TWIC Spring Conference Report, April 2017

Farming and Biodiversity in Scotland – An Essential Partnership

The Spring Conference was held on Saturday 29th April 2017 at the Brunton Hall in Musselburgh and was attended by 70 people. **Graeme Wilson,** TWIC Manager, warmly welcomed everyone to the event and said that he was pleased that the focus of the conference was farming and biodiversity as this was an important topic.

TWIC Directors **Wilma Harper** and **Ian Young** chaired the morning and afternoon sessions respectively.

Complex Soil Communities: Why should we care and how can we use them?

- Dr Tim Daniell (University of Sheffield/ The James Hutton Institute)

Tim Daniell presenting at the TWIC Spring Conference. Photograph: David Palmar.

Soil is really complicated; just one teaspoonful contains more than 40,000 species, over 4 billion microbes, 3 miles of fungal hyphae, 10,000 protozoa and 20-30 beneficial nematodes. Understanding how these complex communities function is essential to maintain soil health for sustainable food production, and to reduce global warming and protect valuable habitats.

Current mis-management of soil releases greenhouse gases and degrades soils. No part of our planet is immune. But what is healthy soil? How is soil health assessed? And how can understanding soil help reduce greenhouse gas emissions and global warming?

The DEFRA SQID report identified 13 potential biological indicators of soil quality with high potential for use in a national soil monitoring scheme. Among them, the study of nematode community structure was identified as a priority for development.

Nematodes are good indicators of soil health because they are ubiquitous, have short generation times, grow rapidly and are responsive to change. They occur in a range of trophic groups at all levels of the food web and their feeding group – fungivore, bacterivore, plant parasite or predator – is indicated by their mouthparts. Nematodes are KEYSTONE organisms in soil processes and indicate what is happening in the whole system. However, they are also a taxonomic nightmare! Identification using morphology requires examination under a microscope, which is difficult and time consuming and very few people have the required expertise.

New work, **Directed T-RFLP (Terminal Restriction Fragment Length Polymorphism)** has been used to develop an alternative. Nematodes are collected from soil samples and their community DNA is extracted and analysed. This is fast – and peaks in the DNA profile correspond to different species/feeding groups. A study of pasture with different fertilisation regimes showed that adding fertiliser alters the nematode population and community composition, as does varying the rate and type of fertiliser applied. Current research is focussing on developing a simple tool that uses nematodes as a bioindicator of soil health.

In the second part of his talk, Tim discussed the need to address how we produce food in an effort to limit greenhouse gas emissions. The Green Revolution facilitated a huge increase in world population through improved crop varieties – but it was the use of chemical fertilisers that really boosted production. In the UK, agriculture contributes around 9% of all greenhouse gas emissions – but this figure does not include emissions from production of the chemical fertilisers used to enhance crop yields. Current demand for and usage of such fertilisers is unsustainable – so what can be done? "No cost" options, such as reducing tillage to a minimum and reducing and tailoring fertiliser use will help, as would the swapping of chemical fertilisers for green waste compost. However, there is also scope to reduce plant-driven nitrification through the use of different crop species – and even different cultivars. For example, different barley cultivars can have significantly different nitrous oxide emissions, so an opportunity exists to breed plants for this quality.

References:

Black, H.I.J.; Ritz, K.; Campbell, C.D.; Harris, J.A.; Wood, C.; Chamberlain, P.M.; Parekh, N.; Towers, W.; Scott, A.. 2008 SQID: Prioritising biological indicators of soil quality for deployment in a national-scale soil monitoring scheme. Summary report. NERC/Centre for Ecology & Hydrology, 22pp. (CEH Project Number: C03061, Defra Project No. SP0529)

Jackie Stewart

Arable Weeds - A Disappearing Problem?

- Luke Gaskell (Kittyfield Farm and Botanical Society of Britain & Ireland recorder)

Luke Gaskell speaking at the TWIC Spring Conference. Photograph: David Palmar.

Agriculture is part of the reason for humankind's success. However, this success has come at a price – and one of the casualties is the loss of wildlife on farms.

Farming has been around since 6,500 BC and arrived in Britain in the early Neolithic at around 3,000 BC. With the arrival of agriculture came unintended passengers – weeds. A 'weed' can be defined as a 'plant out of place'. The focus of Luke's talk was annual broadleaved weeds.

Weeds make growing food difficult, they compete with crops for light, nutrients and space, make it hard to harvest the crop and in some cases can mean the difference between harvest and starvation. John Clare, the 19th-century rural poet, referred to the yellow corn marigold and the blue cornflower as "troubling the cornfields with their destroying beauty".

There are many ways in which weeds have adapted to agriculture. Some grow quickly and set seed in a short time frame or produce many thousands of seeds to ensure their survival. Others such as Scarlet Pimpernel (*Anagallis arvensis*) are low growing, so are able to flower and set seed after the crop is harvested. Then there are the crop mimics such as Wild Oat (*Avena fatua*) that are harvested and re-sown with the next crop. Some species are so closely related to crops that they cannot be readily controlled with herbicides.

Around half of the arable weed species in Britain are of native origin. Some of these were more traditionally associated with river flood gravels habitats. The other half are aliens – species arriving in this country as a result of human involvement. Some of the alien species came in with early agriculture or were brought in by dirty seed crops, for example Corn Buttercup (*Ranunculus arvensis*), which is now extinct in Scotland. Aliens are split into two categories: **archaeophytes** – species that arrived before 1500 or **neophytes** – species that arrived after 1500.

One archaeophyte, Black-grass (*Alopecurus myosuroides*), is still evolving. This grass is a weed of no-plough cereals. It produces 50,000 seeds per square metre, has a short dormancy period and bad infestations can reduce crop yields by as much as 40%. Black-grass has also developed herbicide resistance, which makes control even more difficult. In the past deep ploughing buried the seed, but this practice has been discontinued.

In the early days of agriculture farming operations were small scale and food was eaten locally. Weeding was done manually with hoes and crop yields were much lower than today (c. 1/2 tonne per ha cf. 2 ½ tonnes per ha). Now, as a result of modern farming methods, such as more efficient seed-cleaning techniques and the use of herbicides, arable weed species are struggling and might cover only c. 1% of land. This has had knock-on effects for the species that depend on them such as farmland birds, insects and mammals.

There are certain ways in which arable weeds can be maintained in the agricultural landscape:

- Having a diverse mix of enterprises and a rotation
- Keeping unproductive areas in cultivated fields
- Leaving some crops unsprayed if weed numbers are low
- Direct sowing grass and clover leys which can be topped rather than sprayed
- Using rotational unsprayed headlands around the spring barley
- Not ploughing stubbles until the late winter
- Growing turnips and fodder crops which are good for weeds (e.g. Field Woundwort, *Stachys arvensis* and Fool's Parsley, *Aethusa cynapium)*
- Unharvested crops
- Experimental introduction of weeds (e.g. Common Poppy, *Papaver rhoeas* and Corn Marigold, *Glebionis segetum*)
- Natural regeneration set-a-side is no longer available but was excellent for weeds

Food production, conservation and landscape are not natural bedfellows, but farmers like Luke Gaskell are trying to farm with all three in mind. It is hoped that future agricultural support schemes will continue to promote conservation on farms. Collectively farmers can make a huge difference to wildlife in the countryside.

Natalie Harmsworth

The PARTRIDGE Project: Grey Partridge Conservation in the EU and Scotland

- Fiona Torrance (The Game and Wildlife Conservation Trust)

The Grey Partridge (*Perdix perdix*) is a farmland indicator species with specific habitat requirements – NOT pear trees! Arriving in Britain after the last ice age, the bird was once widespread and a popular shooting

species. However, over the last 40 years, their population has decreased by 91% and the Grey Partridge is now a UK Biodiversity Action Plan (BAP) priority species.

Adult Grey Partridge have distinctive orange faces and markings and the male has a characteristic raspy call. The birds are ground nesters on farmland and favour cereal crops on well drained soils. A margin managed as an insect-rich conservation headland provides a food source for the chicks which require protein-rich foods, whereas adult birds eat shoots and seeds. A narrow strip of bare ground offers space where chicks can dry out after rain – and can also help prevent weeds invading the crop. Herbs and tussock-forming grasses provide cover for chicks. Grey Partridge do not need hedge cover but a hedge on a wide raised bank provides adjacent well-drained nest sites and has additional benefits for farming and other wildlife.

Factors implicated in the Grey Partridge decline include changes in agricultural practices, increased predator numbers, pesticide use, hedge removal, insufficient winter food and lack of suitable cover crops, making the birds more vulnerable to predation. To halt this decline and help populations recover, it is necessary to provide suitable cover for nesting and brood rearing, provide winter feeding and control predators.

The **Scottish Grey Partridge Recovery Project** started 6 years ago at **Whitburgh** in Midlothian. This 1000 hectare farm is predominantly arable and has a high density of raptors and hares. In 2014, work began at a second site, the 750 hectare **Balgonie** Farm in Fife, to determine which cover crops work best for bird populations and investigate the effects of conservation crops. These two "demonstration farms" are used to educate policy makers on a number of issues and aim to develop management guidelines that others can use.

Research into the effects of management for Grey Partridge involves **Partridge counts** in spring and autumn to give a measure of population stability, **radio tagging** to assess Partridge movements and mortality, assessment of the density of breeding raptors and the numbers of breeding/wintering farmland birds, and moth and hare counts.

Notable findings so far are:

- Grey Partridge numbers increased significantly after conservation crops were added, as did winter farmland bird numbers.
- Grey Partridge numbers were extremely low in 2012/13 because it was a very wet season. Birds tended to stay in open areas to aid drying and were therefore more susceptible to predation.
- Buzzard numbers at Whitburgh are among the highest in Europe.

Whitburgh and Balgonie are also part of **The PARTRIDGE Project – Protecting the Area's Resources through Researched Innovative Demonstration of Good Examples.** This is led by the GWCT in partnership with European organisations and is co-funded for 2016-2020 by the GWCT and Interreg.

Best practice techniques developed in 5 countries (Scotland, England, The Netherlands, Belgium and Germany), aim to show how improving agri-environment schemes can increase biodiversity and ecosystem services by up to 30%. Each country has 2 demonstration sites and a control site. The project is needed because species and habitats are declining, while pressures on land use and financial pressure on farmers is increasing, and there is a need for better communication between stakeholders and the wider public.

The PARTRIDGE Project aims to improve stakeholder communication and dissemination of results through demonstrations, site visits, knowledge exchange, farmer cluster groups and engagement with government. The plan is to showcase new solutions to improve farmland ecosystems through site-specific management plans, and to develop new transnational standardised monitoring methods for key indicators. Finally, it will collect new information on social-economic behaviours to promote long-term change. Different regional schemes and farming practices and distrust among stakeholders may present challenges – as will financial cost, climate change and resource availability – but there is much to gain.

Volunteering opportunities with the project include breeding bird surveys, partridge playback surveys, hare surveys, farmer clusters, the Partridge Count Scheme and Big Farmland Bird Count. For further information email ftorrance@gwct.org.uk or visit: https://goo.gl/jJbwiW or http://www.northsearegion.eu/partridge/.

Jackie Stewart

The audience assembled in the Brunton Hall, Musselburgh for the talks. Photograph: David Palmar.

Lunchtime exhibitors

During lunch there was a chance for delegates to browse the displays and to network. The following organisations provided displays at the event: Caledonian Conservation Ltd; David Palmar photoscot.co.uk; Edinburgh Natural History Society (ENHS); and British Arachnological Society (BAS).

Managing Farmland for Biodiversity: A Land Manager's View

- Teyl de Bordes (Whitmuir Farm, near Selkirk)

Teyl de Bordes opened with an overview of the Whitmuir Estate, near Selkirk, which he manages. The estate is 176 ha, comprising: 42 ha of arable land (50% of this fallow due to the short growing season); 83.5 ha of set aside for grazing, mostly for sheep; 29 ha of woodland; 8.7 ha of species-rich grassland; 2.5 ha of small bird seed plots; 6.2 ha of birch/willow carr; 4.1 ha of buildings and yards; 4 holiday cottages; 2593 m of dykes rebuilt since the 90s; and 1650 m of hedges (a third cut annually). Estate management is aimed at helping biodiversity, but this has had mixed outcomes.

Wild Thyme (*Thymus polytrichus*) grew on a section of grassland near the SSSI, so Teyl decided to create some species-rich grassland and encourage the orchids on site. Unfortunately, by excluding sheep grazing, the Thyme was soon shaded out. In fact, it only took 4 months to remove it all! There was however a 500% increase in Common Spotted Orchids (*Dactylorhiza fuchsii*) the following year. But in the long run, the biodiversity has declined from the initial spike and the Thyme has been lost.

Orchids on the farm are now counted in the thousands, around 5-6,000. Much of this is to do with land management, for example removing sheep from grasslands at the right time to prevent them eating the orchids and allow them to flower. It is not all good news however. There was a beetlebank along a field border but the new agri-scheme rules no longer lists this as a priority, so now it is ignored as it isn't worth it.

Some of the efforts to create biodiversity are not obvious. The winter stock field can turn into a mud-bath due to heavy grazing, but it is a calcareous grassland with an excellent fungal community. The grazing creates gaps in the sward that allow fungi and less competitive herbs to thrive.

Every year another 20 bird boxes are put up in the estate. They have an 85% use rate, mostly by various types of Tit but also Tree Sparrows (*Passer montanus*). Wood Mice (*Apodemus sylvaticus*) and Tree Bumblebees (*Bombus hypnorum*) use them as well. Oystercatchers (*Haematopus ostralegus*) have nested on a shed roof for the last 7 years. Teyl has assisted them by leaving nest-building materials nearby. Chicks have been dying due to dehydration and predators - now Teyl has a "taxi-service" where the chicks are taken down to the car park at the end of the afternoon in order to protect them.

Large numbers of birds arrive at Whitmuir throughout the autumn and winter. A BTO ringer assists with regular monitoring and bird ringing. Curlews (*Numenius arquata*) nested on the farm 10 years ago but not anymore. Carrion Crows (*Corvus corone*) used to be trapped under a general licence, but around 3 years ago they stopped, and now there are no Curlews. Whether the two things are connected is unproven. Lapwing (*Vanellus vanellus*) numbers dipped at the same time. Now that they have restarted trapping, Lapwing numbers have increased.

Both Red-legged Partridges (*Alectoris rufa*) and Grey Partridges (*P. perdix*) occur at Whitmuir. Attempts have been made to reintroduce more Grey Partridges. These are sourced from different areas, as closely related birds will not mate. The birds are kept in separate pens so they can hear each other before they are released. In order to deter predators the pens are sprayed with aftershave, but it does not seem to discourage Badgers! Badgers (*Meles meles*) have increased in number at the same time that Hedgehogs (*Erinaceus europaeus*) numbers have crashed. Whitmuir was one of the first places in Scotland to carry out the footprint tunnel surveys to monitor Hedgehogs. Roe deer (*Capreolus capreolus*) are carefully managed on the estate, with weak or diseased animals removed to keep the herd healthy. Small mammal monitoring has been carried out at the farm since 2011 with the local mammal group.

A Wood Mouse caught as part of the live mammal trapping at Whitmuir farm, Selkirk. Photograph: Teyl de Bordes.

Numerous fungi occur in the calcareous grassland habitats. It was thought that Big Blue Pinkgill (*Entoloma bloxamii*) was present on the farm, but DNA analysis showed it to be *E. madidum*! Many volunteers visit to record Whitmuir's fungi and continue to record here.

Teyl concluded his talk by referring to a new European scheme that rewards farmers for biodiversity achievements. This is where recorders come in, as proof i.e. data will be needed to show that land management actions are having the desired outcomes.

Steve Hannah

Building Biodiversity into Decision Making for Farmers

- Dr John Kerr (Science and Advice for Scottish Agriculture)

Dr John Kerr speaking at the TWIC Spring Conference. Photograph: David Palmar.

Dr John Kerr of Science and Advice for Scottish Agriculture (SASA) started off by acknowledging the work of recorders. Recorders are crucial as without them there would not be the evidence-base for biodiversity loss that underpins political action.

Agricultural chemicals impact directly on "pest" populations but also indirectly on species that feed on them, for example Spotted Flycatcher populations have declined in recent decades due to prey reduction. This is one of the reasons that money invested in Research and Development has swung away from agrochemicals and towards seed traits. If agrochemical use continues to decline, there will be the need for something to replace them in order to sustain current crop yields on the agricultural land currently available. It is a case of critical limits versus competing objectives.

It was Kenneth Boulding – an economist and President Kennedy's environmental advisor – that said: "Anyone who believes in indefinite growth in anything physical, on a physically finite planet… is either mad – or an economist." It is unsustainable for agriculture to continue producing nitrous oxide at its current rate – a chemical 300 times more polluting that carbon dioxide.

Humankinds' success with agriculture has enabled rapid population growth, but this has brought with it a host of environmental issues. In a political context, the issues around agriculture and the environment have long been known but in some ways little has changed. At the Conservative Party Conference in 1988 the former Prime Minister, Margaret Thatcher said: "The last thing we want is to leave environmental debts for our children to clear up." "No generation has a freehold on this earth. All we have is a life tenancy – with a full repairing lease."

With Brexit there are both opportunities and threats ahead. Scotland is looking at the opportunities in the Natural Capital model, as indicated in Nicola Sturgeon's speech to the World Forum on Natural Capital in Edinburgh in 2015: "In Scotland we are determined to play a leading role in developing the thinking about the concept [of natural capital] and its application."

Natural Capital is defined as the world's stocks of natural assets which include geology, soil, air, water and all living things. It is from these stocks that we derive the flow of ecosystem services that sustain people, e.g. food (an ecosystem service) is derived from agricultural land (a stock). Since these flows of services have value, the emerging system of natural capital accounting could, if harnessed properly, deliver that value as income to those who can demonstrably protect and improve the flow of these services. Businesses able to maintain and enhance their stock of natural capital will be best placed in the future to reap the rewards of their investment.

The IUCN document "No Net Loss and Net Positive Impact Approaches for Biodiversity" details this model (see: https://goo.gl/m7FSiF for the PDF report). Stage 1 of the model is to identify priority biodiversity values in the region and define Net Positive Impact goals. Stage 2 is to map locations, compile trends, and establish a baseline or reference frame of the selected biodiversity features. This can be done through documents like *Scotland's Biodiversity - a Route Map to 2020*, and BTO's *Breeding Bird Survey*. Stage 3 involves overlaying production plans on a biodiversity map and applying the mitigation hierarchy to see if there is a positive or negative biodiversity outcome value.

An example of this in practice is tackling the increase of the Potato virus Y (PVY) in Finland. Insecticides were found to be ineffective in controlling PVY transmission but control could be achieved by using a healthy seed in conjunction with a straw mulch to discourage aphids from feeding on young plants. This allowed growers in Finland to gain control of PVY (Kirchner et al., 2014).

Another example closer to home is Rush control in Scotland. An infestation of soft rush is bad for both farmers and biodiversity outcomes. Ayrshire, Caithness and Strathspey are all examples of successful partnership working between farmers and conservation bodies. Control measures include topping, weed wiping and reseeding. All these measures improve both grazing and habitat value attracting financial support.

Through research based on good biological data it is possible to reduce agrochemical impacts and benefit biodiversity, whilst still producing levels of food needed.

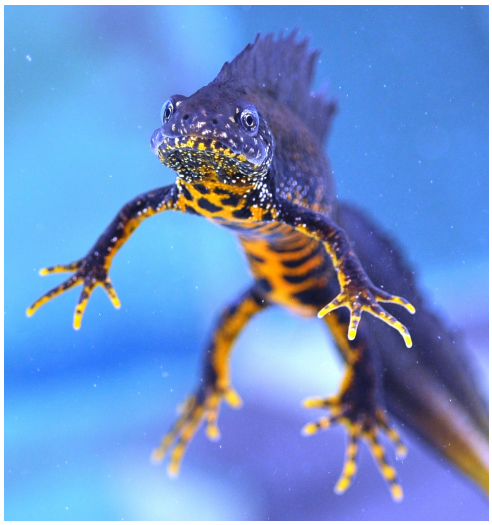
References:

Kirchner SM, Hiltunen LH, Santala J, Döring TF, Ketola J, Kankaala A, Virtanen E, Valkonen JPT. 2014. Comparison of Straw Mulch, Insecticides, Mineral Oil, and Birch Extract for Control of Transmission of *Potato virus Y* in Seed Potato Crops. Potato Res 57: 59-75.

Graeme Wilson

Great Crested Newt Detectives - 1 year on

- Pete Minting (Amphibian and Reptile Conservation Trust)



Great Crested Newt. Photo: Chris Dresh.

Amphibian and Reptile Conservation Trust (ARC) is a UK-wide charity dedicated to amphibian and reptile conservation. Established in 1989, the charity is based in Bournemouth, employs 25 staff and has 80 reserves in the UK, although there are currently no reserves in Scotland.

The Great Crested Newt Detectives project was launched in April 2016 and is a 2-year initiative funded by the Heritage Lottery Fund with match funding from Scottish Natural Heritage and ARC. The aims are to trial the Environmental DNA (eDNA) sampling method for Great Crested Newt (*Triturus cristatus*) and to engage the public in amphibian conservation. While the focus of the project is on Great Crested Newt, records of other amphibians are also being generated as a result.

Great Crested Newt populations are known from four main areas of Scotland. One of these – the Inverness population – is isolated from the other populations in Scotland. It has shown to be native rather than introduced as previously thought.

Modelling was undertaken to highlight areas that might hold Great Crested Newt based on their proximity to existing populations and habitat suitability. These areas have been targeted for volunteer surveys, the aim being to try to locate more Great Crested Newt populations. In addition, known Great Crested Newt sites were surveyed to test the eDNA method.

In 2016 the focus was on southern Scotland where 220 volunteers were trained in eDNA sampling and amphibian ID. Of the 52 sites sampled, only four (8%) tested positive for Great Crested Newt. Three 'new' Great Crested Newt breeding ponds were discovered by volunteers – at Cummertrees in Dumfriesshire, Coldingham in Berwickshire and Culzean Country Park in Ayrshire. The result from Coldingham was interesting as it provided the 'missing link' between Great Crested Newt populations in the Dunbar and Berwick-upon-Tweed areas. There were also a further 3 'false negative' results i.e. sites where Great Crested Newt were known to occur but were not detected by the eDNA test. Another interesting finding was the first 'paedomorphic' Great Crested Newt found in Scotland (adults retaining juvenile or larval features).

Public engagement activities have focussed primarily on working with schools. So far 17 schools have been directly involved in the project. In 2017 a wildlife art and writing competition on the theme of 'Amazing animals, brilliant science!' has been launched for schools. The deadline for entries is June 30th and awards will be presented at an event at Edinburgh Zoo on October 31st 2017.

In 2017-2018 volunteer survey effort will be focused on northern Scotland. In addition follow-up surveys will be undertaken at false negative sites from 2016 to try to determine the reason for these. The data from the surveys will be incorporated into the model and the Great Crested Newt map updated.

Natalie Harmsworth

Scottish Spider Search

- Katty Baird (British Arachnological Society)

The Scottish Spider Search is a new public survey to collect records on four easily identified spiders in Scotland. Spiders are an under-recorded group, so it is hoped that the survey will generate interest and data for spiders in Scotland. The four species featured in the survey are the Four-spotted Orbweb Spider (*Araneus quadratus*), Daddy long-legs Spider (*Pholcus phalangioides*), Zebra Spider (*Salticus scenicus*) and Nurseryweb Spider (*Pisaura mirabilis*). Recorders are encouraged to look out for these spiders when they are out recording other things and send in their records and photographs to TWIC. See: https://goo.gl/gx8TII for more information and to enter your sightings. Records will be verified by the British Arachnological Society recorders and uploaded to the NBN Atlas Scotland.

The Scottish Spider Search postcard showing the four spider species in the survey.

Hibernating Heralds

- Katty Baird (Butterfly Conservation National Moth Recording Scheme)

Top photograph: Herald moths (*Scoliopteryx libatrix*). Photograph: Katty Baird. Bottom photograph: Tissue moth (*Triphosa dubitata*). Photograph: Mark Cubitt.

The Hibernating Heralds project began as a result of recording for Butterfly Conservation's national macro-moth atlas – the last field season for the atlas was 2016. The **Herald** (*Scoliopteryx libatrix) is one of the few moths that* overwinters so can be located outside the main recording season. There were large gaps in record coverage for this species in East Lothian vice-county as in other parts of Scotland, so Mark Cubitt and Katty Baird decided to target potential overwintering sites to see if they could fill some of the gaps in recording and locate new hibernating sites.

Potential hibernating sites across the Lothians were checked. These included outhouses, cellars, ruined buildings, caves, drains and mines – places Katty described as the "dark, damp and dodgy"! The group collaborated with the Lothian Bat Group in order to gain access to bat hibernacula (bats and their hibernacula are protected so individuals can only access these sites with an appropriately licenced person). Historic Environment Scotland also assisted in the survey by providing access to some of their sites – including a pit prison!

The public were encouraged to check their outbuildings, cellars etc. for Heralds – taking appropriate safety precautions – and submit their records and photos on the Hibernating Heralds iRecord Activity. A Facebook page https://en-gb.facebook.com/hibernatingheralds/ was also set up to generate interest on the project and give feedback to volunteers. Individuals can also follow and contribute on Twitter #hibernatingheralds.

In 2016/17, 170 sites with Herald moths were located (33 sites without). 2005 Herald moths were recorded, in comparison to 1717 Herald moths recorded by the National Moth Recording Scheme since 2000. In addition, 3 mating Herald pairs have been observed. Hitherto, Heralds were generally thought to mate after emerging from hibernation, so it was exciting to see these pairs. Even more notable was the discovery of 31 **Tissue moths** (*Triphosa dubitata*) at 11 sites. Previously only 28 Tissues had been recorded in Scotland *ever* and only 10 since 2000! Moreover, none had ever been found overwintering in Scotland, although it is likely that they have gone unnoticed for a while.

Numbers of hibernating Heralds have declined towards the end of March, but they are yet to find out when they finally leave the hibernating sites. In summer the focus will shift to looking for caterpillars. Then the #HibernatingHeralds will be back again in the autumn when the group will target further geographical gaps.

The project is a good illustration of what can be discovered with targeted survey effort and should give recorders heart that discoveries in the field of entomology can still to be made.

Natalie Harmsworth

Summing up

- Ian Young (TWIC Director)

TWIC Director Ian Young summed up a day of interesting, engaging and thought-provoking presentations, highlighting the good quality of questions and discussion following the presentations. Agriculture and Biodiversity can often be a divisive subject but even though the audience came from diverse backgrounds the discussion was always good natured and friendly.

Ian thanked all those involved in making the conference such a success, including the staff and volunteers at TWIC, highlighting the work put in by Natalie. Thanks also went to all the excellent speakers and to Chris Cathrine of Caledonian Conservation, www.caledonianconservation.co.uk, for sponsoring the lunch. Finally thanks went to those attending the conference. TWIC's Autumn Conference will take place on Saturday 25 November 2017 with a venue in the Scottish Borders to be confirmed.

Graeme Wilson