Delamere's Dragons

Final report

September 2017

Report Author: Chris Meredith

LOTTERY FUNDED

Contents

Summary 3

1. Project Overview 4

   1.1 Project aims and objectives 4

2. Project Progress 5

   2.1 White-faced darter dragonfly reintroduction 5

   2.2 Community engagement 15

   2.3 Growing a meres and mosses community and integrating dragonflies into the visitor economy of Delamere Forest 20

Acknowledgements 23

Appendices 24

Appendix 1: Maps of donor sites 24

Appendix 2: British Dragonfly Society transect methodology 26

Appendix 3: Trainee role descriptions (removed) .....

Appendix 4: Volunteer Trainee personal development summary (removed) .....

Appendix 5: Newspaper publicity 31

Summary

The white-faced darter dragonfly was last seen in Cheshire in 2003. It is a Local Biodiversity Action Plan (LBAP) species and is confined to only four significant breeding sites in England, including one reintroduced population in Cumbria. Inhabiting lowland bog pools the habitat of white-faced darters has always been highly fragmented, but drainage, nutrient run off and peat cutting or *Sphagnum* collection have further added to the pressures on the species. After extensive habitat restoration in Delamere Forest and a reintroduction pilot in 2013 Cheshire Wildlife Trust, alongside its partners, began the Delamere's Dragons project in 2014.

Project Outputs – Reintroducing the white-faced darter dragonfly:

- **450** larvae translocated
- **11,222** exuviae (larval skins) counted at the donor sites
- **50** exuviae survey days at donor sites
- **111** exuviae counted at Doolittle Moss
- **967** exuviae sexed and measured
- **18** adult white-faced darters seen in Delamere
- **360** litres of *Sphagnum* moss translocated
- **244** dragonfly transects walked across Delamere Forest
- **22** species of dragonfly seen
- **168** mossland habitat surveys completed

Project Outputs – Community engagement:

- **14** talks given
- **19** public engagement events attended
- **18** guided walks
- **3** visits by MPs, including the Secretary of State for the Environment
- **60** printed press releases
- **12** training days
- **236** volunteers engaged
- **3820** volunteer hours contributed
- **3** volunteer Trainees
- **8** university projects completed

Project Outputs – Growing a meres and mosses community and integrating dragonflies in to the visitor economy:

- **2** school activity days
- **5** local parish councils engaged
- **2** nature trails improved
- **2** local businesses engaged in visitor giving
- **1** grant from the rural regeneration fund through Cheshire West and Chester Council
- **2** large donations from local businesses
- **1** appeal generating funds for the reintroduction of white-faced darter
- **22** businesses contacted
- **15** businesses visited/engaged
- **11** businesses supporting the project

1. Project Overview

The white-faced darter (*Leucorrhinia dubia*) is an endangered (UK red data list) species of dragonfly that is a highly localised species of lowland peatbogs. It was present at two sites in Delamere, Cheshire until 2003, after which it was considered to be extinct in the county, thought to be a result of the degradation of its bog pool breeding habitat. However, since 2003 the peatland resource across Delamere has been recognised and widespread restoration work has taken place. With this restoration and the start of a similar white-faced darter reintroduction project in Cumbria, a Delamere White-faced Darter Steering Group was established in 2010. The group commissioned a feasibility study, *'Assessment of Basin Mire Sites in the Delamere Forest Area - Potential for the Reintroduction of the White-faced Darter'* in 2011 which discovered several basins potentially suitable for the white-faced darter dragonfly with minimal work needed. Following some scrub clearance and outfall blocking work in 2011/12, a peat basin in Delamere Forest named Doolittle Moss was deemed the most likely area of suitable habitat for the species. Natural England commissioned further aquatic invertebrate surveys of Doolittle Moss and the production of the '*Delamere Forest White-faced Darter Action Plan'* in 2012.

Following on from a pilot year in 2013, which was used to test the reintroduction methodology, funding was awarded by HLF in March 2014. The three year project would focus on reintroducing the white-faced darter to Delamere Forest, as well as monitoring other species of dragonfly, assessing mossland habitat condition and incorporating dragonflies into the visitor economy of Delamere, ensuring that the local community are aware of the important habitats on their doorstep. In December 2016 the Delamere's Dragons project was permitted an extension until September 2017, allowing a fourth year of monitoring the white-faced darter population in Delamere.

Delamere's Dragons is funded by the Heritage Lottery Fund, Linley Shaw Foundation and the John Spedan Lewis Foundation. The project is carried out in partnership with the Forestry Commission, Natural England and the British Dragonfly Society.

1.1 Project aims and objectives:

- To reintroduce the white-faced darter dragonfly to Delamere Forest
- Get people involved in a nationally significant dragonfly reintroduction and encourage them to learn about the Delamere landscape
- Grow a meres and mosses community across the Delamere Living Landscape
- Integrate dragonflies into the visitor economy of Delamere Forest

2. Project Progress

2.1 Reintroduce the white-faced darter dragonfly to Delamere Forest

2.1.1 Reintroduction methodology

The reintroduction of the white-faced darter takes place in two stages, the larval translocation in April/early May before the start of their flight season and the egg and hatchling translocation at the end of their flight season in late July/August. Permission was granted by site managers at Fenn's, Whixall and Bettisfield Mosses National Nature Reserve (NNR) and Chartley Moss NNR for 50 final instar (mature) white-faced darter larvae to be collected from each site and translocated into Doolittle Moss in Delamere Forest (Figure 1). Following on from our monitoring of the white-faced darter populations at the donor sites during 2013 and 2014, we were given permission to take 100 mature larvae from each site in 2015 and 2016. The mature larvae were collected by volunteers using pond dipping nets. After netting *Sphagnum* out of the pools it was thoroughly searched for mature larvae, easily identified by their striped underside and the presence of long wing buds. The larvae to be translocated were secured in a sealed container with water and some *Sphagnum* before being transported to Doolittle Moss and released into the pool. We ensured that the larvae were contained in tubs for as little time as possible and released into suitable areas in Doolittle Moss with plenty of water and good *Sphagnum* growth for cover.

Following on from the translocation of mature larvae into Doolittle Moss, monitoring of white-faced darter populations continued at both donor sites and the reintroduction site until the end of the adult emergence period in late June/July. Monitoring took the form of searching for white-faced darter exuviae, the cast larval skin, in the vegetation around the pools from which larvae were taken. Some of the exuviae were collected to provide material for genetic analysis with Manchester Metropolitan University and the remainder removed to prevent them being counted again. Data on white-faced darter emergence was collected at the same time and included information such as how high up vegetation exuviae were found, what plant species they were found on and their distance from the water's edge. Monitoring of the donor sites took place weekly and continued throughout the white-faced darter emergence period.

In early August, towards the end of the white-faced darter flight season, the second stage of the reintroduction process took place; the translocation of white-faced darter eggs and young larvae. Female white-faced darters can lay hundreds of eggs over their adult life. Each round egg is flicked off the abdomen into the water where its jelly-like coating helps it stick to submerged *Sphagnum* moss and develop close to the water's surface over the following 3 weeks. Pond dipping nets were used to collect 60 litres of this *Sphagnum* from each donor site, using the same pools from which final instar larvae were removed in April. The moss was carefully sorted through to remove any non-target organisms large enough to handle, including spiders, water beetles and other dragonfly larvae. The eggs and newly hatched larvae are too small to see with the naked eye and so *Sphagnum* was collected from areas that females were seen ovipositing over the course of the flight season. The *Sphagnum*, white-faced darter eggs and young larvae were transported to Doolittle Moss in sealed buckets filled with water and released the same day (Figure 1), ensuring all material was fully submerged but remained close to the water's surface where sunlight will have kept the eggs warm to aid development.

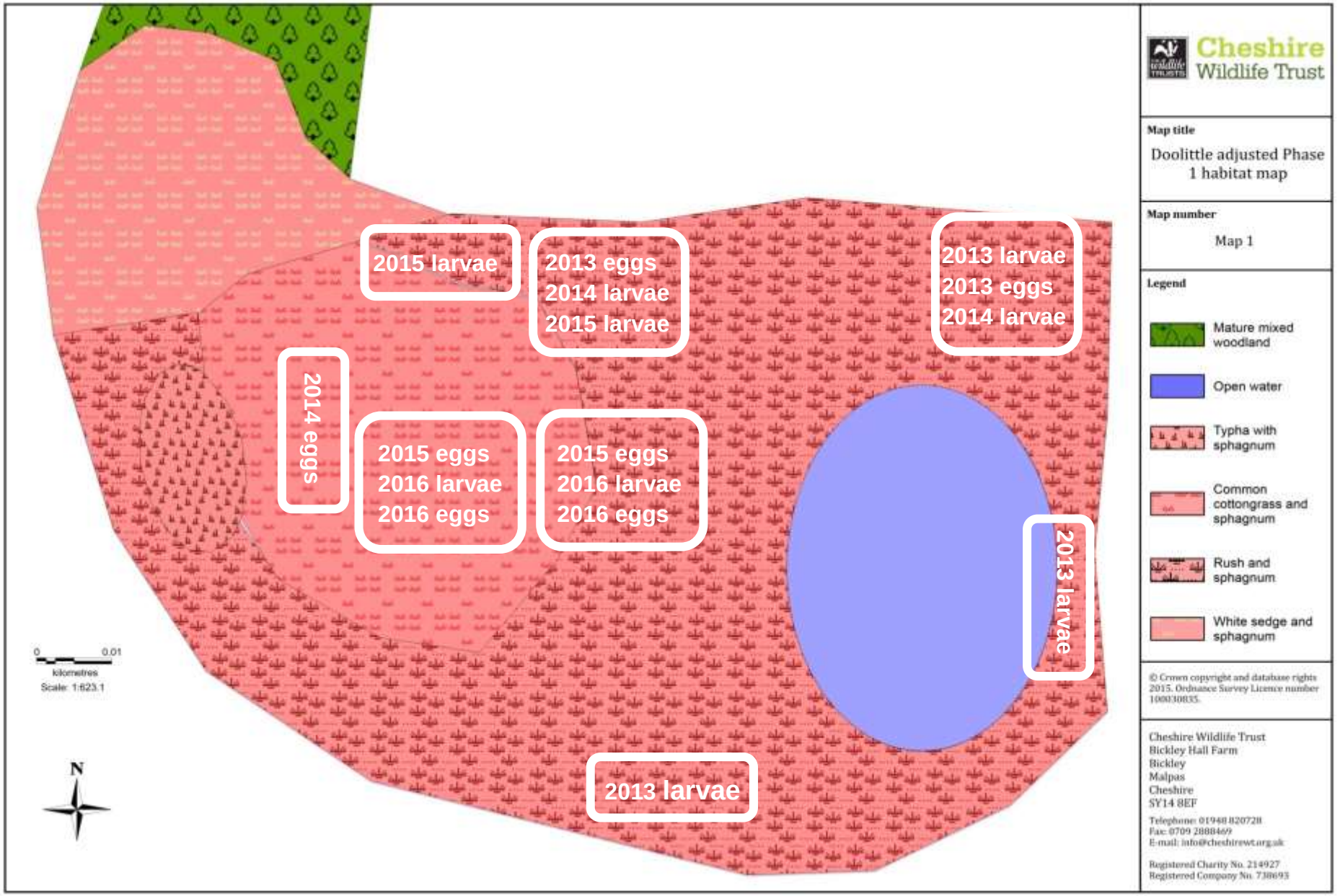


Figure 1. Map showing the white-faced darter reintroduction site, its vegetation composition and areas into which larvae and eggs have been translocated.

2.1.2 Reintroduction results

At the end of April 2014 50 white-faced darter larvae were removed from Chartley Moss, 30 from Europa pool and 20 from Shooter's pool (see map in Appendix 1). At Fenn's and Whixall Moss the larvae were taken from three different pools; 20 larvae from each of section 13.3 and section 31.1, and the remaining 10 larvae were collected from section 15.1 (see map in Appendix 1). Fewer larvae were taken from those pools that were thought to have lower numbers of white-faced darters.

Having received permission for 100 larvae to be removed from each donor site in 2015, the first translocations were from Chartley Moss on 27th April, where despite a frosty start 75 white-faced darter larvae were collected, 23 from Shooter's and 52 from Europa. We had to leave before collecting all 100 larvae to reduce the time those caught would spend in buckets. The first day of translocations at Fenn's and Whixall Moss took place on 30th April when 14 larvae were caught from pool 31.1. Although the day was cold, plenty of smaller one year old white-faced darter larvae were seen, just very few fully developed larvae. For the genetics study to remain unbiased in Delamere, the number of larvae from each donor site needed to remain the same, hence the decision was made to not collect more larvae from Chartley Moss until 75 had been collected from Fenn's and Whixall. The following week we made two more trips to Fenn's and Whixall Moss where we collected the agreed 45 larvae from pool 13.3 and 5 from 15.1. Despite attempting again to collect more larvae from pool 31.1 there were insufficient larvae found in the pool and so no more were removed. A fourth day of translocations from Fenn's and Whixall provided the additional 11 larvae from pool 13.3. There was insufficient time before emergence to collect more larvae from both sites and so only 75 larvae were collected from each donor site.

After the difficulty experienced in 2015 trying to keep to pre-agreed target numbers of larvae from each pool, site managers agreed to leave it to our discretion in 2016. Luckily the weather was somewhat less troublesome at the end of April 2016 when the final white-faced darter larvae were translocated to Doolittle Moss. The first translocations took place on the 18th April from Fenn's and Whixall Moss, where despite a chilly start the sun soon warmed the dark, peat stained water of the white-faced darter breeding pools. Sections 13.3 and 15.1 were visited, collecting 26 and 18 larvae respectively. The second visit to Fenn's and Whixall Moss took place on the 26th April when the remaining 56 larvae were collected. A cloudier night meant that the water was warmer than it was the previous week, allowing 5 larvae to be collected from section 31.1 before heading to section 13.3 where the remaining 51 larvae were collected. The weather was similarly good for both visits to Chartley Moss on the 20th and 27th of April. 50 larvae were collected from Shooters pool on the 20th, with a further 50 quickly collected from Europa on the second visit.

The number of exuviae collected over the course of the monitoring period is shown in Table 1. A total of 11,222 exuviae have been counted at the donor sites over 50 exuviae surveys during the project. Peaks in white-faced darter emergence varied between years in response to weather conditions. In 2014 the peak in emergence was found to be during the 23rd week of the year, whereas after a cold April in 2015, the peak in emergence was two weeks later during the 25th week (Figure 2). In 2016 a warm and fine May brought the peak emergence forward to the 22nd week.

Table 1. Number of exuviae found at the donor sites

		Number of exuviae found		
Site	**Pool**	**2014**	**2015**	**2016**
Fenn's, Whixall and Bettisfield Mosses NNR	13.3	336	356	762
	15.1	58	425	421
	31.1	297	103	212
Chartley Moss NNR	Europa	1292	1710	2007
	Shooters	310	651	568

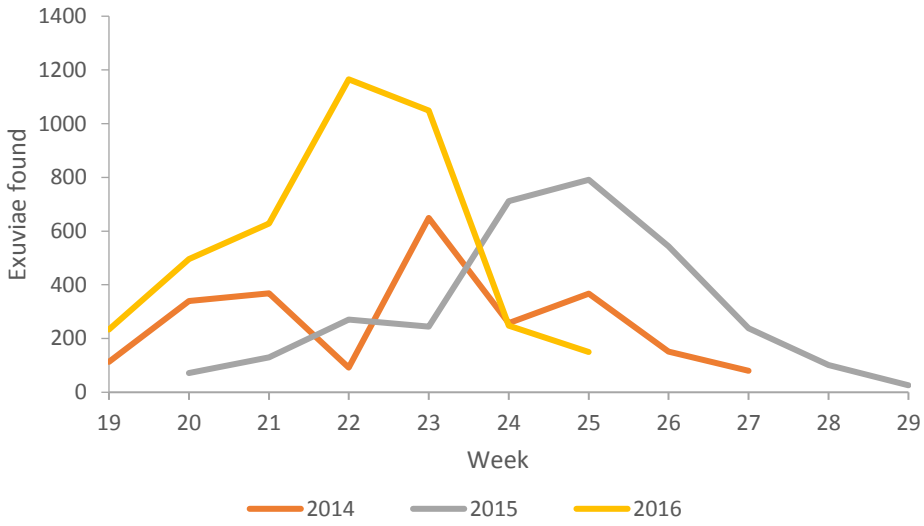


Figure 2. Donor site peak in white-faced darter emergence

Over the same time period exuviae monitoring took place in Delamere at least once a week. In total 111 exuviae have been recovered from the reintroduction site, 28 in 2014, 18 in 2015, 51 in 2016 and 14 in 2017. The focus for the exuviae searches in Doolittle was around the area larvae were released in those years following a translocation. Searching outside these areas was made more difficult by deep water and areas of dense soft rush (*Juncus effusus*). In 2017 a transect route was followed through the pool as no larvae were released, meaning they could emerge anywhere across the pool not just in the vicinity of their release. However, most were found in close proximity to areas where larvae had been released in previous years, implying that they may still exist in higher densities there.

Due to the two year life cycle exhibited by white-faced darters, it will be three years after the last translocation of stock into Doolittle Moss, i.e. 2019, that we will be able to say for certain that emergent white-faced darters are the result of breeding in Delamere. As mature larvae and eggs have been translocated into the same pool, it is impossible to separate translocated individuals from breeding success until then. Finding exuviae in 2017 was significant as it proved that the young larvae can complete their life cycle in Doolittle Moss.

As well as exuviae counts, white-faced darter dragonflies were also monitored at the reintroduction site through direct observation. As well as staff a number of volunteers helped, spending up to three hours at a time sat watching the pool for signs of white-faced darters. This is not made easy by the

distance from the bank to the areas of the pool white-faced darters seem to prefer and the amount of vegetation that serves to obscure the view of the water surface, where most of the territorial males and egg laying females will be found. However, not only have 10 white-faced darters been seen emerging or taking their maiden flight since 2013, but also 16 mature males, some holding breeding territory, two mature females ovipositing (laying eggs) and two tenerals.

During the three years of translocations (2014-2016) 60 litres of *Sphagnum* was collected each year from each donor site and transported to Doolittle Moss with plenty of water to maintain a constant temperature for the eggs and young larvae within. Upon arrival in Delamere the *Sphagnum,* eggs and young larvae were placed into an area of Doolittle Moss that gets plenty of sunlight during the day and has good *Sphagnum* growth below the surface of the water. The area used during 2015 and 2016 was that in which we observed the most adult white-faced darter activity in the preceding years. As white-faced darters have a two year life cycle the effect on the population of the eggs and young larvae placed into Doolittle Moss will only be apparent two years later when the adults will be ready to emerge. However, a large impact was not seen in 2016 from the egg and hatchling translocation that took place in 2014. This could be due to not collecting many of the minute eggs in the *Sphagnum*, the young larvae and eggs being heavily predated in Doolittle, or the material not surviving the translocation process. Those adult dragonflies that were observed in 2017 are either the result of breeding in Delamere or the translocation of eggs and young larvae in 2015.

2.1.3 Increasing knowledge

Despite the loss of white-faced darters from over half their English breeding sites over the last 50 years there are still gaps in our knowledge of the species. Data from the project, as well as the exuviae collected during monitoring, were sent to Manchester Metropolitan University where it has formed a study investigating the genetics of white-faced darters. The genetics study aims to compare the success of white-faced darters from both donor populations in Delamere and assess the diversity found within white-faced darters across Europe. Having trialled the use of lilypad white-faced darter (*L. caudalis*) genetic markers and finding them unsuitable, species specific microsatellite markers have been developed. These microsatellites should be able to inform us of the divergence between populations isolated at the donor sites, as well as the comparative success of the two populations in Delamere. Exuviae have also been obtained from local museums to represent the original Delamere population of white-faced darters so we can see how similar they were genetically to the extant populations in Shropshire and Staffordshire.

Additional masters projects have also looked at:

- Avian predation of dragonflies in Delamere,
- The response of dragonflies to mossland restoration across the forest,
- Habitat use by white-faced darters in both the adult and larval stages.

Three final year undergraduates have also completed their dissertations with data from the Delamere's Dragons project, focussing on:

- The morphological differences in exuviae and whether it affects the choice of emergence microhabitat or the timing of emergence
- The effect of other macroscopic invertebrates in the white-faced darter breeding pools, investigating emergence microhabitat conditions alongside water quality

- The specific emergence microhabitat chosen by white-faced darter at Fenn's and Whixall Moss to better inform management for the species on the site.

In addition to partnership work with local universities, we have sexed and measured all white-faced darter exuviae collected in order to see if body size varies between sites, or even if larval body size is correlated to emergence conditions, such as do larger larvae emerge earlier in the flight season? Three measurements were taken, overall length, head width and wing bud length, although where exuviae are damaged or bent only those that could be accurately measured were taken.

The majority of white-faced darter exuviae at the donor sites were found on common cotton-grass (*Eriophorum angustifolium*), most of which was growing within the pools. The average height larvae climbed up common cotton-grass was 4.47cm although exuviae were found from 1cm above the water to 80cm above. The differences between the heights climbed up different species was found to be significant using an analysis of variance ($F = 121.1$, $P < 0.001$). Exuviae appear to be found higher up on sturdier species (Table 2), e.g. heather (*Calluna vulgaris*), or tussocky species, e.g. purple moor grass (*Molinia caerulea*). Some exuviae were also found on the carnivorous sundew (*Drosera rotundifolia*), many of the individuals had managed to emerge leaving only their exuviae stuck to the sticky leaves, although not all these adults survived. A large number of exuviae found had been dislodged (n = 1546), defined as when an exuviae was found floating in the water, lying on *Sphagnum* without their legs gripping the moss or when they were found on emergent vegetation on the water's surface. The average heights should be taken as a minimum as it is likely that some exuviae may have slipped down the emergent vegetation.

Table 2. The number of records, percentage of the total emergence records and height climbed by white-faced darter larvae up different types of emergence support. The ten most commonly used emergence supports are included.

Species	Exuviae found	Percentage of total (%)	Mean height climbed (cm)
Sphagnum	402	3.55	3.40
Common cotton-grass	6,741	59.58	4.47
Soft rush	49	0.43	6.16
Hare's-tail cotton-grass	1,262	11.15	6.18
Cranberry	68	0.60	6.99
Bog rosemary	50	0.44	7.24
Cross-leaved heath	66	0.58	7.26
Woody spp.	63	0.56	8.38
Purple moor grass	791	6.99	8.72
Heather	130	1.15	8.80

It seems that when emerging on emergent vegetation, white-faced darters are able to judge the strength of the support and show a tendency to climb higher when the support is sturdier or offers more protection from wind and rain. Some larvae climbed high up common cotton-grass but most were found within 5 cm of the water surface, requiring the adults to move up the vegetation as their wings expanded. This response to emergence support structure could increase emergence success by

decreasing the risk of their fragile wings getting wet or wind blowing the emergence support and emergent dragonfly into the water.

The vegetation species used for emergence changed quite markedly between the donor sites themselves and also between pools at the same sites (Figure 3). Although common cotton-grass was the most commonly used species at both donor sites, the second most widely used species differed; at Fenn's and Whixall Moss this was purple moor grass but at Chartley Moss hare's-tail cotton-grass was favoured. Pool 15 at Fenn's and Whixall was the obvious exception to this general rule, with purple moor grass used most extensively for white-faced darters to emerge on and hare's-tail cotton-grass used second most. This suggests that although white-faced darters are widely quoted as showing a preference for common cotton-grass as their emergence support, they emerge on what is available. The perceived preference for common cotton-grass may be in part due to it being the most widespread emergent plant species at most known breeding sites.

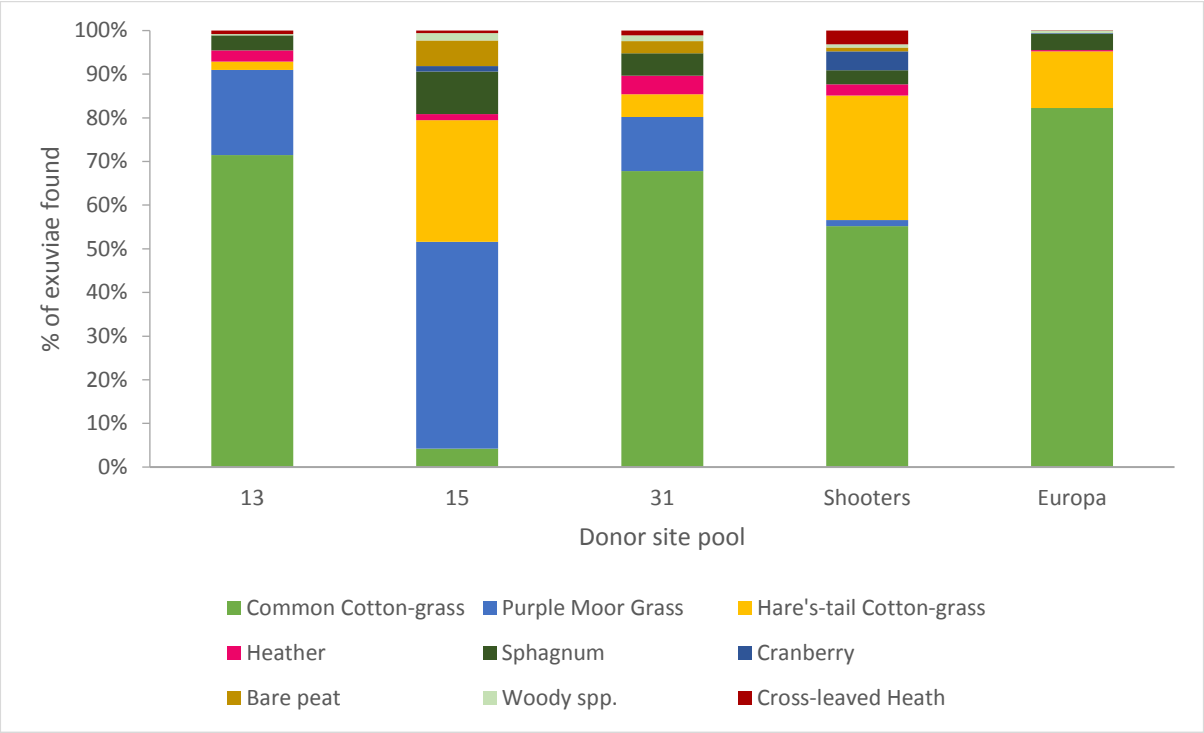


Figure 3. The relative use of different vegetation supports by white-faced darters for emergence from each donor site pool

The majority of white-faced darter exuviae recovered were found on vegetation in the water (n = 7621, 81.3%) as opposed to on the bank (n = 1751, 18.7%). However, this summary does not accurately describe the picture at each pool, for example pool 15 at Fenn's and Whixall Moss has little emergent vegetation and a long, easily searched and well vegetated bank; 56% of all exuviae found here were found on the bank. The opposite was true at Europa pool on Chartley Moss where there are no obvious banks, just a gently sloping *Sphagnum* raft, here only 8.9% were found away from the water. Exuviae recorded as found on the bank were often found close to the water's edge (mean = 12.6cm), whereas those found in the water were further away from the bank (mean = 145.6cm). The height climbed by larvae emerging on the bank, 7.2cm on average, was found to be significantly higher than those emerging from within the water, 4.7cm, using a t-test ($t = 15.7$, $P < 0.001$).

Of the exuviae that were measured, the body length, head width and wing bud length were recorded for 756, 779 and 872 individuals respectively. The wing bud length is not discussed further as the measurement technique did not account for the three dimensionality of the exuviae, which drastically affects the perceived length of the wind bud. The average length of white-faced darter exuviae was 17.95cm and there was no significant difference between the size of exuviae from Fenn's and Whixall Moss and Chartley Moss, as shown using t-tests ($t = 0.24$, $P = 0.81$; head width $t = 0.95$, $P = 0.34$). There was found to be a significant difference between the size of male and female exuviae, the mean female length being 17.73cm and head width 4.80cm, while the average male measurements were 18.22cm and 4.90cm respectively (body length, $t = 6.32$, $P < 0.001$; head width, $t = 2.34$, $P = 0.02$). No correlation was found between the size of the exuviae and their height up an emergence support or their time of emergence.

The emergence times of male and female white-faced darters are of particular interest in relation to the reintroduction attempt. Despite finding no significant difference between the emergence times of males and females in this data, the results suggest that there may be a tendency for female white-faced darters to emerge later in the season than males do. As all larvae for the translocation were collected before emergence began to avoid disturbing fragile emergent dragonflies, there was a chance that more male white-faced darters may have been moved than females.

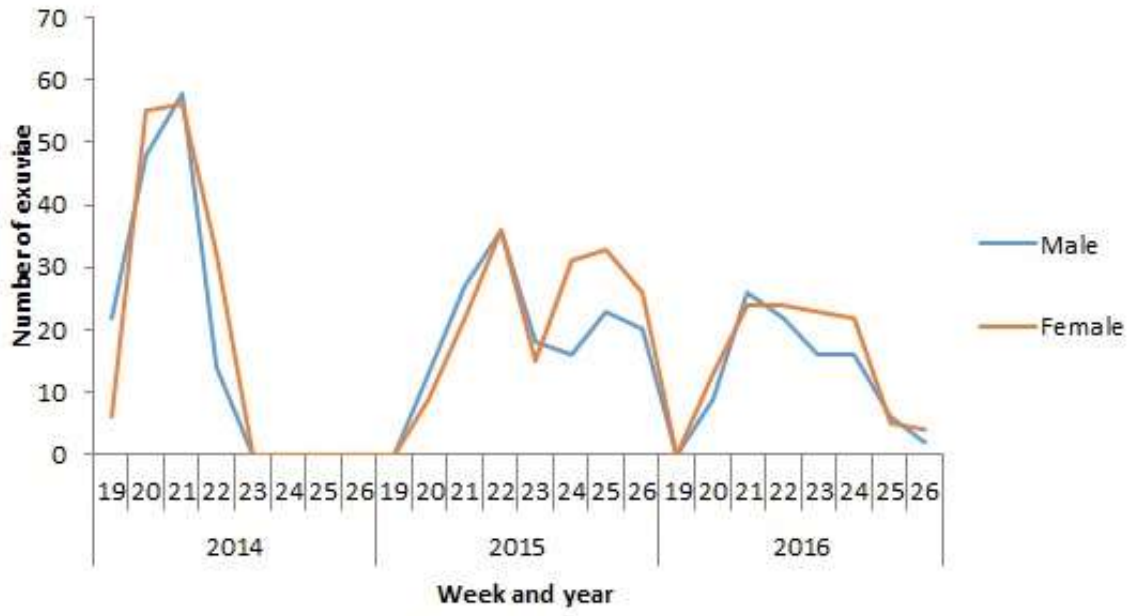


Figure 4. The frequency of male and female white-faced darter exuviae found over three years (2014-2016), including exuviae from Fenn's, Whixall and Bettisfield Mosses NNR and Chartley Moss NNR

2.1.3 Dragonfly survey methodology

Between the end of April when the first species of dragonfly and damselfly can be seen and the middle of September, dragonfly transects were conducted monitoring all Odonata species throughout the Delamere landscape. Six established transect routes were surveyed around Cheshire Wildlife Trust

reserves, restoration sites and the white-faced darter reintroduction site. The British Dragonfly Society transect methodology was used for all transects, requiring that all species are recorded within a 7m wide transect along the edge of the peat basins. For the counts to be valid the temperature must be greater than 17°C with no rain or strong wind. For the full methodology see Appendix 2. Attempts were made to repeat the transects every two weeks with some knowledgeable volunteers conducting independent surveys as well as those joining on led transects.

2.1.4 Dragonfly survey results

Over the course of the project, 244 transects were walked across the Delamere landscape recording Odonata, using six pre-established transect routes. 57 transects were carried out in 2014, 67 in 2015, 60 in 2016 and 60 in 2017. A total of 22 species of dragonfly or damselfly have been recorded over the project (Table 3). Monitoring finished earlier in 2017 than other years, hence fewer of the later species were recorded, e.g. black darters. Many of the species seen infrequently are most likely wayward visitors to the mossland sites, for example the banded demoiselle, ruddy darter and broad-bodied chaser which are more frequently encountered around less acidic waters.

Table 3. Dragonfly species recorded from 6 transect routes across Delamere Forest

Species	2014	2015	2016	2017	Total
Azure damselfly	632	789	484	1469	3374
Banded demoiselle	1	0	0	0	1
Black darter	838	905	1103	582	3428
Black-tailed skimmer	1	5	5	1	12
Blue-tailed damselfly	86	153	80	70	389
Broad-bodied chaser	5	0	0	9	14
Brown hawker	54	27	43	11	135
Common blue damselfly	183	151	208	82	624
Common darter	73	60	134	15	282
Common hawker	37	17	20	2	76
Downy Emerald	0	2	0	0	2
Emerald damselfly	747	435	432	209	1823
Emperor dragonfly	18	9	4	15	46
Four-spotted chaser	224	191	176	297	888
Hairy dragonfly	0	0	0	3	3
Large red damselfly	733	907	767	1081	3488
Migrant hawker	13	9	16	0	38
Red-eyed damselfly	2	0	27	11	40
Ruddy darter	2	0	3	0	5
Southern hawker	20	28	25	5	78
Variable damselfly	27	53	45	28	153
White-faced darter*	0	1	0	2	3

* Although only three white-faced darters were recorded on transects, additional adults were seen during observations

Due to the seasonality of dragonflies not all 22 species are found on the same site at the same time. On any one site the greatest number of dragonfly species seen over a year was 15 at Doolittle Moss, the white-faced darter reintroduction site, during 2015. The data collected so far forms a useful baseline to which future species compositions can be compared to help assess the improvement in

habitat quality of the mosses in Delamere. It could be expected that there will be an increase in the number of specialist species such as black darter, keeled skimmer and variable damselfly. The variable damselfly and downy emerald are species of particular importance, both locally and nationally, and alongside the white-faced darter it is hoped that the number of records of these species will increase following the restoration of water bodies near current populations.

2.1.5 Mossland survey methodologies

Working with the Delamere's Lost Mosses project, mossland habitat surveys across Delamere Forest were undertaken in the form of rapid habitat assessments and *Sphagnum* moss surveys. Rapid habitat assessments require surveyors to walk a transect across the site, or around should the centre be too wet to safely cross, and record plant species in 1 metre quadrats. Instead of identifying all species of vegetation found surveyors simply record the presence of a comparatively small number of positive and negative indicator species. This speeds the vegetation surveys up considerably and allows less confident botanists to get involved independently.

Sphagnum moss surveys require surveyors to thoroughly search each site looking for different species of *Sphagnum*. Samples were collected for formal identification and the rough area covered by each species of *Sphagnum* moss was recorded so that the relative growth of each species can be monitored into the future.

2.1.6 Mossland survey results

In total 50 mossland sites across Delamere had rapid habitat assessments each year. The assessments have shown an increase in both positive and negative indicator species. While some sites have remained fairly constant or improved, some that were at early stages of restoration have shown an increase in negative indicator species. Large trees removed from the surface of the mosses during early stages of restoration, which although beneficial for the habitat in the long term, allow more light to the ground causing rapid growth of undesirable species such as tree saplings, bracken and bramble. The rewetting of many sites helps to control this undesirable scrub as well as increase the cover of *Sphagnum*.

Sphagnum moss surveys were conducted on the same 50 sites as the rapid habitat assessments. In total 12 different species of *Sphagnum* moss have been found in the forest, a high percentage of which are species able to cope with fairly high levels of nutrients suggesting nutrient input into the mossland sites. However, there are a number of small patches of the more specialised bog species, such as *Sphagnum magellanicum,* a deep red *Sphagnum* regarded as a major peat forming moss. Cheshire rarities, such as *S. terres*, have also been discovered.

2.2 Community engagement

2.2.1 Volunteers

During 2014 we built up a very strong volunteer base, and throughout the Delamere's Dragons project have been building on that through recruitment via social media, internal and external press releases, events, talks and guided walks. 236 volunteers registered with the project and they assist not only on the white-faced darter translocation, but also the monitoring of the donor sites, reintroduction site and both habitat and dragonfly surveys around Delamere. Corporate groups contacted through this project have also volunteered and got involved undertaking habitat management at Hatchmere and Norley Moss, supporting the complimentary habitat restoration project in Delamere.

Over the three and a half year project volunteers, not including the Volunteer Trainees, have contributed 2,485 hours to achieve the project's aims, mainly through survey work. Focussing on the white-faced darter reintroduction, during 2014 820 hours were volunteered by 71 people, in 2015, 845 hours by 59 active volunteers and 710 hours by 55 people in 2016. During 2017 staff time was reduced, with a focus on monitoring the Delamere white-faced darter population. This was shown in the number of volunteer hours contributed, only 110. Since April 2014 we have had 16 white-faced darter translocation days, including larval and egg translocations, 50 white-faced darter exuviae counts at donor sites, 244 dragonfly surveys, of which 138 were conducted independently by volunteers and over 50 white-faced darter surveys of Doolittle Moss.

General mossland surveys were carried out by 20 active volunteers and included rapid habitat assessments and *Sphagnum* moss surveys on 50 mossland sites across Delamere. An estimated 250 volunteer hours were spent on these surveys, many of which were given by volunteers working independently following training sessions.

All volunteers were kept up-to-date with project progress throughout the year through the regular volunteer opportunity emails. Volunteer thank you events were held each year of the project summarising the season's work to the volunteers and making sure they felt valued and their contributions worthwhile.

Prior to volunteering on the Delamere's Dragons project volunteers were asked to complete a questionnaire to assess how they view Delamere Forest and its value for wildlife. Towards the end of the project volunteers were asked to complete a similar questionnaire so that we could evaluate how involvement with the project affected how people view Delamere Forest and its natural heritage. A summary of all the project's feedback can be found in the '*Delamere's Dragons Evaluation Report*'.

Six volunteer training sessions have been held on dragonfly identification and survey methodology, one each year in Delamere Forest and a series of three additional training sessions in 2016 looking at dragonflies and damselflies in a range of wetland habitats across Cheshire. In total 66 people attended the six sessions. The majority of training is given 'on-the-job' with all active volunteers getting guidance on dragonfly identification as well as dragonfly ecology and a simple to use 'Dragonflies of Delamere' identification sheet. As well as adult dragonfly identification a number of interested volunteers have been taught identification skills for dragonfly exuviae, again a simplified identification sheet was produced to aid their learning.

Feedback was requested for both organised training sessions and a summary of the responses is provided in the '*Delamere's Dragons Evaluation Report*'. Hand-outs and identification guides were provided from 2015 in response to comments received following the training in 2014. Generally feedback was very positive with people enjoying the subject matter and teaching style.

A further six training sessions were run in the field for volunteers wishing to participate in mossland surveys covering rapid habitat assessment methodology and *Sphagnum* moss identification. Around 35 people attended these training events.

2.2.2 Volunteer Trainees

Volunteer Trainee role descriptions (Appendix 3) were drawn up and the opportunities advertised on the CWT website, newsletters and in the volunteer sections of countryside jobs' websites. A total of 20 applications were received. Three Volunteer Trainees were taken on for the project and each agreed with project staff an individual learning plan so they could make the most of their traineeship. Due to staff changes in 2014 no trainee was taken on that year. We took the opportunity to advertise for two slightly different Volunteer Trainee roles in 2015, one more focussed on the dragonfly reintroduction and the other on community engagement. We found that most people were interested in the more conservation orientated role and so a combined role description was agreed for both Trainee roles as there was still some interest to assist with the community engagement element of the project. One of the Volunteer Trainees assisted for three months of the six month opportunity before leaving for paid work with an ecological consultancy. To make up for this time we extended the Trainee role in 2016 to run for nine months. However, after 6 months the Trainee left to begin paid work leading volunteer groups with a charity. Throughout the traineeship all Trainees assisted with conservation work, community engagement, volunteer leadership and the production of awareness raising and promotional project literature. As part of the project evaluation an exit interview took place for the two Trainees that stayed for 6 months and any lessons learnt carried forward. The Volunteer Trainees contributed a total of 1,351 hours to the project, in return for a training budget and access to any Cheshire Wildlife Trust training courses. The budget was spent on a wide breadth of courses, including species identification, project management and practical skills. A report in Appendix 4 details the experience and personal development of one of the Volunteer Trainees.

2.2.3 Production of learning materials

To help raise awareness of the natural heritage of Delamere a suite of interpretation and learning materials were produced, promoting the importance and beauty of mosslands and dragonflies. This included:

- A locally branded gazebo designed with the Delamere meres and mosses in mind
- Two branded event flags to draw attention to our display
- Two pull up banners, one about the white-faced darter dragonfly and one about mossland habitats
- A set of display panels raising awareness of the importance of the white-faced darter, mosslands and encouraging volunteer involvement
- Two leaflets, one focusing on the white-faced darter dragonfly and one about mossland habitats
- A film about the reintroduction was created and hosted on the Cheshire Wildlife Trust website
- A calendar showcasing the species and habitats found with Delamere's meres and mosses
- A living 'bog in a box' model was created which contains peat, *Sphagnum* moss, cotton-grass and sundew. Designed to bring mosslands to people, the herbarium was taken to many events where exuviae were often placed on some of the grasses to explain the life-cycle of

the dragonfly and the habitat white-faced darters need. The model was very useful to explain habitats and how looking closer at a Moss can reveal an amazing tiny world.

- A suite of posters displayed throughout Delamere encouraging volunteer involvement in the project and displaying information
- Two interpretation boards were installed in Delamere Forest to raise awareness of the importance of mosslands for dragonflies and other specialist animals and plants, one at Black Lake nature reserve and the other by Doolittle Moss
- Two interpretation boards, finger posts and an information board installed at Hatchmere nature reserve funded by Delamere Dairy

2.2.4 Promoting the project and encouraging participation

Since funding was awarded for Delamere's Dragons the project has gained a significant amount of press coverage, both local and national. Local newspapers and magazines have run 60 articles on project events, visits from local MPs and the Secretary of State for the Environment, Delamere's Dragons volunteers, mossland species sightings and more general articles on the project. Short pieces have also been printed in several local parish newsletters as 'Nature Notes' and in the Delamere Forest Discovery Pass, a publication produced by the Forestry Commission for visitors to Delamere Forest. An article about the white-faced darter reintroduction was also published in Cheshire Life. The Delamere's Dragons project has had a number of online press releases and 7 articles in the Cheshire Wildlife Trust members' magazine, the Grebe. Appendix 5 shows the newspaper articles published about the project. Project pages were created and hosted on Cheshire Wildlife Trust's website detailing the project and how to get involved.

To engage with the local community a number of guided walks and talks to community groups have been carried out as part of the Delamere's Dragons project. Since April 2014 18 guided dragonfly and mossland walks have engaged over 200 people. Fourteen took place in Delamere Forest, one at a Cheshire Wildlife Trust Delamere mossland reserve, two at Bickley Hall Farm and one on Fenn's and Whixall Moss. Fourteen project talks have been given to community groups and at conferences, including local Women's Institutes, wildlife groups, National Nature Reserve managers and a British Dragonfly Society AGM. A talk and display at a Staffordshire invertebrate science fair also helped increase volunteer support at the Staffordshire donor site, Chartley Moss. A scientific poster presentation was given at an international peatland conference, 'In the Bog', held in Sheffield during September 2014.

There were guided walks in Delamere in conjunction with local businesses, linking in with Delamere Café and with veterans working for a company called Executive Solutions.

The Wildlife Trust movement promotes 30 days wild throughout the month of June every year in order to encourage people to get out and explore their local wildlife. In 2016 the project organised an activity week in Delamere as part of 30 days wild which included art on a mossland, a photography course, guided walks, children's dragonfly making and liaising with local schools.

An ITV film crew filmed a piece for their Countrywise program about the white-faced darter reintroduction and mossland restoration in Delamere which was aired in November 2015. In 2014 a short piece was aired by the BBC on BBC North West Tonight. A 10 minute interview was also given to BBC radio Manchester at 8:00 am on 17th July 2017.

In partnership with the Sandstone Ridge Trust, Cheshire West & Chester Council, the Meres and Mosses of the Marches Nature Improvement Area and the Earth Skills project there was a 3 day public event and sponsored walk in aid of the white-faced darter and the 40th anniversary of the Sandstone Trail, a 38 mile walking route between Whitchurch and Frodsham, passing through Delamere. Following on from the event the project liaised with Cheshire West and Chester Council to put posters promoting the project in the information boards along the Sandstone Trail. The information boards were installed several years ago through the HLF funded Habitats and Hillforts Landscape Partnership Scheme. CWT has attended three large scale meres and mosses focussed 'MereFest' events with the purpose of raising awareness of the white-faced darter and Delamere's mosslands within the meres and mosses landscape.

In the early stages of the project a local graphics student and an art student worked to successfully produce artwork which was used as an aid for interpretation of the Delamere mossland landscape and to inspire people to appreciate nature in Delamere. More recently the project linked up with Hazel Thompson, a local artist painting Delamere Forest and its habitats throughout the seasons from Autumn 2016 to Autumn 2017. Hazel's art has been influenced by what she learnt through the Delamere's Dragons project and the exhibition will include information on the conservation work in Delamere.

To complement the array of interpretation boards, project literature and poster displays a simple trail was created through Delamere Forest. It takes people past the two interpretation boards and some of the attractive mossland pools to encourage visitors to enjoy the varied habitats found in the forest.

In February 2017 the project held an event for volunteers and project partners entitled 'The Story So Far'. The aim was to explain the background to the Delamere's Dragons project, what it had achieved and what the future plans were for the white-faced darter reintroduction monitoring. The event also helped supply information for the project evaluation as we investigated people's thoughts about the project and what it had achieved.

2.2.5 Conservation excellence

The Delamere's Dragons project has been recognised nationally as delivering high profile and important conservation work. Invited by journal editors, specialist articles have been published in Conservation Land Management, focussing on the habitat restoration carried out through Delamere Forest for the white-faced darter, and in the British Dragonfly Society Journal, focussing on the habitat and emergence preferences of the white-faced darter dragonfly as well as notes on the reintroduction attempt. A case study about the project was also included in the 2016 State of Nature: England report.

In June 2017 it was announced that the conservation and community engagement work in Delamere, delivered through this project and its sister project, focussed on mossland habitat restoration funded by WREN, had won a prestigious award from the Chartered Institute of Ecology and Environmental Management (CIEEM). The Delamere Landscape work won the award for Best Practice - Large-Scale Practical Nature Conservation.

2.3 Growing a meres and mosses community and integrating dragonflies in to the visitor economy of Delamere Forest

2.3.1 Working with local business

Background research and scoping was undertaken to inform the approach to engaging with local businesses. This included visiting the Director of Nurture Lakeland, a Cumbrian organisation linking tourism businesses and conservation, to learn about best practise and lessons learnt in setting up visitor giving schemes. An audience development plan was generated to prioritise the businesses which would be contacted based upon their green credentials, locality to Delamere and type of business.

When the Delamere's Dragons project was created Forest Holidays had been successful in getting local authority planning approval for over 70 lodges within Delamere Forest. One of the aims of the project was to work with Forest Holidays on integrating visitors and the wildlife in Delamere, seeking ways they could financially help local conservation work through visitor giving. After an appeal the planning application was rejected by the Secretary of State for the Environment in December 2014. In August 2016 Forest Holidays resubmitted the application with amendments. In April 2017 the application was again turned down, this time by the local authority.

As no forest lodges were to be built within Delamere Forest, early on in the project effort was directed into seeking opportunities with other local businesses. A variety of businesses were approached resulting in varying degrees of success.

Local businesses contacted ranged from local farm shops and camping sites to local breweries, hotels and outdoor pursuits. Project staff met with the Director of Peckforton Hills Spring Water who was interested in the project and offered free bottles of water for large project events.

Local outdoor activity businesses proved successful in engaging with the project. Go Ape, Delamere Fitness and Forest Explorers got involved and staff from the businesses attended learning sessions about the meres and mosses in Delamere Forest. Inspired from that they went on to advertise the conservation work and ways to get involved. Delamere Fitness took their clients around the mosses on organised runs and Forest Explorers learnt about the meres and mosses and integrated it in to their regular children's activities. A local Nordic walking group was also inspired by the project and people from the group went on to attend Delamere's Dragons events. Brooks HellRunner series organise a unique off road running experience in Delamere Forest every year. They worked with the project providing promotion to the conservation work locally and financial support through bookings from runners. The unique and high profile nature of HellRunner enabled the project to reach a different audience and user group of Delamere.

Delamere Café, situated in the heart of the visitor centre at Delamere Forest supported the project and produced and sold dragonfly shaped biscuits. The project received 30p from every pack of biscuits sold. Project posters and information were available inside the café, alongside donation boxes, there were even fun dragonfly facts printed on each biscuit pack.

The Delamere's Lost Mosses project, which complimented this project and focussed on mossland habitat management, began making charcoal from the silver birch scrub taken down as part of the process of restoring the Mosses. This project took the bags of charcoal and sold them through a variety of avenues including local farm shops, at events and to regular volunteers. It proved to be another way of helping people understand what's involved in conserving the unique mossland habitats.

Local businesses which were part of national franchises, such as the Camping and Caravanning Club which has two sites in Delamere, and hotels, presented a challenge for local visitor giving schemes. Decisions about involvement in any visitor giving schemes needed to be discussed and agreed with the national office, however getting the national offices engaged proved time consuming. Locally the businesses were able to help promote the project.

Delamere Dairy, a national supplier of speciality cow and goat milk products celebrated their 30th year of trading in 2015. The company wanted to do something local, where they had started out, to

celebrate their anniversary. They teamed up with the project and supported the upgrade of a nature trail around Hatchmere, adjacent to Delamere Forest. Hatchmere is one of the core meres and mosses sites within the Delamere landscape, nationally designated for its habitats and dragonfly assemblage. The trail provides a way-marked walk around the mere and interpretation boards promote the meres and mosses and the species which rely upon them including dragonflies. Extensive publicity of the nature trail included articles in CWT's magazine, The Grebe, and other press releases. The story of the trail and the importance of meres and mosses was printed on 500,000 packs of goat's milk and sold nationally through popular retail stores.

Through a HLF LPS funded meres and mosses project led by Shropshire Wildlife Trust, the concept and development of a Meres and Mosses Business Environment Network began in 2014. The Delamere's Dragons project enabled staff time to help the development of this network into the meres and mosses landscape of Cheshire. CWT sits on the Network's Steering Group and provide advice and support in relation to activity and promotion in Cheshire.

2.3.2 Working with local communities

The Delamere's Dragons project has supported and engaged local communities as well as businesses. The project was successful in influencing local plans and embedding the importance of the meres and mosses in them. Advice was provided to the Norley Parish Wildlife Group in the development of their Neighbourhood Plan. The parish of Norley includes three important meres and mosses wildlife sites so it was important that the national significance of the habitats was recognised within the local plan. Norley Wildlife Group continued engaging with the project, supporting mossland habitat management, wildlife surveys, local events and raising awareness of local wildlife. Other local plans that were influenced included the Delamere and Oakmere Community Led Planning Framework and the Manley Neighbourhood Plan.

There are five Parish Councils which cover the core area of current conservation focus in Delamere. Each have engaged with the project and have provided financial support. The project has developed a relationship with each of the parishes resulting in the parish magazines providing project updates and information to their constituents raising the profile of local conservation work.

Volunteers recruited through this project and the Delamere's Lost Mosses project now take the form of a local Delamere volunteer group which meets regularly. Through this new group friendships have been made and links to local schools and colleges as younger volunteers seek work experience with the Delamere conservation projects. Before the project there were no volunteering opportunities in Delamere Forest. The Forestry Commission have commented on how helpful this project and the Delamere's Lost Mosses project were in capitalising on the enthusiasm of people wanting to volunteer in Delamere.

2.3.3 Delamere Forest

Delamere Forest is at the centre of the dragonfly and mossland habitat work in Delamere; as a publically accessible site with good visitor infrastructure and plenty of things to do it is ideal for helping promote that work. Go Ape and Delamere Café sit within the forest and alongside working with them the Delamere's Dragons project worked with the Forestry Commission in relation to onsite

interpretation and project promotion. Delamere Fitness and Forest Explorers were other businesses which rely upon the availability, access and infrastructure of Delamere Forest.

A new waymarked trail was installed around the forest which provides a self-led walk taking in some of the best mosslands for dragonflies. The trail encompasses both Black Lake and Doolittle Moss where two new interpretation boards provide information about dragonflies, other mossland species and their habitats. The mossland leaflet developed as part of the project helps provide additional information on the unique meres and mosses found in the forest and where to go and see the mosses for themselves.

Posters encouraging people to get involved were displayed in noticeboards and project information was provided in the Forestry Commission's Delamere Discovery Pass leaflet. Events at Delamere Forest such as the Sandstone Trail 40th anniversary and frequent low key dragonfly activity days or volunteer survey days have helped boost local awareness about the project.

Delamere Forest is widely regarded as important for Cheshire for its woodland resource, therefore it was very important that any promotional material in relation to the under-promoted meres and mosses really stood out. A brand was developed for any Delamere focussed promotional literature to provide consistency and recognition of the local meres and mosses conservation work done by Cheshire Wildlife Trust and its partners. The brand encompassed the theme of dragonflies and mosslands and was in keeping with Cheshire Wildlife Trust's current brand identity as well as working in harmony within Delamere's natural landscape surroundings.

In 2015 the Forestry Commission updated the Delamere Forest Design Plan. The main objectives for the Forest Plan were the continued production of commercial conifers and broadleaves balanced with the provision of informal recreation, the restoration of former ancient woodland sites, managing the forest for biodiversity and making the economic potential of the forest more resilient in the face of a changing climate, pests and diseases. The plan detailed management operations including felling and restocking for the next 10 years with outline proposals for the next 50 years. The Delamere mossland projects not only helped raise the profile of the meres and mosses in the local community but also within the Forestry Commission including its national office. The Forestry Commission liaised with Cheshire Wildlife Trust on how best to incorporate the management of the meres and mosses and the white-faced darter dragonfly needs within the Forest Plan ensuring a legacy for the project.

Acknowledgements

The Delamere's Dragons project is generously funded by:

- Heritage Lottery Fund;
- Linley Shaw Foundation;
- John Spedan Lewis Foundation.

We would also like to thank the following partners who have contributed support to the project:

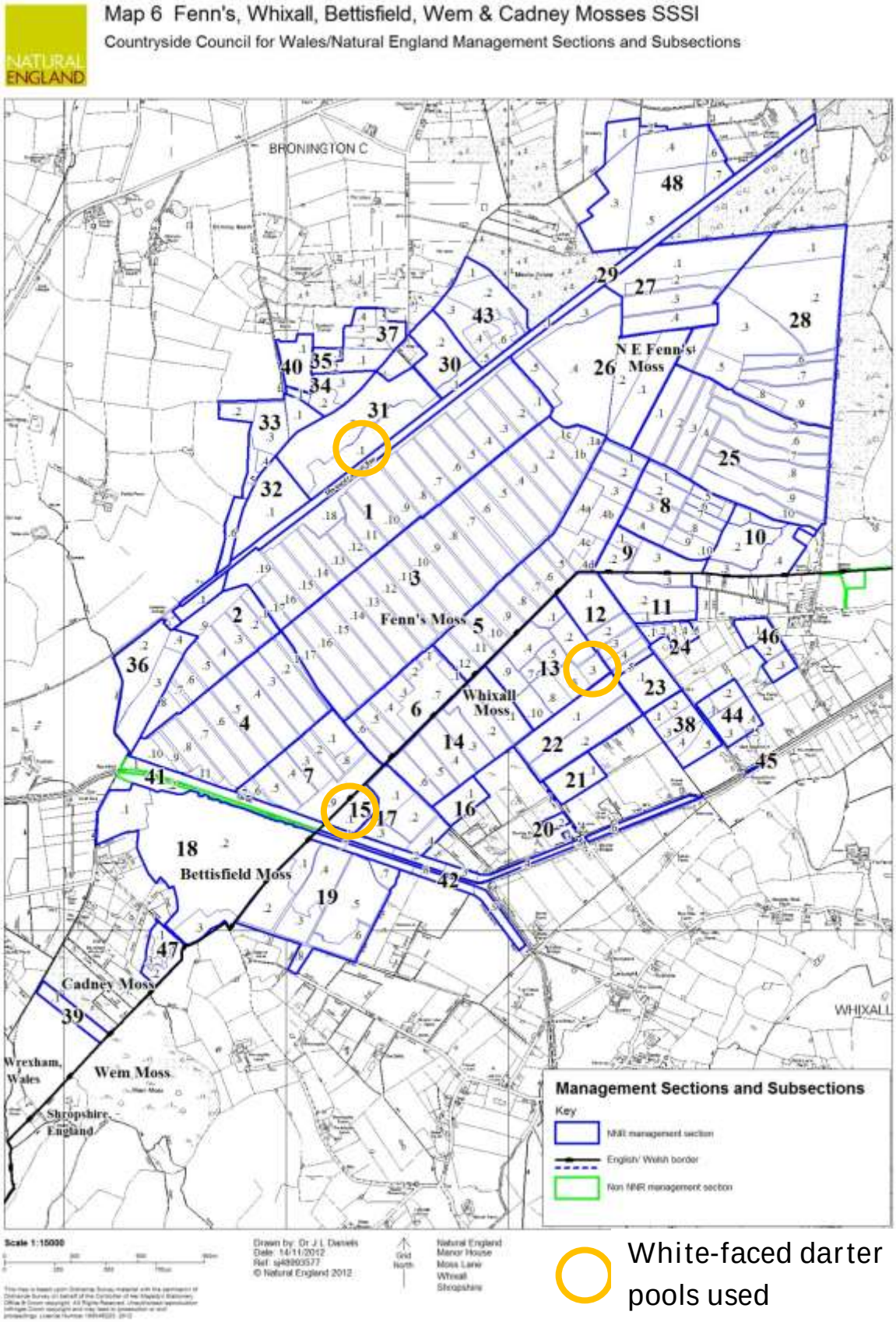
- Forestry Commission
- Natural England

- British Dragonfly Society
- White-faced Darter Reintroduction Steering Group
- Delamere Dairy
- Befesa Salt Slags Ltd
- Delamere Café
- Cheshire West and Chester Council
- Delamere Fitness
- GoApe
- Forest Hills Hotel
- Delamere Caravan club
- Fishpool Caravan Park
- Cotebrook Shire Horse Centre
- The Sandstone Ridge Trust
- Earth Skills Project

Finally, many thanks to our project volunteers and trainees who have devoted a large amount of their time to assist with survey work, events and keeping a watchful eye on the white-faced darters of Delamere.

Appendices

Appendix 1. Location of pools at Fenn's & Whixall Moss and at Chartley Moss



Chartley Moss

White-faced darter pools used

Appendix 2. Full transect methodology

Dragonfly transect count information

It is important that dragonflies are counted along the same transect route each year using the same standardised method.

Make at least **fortnightly** visits between May 1st and September 17th for all species transects.

Try to spread out the counts evenly over the counting period. Weekly counts should be at least three days apart, fortnightly counts at least a week apart.

If a count cannot be made in any of the required periods, make two counts in the following period. When you know in advance that you will not be able to do a count, it is acceptable to count twice in the previous period or to ask someone else to do your count for you. Try to avoid missing a count completely.

Counts should only be carried out when most dragonflies are active, using the following guidelines:

- Counts should be carried out between 10:00 and 16:00. On hot days (above 22°C), counts between 09:30 and 16:30 are permissible.
- Count during sunny weather, with cloud cover <60%.
- Do not count if the wind is stronger than force 4 on the Beaufort scale (i.e. >18 mph, when small trees in leaf begin to sway).
- The temperature should be at least 17°C in the shade. On sunny, calm days, counts may be made at a slightly lower temperature, but never lower than 15°C.
- Do not count during rain, or when the temperature exceeds 30°C.

Counting dragonflies

Walk slowly. Occasional stops to scan with binoculars may be helpful. Sometimes it may be difficult to identify and count all dragonflies during a single transect walk. If so, walk the transect once, counting the damselflies and darters, then again to count the other larger dragonflies.

Count all the individuals seen within a 5m box of you. Try pacing out 5 paces from a tree and look back to give you an idea of the distance. The zone over the water includes the emergent plant zone.

Access should be relatively easy for all sections of all transects but if it is not possible to record within the5 m zone for some or all of the transect, the distances may be varied to ensure that reasonable numbers are counted. If access to the water's edge is limited, do **fixed point counts** from suitable vantage points at least 10 m apart; each count should last at least 1 minute and not more than 5 minutes. In all cases it is **essential** that the route and position of fixed point counts are recorded so that **all** subsequent counts are made in the same way.

Count all individual adults. A pair in tandem or mating counts as two individuals.

Try to identify the species on sight; close-focus binoculars will help. This causes less disturbance and saves time. If necessary, return later and catch some individuals to confirm identity.

Some females, tenerals and species groups, notably blue damselflies, are difficult to identify. If you are unsure, count all individuals then return, catch and identify a number at random (ideally 10-15) and then extrapolate. For example, if you counted 100 blue damselflies and caught 10 of which two were Common Blue and the rest Azure, you record 20 Common Blue Damselflies and 80 Azure Damselflies.

Counting can be difficult when dragonflies are very numerous. The following tips might be helpful:

1. When large numbers of damselflies are present, an exact count is not necessary. Try to make a sensible estimate.
2. When many individuals of, for example, Four-spotted Chaser (*Libellula quadrimaculata*) are patrolling, it can be difficult to keep track of the numbers. Divide the section into smaller parts and count the individuals present in each.

All species Transects

Use one form for each visit. Enter the total adult dragonflies counted in each section, entering a zero if there were none in a section counted and note all the different life stages seen. Please complete the form even if you record no dragonflies.

The form has space to enter the average temperature and wind speed (Beaufort Scale: 0 = smoke rises vertically; 1 = slight smoke drift; 2 = wind felt on face; 3 = leaves in slight motion) during the visit, and % cloud cover during each section.

Use the Notes box to describe the habitat state, any changes since the previous visit and any other factors that may have influenced the count, such as:

- Pondweed, sediment or ditch clearance
- Spread of invasive emergent plants
- Grazing or cutting of bankside vegetation
- Water level and clarity
- Flow rate
- Length or percentage of margin shaded by trees

Counting

- Please read the comprehensive notes supplied prior to your first count.
- Walk slowly, counting any that you can identify. Note down numbers and life stage. If less than 10, note down the exact number but when over 10, note in increments of 5 (eg 10+, 15+).
- Count and note distance in a strip ideally from 2 m inland to 5 m out from the bankside.

Can I count?	**10:00-16:00 BST**	**09:30-16:30**

Temperature	<15°C	15–17°C	17–22°C	Over 22°C	Over 30°C
Cloud >60%	No	No	Yes	Yes	No
Cloud <60%	No	Yes	Yes	Yes	No
Wind >force 4	No	No	No	No	No
Rain	No	No	No	No	No

All species Transects

Use one form for each visit. Enter the total adult dragonflies counted (excluding any newly emerged) in each section, entering a zero if there were none in a section counted. Please complete the form even if you record no dragonflies.

The form has space to enter the average temperature and wind speed (Beaufort Scale: 0 = smoke rises vertically; 1 = slight smoke drift; 2 = wind felt on face; 3 = leaves in slight motion) during the visit, and % cloud cover during each section.

Use the Notes box to describe the habitat state, any changes since the previous visit and any other factors that may have influenced the count, such as:

- Pondweed, sediment or ditch clearance
- Spread of invasive emergent plants
- Grazing or cutting of bankside vegetation
- Water level and clarity
- Flow rate
- Length or percentage of margin shaded by trees

Counting

- Please read the comprehensive notes supplied prior to your first count.
- Walk slowly, first counting damselflies and darters, then count the remaining species during a second walk of section 1a and 1b. Only count demoiselles and anisoptera (large dragonflies) in further sections.
- Do not count newly emerged individuals.
- Count and note distance in a strip ideally from 2 m inland to 5 m out from the bankside, or from fixed points where visibility is severely limited and note any identified species more than 5m away.

Can I count?	**10:00-16:00 BST**			**09:30-16:30**	
Temperature	<15°C	15–17°C	17–22°C	Over 22°C	Over 30°C
Cloud >60%	No	No	Yes	Yes	No
Cloud <60%	No	Yes	Yes	Yes	No
Wind >force 4	No	No	No	No	No
Rain	No	No	No	No	No

All records will also be submitted to the British Dragonfly Society national recording scheme.

Cheshire Wildlife Trust Bickley Hall Farm, Bickley, Malpas, Cheshire SY14 8EF.
Landline: 01948 820728 Registered Charity No. 214927.

Transect Name: **Recorder:**

Year: **Date:** **Average temp:** **Start:** **Finish:**

SECTION:	**1**	**2**	**3**	**4**	**5**	**TOTAL**	
Example:	**20+. T,A**	**1. Ex,T**	**3. A**	**25+. E,T**	**4. Ex,T**	**55+**	
Emerald Damselfly							Lestes sponsa
Azure Damselfly							Coenagrion puella
Variable Damselfly							Coenagrion
Red-eyed Damselfly							Erythromma najas
Large Red							Pyrrhosoma
Common Blue							Enallagma
Blue-tailed							Ischnura elegans
Southern Hawker							Aeshna cyanea
Brown Hawker							Aeshna grandis
Common Hawker							Aeshna juncea
Migrant Hawker							Aeshna mixta
Emperor Dragonfly							Anax imperator
Golden-ringed							Cordulegaster
Downy Emerald							Cordulia aenea
White-faced Darter							Leucorrhinia dubia
Broad-bodied							Libellula depressa
Four-spotted							Libellula
Black-tailed							Orthetrum
Black Darter							Sympetrum danae
Ruddy Darter							Sympetrum
Common Darter							Sympetrum
	1	**2**	**3**	**4**	**5**	**TOTAL**	**AVERAGE WIND SPEED (f0-3)**
% CLOUD COVER							

NOTES (e.g. any factors affecting count, changes since last visit in % cover of floating plants or algae, water level, flow rate, etc. and identified dragonflies over 5m away – species and distance and section)

Stages:Ex = exuvia, T = teneral, E = emerging, A = adult

Appendix 3. Volunteer trainee role descriptions

Appendix 4. Volunteer Trainee personal development summary.

Appendix 5: Newspaper publicity:

Newspaper articles for project April 2014 – September 2017.

Month	Date	Newspaper/publication	Subject	Headline
April	04.14	Welsh Border Life	White-faced darters	Dragon's den
May	21.05.14	Northwich Guardian	Delamere's Lost Mosses	Lost habitats at Delamere
June	04.06.14	Northwich Guardian	White-faced darters	Back feeling at home in forest
July	07.14	Cheshire Life	White-faced darters	Seeing the bog for the trees
July	03.07.14	Chester Chronicle	White-faced darters	Rare dragonfly to dart again in forest habitat
August	13.08.14	The Leader (Chester)	Graham Evans MP Visit	Forest hopes to get lost mosses back
August	13.08.14	Northwich Guardian	Graham Evans MP Visit	MP takes a look at the wild forest
August	13.08.14	The Leader (Wrexham)	Graham Evans MP Visit	Forest hopes to get lost mosses back
September	15.09.14	Chronicle Xtra	Graham Evans MP Visit	Forest regeneration project seen by MP
September	17.09.14	Northwich Guardian	Sandstone Trail/WFD	Trail's milestone celebrations
September	25.09.14	Chester Chronicle	White-faced darters	Family fun marks trail's milestone
October	01.10.14	Whitchurch Herald	Sandstone Trail/WFD	Pupils given a close-up of Bickley Hall's rare wildlife
October	09.10.14	Chester Chronicle	Sandstone Trail/WFD	40 years of Sandstone Trail
October	06.10.14	The Leader (Chester)	Sandstone Trail/WFD	Communities celebrate 40 years of Sandstone Trail
October	09.10.14	The Standard (Chester)	Sandstone Trail/WFD	Communities celebrate 40 years of Sandstone Trail
November	05.11.14	Northwich Guardian	Thermo Fisher @ Delamere	Team restores lost mosslands
December	03.12.14	Northwich Guardian	Rally for nature	Charities say nature must be on political agenda
December	11.12.14	The Standard (Chester)	Raising money for rare dragonfly	Eco-champs run through swamp for rare dragonfly
February	05.02.15	The Leader Wrexham	Meres and Mosses meeting	New inter county network gets down to business

February	04.02.15	Whitchurch Herald	Meres and mosses Meeting	New network gets down to business
March	11.03.15	Whitchurch Herald	Meres and Mosses	Meres and mosses Business Network proving successful
March	18.03015	Whitchurch Herald	The Common - Meres and Mosses play	Take a look at the future
March	04.03.15	Northwich Guardian	Environmental Secretary visit to Delamere	Secretary visits forest to learn about dragonfly reintroduction plan
May	04.05.15	The Leader Chester	Rare Butterfly	Butterfly in rare forest appearance
May	07.05.15	The Standard (Ellesmere Port)	Rare Butterfly	Butterfly in rare forest appearance
May	06.05.15	Northwich Guardian	Butterfly	Rare declining butterfly spotted at nature reserve for the first time in history
May	02.05.15	Northwich Guardian	Butterfly	Rare Butterfly spotted at Delamere
May	06.05.15	www.so-cheshire.co.uk	Green hairstreak Butterfly	Butterfly spotted at Cheshire's Black Lake Nature reserve
August	12.08.15	Ellesmere Port Pioneer	Delemere Forest	The Guide
September	10.09.15	Middleton Guardian	Photographing butterflies and dragonflies	All of a flutter over close-ups
September	11.09.15	Accrington Observer	Photographing butterflies and dragonflies	All of a flutter over close-ups
September	11.09.15	Rossendale Free Press	Photographing butterflies and dragonflies	All of a flutter over close-ups
September	10.09.15	Heywood Advertiser	Photographing butterflies and dragonflies	All of a flutter over close-ups
September	09.09.15	Macclesfield Express	Photographing butterflies and dragonflies	All of a flutter over close-ups
September	09.09.15	Rochdale Observer	Photographing butterflies and dragonflies	All of a flutter over close-ups
October	28.10.15	The Leader (Chester)	Delamere Forest	Forests starring role in TV Country Show
October	29.10.15	The Standard (Chester and District)	Delamere Forest	Forests starring role on TV Country Show
November	04.11.15	Northwich Guardian	Countrywise	Project at forest hits screens
January	21.01.16	Runcorn Weekly News	Delamere Dairy	Lakes spotlight on nature

January	20.01.16	Knutsford Guardian	Delamere Dairy	Firm teams up with trust to give nature trail boost
February	01.02.16	South Warrington News	Delamere	Dairy teams up to lay down a nature trail
June	15.06.16	Northwich Guardian	White-faced darter	Bid to reintroduce rare dragonfly to wetlands
June	20.06.16	The Leader (Chester)	Rare Dragonfly	Rare dragonfly project takes flight in forest
June	20.06.16	The Leader (Wrexham)	Rare Dragonfly	Rare dragonfly project takes flight in forest
June	23.06.16	The Standard (Chester and District)	Dragonfly	Dragonfly mission takes flight in forest
June	29.06.16	Northwich Guardian	Delamere	Village Wildlife volunteers dig in to reintroduce wetland mossland dragonfly
July	22.07.16	The Guardian	Delamere	Country Diary Delamere Forest Cheshire
April	18.04.17	Chester Leader	Best Practice Award	Forest's mossland project is nominated for national award
April	20.04.17	Northwich Guardian	Best Practice Award	Delamere Mossland Project shortlisted for national award
April	20.04.17	Ellesmere Port Standard	Best Practice Award	Forest's mossland project is nominated for national award
June	14.06.17	Wrexham Leader	White-faced darter	Delamere darters' are appearing in the forest
June	14.06.17	Whitchurch Herald	White-faced darter	Dragonfly project is significant success
June	14.06.17	Chester Leader	White-faced darter	Delamere darters are appearing in the forest
June	15.06.17	Chester Standard	White-faced darter	Delamere darters are appearing in the forest
June	22.06.17	Knutsford Guardian	White-faced darter	White-faced darter arrives in Cheshire
June	22.06.17	Northwich Guardian	White-faced darter	White-faced darter arrives in Cheshire
July	06.07.17	Congleton Chronicle	CIEEM Award	Project wins best practice award
July	07.07.17	Chester Chronicle	White-faced darter	Rare dragonfly species has been spotted in Delamere Forest
July	18.07.17	Northwich Guardian	CIEEM Award	Delamere Mossland Project recognised with national award
July	20.07.17	Northwich Guardian	CIEEM Award	Hard work pays off as Delamere Mossland Project receives national award