is useful for birds and insects.

4.6. KESTREL BOX

The silhouette of a bird of prey can deter unwanted visitors from the plot, and kestrels also help keep the mouse population in balance.

Therefore, a kestrel box was installed on a long pole at a corner of the plot: kestrels need cavities to breed in, at a reasonable height, with a sufficiently clear view from the box.

Figure 5: Kestrel in the nest box in 2021.

5. Monitoring techniques used

The starting signal to get started with the plot was also the starting signal to implement a monitoring strategy. The beacons for this were set in advance, but things changed along the way: "learning by doing" (which is also one of the objectives of the plot). New types of monitoring techniques were added, adjustments were made to the setup of the traps, or some techniques were no longer included after an initial test.

Below is an overview of the monitoring techniques that were tested and/or included in the final monitoring strategy used in the long term.

5.1. PITFALL TRAPS

The use of pitfall traps is a standard method to monitor the fauna active on the soil surface. Pots (in our case type WECK, 850ml) are buried in the soil so that the top edge of the pot is level with the ground surface and filled with a liquid. A roof (plexiglass) is often placed about 1.5cm above the pitfall trap to prevent the pot from quickly overflowing in rain or to slow down evaporation in dry weather, and it also limits access for mice.

Since 2021, the pitfall traps are set up in the field for 3 nights, in 4 parallels per catch location, and filled with water + a few drops of odorless soap. Previously, various liquids were used (saturated salt solution or 70% ethanol), and initially, the traps were set up longer in the field and in more parallels.

Animals moving across the soil surface fall into the pot. Since there is no attractant associated with the trap, the contents of the trap reflect the normal activity of the animals at that specific sampling location at the time of sampling.

5.2. WINDOW TRAPS

Just as pitfall traps capture fauna at the soil surface, window traps operate in the air. The design of the trap is significantly different, but the interpretation of the results remains the same: insects flying around the trapping location collide with the window (two plexiglass plates arranged in a cross (+) approximately 1.3 meters above the ground) and are captured in a liquid. Therefore, the outcome here also reflects the actual activity of organisms at a specific location.

Figure 1: Window trap in operation (version 2023).

A key condition is that the collection container holding the liquid must be neutral in color: the trap should not have a bait function to make valid statements about the activity of organisms at a specific location (as with the pitfall traps). A bait increases the effective range of the trap and creates bias towards organisms that are actually attracted to the bait. While traps with baits certainly have their applications, in the setup of the agronature plot, it is preferable to use "passive" traps (i.e., without bait).

In 2023, new traps were constructed, all identical: the two plexiglass windows measure 35 x 60 cm each and are placed above a gray collection container. Throughout the season, several issues were identified with the traps, so further adjustments will likely be made for the 2024 campaign.

Before 2023, window traps in various colors were used: the exterior color was always neutral (green or gray), but the interior was yellow. The dimensions of the plexiglass windows were slightly different (42 x 50 cm), but the total area remained the same. The color contradicted the previously mentioned condition of traps without bait function, but we utilized the traps that were available at that time. The number of days and the dates on which the window traps were in the field were always in parallel with the pitfall traps, and the liquid used to capture the organisms was the same.

5.3. GRAIN APHID TEST

To monitor the effectiveness of the natural enemies present in the cultivation part of the plot, a relevant, easily executable, and replicable technique was sought.

The idea behind the grain aphid test was to introduce a fixed number of aphids into the plot at each sampling in several parallels and determine the number of disappeared aphids after the sampling period (the sampling period would be as long and parallel to that of the pitfall traps and window traps). The number of disappeared aphids could then be a measure of the effective pest control capacity of the predators in the cultivation system at that time. The great advantage was that a commercial product was available that was also used as a "banker system" in the integrated pest control of greenhouse crops: Ervibank (Koppert). This product consists of a clump of young grain plants inoculated with 500 grain aphids (Sitobion avenae).

The experience with the technique in 2018 showed that there were several shortcomings to using this as a standardized system for monitoring the plot:

- The deviation in the number of aphids present on each clump of grain plants at the start was too large to make a relevant statement about the total number of disappeared aphids after the field phase of each sampling.
- Once the grain clumps were placed in the field, they had to continuously have sufficient water to maintain the water pressure in the plants (to ensure that the aphids did not seek other places because their host no longer met their needs). The watering method used was not sufficient to ensure the water pressure in the plants (a thick piece of cultivation mat (used in greenhouse cultivation to grow tomatoes, for example) was placed in a plastic bag and abundantly poured with water. This whole was buried in the field, and then the grain clump was placed on the cultivation mat). A good alternative did not seem available.
- As a control, grain clumps were also placed in the field simultaneously in closed breeding cages with insect mesh. When the grain plants were retrieved after the field phase, aphids were crawling around in the cages. Our assumption (and a condition to be able to carry out the test in a standardized manner) that the aphids would neatly stay on the grain clumps turned out to be incorrect.

The grain aphid test was no longer used in the monitoring work.

Figuur 2: Test setup of the grain aphid test in 2018.

5.4. SOIL INCUBATION

One of the agronature measures implemented on the plot is the "beetle bank." A description is given earlier in this article.It is a concept developed in the United Kingdom to provide a wintering spot for natural enemies (mainly for beetles that hibernate at the base of tuft-forming grasses sown on the beetle bank): due to the elevation, the soil would warm up faster in the spring and remain drier in the winter.

To visualize the added value of the wintering object compared to other habitats, a custom methodology was devised: soil incubation. Moreover, this technique allows us to investigate where the insects that are active during the growing season hibernate in the various habitats: which wintering objects are used by the organisms active in the plot during the growing season?

Soil samples of 25 x 25 x 20 cm are excavated on a cold day in the winter (around mid-February) and placed in "soil incubation boxes." These boxes are designed so that the organisms that awaken are collected in jars hanging under the box. The organisms that emerge are periodically collected until August. Through this working method, it is possible to obtain a fairly passive image of which organisms are located in which environment during the winter months.

In 2019, this was first carried out as a test, but the soil samples were collected in a manner that compacted and crumbled the soil more and with a smaller quadrant. Moreover, the existing vegetation had not yet been cut, causing problems with mold growth, and the awakening organisms were only collected until May.

In 2019, the soil samples were 20 x 20 x 20 cm; in 2020, the dimensions were 25 x 25 x 20 cm; in 2021, they were 25 x 25 x 20 cm; in 2022, they were 25 x 25 x 20 cm; and in 2023, they were 20 x 20 x 20 cm.

Figure 3: Soil incubation container in operation.

5.5. EARTHWORM MONITORING

Since 2023, the presence of earthworms in the soil of the plot has also been monitored as a measure to track soil health over the years. This is done by measuring the number and total weight of earthworms present in soil blocks measuring 20 x 20 x 20 cm.

However, this method has a significant disadvantage: it does not effectively account for a crucial group of earthworms known as "anecic" earthworms. These are earthworms that dig deep vertical burrows in the soil and are typically located deeper in their burrows during the day when the soil blocks are excavated.

Experiments have been conducted with other methods to identify anecic earthworms, such as using a soil solution method and counting the number of holes in the horizontal soil surface beneath each soil sample at a depth of 20 cm. However, these methods have proven unsatisfactory: the soil solution often barely penetrates our heavier clay and loam soils, and counting the holes is usually not feasible because the soil surface at 20 cm depth often becomes compacted when excavating a soil sample.

Figure 4: To count the number of earthworms in a sample, the soil samples are completely crumbled.

5.6. LED-BUCKETS

Moths are often an overlooked group in many studies of agricultural landscapes. In recent years, this group has gained increasing recognition for its role as nocturnal pollinators of various plants.

LED buckets are moth traps developed in the Netherlands, and they have two significant advantages: 1) they can operate all night long without mains power (light source), and 2) the range within which the traps attract moths is limited. This allows for sampling of different habitats within the same plot without much interference between the traps (which would not be possible with the bright lamps used in traditional moth traps).

Since 2023, LED buckets have been used to monitor moth diversity at various times throughout the year.

Figure 5: Setup of an LED bucket. The lamp automatically turns on when it gets dark.

5.7. AUDIOMOTH

In 2023, the first steps were taken to implement audio moth devices on the plot. These devices are used to automatically inventory species based on the sounds they produce. The devices record and log sound fragments but do not process the collected data further. On the demonstration plot for agronature, they will be used to map the presence of bats, as there are well-functioning algorithms available for identifying species from the sound fragments. We are currently exploring whether and how we can also use them to monitor birds.

Starting in 2024, these devices will be structurally deployed on the agronature plot in Beitem.

Figure 6: Audiomoth devices are mounted on a pole.

5.8. TEST: "BEECAM"-SENSOR

In 2018, a device was tested to map insect activity based on video footage recorded in the field: the "BEECAM" (a product from Advansee). This device counts the number of animals flying in and out of a specific area in the footage. At that time, the image processing capability was unable to distinguish between different groups of insects.

To ensure the algorithm functioned properly, it was necessary to have a uniformly colored background in the focus of the image. Therefore, a large gray panel was placed in the field, considering the sun's position to maximize light on the focus object and minimize hours of shadow.

In the experimental setup, a dummy flower was used: a yellow lid from a jar was nailed to a post and placed in the field so that the lid was approximately at the same height as other flowers in that location.

In the software used to process the images, a search area must be designated within which all incoming and outgoing objects are counted. However, several issues became apparent during the operation of the device, which, despite the specific setup, still caused disruptions in the algorithm. This was primarily because the algorithm could not distinguish between the objects passing through the image; for example, the shadow of swaying plants on the gray panel or even raindrops rolling down the panel were counted as insects moving in and out of the marked search area.

While this device can certainly be useful for certain objectives, it proved to be not user-friendly enough for our goal of monitoring insects under field conditions, such as in a flower border, due to excessive data noise.

Figure 7: Test setup of the Beecam.

5.9. TEST: "POLLY"-SENSOR

Pollinators are typically monitored visually in the field. However, this method has several significant limitations: observations are often short in duration, dependent on current weather conditions, and occur at relatively infrequent intervals throughout the season. When trying to monitor multiple locations, it is impossible to be present at all sites simultaneously, resulting in different weather conditions and times of day across monitoring points.

Automated trapping systems could address these limitations. Such sensors would certainly be beneficial in experiments involving flowering crops. Therefore, in 2023, a new type of sensor was tested to monitor insect activity: the "Polly" sensor (from Agrisound).

This sensor continuously records the activity of pollinators based on sound within a half-sphere with a radius of 0.5 meters. During field tests, the sensor's limited operational range emerged as the primary obstacle. In a perennial grass-flower strip, such as those at the agronature site, flowers are not always located close together. While the sensor can be placed near a few flowers, once they wilt, newly blooming flowers are likely to fall outside the sensor's range. Additionally, the sensor primarily measures the activity of pollinators on that specific plant, rather than providing a representative value for the flower strip as a whole.

Implementing a network of sensors could potentially mitigate this issue, but the costs could escalate quickly. In some flowering crops, however, the sensor proved to be useful—particularly in crops where new flowers develop close to older ones, such as field beans. In this case, the sensor must be manually adjusted at least weekly to keep pace with the upward growth of flowers on the stem.

Figure 8: Test setup of the Polly sensor in a plot of clover.

5.10. TEST: "EDAPHOLOG"-SENSOR

In 2023, we had the opportunity to test a sensor designed to classify and count arthropods as part of an international pilot working group with Syngenta. The focus is on arthropods involved in the nutrient cycle in the soil, particularly various groups of springtails.

The system is based on the functioning of a Berlese funnel. At the top of the funnel, a sample is placed under a bright light source that also generates significant heat. The organisms in the sample instinctively move away from the light, heat, and dryness, falling into the funnel below. A camera is mounted at the bottom of the funnel, automatically taking photos when an organism lands on the lens.

While there were some initial teething problems—particularly with the smartphone app and data transmission—the system was generally straightforward to use. In an initial test, we received a report from a sampling session, though we have yet to see the results from the actual pilot study.

The report provided various metrics, including diversity indices and organism counts, reflecting the health of the soil. However, the report from this test did not allow for further interpretation of these values. For example, is a score of X considered good or bad? How does the score of my plot compare to similar plots? These questions remain unanswered, highlighting the need for more contextual information to fully understand the implications of the data collected.

Figure 9: The Edapholog sensor.