European Innovation Partnership (EIP) Wales

The Welsh Farmland Bird Initiative

Menter Adar Ffermdir Cymru

Overwinter feeding of farmland birds to reverse biodiversity decline on productive pasture-based farms

Final Report

Matt Goodall

Game and Wildlife Conservation Trust

March 2023

Executive Summary

The Welsh Farmland Bird Initiative project was designed to test the efficacy of wild bird seed mix cover crops and supplementary feeding of farmland birds on two pasture farms in Wales.

Farmland birds have declined dramatically in recent decades due to a variety of reasons surrounding agricultural intensification and degradation of habitat. One concern has been the decline of seed-eating farmland birds, with a causal factor being the loss of winter food from the farmed environment, caused by the shift away from mixed farming and the lack or cropping on many farms in Wales.

The project worked with two very different farms in North Wales, both providing independent obstacles to overcome. Establishing cover crops on pasture farms can be difficult, and this project aimed to demonstrate they can be established on any farm type in Wales, in any location. Therefore, a lowland dairy farm offered the challenge of an organic system with associated weed control challenges, whilst an upland traditional sheep and beef farm offered the challenge of poor weather, soil fertility and altitudinal challenges.

Alongside the challenge of establishing the crops, this project aimed to demonstrate the benefits such conservation measures can provide Welsh farmland birds. Additionally, the project aimed to highlight multiple benefits, which could make these conservation measures more attractive as options in the future Sustainable Farming Scheme in Wales by providing value for money.

Through a combination of winter and breeding bird surveys, the project documented how bird populations responded to the conservation measures. Additional invertebrate and butterfly surveys also documented multiple benefits.

Firstly, the project proved that these crops can be grown in the challenging environments provided by each farm.

Secondly, the project achieved extremely positive results for farmland bird conservation in Wales. The combination of the conservation measures increased the density of birds on both farms; by 4.4-fold on the lowland farm and 6.3-fold on the upland farm in the winter, and by 1.4-fold on the lowland farm and 1.7-fold on the upland farm during the breeding season.

Additionally, the project also demonstrated and a 3-fold increase in butterflies as indicators for pollinators in the cover cropped areas, and a 1.3-fold increase in invertebrate diversity and 1.4-fold increase in invertebrate abundance.

It is also commonly accepted that cover crops offer the potential for improved carbon sequestration.

When considering Welsh Governments declarations of biodiversity and climate crises in Wales, these conservation measures which successfully conserve farmland birds, and offer additional multiple benefits, should be highly regarded as value for money options in the future Sustainable Farming Scheme. If many farms adopted these measures in Wales the benefits could be magnified and reverse farmland bird declines seen in recent decades.

Contents

1. Introduction

The Welsh Farmland Bird Initiative was designed to investigate solutions to farmland bird declines in Wales. It is well known that agricultural policies and subsidies between the 1970's and 1990's were successful in increasing food productivity, however an unintended consequence of these policies was habitat and biodiversity loss, with farmland birds in Wales particularly effected.

The State of Birds in Wales 2018 report demonstrated a stark decline in birds which occupy farmed habitats. This decline is also seen at the UK scale, estimated as a 55% decline in the last 50 years.

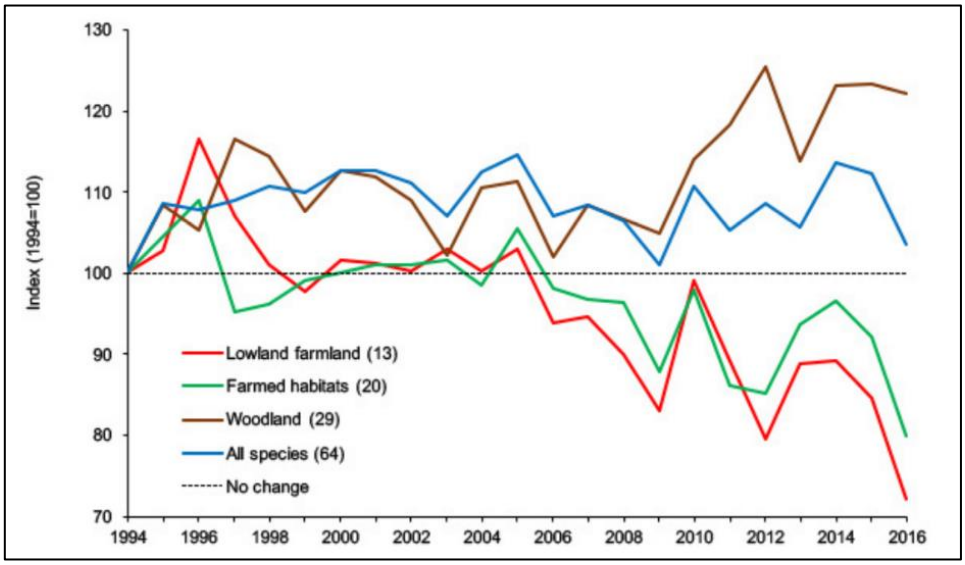

Figure 1. Wild bird indicator for Wales 1994 – 2016 from The State of Birds in Wales 2018 RSPB report

https://www.bto.org/sites/default/files/publications/state-of-birds-wales-2018.pdf

Although there have been many drivers for farmland bird declines in Wales and the UK, one driver perhaps more prevalent in Wales is the polarisation of farm types. The move away from mixed farming and the associated loss of cropping, alongside the increase in silage production are most likely the main drivers of seed-eating farmland bird decline. The Welsh landscape is dominated by pasture and therefore contains little seed availability throughout the year.

To give confidence the project results would be repeatable, and for the project to be relevant for most farms across Wales, two different farm types were chosen for the project. The two farms, one a lowland, organic dairy farm and the other a traditional upland hill sheep and beef farm, reflected the myriad of difficulties other Welsh farms might face should they replicate the conservation measures adopted within the project.

As the Basic Payment Scheme is withdrawn in Wales, this project aimed to demonstrate an effective blueprint for seed-eating farmland bird recovery in Wales, which could be adopted in the new Sustainable Farming Scheme, due to be introduced from 2025. The conservation measures adopted as the blueprint were wild bird seed mix cover crops combined with supplementary feeding.

The project ran from October 2020 to March 2023.

2. Project Outline

2.1 Project Location

The project was based on two farms in North Wales. One farm is a lowland organic dairy farm near Trefnant, Denbighshire, whilst the other is a traditional hill sheep and beef farm near Pentrefoelas, Conwy. These farms demonstrate very different farming practices on very different ground, but together highlight the varied difficulties of crop establishment in Wales. The organic system of the lowland dairy farm dealt with weed burden and associated competition with establishing crops, whilst the upland hill farm dealt with issues associated with soil fertility, altitude, and slope aspect.

2.2 Wild bird seed mixes

Establishing blocks of wild bird seed mix cover crops on farmland is a recognised conservation measure to provide a winter food source for seed eating farmland birds. Although recognised, it is a measure rarely associated with pastoral landscapes and we demonstrate throughout this project how it could be an especially important measure for pasture farms in Wales. The pastoral landscape of Wales is especially seed depleted in the winter, and high winter mortality from starvation is a component driving annual declines of seed eating farmland birds. To address this aspect, the project established wild bird seed mix cover crops to provide food and cover during the winter months.

Alongside the biodiversity benefits of this conservation measure, the project aimed to demonstrate how flexibility and realistic payments for such measures are needed in a future scheme. Sowing dates for mixtures can be delayed by seasonal fluctuations, and different seed mixtures can be required to get the right mix establishing in the right place. Realistic costings need to reflect costs incurred, including if contractors are needed, and the realistic cost of income forgone needs to be covered. To the contrary, Glastir Option 33 ‘Establish a wildlife cover crop on improved land’ stipulated that a crop must be established before 15th May, that the mix must include at least 80% cereals and had an associated payment of £604 per hectare. Unfortunately, all of these stipulations

have been found to be unattractive, with mixes often establishing better when drilled in early June (mix dependent) as an example. Additionally, the preference for cover crops should be for biennial crops, whilst the Glastir stipulation of 80% cereals limits the crop to an annual mix.

To determine the location for each crop, we balanced maximising biodiversity benefit and landscape connectivity with the need to minimise the impact on the farm's operations. As a point to note, this project could not cover income forgone for the areas taken out of production.

Soil testing for pH, phosphorus, potassium and magnesium was undertaken at each location to determine the appropriate pre and post drilling management. We also undertook soil VESS (visual evaluation of soil structure) scoring to further ascertain soil condition prior to crop establishment.

In total three different seed mixes were used within the project. On the organic farm we established a biennial crop, to minimise the difficulties of crop establishment in an organic system (only establishing one crop in each location rather than two over consecutive years) and allow the additional benefits of a year-round habitat. The seed mix established here was called organic Moir mix provided by Kings Crops and contained Coleor Kale Untreated, Organic Romessa Oil Radish, Organic Phacelia, Organic Mustard, Gold of Pleasure and Utopia. This mix was established by conventional tillage at three locations on the farm, totalling 3.42 hectares at altitudes between 45 – 70m.

Image 1. Kings Organic Moir Mix cover crop at the lowland organic dairy farm near Trefnant, Denbighshire.

Image 2. An aerial photograph showing the pastoral landscape and two of the three cover crop sites at the lowland organic dairy farm near Trefnant, Denbighshire.

The concept of such mixes is to provide seed bearing plants in the first year through the annual plants such as Romessa Oil Radish, Mustard, and Gold of Pleasure, whilst the kale and utopia provide cover and shelter in year one. In the second year the kale sets seed providing a winter food source and cover in year two.

As stated above, the preference for wild bird seed mixes, where possible, should be for either a biennial or perennial crop. Crops in the ground for more than one winter offer a fantastic insect rich habitat through the spring and summer, allowing birds to forage and find food for their chicks, benefitting chick survival and fledging success. Additionally, having these crops in place through the spring and summer can provide a multitude of flowering plants benefiting pollinators, demonstrating the multiple benefits of cover cropping.

On the upland hill farm two separate mixes were chosen covering a total area of 2.4 hectares. Both mixes were annual as this farm needed to balance the commitment of the project with the sheep production requirements of the farm. It was agreed that the crops would be grazed off in early spring. The crops for this farm therefore were required to be established twice during the life of the project.

One crop location established a seed mix called Alba mix provided by Kings Crops and contained fodder radish, Kings kale rape, phacelia, triticale, barley, utopia and Vittasso brown mustard. This mix was established by direct drilling and was 1.2 hectares at an altitude of 300m.

Image 3. Kings Alba mix cover crop at the upland sheep farm near Pentrefoelas, Conwy County.

The second crop location established a seed mix called Highland mix provided by Kings Crops and contained triticale, barley, oats, rye, wheat, and linseed. This mix was established by direct drilling and was 1.2 hectares at an altitude of 340m.

2.3 Supplementary feeding

The conservation measure supplementary feeding was also implemented alongside the provision of wild bird seed mixes. This measure is similar in concept in that it aims to provide seed eating farmland birds food through the winter and into early spring, a period otherwise known as the hungry gap from the 1st of December to the 30th of April.

Although wild bird seed mixes are designed to provide seed through autumn and winter, studies show that the best- and well-established wild bird seed mix cover crops can become seed depleted

by late December or early January. Therefore, additional food, provided in songbird specific feed hoppers (feeding stations) known as farmland bird feeders can be provided into mid-Spring.

As with wild bird seed mixes, supplementary feeding is also a recognised conservation measure but again is not familiar to many farmers in Wales and has never been adopted at any real scale. Within Glastir there was an option for bird food as a capital works item, with an associated payment of £500 per item. Although there is no further additional information available, and it seems as though this option was not advertised outside a twite conservation project area.

As part of this project each farm was provided a feeding station and 500kg of supplementary feed per hectare of cover crop established. This was based on the guidance provided for option AB12 within Countryside Stewardship of one tonne per two hectares of cover crop.

The supplementary feed provided consisted of 60% wheat, 5% oil seed rape, 14% canary seed, 10% black sunflowers, 3% sunflower hearts, 1% linseed, 2% seed white millet, 4% mustard and 1% buckwheat.

Image 4. Farmland Feeder feeding station positioned at one of the cover crop sites.

2.4 Surveys

Beginning in the winter of 2020/2021 and ending in the winter of 2022/2023 this project undertook a variety of surveys collecting data to determine the combined benefits of wild bird seed mix cover crops and supplementary feeding within the pastoral landscape in North Wales. Four transects were established on each farm which were all similar before the cover crops were established i.e., habitat types, quantity and quality were similar across transects. Two transects acted as control sites, whilst the remaining two were experimental sites, where the cover crops and supplementary feeding were implemented. The transects were designed to be far enough apart to not be influenced by the management practices implemented within the project.

As discussed above, winter mortality from starvation is deemed to be a contributing factor to farmland seed eating birds. To assess the efficacy of wild bird seed mix cover crops and supplementary feeding through the winter, bird counts were undertaken between December and February. Furthermore, breeding bird counts were then undertaken in late spring and early summer to assess the year-round efficacy of these conservation practices. Invertebrate counts were undertaken to determine whether these conservation practices had additional benefits to aid chick survival, and butterfly counts were undertaken to assess wider benefits for pollinators.

2.41 Winter bird surveys

Two visits were undertaken on each farm in each winter of the project. The initial winter of 2020/21 represented baseline data to which future data could be compared. Whilst the control transects allowed the project to determine whether changes could be attributed to the conservation practices or other variables.

Four one kilometre transects were walked in the morning, with the order of transects walked, and the direction of travel reversing between the two visits per season. The experimental transects began approximately 400 metres before a cover crop and finished approximately 400 metres from a cover crop.

2.42 Breeding bird surveys

Two visits were undertaken on each farm in each breeding season of the project. The initial breeding season of 2020/21 represented baseline data to which future data could be compared, as no project

interventions would have impacted farmland bird populations at that stage of the project. Whilst the control transects allowed the project to determine whether changes could be attributed to the project's conservation practices or other variables such as a good or bad breeding season.

The transects used were the same as for the winter bird surveys. Four one kilometre transects were walked beginning approximately one hour after dawn, with the order of transects, and the direction of travel reversing between the two visits per season. The experimental transects began approximately 400 metres before a cover crop and finished approximately 400 metres from a cover crop.

2.43 Invertebrate surveys

Invertebrate surveys using a sweep net were undertaken in the summer of 2021 and 2022 to compare invertebrate diversity and abundance between experimental cover crop sites and adjacent pasture. Each year eight samples were collected for each farm, four from experimental cover crop sites and four from adjacent improved pasture. These surveys were undertaken in the early afternoon and coincided with the butterfly counts undertaken for the project.

2.44 Butterfly counts

As with the invertebrate surveys, butterfly counts were undertaken in the summer of 2021 and 2022 in the early afternoon. These surveys compared the experimental sites with adjacent improved pasture and aimed to demonstrate the potential for an additional benefit of cover crops on pastoral farms for pollinators.

2.45 Farmer self-assessment

The project also presented an opportunity to design and assess a farmer self-assessment element, which could potentially demonstrate how farmers in Wales could monitor and assess their own farmland bird populations. The Game and Wildlife Conservation Trust have championed farmers as working conservationists and initiated the annual Big Farmland Bird Count in 2013 to demonstrate the conservation work of farmers; adopting the mantra 'you can't manage what you don't measure'. In future agri-environment schemes it is expected that some form of evidence will be required to demonstrate efficacy of conservation efforts.

This project aimed to explore whether a data collection App could be used to enable farmers to undertake their own bird counts. Furthermore, the results could be used to model how accurate such surveys are compared to seasoned surveyors and standardised methodologies.

3. Results

3.1 Winter bird surveys

The outcome of the winter bird surveys was expected to be positive, as the combination of wild bird seed mix cover crops and supplementary feeding have been proven to be successful conservation measures elsewhere; hence their inclusion in agri-environment schemes and positive reputation in England, especially in arable areas. However, as discussed above the uptake of these options in Wales, and pastoral areas in general has been poor, despite the potential to offer magnified benefits in seed depleted pastoral landscapes.

The purpose of this project was not to evaluate the two farms against one another. They are completely different farms in completely different locations with many variables. However, it is interesting to note results both separately and combined.

At the lowland organic dairy farm there was an average of a 4.39-fold increase in birds per kilometre at the established cover crop sites compared to the baseline data. Whereas at the upland traditional sheep and beef farm there was an average of 6.27-fold increase in birds per kilometre at the established cover crop sites compared to the baseline data. Combined, this equated to an average increase of 5.33-fold.

It is important to note how these results compared to the control sites where no cover crops were established. At the lowland organic dairy farm there was a slight overall decrease across the project, with a 0.32-fold decrease in birds per kilometre. Whereas at the upland traditional sheep and beef farm there was an overall increase across the project, with a 1.76-fold increase in birds per kilometre.

These results demonstrate an overwhelmingly positive impact of establishing the combination of wild bird seed mix cover crops and supplementary feeding at both farms in North Wales.

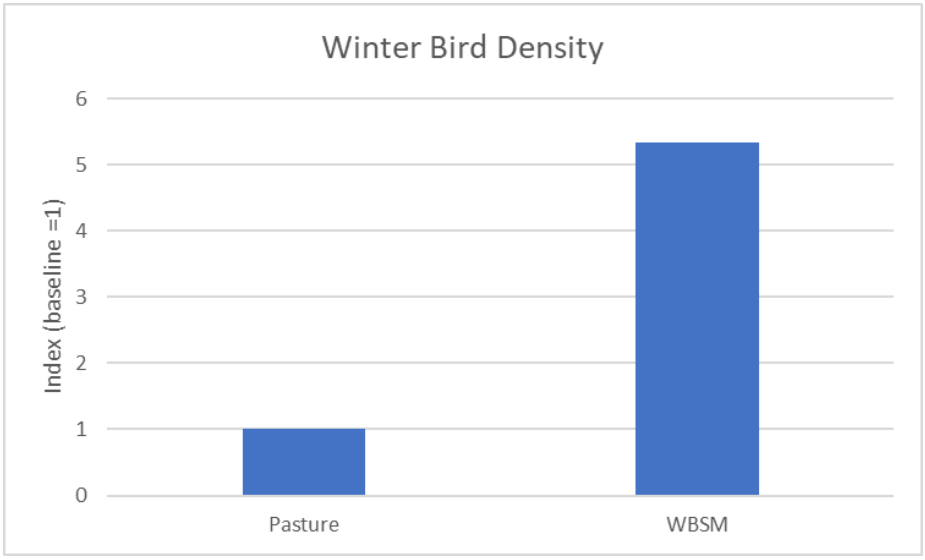

Figure 2. Winter bird density index at wild bird seed mix (WBSM) experimental sites compared to the baseline winter (pasture), combined for both farms and multiple years.

3.2 Breeding bird surveys

The expected outcome of the breeding bird surveys was more difficult to forecast. Whilst the impact of these conservation measures during the winter are well understood, potential on-going benefits and influence on breeding bird populations are less well-researched, although there is research that supports this project's findings. It should be noted however, that due to the life of the project only two breeding bird seasons could be included; a baseline year followed by an experimental year.

The purpose of this project was not to evaluate the two farms against one another. They are completely different farms in completely different locations with many variables. However, it is interesting to note results both separately and combined.

At the lowland organic dairy farm there was an average of a 1.40-fold increase in birds per kilometre at the established cover crop sites compared to the baseline data. Whereas at the upland traditional sheep and beef farm there was an average of 1.70-fold increase in birds per kilometre at the established cover crop sites compared to the baseline data. Combined, this equated to an average increase of 1.55-fold.

It is important to note how these results compared to the control sites where no cover crops were established. At the lowland organic dairy farm there was a slight overall decrease across the project, with a 0.10-fold decrease in birds per kilometre. At the upland traditional sheep and beef farm there was also a decrease across the project, with a 0.45-fold decrease in birds per kilometre.

These results demonstrate that establishing these conservation measures in the winter has an overwhelmingly positive impact for breeding birds later in the year. Despite what was potentially a poor breeding season. However as discussed above, with only one year's data and many variables to consider for the control sites more research is needed to enable a more robust understanding.

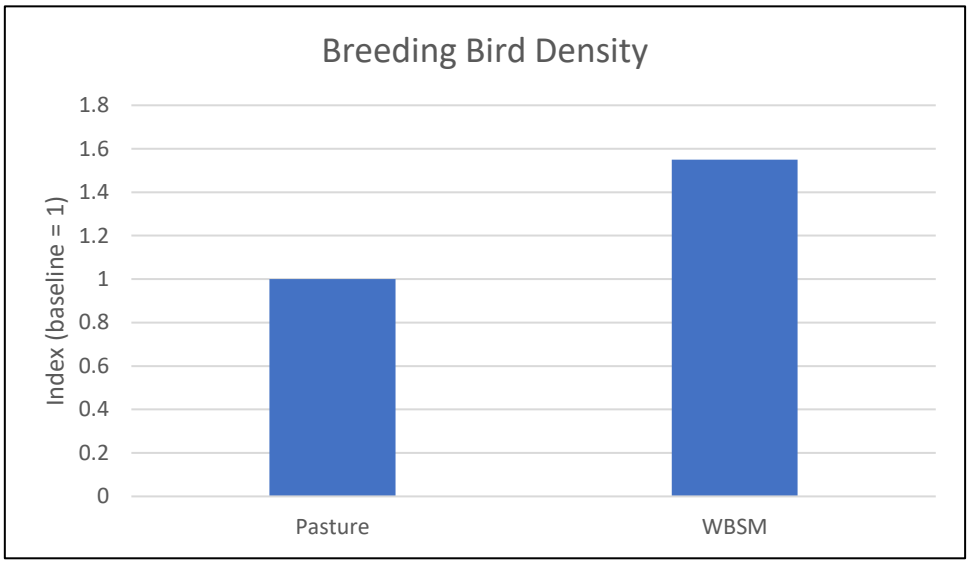

Figure 3. Breeding bird density index at wild bird seed mix (WBSM) experimental sites compared to the baseline winter (pasture), combined for both farms.

3.3 Invertebrate surveys

Insect rich habitats are a critical element of farmland bird conservation. Insects provide a high-protein food source essential for chick growth at a key time in their development. Studies show that chicks accessing better quality habitat with a higher abundance of invertebrates grow and feather up faster, leaving them less vulnerable to hypothermia and other ailments. Additionally, studies show that having a more diverse variety of invertebrates available also improves chick condition.

Invertebrates were sampled and those that are commonly viewed as chick food were grouped and analysed. Invertebrates were separated into the following categories: spiders, pollen beetles, flea beetles, weevil, rove beetles, other beetles, tipulid, flies 2-3mm, plant bugs, aphids, hoppers, other homoptera, sawfly/ lepidoptera, parasitic wasps 2-3mm and parasitic wasps >3mm.

The purpose of this project was not to evaluate the two farms against one another. They are completely different farms in completely different locations with many variables. However, it is interesting to note results both separately and combined.

The cover crops at the lowland organic dairy farm were 22% more diverse and contained 14% more invertebrates than the adjacent pasture. Whereas the cover crops at the upland traditional sheep

and beef farm were 50% more diverse and contained 58% more invertebrates than the adjacent pasture.

Combined for both farm types, the cover crops were 43% more diverse and contained 34% more invertebrates than the adjacent pasture.

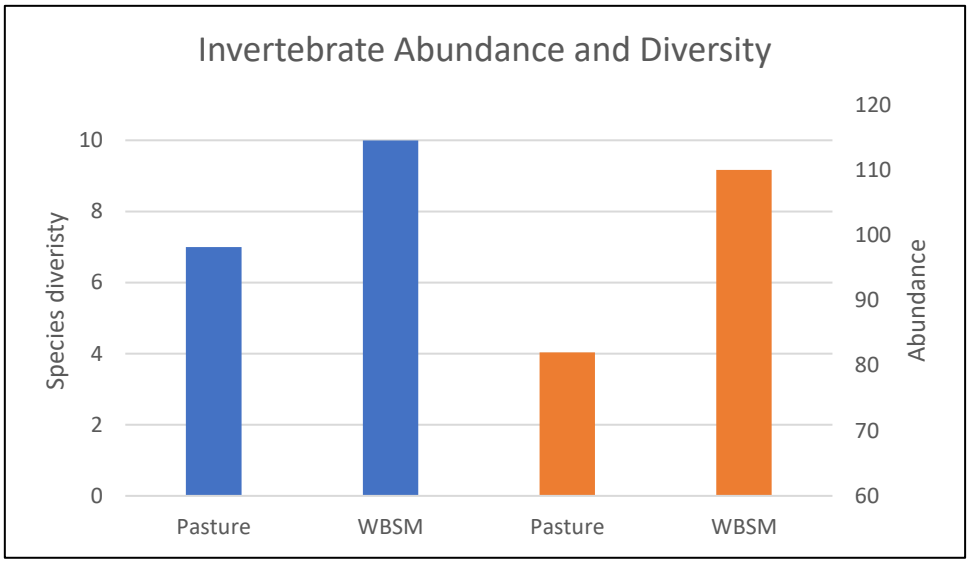

Figure 4. Invertebrate diversity and abundance at wild bird seed mix (WBSM) experimental sites compared to surrounding pasture, combined for both farms.

3.4 Butterfly counts

Pollinator declines are documented throughout the UK, with studies referring to a 21% decline across the UK since the late 1980s. The butterfly counts undertaken as part of this project aimed to highlight the potential additional benefits cover crops can have for pollinators, with butterflies as indicators for wider pollinator use.

The purpose of this project was not to evaluate the two farms against one another. They are completely different farms in completely different locations with many variables. However, it is interesting to note results both separately and combined.

The cover crops at the lowland organic dairy farm contained five-times as many butterflies as surrounding the surrounding pasture. Whereas the cover crops at the upland traditional sheep and beef farm contained three-times as many butterflies as the surrounding pasture.

Combined for both farm types, the cover crops contained three-times as many butterflies as the surrounding pasture.

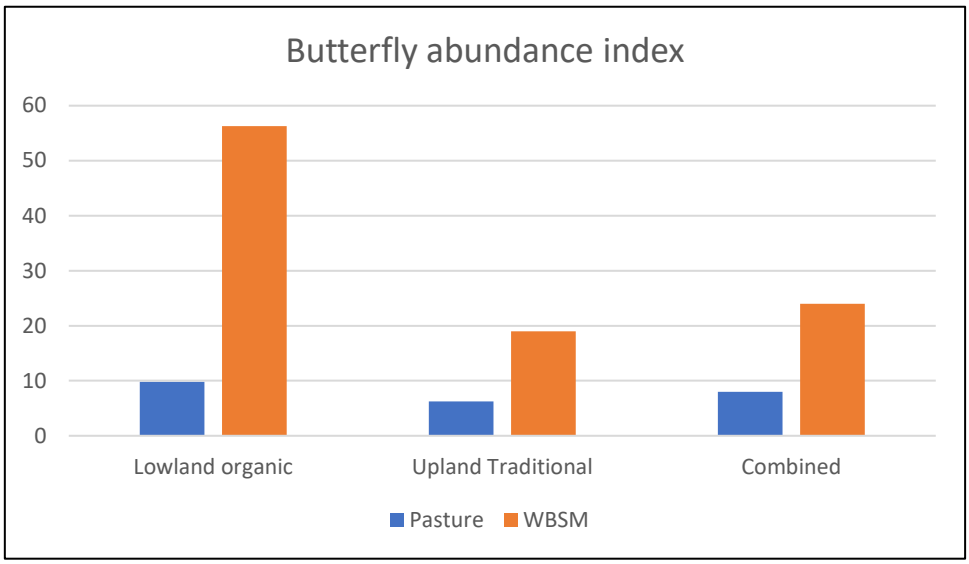

Figure 5. Butterfly abundance at the cover crop sites compared to surrounding pasture.

3.5 Farmer self-assessment

This experimental, progressive element of the project was subjective, based on the bird identification skills and knowledge of the farmers involved.

A data recording App was set-up to allow the farmers to undertake their own surveys to compare a citizen science survey, in this case farmer self-assessment, with survey data collected by professionals. It was hoped that results could be modelled to give an index of corresponding bird density.

During the life of the project the complexity of the survey design was deemed to be too high and difficult, and this element was not analysed further. However, the results were useful in that the feedback can inform future farmer self-assessment efforts.

4. Discussion

The results from the project were overwhelmingly positive as expected. It is excellent to successfully demonstrate these conservation measures on pastoral farms in Wales. All the crops established very well at both farm locations, proving that these measures can be adopted on many farms across Wales.

4.1 Surveys

It has been interesting to note the differences in responses at both farms and to examine whether these measures might have a greater impact at one type of location or type of farm. However, all though there were differences, these must be viewed cautiously given the short timescale of the project. Further years data collection would give more reliable results.

Whichever way the results are viewed and given the caveat of only one to two experimental years' worth of data collection, the project has been overwhelmingly successful. Starting with successfully establishing the cover crops in these notably difficult pastoral environments, the subsequent benefits have been marked and better than expected.

To increase breeding bird numbers on average by 55% is very promising and the data suggests that these measures in an upland, or potentially non-organic setting could have greater success, with the upland breeding bird numbers increasing by 70%.

It is expected that many of the over-wintering birds would have moved on to different breeding locations, however the measures undertaken have undoubtedly led to more birds surviving and entering the breeding season in much better condition, with an average of greater than five times as many birds using these areas for food and cover through the winter.

The multiple benefits of the cover cropping were also demonstrated, with a higher diversity and abundance of invertebrates found in the cover cropped areas compared to the surrounding pasture. Additionally, there were also increased numbers of butterflies using the cover crops, indicating their benefit to pollinators.

It was interesting to note the greater increase seen at the upland farm in the winter. It is likely that the impact of such conservation measures was magnified in this environment for two potential reasons. One being that the increase was larger due to the baseline density being lower, and the second being that the crops and feed acted as a greater honeypot in a harsher landscape and environment.

The density of birds at the lowland farm's control pasture areas decreased in the winter. This could potentially have been caused by harsher day-weather conditions in 2022 and 2023, drawing birds from a close locality into the cropped areas, whereas in the baseline year there would have been no incentive to move between these locations. However, this difference could have been caused by several variables outside the scope of the project.

Whereas at the upland farm's control pasture areas there was an increase seen throughout the project. One theory is it may have been due to milder conditions on the experimental survey days compared to the baseline year. However, it could potentially have been the conservation measures impacting a wider area than we had anticipated due to an increased honeypot effect in the harsher landscape and environment. This is the opposite effect to that described for the lowland farm and we are unable to give a definitive answer for either effect due to the timescale and scope of the project.

The breeding bird counts were especially interesting, with the upland farm having a higher baseline density of breeding birds and then having the greater increase from the conservation measures. The higher baseline breeding density may be due to several factors such as better-quality nesting habitat available, or the quality nesting habitat being isolated within the landscape i.e., birds are drawn to breed there as there is less available nesting habitat in the surrounding landscape. Whereas at the lowland farm there may have been a lower baseline density as birds may have been spread more evenly across the landscape. It is difficult to explore these variables further within this project.

What is clear is that at both farms the breeding density increased dramatically because of the conservation measures implemented in the project. Population increases can take multiple years, and the progress achieved within this project, a 40% increase at the lowland farm and 70% increase at the upland farm, is excellent.

Again, it was interesting to note that this increase was greater at the upland farm, despite the crops being annual rather than biennial, with the crops being grazed off in spring. One explanation may have been the increase in invertebrates found within the crops, even though they were annually established and had only been growing for a couple of months at time of survey. Another explanation is that even though the crops were grazed, this did not revert the cropped areas back to pasture and the 'messy' fallow like area still acted as an alternative habitat within the landscape.

It is also interesting to note the decrease of breeding birds seen at both farms on the control pasture areas, although it was likely to be insignificant at the lowland farm. The decrease at the upland farm may suggest a worse breeding season in 2022 compared to 2021, although it could also suggest that breeding birds were drawn closer to the crops than we had anticipated. However, there may be other variables to consider, and no long-term trends could be determined due to the length of the project.

The invertebrate samples could be explained by the organic farm having a greater diversity and abundance of invertebrates within its pasture fields to begin with. These are multi-species leys grown for silage and grazing and have a greater sward height than pasture grazed by sheep. Therefore, the increases seen from the conservation measures were not as great at the organic farm but were still

marked. Whereas at the upland farm, even though the crops were only recently established each year at the time of invertebrate surveys, the contrast between the cropped areas and the tightly sheep grazed pasture fields was much greater. Nevertheless, the increase in diversity and abundance caused by introducing crops at both farms in both environments was dramatic, and should be explored further, given the crisis of declining invertebrates across the UK and Europe.

The butterfly counts as indicators for pollinators, demonstrated a much greater increase on the lowland organic farm. It would have been interesting to have a baseline year for this data, as although the crops being established in 2021 would not have impacted the bird populations, the recently established crops could have affected how many butterflies were seen in cover crop or pasture. Therefore, the results could have been caused by more butterflies being present in the area before being drawn to the established crops. It is likely this was also the case at the upland site too, although it is likely there were less butterflies in the locality to begin with, due to the altitude and associated weather conditions. Nevertheless, the data does suggest these crops established for farmland birds also provide a priority habitat for pollinator species and deliver multiple benefits.

4.2 Project Costings

It is essential that future AES grants in the Sustainable Farming Scheme in Wales realistically reflect at least a cost incurred, plus income forgone payment and should ideally include an additional incentive. Without a true representative figure there will be no incentive to adopt such measures, no matter how successful they may be at achieving their conservation objectives.

In the polarised pastoral landscape of Wales, many farms have moved away from establishing crops themselves, with any forage crops often drilled by contractors. It was important that this project reflect the true costs incurred and included the real-world costings of using contractors on the two pasture farms to establish the crops.

The labour for the crop establishment for the lowland organic farm was much more expensive, due to the number of passes required with conventional tillage and additional harrow passes for weed control. Whereas the labour cost for the upland hill farm was cheaper as it required less passes, the grass crop being sprayed off before the cover crop was direct drilled.

The seed cost was variable based on the mixture used and it should be noted that allowing flexibility in mix type is key to match the right crop in the right place on the right farm.

One keynote here is that the lowland organic crop was a biennial crop which lasted for two years, offering much greater value for money whilst also offering additional benefits such as insect rich habitat and flowering habitat for pollinators. Biennial crops should certainly be encouraged, although the flexibility element should also enable annual crops to be established where necessary.

Farm type & measure	Labour (£/Ha)	Seed (£/Ha)	Income forgone (£/Ha)	Total annual cost (£/Ha)	Total cost over 2 years (£/Ha)	Glastir annual (£/Ha)	Countryside Stewardship annual (£/Ha)
Lowland organic biennial crop	316	131	350*	797	1,147	604	732
Estimated lowland conventional biennial crop	163	131	350*	644	994	604	732
Upland conventional annual crop	163	180	350*	693	1,386	604	732
Supplementary feed		315		315		250**	335**

Table 1. Costs and associated payments of cover crop establishment and supplementary feeding

*Based on income forgone element of current Welsh Woodland Creation Grant 2023.

**Based on 500kg per Ha of associated cover crop

4.3 Supplementary feed

In Glastir, bird food was included as a capital grant item for £500 per item, with no further information available. Presumably this reflected £500 per tonne. In the Countryside Stewardship option AB12 in England the payment is £669 per tonne which is linked to a minimum of 2 hectares of winter bird food AB9 option i.e., wild bird seed mix cover cropping.

During this project, and in other farmland bird feeding projects in Wales, the Game and Wildlife Conservation Trust has found the figure of one tonne per two hectares or 500kg per hectare is seemingly more than is required. With the project using approximately a half to two thirds of the feed provided.

However, in the Countryside Stewardship in England there is a stipulation that only 10% of the feed should be hopper fed, with the remaining 90% spread on the floor along tracks in key areas i.e., alongside cover crops. This project did not include such a stipulation, and the feed was supplied solely through feed hoppers at feed stations as shown in image 4. On pasture farms in Wales, in our experience, there are fewer hardstanding tracks across farms and the stipulation of feeding on the floor is less practical and less effective when fed on grass, especially longer grass.

Undoubtedly, feeding on the floor in the right circumstances and locations more birds are likely to be fed and the conservation measure would be more effective. In this instance the 500kg per hectare calculation could be more accurate. However, this project has shown that even with hopper feeding only, supplementary feeding combined with wild bird seed mix cover cropping still has a very desirable outcome. Flexibility is again key, with the option to either floor or hopper feed at whatever ratio is suitable for each farm involved.

One area covered by the project, but presumably not covered within AES is a payment to cover the labour and fuel cost involved in supplementary feeding. Invariably this takes time and could potentially be covered within a future grant. Currently as demonstrated in Table 1, the payment rates only realistically cover the cost of the feed itself.

It should also be noted that supplementary feeding farmland birds can also supplement unwanted species such as brown rats and grey squirrels. Farmers adopting this measure should be made aware of this possibility and be prepared to manage any associated unwanted activity; being aware that both brown rats and grey squirrels can act as nest predators.

4.4 Farmer self-assessment

Although the farmer self-assessment element of this project was more difficult than originally anticipated, it did give a reflection of the realistic capabilities of farmers who are also keen conservationists. Identifying and surveying multiple species, either by visual or audio identification is a difficult task for the majority, even with the aid of modern technology such as bird visual identification Apps and bird audio identification Apps. Additionally, expecting farmers to have the time required to undertake such surveys is unrealistic and a balance must be struck.

Whereas the Game and Wildlife Conservation Trust's Big Farmland Bird Count asks farmers to survey all species seen at one key location for 30 minutes annually; this type of survey becomes much more difficult in spring and summer for breeding birds. Whilst this annual bird count should be encouraged within the farming community, there are additional options which could be explored in the future.

One future potential methodology could be to determine a list of Birds of Conservation Concern (BoCC) species which occupy a farm and will respond to conservation measures being adopted, before asking the farmer to pick one they have an interest in. That species, or even potentially several key species, could then be surveyed in a standardised way annually to determine any changes in the long-term. Their 'key species' could then act as an indicator species for the health of the wider farmland bird population on the farm.

Alternatively, future use of Artificial Intelligence for either visual identification of species at feed stations or audio recognition of species at cover crop sites could be further researched and implemented to provide evidence of a conservation measures efficacy.

4.5 Future research

This project was unable to collect data on the feed value for livestock of the wild bird seed mix cover crops used. It would be interesting to investigate how feed value changes through the season, as it is expected that in late winter the feed value diminishes, but to what extent? It would be useful to further understand how a wild bird seed mix cover crop, grown for conservation, could be beneficial to livestock and therefore the farm business too. In the past it has been discouraged to have a payment for a conservation outcome being advantageous to the farms' business. However, if those barriers have been removed, then it is logical to find as many multiple benefits to one option as possible.

Furthermore, if the above is to be considered then there may be opportunities to design and develop mixed crops which are both beneficial to farmland birds and provide valuable feed for livestock.

This project was also unable to collect data on the carbon sequestration potential of the cover crops established. Unfortunately, where conventional tillage is required, there is the potential to lose carbon when the soil is turned. However, there is much potential for improved carbon sequestration, improved soil organic matter and improved soil health through cover crop provision when minimum tillage is practiced. An interesting area of work would therefore be to further examine the carbon sequestration potential of these cover crops and examine an associated monetary value. This work would truly demonstrate the multiple benefits of conservation cover cropping and would help provide additional evidence of the true value of such measures for Welsh Government, considering the announcement of both a biodiversity and climate crisis in Wales.

5. Outreach

5.1 Presentations

Project presentations have been given at the following:

- BFBC GWCT & FUW event Pentrefoelas February 2022
- BFBC GWCT & FUW event Carmarthenshire February 2022
- BFBC GWCT & FUW online webinar February 2022

- BFBC GWCT, RSPB & NFFN online webinar February 2022
- Royal Welsh Show – Working Conservationists Farming Community Launch 2022
- Conservation Matters evening Bangor 2022
- BFBC GWCT & FUW event Gwynedd February 2023
- BFBC GWCT & FUW event Pembrokeshire February 2023
- BFBC GWCT & FUW online webinar February 2023
- EIP Welsh Farmland Bird Initiative Project Day Pentrefoelas – December 7th 2022 (Cancelled due to snow), March 9th 2023 (Cancelled due to snow– rescheduled for April 6th 2023)

5.2 Media coverage

- ITV Cymru February 18th, 2023
- https://businesswales.gov.wales/farmingconnect/news-and-events/news/sixfold-increase-farmland-bird-numbers-welsh-cover-crop-project-sites
- https://www.youtube.com/watch?v=vA4nkees7tw
- https://www.youtube.com/watch?v=NryW2C7FTag
- https://businesswales.gov.wales/farmingconnect/sites/farmingconnect/files/documents/4198_MaB_FC_Technical_Booklet_Issue_38.pdf#page=14
- https://businesswales.gov.wales/farmingconnect/news-and-events/technical-articles/supporting-farmland-birds-supplementary-feeding-and-long-term-habitat-restoration
- https://www.youtube.com/watch?v=t1PMstJfS18
- https://www.youtube.com/watch?v=eo2JNdAgKO8
- https://www.fginsight.com/news/cover-crops-double-farmland-bird-populations-on-welsh-farms-133714
- https://www.workingforwildlife.co.uk/case-studies/uplands/bringing-back-the-birds/
- https://www.walesfarmer.co.uk/news/23377097.sixfold-increase-farmland-birds-cover-crop-project-sites/