LIFE22-NAT-DK-LIFE ORCHIDS
Project: 101113801

Task T.4.6 – Supplementary breeding program for *Phengaris arion.*
The tasks have been carried out in Klinteskoven and Klinteskoven Kalkgrund SAC DK006X090 and SPA DK006X090.

Baseline-report describing research on the Large blue butterfly *Phengaris arion*

David Simcox, Sarah Meredith and Jeremy Thomas – November 12th 2025

Disclaimer

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Progress report on *Phengaris arion* work by the UK team from Royal Entomological Society – part of the Denmark EU Life Orchids Project

Sarah Meredith, Jeremy Thomas, Ditte Gammeltoft and David Simcox

Visit One 31/03/2025 to 04/04/2025 (5 days)

UK Team: Sarah Meredith, Jeremy Thomas, David Simcox

- Meeting Peer Ravn, Carsten Horup, Ditte Gammeltoft who showed the UK team around the existing *P.arion* site at Høvblege and potential future reintroduction sites at Jydelejet, Hundevænge Overdrev and Ormebanke.
- Installed 9 temperature dataloggers on Høvblege, 4 on Ormebanke and 8 on Jydelejet. The results will allow comparisons with UK sites and crucially, to identify future introduction sites in Denmark which are likely to succeed and will prosper under a warming climate.

Installing dataloggers (5&6) on Høvblege Main Slope

Location of 9 dataloggers on Høvblege

Location of 4 dataloggers at Ormebanke

Location of 8 dataloggers at Jydelejet

Visit Two 07/05/2025 to 14/05/2025 (7 days)

UK Team: Sarah Meredith, Jeremy Thomas, David Simcox

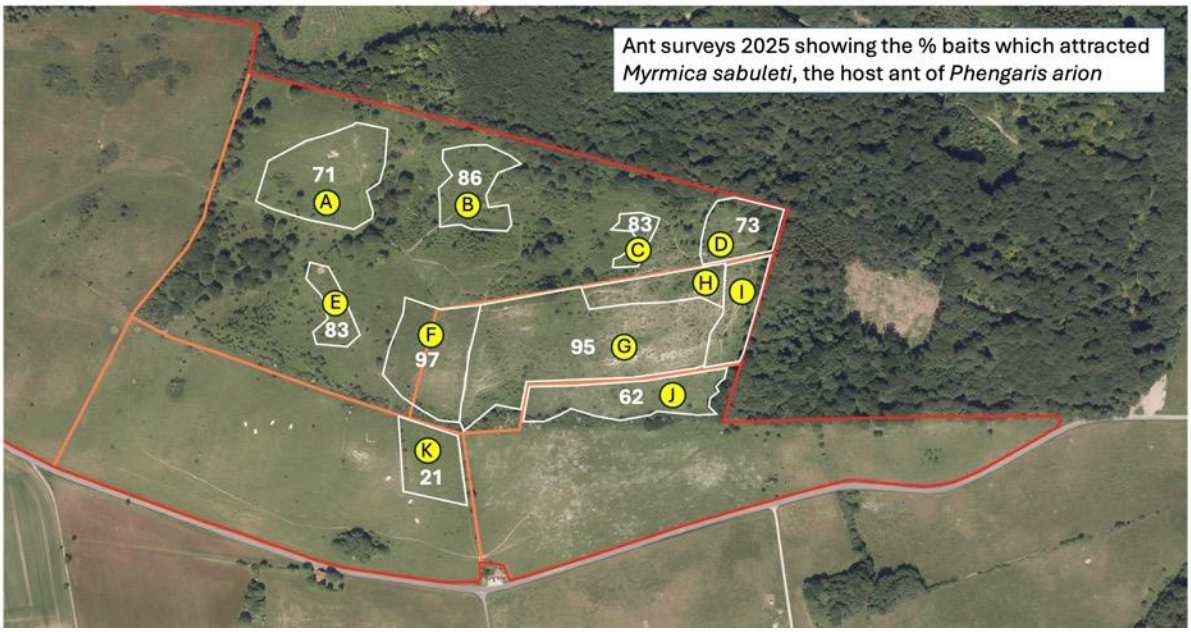
Following the first visit in April and discussions between Danish and English colleagues, it was decided that the priorities for 2025 fieldwork would be on:

Høvblege collecting data from the one remaining population of *P.arion* and Jydelejet as a former site and a leading candidate for a future re-introduction of the butterfly.

The key activities during this visit were to undertake detailed ant surveys, to learn about both historic and current grazing and to discuss potential scrub management.

Ant surveys measure the % of *Thymus* & *Origanum* that lie within the foraging range of the Red ant *Myrmica sabuleti.*

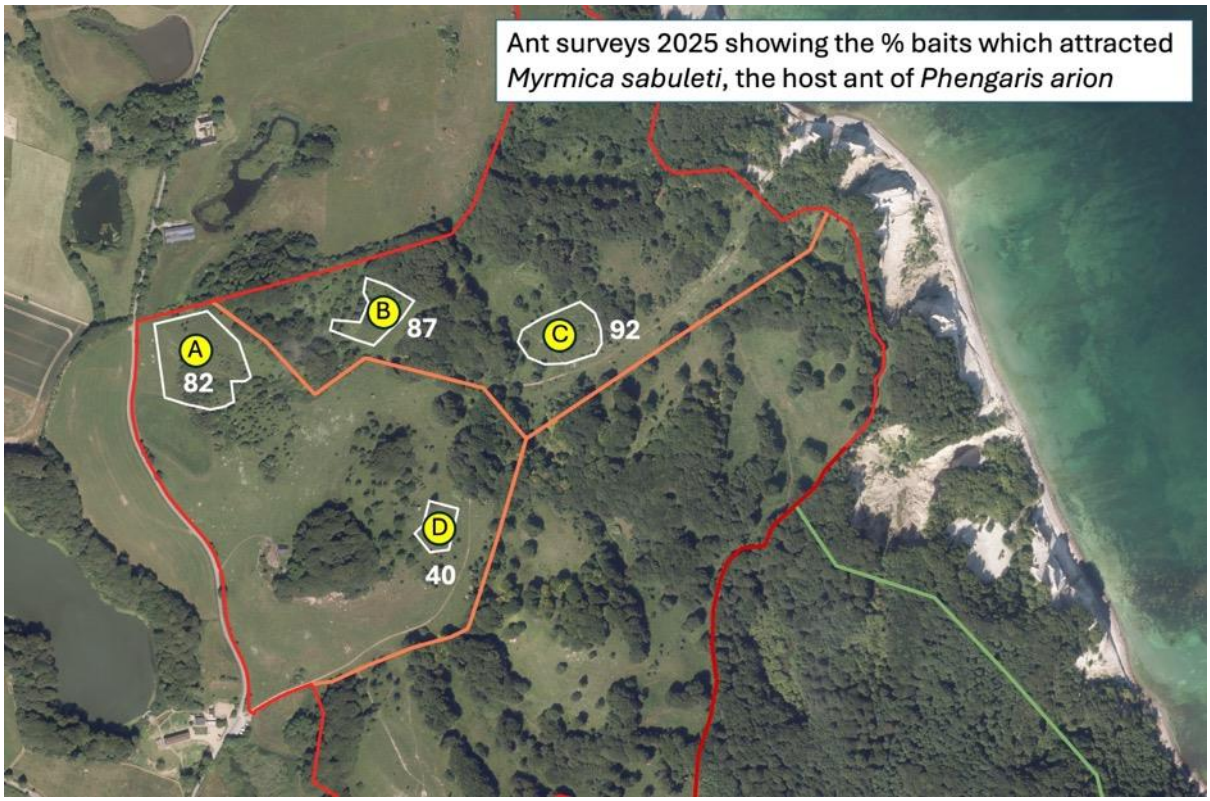
Small piles of cake are placed next to the foodplants and checked one hour later. The species of ant is recorded, together with the number of ants and the average turf height.



	Area Name - English	No. of baits	No. with M.sabuleti	% with M.sabuleti	% baits >30 ants	Mean turf hgt (cm)
A	Kongsbjerg	31	22	71	86	5.3
B	Amphitheatre	44	38	86	71	6.1
C	North facing slope	12	10	83	34	4.5
D	North-east plateau	40	29	73	21	5.4
E	Slumrehule	30	25	83	80	5.3
F	Main slope west	31	30	97	33	3.8
G+H+I	Main slope centre	55	52	95	97	3.1
J	South-east arable reversion	77	48	62	43	4.4
K	South arable reversion	28	6	21	33	5.2
	Totals	**348**	**260**	**75**		

Data collected in May, June & July 2025 from Høvblege is shown above.

The results of ant surveys at Høvblege show why the site is able to support a large population of *P.arion* and also that the south-facing 'Main slope' F,G,H & I is presently the best area. Encouragingly, the ants are also present in good numbers on the less southerly slopes of E,C & D offering places of refuge in drought years and providing mitigation for the future under a warming climate.



	Area Name	No. of baits	No. with M.sabuleti	% with M.sabuleti	% baits >30 ants	Mean turf hgt (cm)
A	Store Langebjerg	98	80	82	58	3.5
B	Between A & C	30	26	87	65	5.0
C	Store Staklebjerg	72	66	92	76	4.8
D	Lille Langebjerg	30	12	40	83	4.2
	Totals	**230**	**184**	**80**		

Data collected in May, June & July 2025 from Jydelejet is shown above.

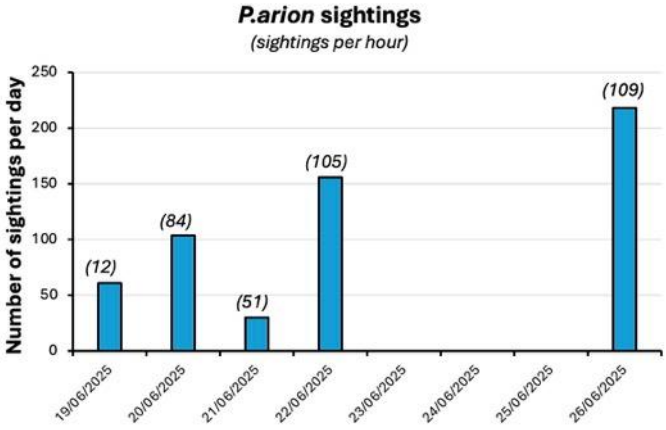
The results for areas A, B & C are particularly encouraging and offer the potential to create a whole landscape capable of supporting a meta-population of *P.arion*. However, prior to an attempted re-introduction we recommend implementing a programme of scrub control to prevent the loss of high-quality grassland and to facilitate greater connectivity between areas. These were discussed further during our June and July visits and as part of meetings with Ditte Gammeltoft, H.C.Gravesen and Per Stadel Nielsen.

Visit Three 18/06/2025 to 27/06/2025 (10 days)

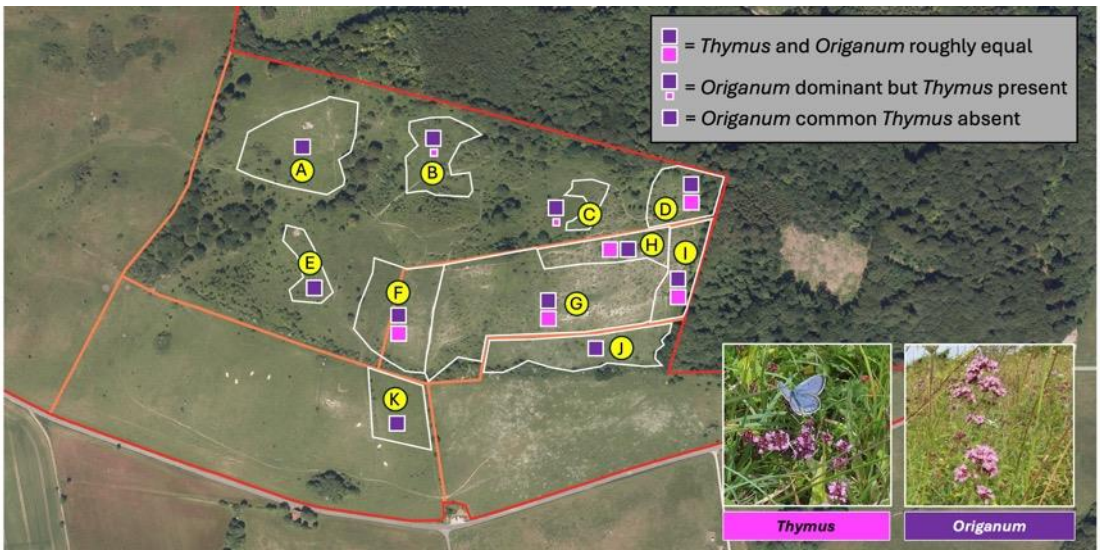
UK Team: Sarah Meredith & David Simcox

We were delighted to find that during the month since our previous visit there had been significant rain and there was little evidence of drought.

Key activities during this visit included: carrying out timed counts of adult *P.arion* and monitoring their distribution across Høvblege together with their foodplants *Thymus* and *Origanum* and measuring the abundance of eggs on *Thymus*.



Timed counts: counts of adult butterflies were generally made whilst undertaking other surveys and are therefore likely to be underestimates. However, they showed that the butterfly was present in considerable numbers. By noting the amount of time spent recording each day we are able to show the density of butterflies as sightings per hour – this is our preferred method for recording adult butterflies and allows comparisons to be made between years and between multiple sites.



Distribution of Thymus and Origanum being utilised by P.arion across Høvblege

Whilst *Origanum* can be found right across Høvblege, *Thymus* is restricted to areas of more skeletal soils, its absence from areas A & E probably due to historical afforestation and J & K as former arable fields.

To estimate the number of eggs laid on *Thymus*, a total of 60 x 1m^2 quadrats were randomly thrown across areas of the site with *Thymus*, every flower was searched and the number eggs recorded.
A total of 160 eggs were found at a density of 2.67 per m^2. 40% of quadrats contained flowering *Thymus* and 75% had non-flowering plants.

	Area Name (English)	Area with thyme (m^2)	Estimated No. eggs on *Thymus* per area
B	Amphitheatre	150	401
C	North facing slope	271	723
D	Nort-east plateau	2,630	7,022
F,G,H&I	Main slope	32,378	84,830
Total P.arion egg population on *Thymus* in 2025			**92,615**

Table showing the estimated number of eggs laid on *Thymus* by area - Høvblege 2025

During this visit Sarah Meredith (bottom left) demonstrated our method for surveying ants (from left) Jens Søgaard Hansen, Ditte Gammeltoft, Per Stadel Nielsen and Carsten Horup.

Visit Four 09/07/2025 to 25/07/2025 (17 days)

UK Team: David Simcox & Maddy Simcox

After working on drought stressed *P.arion* sites in the UK for the previous ten days it was a pleasure to return to a green and verdant Denmark.

Key activities during this visit included: surveys to measure the number of Origanum plants on Høvblege, taking a sample of 300 *Origanum* spikes into captivity to firstly confirm that this foodplant was being used and secondly to estimate the population of eggs laid on *Origanum*. In addition to spend time on Jydelejet learning about its management history and to explore management options for the future.

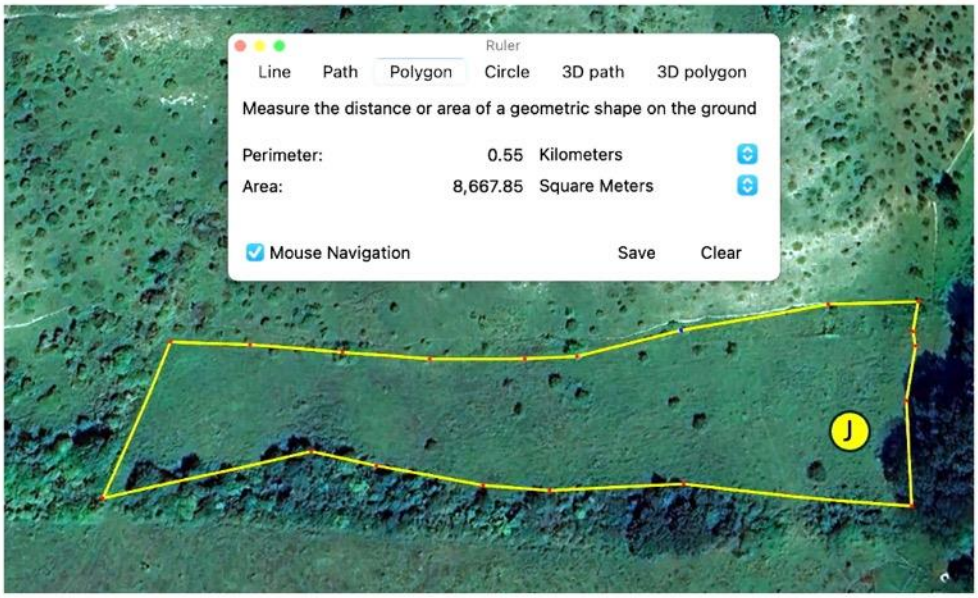
Measuring the number of P.arion eggs laid on Origanum at Høvblege

i. By monitoring adult butterfly numbers it was possible to identify when females had begun laying on *Origanum*, which flowers later than *Thymus*, and therefore when to start making the following assessments, this was begun in mid-July in 2025. The phenology of flowers is categorised into three stages.

ii. The majority of eggs are laid on 'Stage 2' ensuring that when they hatch after a week that the flowers have moved to Stage 3' and there are plenty of petals for the caterpillars to eat.

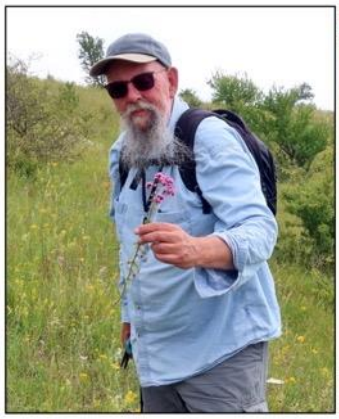
iii. To measure the *P.arion* egg population it was important to measure the abundance of *Origanum* in each part of the site. A 1m cane was randomly thrown and where it fell a m^2 quadrat was created either side of the cane. The number of 'Stage 3' *Origanum* flower spikes in each quadrat was counted.

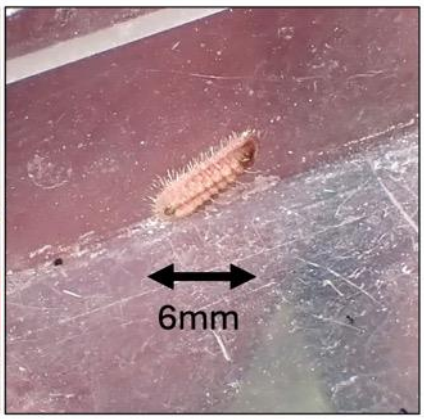
iv. The graphic below shows how the population of Stage 3 *Origanum* spikes was calculated for Area J, the Arable reversion in the south-east corner of the site. The same method was used on other parts of the site.



No. quadrats	Total No. Stage 3	Average per m^2	Area Site m^2	No. Stage 3 spikes
thrown	*spikes counted*	*127/54*	*Google Earth*	*2.35 x 8,668*
54	127	2.35	8,668	**20,368**

v. Samples of 25 x Stage 3 *Origanum* spikes were taken from each area of the site and placed into 2 litre bottles of water, each which was placed into a separate large plastic bowl. The water was topped up daily and the flowers given regular sprays with water to mimic the daily effect of dew and rain.
Over a period of ten days, the larvae fed on the *Origanum* flowers until they reached their 4th and final instar when they drop into the bowl. The larvae, which are only 6mm long at this point, are counted and then returned to the site. Using this information it is then possible to calculate the density of *P.arion* larvae per *Origanum* spike. Although this is a laborious method it gives very accurate results and is essential as eggs which are easy to count in the field on *Thymus* are impossible to count on the dense *Origanum* flowers.

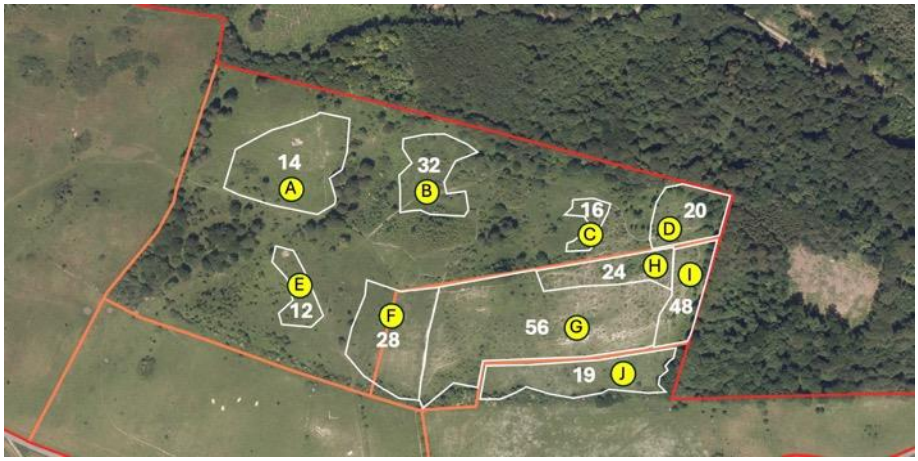




vi. The table below shows the density of larvae per Origanum spike and the estimated number of eggs for each area. In calculating the number of eggs for the Main slope Areas F,G,H & I have been amalgamated.

	Area Name - English (Sample size N=)	Measured No. larvae per *Origanum* spike	No. larvae produced from sample	Density expressed as No. larvae per 100 spikes	Estimated No. eggs on *Origanum* per area
A	Kongsbjerg (50)	0.14	7	14	6,144
B	Amphitheatre (25)	0.32	8	32	6,096
C	North facing slope (25)	0.16	4	16	155
D	North-east plateau (25)	0.2	5	20	389
E	Slumrehule (25)	0.12	3	12	1,415
F	Main slope West (25)	0.28	7	28	
G	Main slope centre (25)	0.56	14	56	F+G+H+I 55,181
H	Main slope top (25)	0.24	6	24	
I	Eastern Gulley (25)	0.48	12	48	
J	South-east arable reversion (47)	0.19	11	19	3,931
	Total *P.arion* egg population using *Origanum* in 2025				**73,311**

The aerial below shows the same data but in a different and more relatable format. The numbers represent the number of larvae per 100 *Origanum* spikes found in each area. Larvae were found to be present on 56% (more than half) of all Stage 3 *Origanum* spikes on Area G.



The data also confirms the theory that there are more butterflies on the eastern half of the site (*Per Stadel Nielsen pers comm*).

On 21st July, there were eight larvae which had reached their 4th instar and needed to be returned to the site. It was with great pleasure that a small group were all able to watch a *P.arion* larva being adopted by *Myrmica sabuleti* ants – surely the eighth wonder of the world and one which very few people have ever witnessed.

The *Phengaris arion* population at Høvblege in 2025

	Area Name (English)	Egg estimate *Thymus*	Egg estimate *Origanum*	Total estimated egg population 2025
A	Kongsbjerg		6,144	6144
B	Amphitheatre	401	6,096	6497
C	North facing slope	723	155	878
D	North-east plateau	7,022	389	7411
E	Slumrehule		1,415	1415
F,G,H&I	Main slope top	84,830	55,181	140011
J	South-eastern arable reversion		3,931	3931
Total P.arion egg population		**92,976**	**73,311**	**166,287**

Here are some key points:

- UK research has shown that females lay an average of 51 eggs.
  Therefore, $\frac{166,287}{51}$ = 3,260 female butterflies X 2 (to account for males) = 6,520
  We estimate that approximately 6,520 butterflies flew this year on Høvblege.

- The butterfly is using both *Thymus* and *Origanum* as larval foodplants on Høvblege.

- In 2025, 56% of eggs were laid on *Thymus* and 44% on *Origanum*. In the UK we have several sites where both foodplants are being used and the proportion of eggs varies from year to year.

- *P.arion* adults were first reported this year on 12/06/2025 (source from social media / Carsten Horup). The latest we observed were on 19th July but some were probably seen later. Notwithstanding, this equates to a flight period of at least 37 days. In the UK we find that sites with both foodplants have longer flight periods than on sites where only one foodplant occurs.

- This is a very significant and large population which could be a reliable donor population to reintroduce the butterfly to Jydelejet and beyond.

- **Caution!** In the UK two of our core *P.arion* populations in Somerset have been hit by very severe droughts in 2025 causing both populations to decline by -96%. Fortunately, we have other colonies in other areas which were not so drought stressed. This highlights the importance of having >1 colony and incorporating climate change mitigation into future management plans.
  A decline of similar proportions at Høvblege would result in a total population of 260 adult butterflies rather than 6,520.

Visit Five 17/10/2025 to 24/10/2025 (8 days)
UK Team: David Simcox & Sarah Meredith

We began by visiting the sites at Høvblege, Ormebanke and Jydelejet to first locate and then download the data from the temperature data loggers.

Above: Removing datalogger from Kongsbjerg, Høvblege in beautiful weather.
Below: Removing datalogger from Ormebanke

Whilst collecting dataloggers, we were able to assess the development of scrub across all sites.

Above: Removing dataloggers from Area Aii at Jydelejet
Below: Removing dataloggers from Area C at Jydelejet

Data collected will be analysed over the winter and allow comparisons to made between sites.

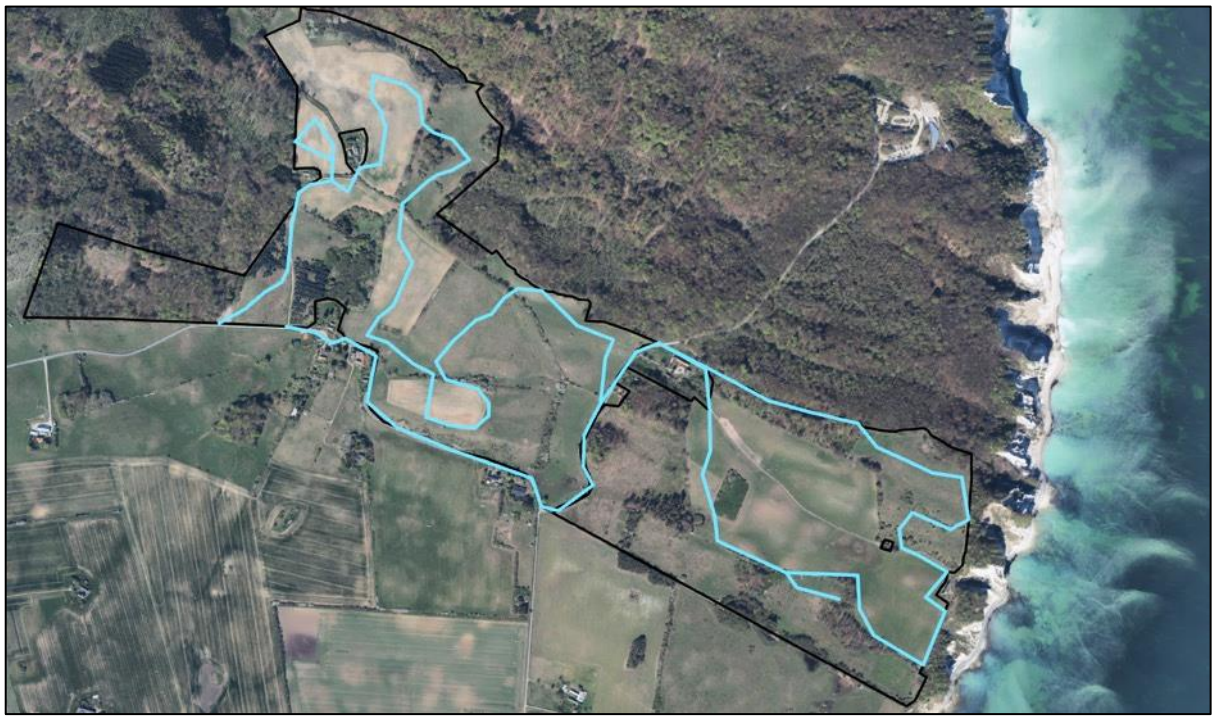
On Tuesday 21st October we attended a meeting to discuss winter scrub management on both Jydelejet and then Høvblege. From right: Carsten Horup, Alberte Margrethe Kofoed Larsen, Anna Ravn, David Simcox, Peer Ravn, Ditte Gammeltoft, Markus Raeder Konner, Helle Stuhr and Jens Ljungmann Pedersen. Photo by Sarah Meredith.

We enjoyed the demonstration of the Roboflail (inset) and seeing the goats.

The group then moved to Kongsbjerg on Høvblege to consider priority management for this site. We also discussed how Juniperus was thriving here but potentially might cause the loss of species rich grassland. It was decided to look at the possibility of using small seedlings of Juniperus growing on Høvblege to colonise other sites within the project area.

Finally, it was agreed that the cattle would be moved onto the main site at Høvblege to graze down the developing tall sward, this will benefit *P.arion* and many other species.

During the same visit we were very pleased to be introduced to and welcomed by Carl Gustav Scavenius, owner of the Klintholm Estate. It was interesting to learn about the history of the Estate and the importance of nature and wildlife to their farming and tourism businesses. He kindly gave us permission to carry out surveys on Estate land.



We were then driven, off road (above), around parts of the Estate by Peer Ravn and Carsten Horup. We were struck by the possibilities presented by this area, which could support a greater range of wildlife, including *P.arion* in the future. To realise this potential, it will be necessary to introduce a management plan including heavy restoration grazing followed by on-going regular grazing and, in some areas a programme of scrub clearance too. With the correct management this area could greatly increase both the area of suitable habitat for

P.arion but also help to connect the Høvblege and Jydelejet landscapes. Above photo taken of Klintholm grasslands from Høvblege. *Photo courtesy Carsten Horup*

Workplan for Royal Entomological Team for 2026

Temperature Dataloggers

Analyse data collected by temperature data-loggers in 2025 from Høvblege, Ormebanke and Jydelejet and make comparisons between these three sites and UK Large blue sites. The results will be incorporated into the 2026 report.

In March 2026 we will re-install dataloggers with new batteries onto these sites but also bring an additional twenty more to sample new areas on the same sites and particularly on the Klintholm Estate sites.

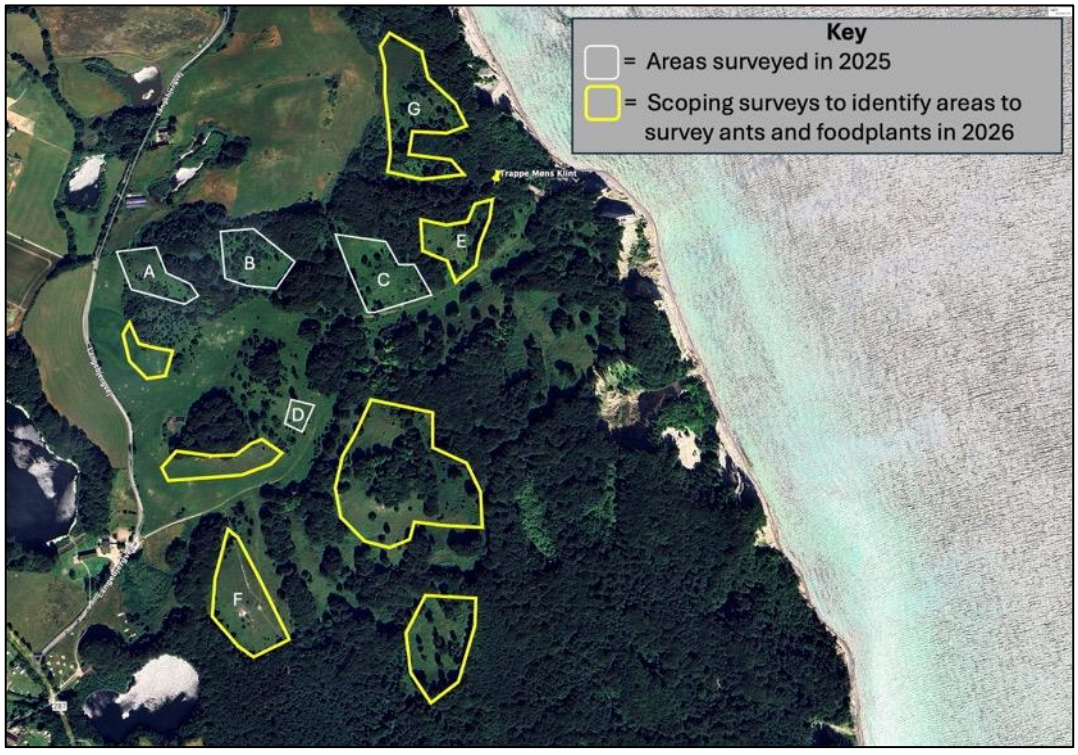
Obtaining licences for future work on P.arion

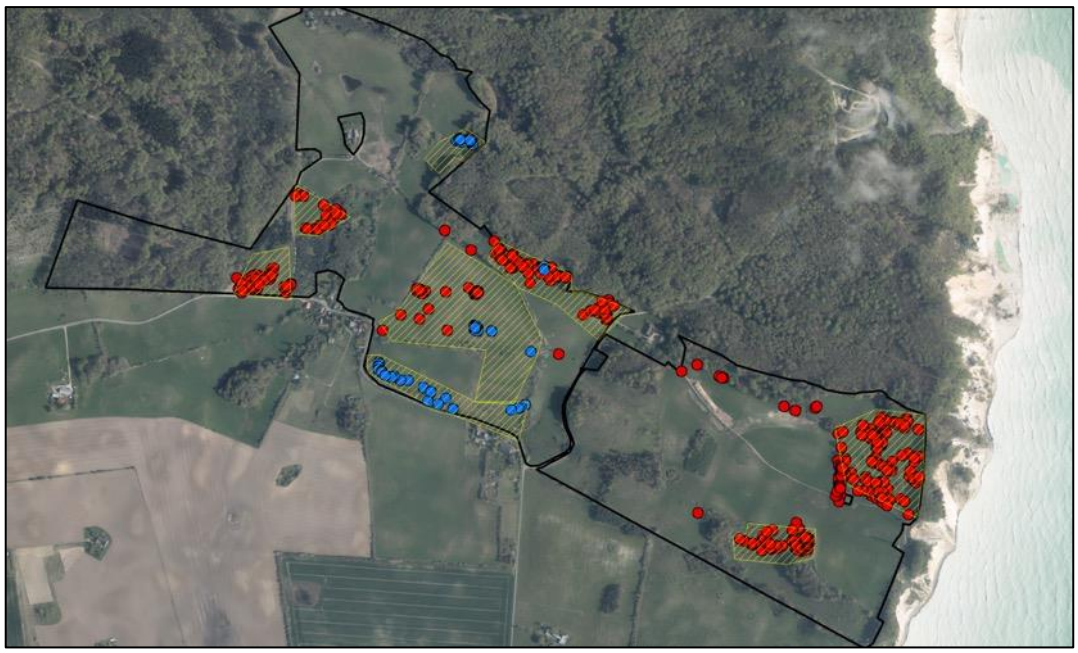
To work with Denmark team to prepare applications for licensing a re-introduction from Høvblege to Jydelejet, hopefully in June/July 2026, subject to ant surveys (May 2026) and sufficient numbers of *P.arion* emerging on donor site. Also seek permission to excavate up to six *Myrmica sabuleti* nests on Høvblege to see if they are capable of rearing more than one P.arion larvae at the same time.

Ant surveys, on Jydelejet - crucial for assessing the suitability of P.arion habitat

Ant surveys at Jydelejet in May 2026. Repeat Areas A, B, & C to measure the impact of winter management, scrub clearance and grazing, on ant populations.

Scope all the areas marked in yellow to identify areas for further ant surveys. Areas marked, E, F,& G will be prioritised for surveys in May 2026.





Ant surveys Klintholm Estate grasslands - to assess the suitability of P.arion habitat
The above map was kindly supplied by Carsten Horup and shows the results of botanical surveys carried out by his colleague Danuta. Blue circles show the distribution Thymus and red dots Origanum. The yellow hatched areas show areas we will target for ant surveys between May and September in 2026.

Surveys of P.arion – June & July 2026
We will repeat the surveys on Høvblege of adult butterflies and eggs laid on both *Thymus* and *Origanum*. This will enable us to estimate the population but also to evaluate whether the population is large enough to be harvested for an introduction to Jydelejet. This will be apparent by late June to early July 2026. Provided numbers are sufficiently high, permissions are in place, and the ant surveys at Jydelejet are good, larvae will be reared in captivity in the same property in Råbymagle for an introduction.
Larvae that reach their 4th and final instar will be put on the recipient site on a daily basis. If adult numbers on Høvblege are abundant then the introduction of larvae may be supplemented with up to 20 female butterflies.
We would be happy to arrange opportunities for anyone to see larvae being adopted by ants as we were able to do in 2025.
Please note, the RES team will keep in regular contact with the Danish Nature Agency (Ditte Gammeltoft, Markus Raeder Konner, Helle Stuhr and Jens Ljungmann Pedersen), Vordingborg Kommune (Carsten Horup) and Ravn-nature (Peer and Anna Ravn) throughout the whole process.
We are also available to answer any questions.

Site Management meeting October 2026
To attend a similar meeting on the above sites with the Danish partnership to discuss scrub management, grazing and any other issues. During this trip we will also download data from all temperature dataloggers.

Acknowledgements

We would like to thank all the Danish team for making us feel so very welcome, including Ditte Gammeltoft, Helle Stuhr, H C Gravesen, Markus Raeder Konner, Jens Ljungmann Pedersen, Carsten Horup, Peer Ravn and Per Stadel Nielsen.

We would also like to thank Per Stadel Nielsen for sharing his knowledge about Arion at Høvblege and elsewhere in Denmark. Information regarding historical management both here and at Jydelejet described by him and H.C.Gravesen has been particularly helpful.

The Danish Nature Agency sites are extraordinarily beautiful and rich in wildlife, the team are a pleasure to work with and we look forward to collaborating further in the next few years.

We also are keen to get to know the Klintholm Estate grasslands and to help them to reach their true potential for wildlife and *P.arion*.

Finally, without Peer Ravn's great vision, ably supported by Carsten Horup, this ambitious and vital project would never have come to fruition – thank you.

We look forward to carrying on this very interesting work with you all.

David Simcox 26/08/2025

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