

North West Brown Hare Project

Final Report – January 2013



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Executive Summary

The brown hare has suffered a 75% decline in England since the 1960's (Game & Wildlife Conservation Trust). The significant decline in the UK population subsequently led to it being designated a UK BAP priority species in 1994. The substantial decline is due partly to changes in land management and agricultural intensification, but also from poaching and illegal coursing (Hutchings & Harris 1996, Cowan 2004). One key problem facing the brown hare in the region is the lack of systematically collected and analysed data. Further development of the monitoring undertaken in the region would inform current density/ distribution information and any reliable action to increase the status of brown hare. The Tracking Mammals Partnership has identified the North West as having a significant decline in brown hare populations between 1995-2007, making it an important area to focus efforts and help build a coherent, sustainable landscape-scale ecological network for the conservation of brown hares.

Project Outputs – Training

- Over the period of the project 15 training events were delivered, which equates to approximately 300 people taking part in training on brown hare ecology and surveying techniques.

Project Outputs – Hare records

The North West Brown Hare Project (NWBHP) brought together 2969 individual records of one or more brown hare being sighted between 1991 and 2010.

- During the time of the project, between Jan 2010 and Dec 2012, 343 volunteer recorders sent in 1417 individual records of one or more brown hare being sighted via the project's website or the local record centres. In the two years that the project has been running, there has been a 48% increase in the number of brown hare compared with the previous 20 years.

Project Outputs – North West Brown Hare Project (NWBHP) Survey

- In total 418 transects were completed over the duration of the project. This breaks down to 134 in Spring 2011, 46 in Autumn 2011 and 152 in Spring 2012. A further 86 surveys were organised for the rest of Lancashire by The Wildlife Trust for Lancashire, Manchester and North Merseyside, (LWT). Within the project area volunteers walked 1,159 kms, which is the same distance as a trip from Blackpool to Munich, as the crow flies.

NWBHP findings and legacy

A set of baseline data stratified against a measurable landscape scale is now in place. While it is too early to see any trends in population gains or losses, the survey has provided a much more comprehensive picture of hare distribution within the survey area. The work completed in 2011 and 2012 will mean that future surveys will be easier for volunteers to complete, can be repeated year on year with little time or cost to the organiser and cover a wide geographical area. Surveys by different organisations can now be compared with greater ease through the use of a common stratification using broad landscape characters.

Based on survey data from the NWBHP survey and the British Trust for Ornithology's Breeding Bird Survey,(BTO BBS) data, the population of brown hare within the project area has been stable over the last 16 years. However there are marked differences in the presence and absence of brown hares within the project area and the initiatives that are taking place across the varying landscapes.

- In 2011 over the whole project area, the density of brown hares calculated by total number of hares observed per 1km² surveyed was 1.77 Hares/km², while the estimated density (per km²) calculated by *DISTANCE*(D) was 2.06 (Lower confidence limit,(LCL) of 1.74 & Upper confidence limit (UCL) of 2.45).
- In 2012 1.42 hares were observed per each 1 km² surveyed, yet the *DISTANCE* calculations produced a density estimate of 3.88 hares per km² (LCL 3.43 & UCL 4.38).
- Wetland (former mossland) landscapes that have mostly been converted to arable agriculture and make up large parts of Merseyside and South Lancashire, produced the largest density estimates in 2011 (4.3 hares/km²) and 2012 (7.77 hares/km²). Assuming that the 2012 figures are more accurate, this density estimate is slightly higher than Hutching and Harris 7.12 km² density estimate for arable areas. Wetland landscapes also produced the most hare sightings in the BTO BBS data.
- Because records were so low for moorland landscapes in the 2011 and 2012 surveys, *DISTANCE* estimates were not possible. The lack of sightings on moorland shows that this landscape was the least favourable habitat for brown hares and coincides with the BTO BBS figures.
- The Manchester Mosses area, that straddles Wigan and Salford, is the main stronghold for brown hare in Greater Manchester. There are also small populations around the Pennine fringe areas of the West Pennine Moors and the South Pennines.
- South Lancashire and Merseyside hare strongholds seem to be in the arable former wetland/mossland and flat sandy farmed landscapes, as described in the North West Landscape Character Framework (Porter et al, 2009).

Wetland (Mosslands) and Sandy Farmland, which currently have the highest densities of hares in the project area, also have the most conservation effort directed to them.

One of the best ways to improve farmland habitat for brown hares is to increase the take up of entry level and higher level stewardship.

It could be argued that these are the areas that should receive the least amount of focus, as brown hares can be found in good numbers here already. In Britain there is greater potential to increase hare numbers in pastoral landscapes than in arable landscape. Agri-environment schemes should target the regeneration of heterogeneity in pastoral landscapes, by encouraging changes such as an increase in fallow land and a reduction in livestock density (Smith 2004).

Conversely, pastoral areas are seen as sub optimal for brown hares and it could be better to focus resources into other areas, especially when there is a population of mountain hare in the South Pennines that could be considered a higher priority in that region.

What is apparent from the records and is often over looked when discussing the reasons for hare decline, is the number of historic brown hare records that would now be recorded in built up areas. Changes in land management by farmers is often cited as the major cause of brown hare decline, yet habitat loss and fragmentation due to residential, commercial or industrial development is often over looked.

The NWBHP project will continue to operate through the Lancashire and Greater Manchester Mammal Group, which was set up at roughly the same time. The continuing aim of the project will be to develop an ongoing annual survey that will highlight trends in brown hare numbers across the project area and beyond into the rest of Lancashire.

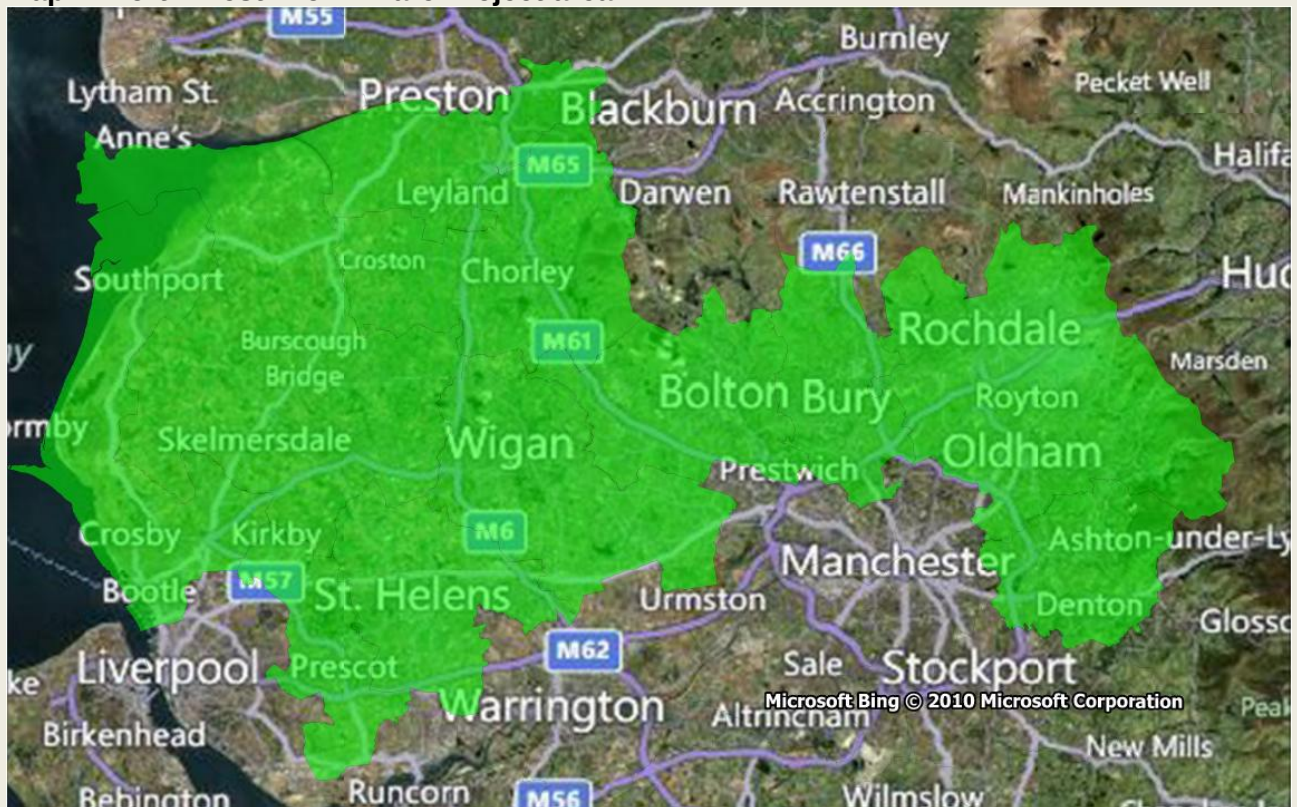
1.0 Introduction

1.1 Project Overview

The North West Brown Hare Project (NWBHP) aimed to improve our understanding of the brown hare population and distribution within Greater Manchester, North Merseyside and South Lancashire. The goal over the two years of the project was to highlight isolated or fragmented populations, helping to link up or expand populations into areas where they are absent and deliver landscape scale benefits to farmland biodiversity. The project was to directly inform the Greater Manchester, Lancashire and North Merseyside Biodiversity Action Plans (BAP) (Waymont, 2003, Ashley, 2007, Rogers, 2008). Information relating to BAPs is still quoted in planning cases and the baseline data provided by the NWBHP will serve to underpin and reinforce BAP targets.

1.2 Project Location

Map 1: North West Brown Hare Project area



The project area encompasses several broad but distinct geographical areas. The north and east of Greater Manchester are made up of the Southern Pennines, West Pennine Moors and the

Pennine fringe. Predominately pastoral, there are densely urbanised mill towns set within strongly enclosed valleys which contrast with the open moorland and in-bye land.

To the east of Greater Manchester and into South Lancashire, the Mersey Valley and Lancashire Coal Measures take over. They include open, flat, large scale farmland, some derived from improved/drained moss land, which supports mixed agriculture with little woodland cover. The Coal Measures' farmland has a weak vegetation structure and much of the area has been settled and developed.

Moving further into North Merseyside and South Lancashire are the West Lancashire Plains. Drained mosses now comprise of ordered fields divided by drainage channels with few hedgerows and trees. Finally, to the west, the Sefton Coast is characterised by intertidal sands and silts, dune systems, coastal heath and is backed by arable farmland (Porter et al., 2009).

1.3 Summary of the project aims

The success of the project was measured against a specific number of aims put in place at the outset of the project. A summary of how these aims were met can be found in section 10.0. The project aims were:

- To collate and analyse current data to identify survey areas.
- Provide training of volunteers to carry out surveys.
- Promote the project to landowners to encourage them to get involved and liaise with landowners to obtain permission to survey.
- Analyse survey data to identify areas for habitat management, work with project partners to liaise with landowners to bring these areas into positive management.
- To promote best practice for habitat management by creating 'demonstration sites'.
- Hold best practice events for landowners to promote positive management, this could be combined with other organisations such as FWAG, Natural England (LMAS/ADAS), RSPB and the Environment Agency.

- To promote wider use of the NWBHP website for record submission www.brownhare.org.uk.

2.0 Current status of brown hare in the South Lancashire, North Merseyside and Greater Manchester.

The Mammal Tracking Partnership has published the most up to date information on brown hare numbers, at a country wide level. They have observed a 37% increase in hare numbers over 25 years and somewhere between a 3% to 19% increase over 10 years. However, these figures are not seen to be statistically significant and trends are unclear (Anon, 2009).

In the North West region, national game bag records have shown a 33% decrease in the index of game bag densities between 1995 and 2008. However, caution is required as 95% confidence intervals show that this figure could range anywhere between an 89% decrease to a 148% increase (Davey et al., 2010). The habitat management that takes place across game estates is unique to these areas and may not give a true representation of the area as a whole. From anecdotal information, game bag densities may have decreased because of a reluctance by hunters to shoot hares, due to their perceived decrease in numbers.

Within the NWBHP project area, there have been two recent volunteer 1km² transect surveys run by Merseyside Biobank (MBB) between 2008 to 2010 and The Wildlife Trust for Lancashire, North Merseyside and Manchester (LWT) in 2002, 2003, 2005, 2006 and 2008. These surveys provide the most recent indication of hare densities and distribution across Lancashire and North Merseyside.

In order to compare the same geographic areas that were surveyed between 2002 and 2010, figures from the 2011 and 2012 NWBHP brown hare surveys have been compiled for just North Merseyside and for the whole of Lancashire.

2.1 Merseyside BioBank (MBB) and The Wildlife Trust for Lancashire, Manchester and North Merseyside (LWT) historic survey data

Survey results in Lancashire (excluding Greater Manchester) ranged from 7 Hares/km² in 2008 to a low of 2.25 Hares/km² in 2005, with a total mean average of 4.81 Hares/km² over 7 annual surveys completed between 2002 and 2012. The most recent 2012 survey produced a figure of 3.58 hares/km², which is slightly down on the total mean average (Table 1). The standard deviation from the mean was 1.63.

Table 1: Estimated brown hare densities for Lancashire

Lancashire* & North West Brown Hare Project Survey (Lancashire excluding Greater Manchester)**		
Year	Hares/km ²	DISTANCE Density (D)
2012**	3.58	Outside NWBHP remit***
2011**	4.18	Outside NWBHP remit***
2010*	Not completed	Not completed
2009*	Not completed	Not completed
2008*	7.00	Outside NWBHP remit***
2006*	6.29	5.69(D)
2005*	2.25	2.56 (D)
2003*	4.9	5.56 (D)
2002*	5.47	7.54(D)

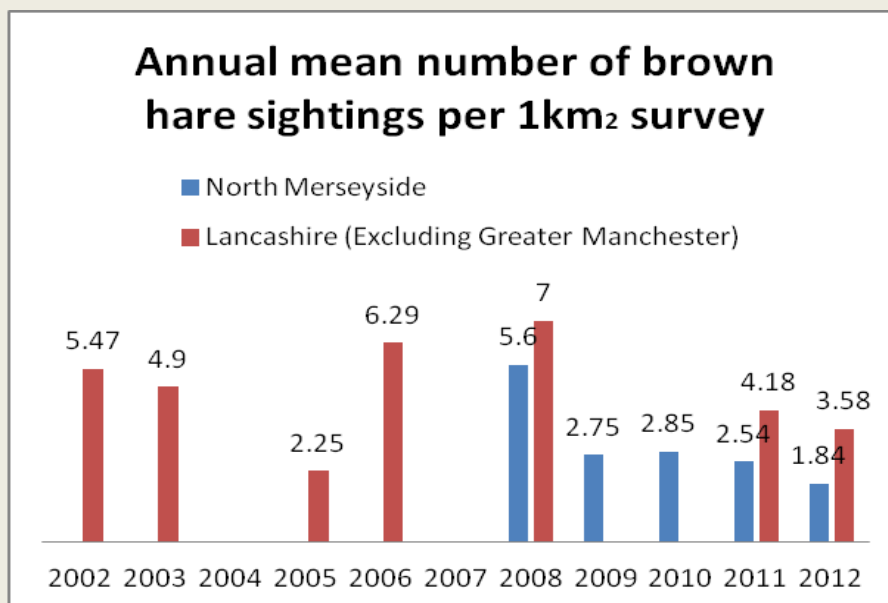
*** The distance measurements for North Lancashire have been recorded, but producing DISTANCE analysis for North Lancashire was outside of the projects remit and will hopefully be calculated at a later date.

Mean annual hare sightings per 1 km² surveyed for Merseyside ranged from 5.6 Hares/km² in 2008 to a low of 1.84 Hares/km² in 2012, with a total mean average of 3.12 Hares/km² over 5 annual surveys between 2008 and 2012. The standard deviation from the mean was 1.44. The current trend, from 2008 to 2012, seems to indicate that there is an ongoing gradual decrease in brown hare numbers in Merseyside. Continued monitoring is required to see if this becomes a long term trend.

Table 2: Estimated brown hare densities for North Merseyside (Mean annual hares/km²)

Merseyside Biobank* & North West Brown Hare Project Survey (North Merseyside only)**		
Year	Hares/km ²	
2012**	1.84	
2011**	2.54	
2010*	2.85	
2009*	2.75	
2008*	5.6	

Chart 1: LWT, MBB and NWBHP brown hare surveys – Mean annual hares/km²



Both surveys have been useful in identifying potential populations, however there is not enough year on year data to infer any long term trends in brown hare densities within each of these areas. Future surveys should ensure that the 1km² transect maps issued for these two surveys are completed before any other transects, in order for MBB's and LWT's historic results to be more comparable with the current set of survey data.

2.2 British Trust for Ornithology (BTO) Breeding Bird Survey (BBS) Mammal Data

The British Trust for Ornithology (BTO) Breeding Bird Survey (BBS) provides independent data on trends in UK bird abundance, part of this survey includes the recording of mammals. The BTO BBS has taken place continually since 1995, providing 16 years of comparable hare data from surveyors. It is conducted twice a year, at any time between 6am and 9am, once between 1st April and mid May and the second between mid May and the end of June (BTO, 2011). Until now only figures for hare numbers in the North West have been assessed, however the NWBHP has assessed the data for North Merseyside, Greater Manchester and South Lancashire.

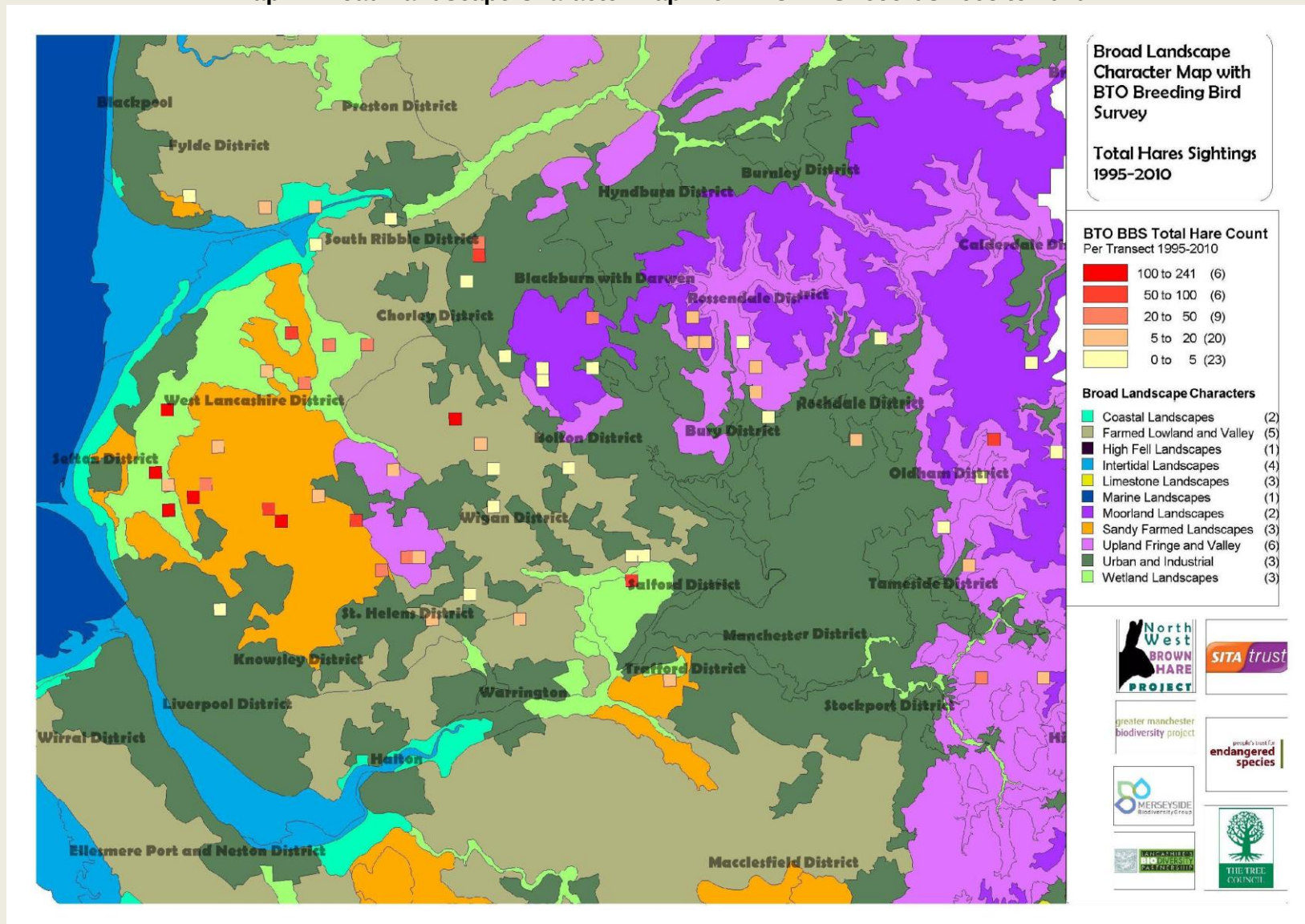
Data for the NWBHP area was kindly provided by the BTO. It should be noted that data for 2001 has been omitted due to a lack of data, owing to foot-and-mouth disease and a subsequent lack of survey effort.

It should also be noted that only positive records have been provided and BBS transects with no hare sightings have not been provided, meaning that the figures provided are higher than they would be if negative surveys were also taken into account. Because of this, it is difficult to compare the BTO data with that from the NWBHP surveys.

Because the main purpose of the BBS is to survey for birds, it is likely that some recorders will not record hares that they see or they will not be actively looking for hares in the same way as volunteers completing the NWBHP survey.

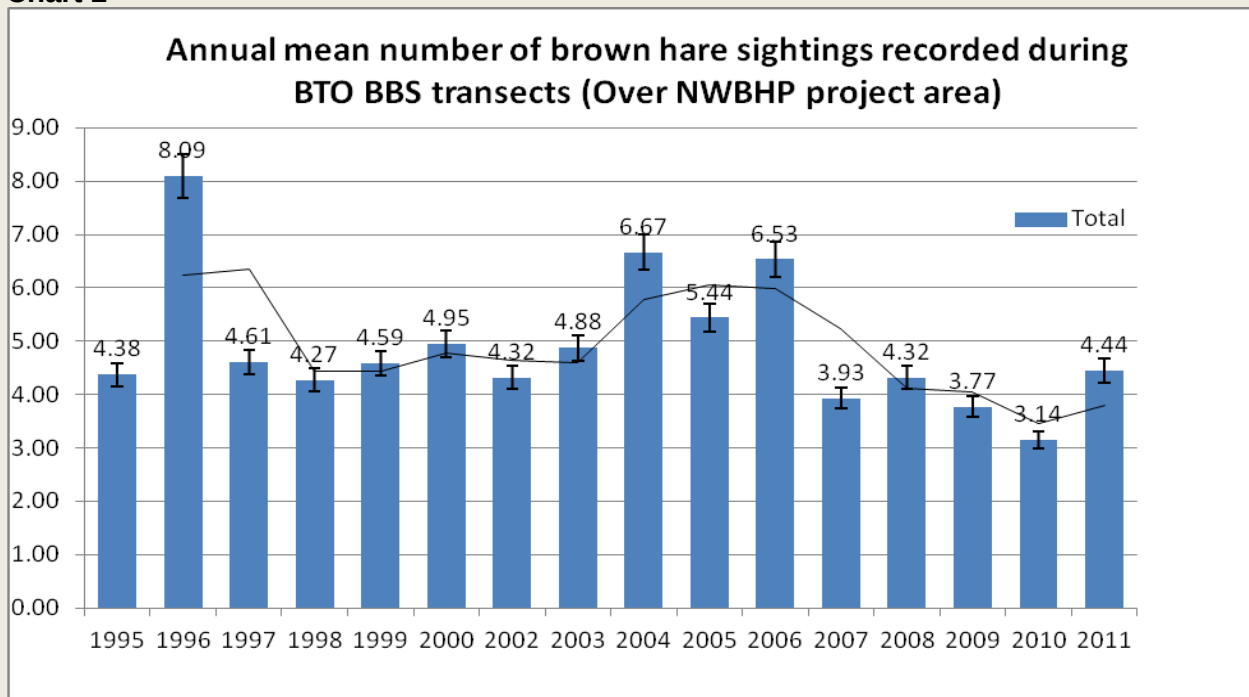
Over the 16 years of the BTO BBS survey, mean annual hare sightings stand at 4.9 hares per transect over two visits within the NWBHP area. While trends indicate that there may have been a slight decrease in hare sightings during this period, a greater period of time needs to pass before this trend can be confirmed. Figures from 2011 recorded 4.44 hares per transect, which is slightly above the results from the initial 1995 figures (see chart 2).

Map 2: Broad Landscape Character Map with BTO BBS records 1995 to 2010



There have been some spikes in the annual mean number of sightings. Schmidt et al., (2004) showed that mild winters were beneficial to European brown hares. Met Office data for annual mean winter temperatures and annual rainfall for North West England and North Wales were compared against annual variations in brown hare survey sightings. However, statistical analysis showed that there is no significant correlation between either data set (Burkmar, per comms – See chart 3).

Chart 2



Other than two peaks in 1996 and 2006, brown hare sightings in South Lancashire have broadly stayed the same (see chart 4). 2011's figure of 94 sightings was higher than the total mean average of 79.88. The rise from 44 sightings in 2002 up to a peak of 153 in 2006 may be explained by the introduction of Arable Stewardship. Arable Stewardship was the first phase of what is now Entry Level and Higher Level Environmental Stewardship, which pays farmers to carry out habitat alterations on their land for the benefit of wildlife. The large decrease after 2006 may be due to the land reaching its carrying capacity, with a crash in the population as a result.

Chart 3

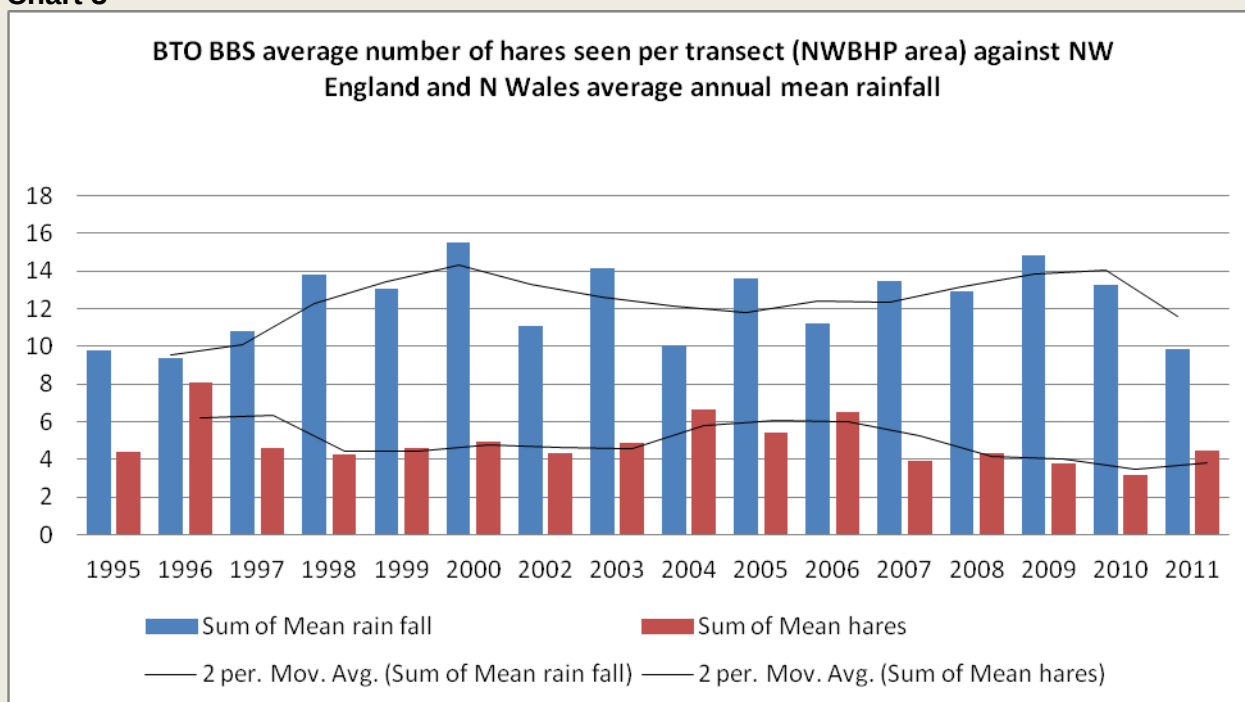
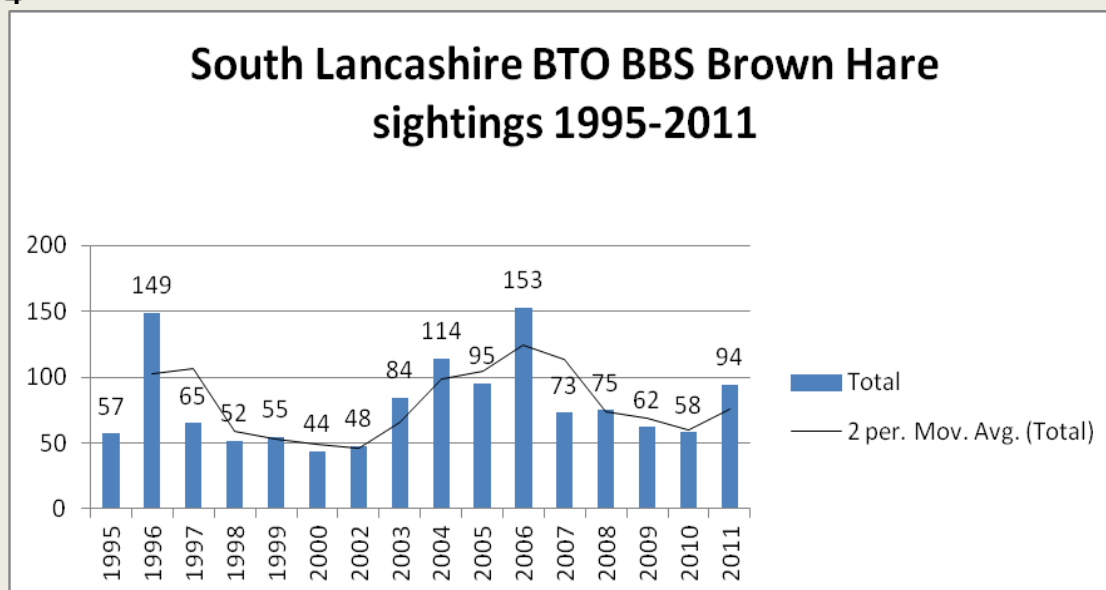


Chart 4

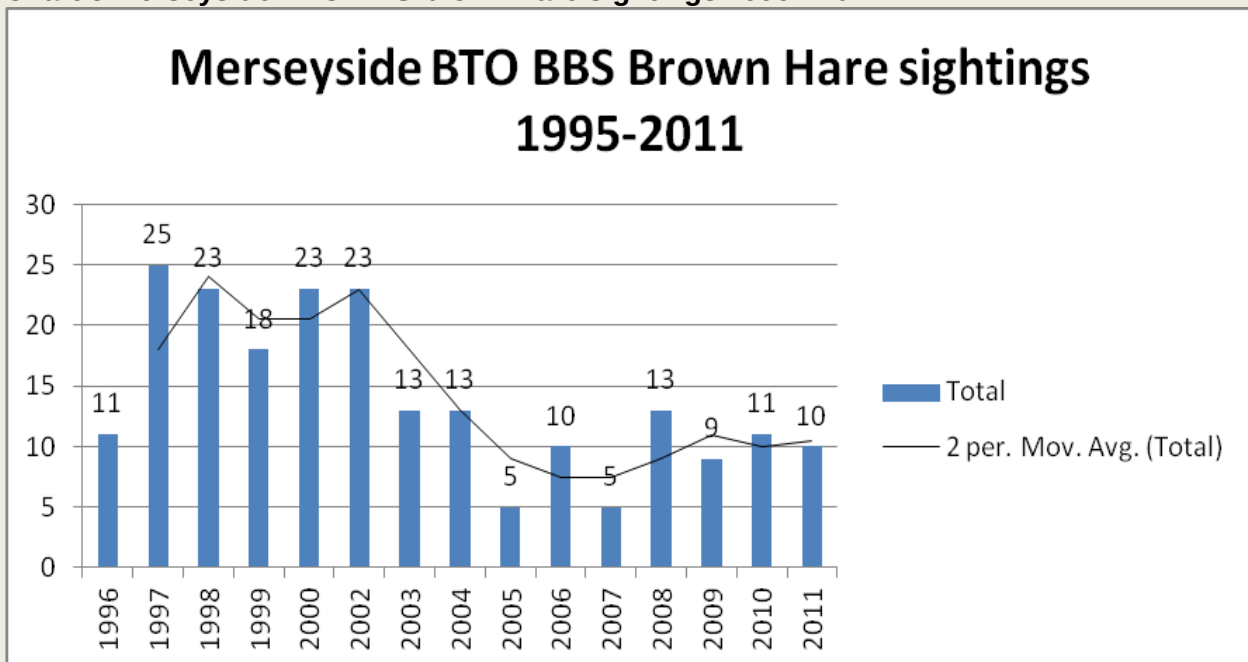


As with the MBB and NWBHP surveys in Merseyside, hare sightings seem to have fallen from the numbers being recorded between 1997 and 2002 (See chart 5). Merseyside was traditionally known as a hot spot for hare coursing. One explanation for its fall in brown hare numbers may be due to the the ban on hare coursing that came into effect in early 2005. Game keepers were known to bring in brown hares to the areas where coursing events, such as the Waterloo Cup,

were taking place. This may have had the effect of making brown hare numbers seem artificially high. In the run up to and after the banning of hare coursing, there may not have been the same motivations for game keepers to support high levels of brown hare numbers. Traditional keeping activities such as deterring illegal night time lamping and poaching, which can have the effect of reducing brown hare numbers, may not have been prioritised as they were before the coursing ban.

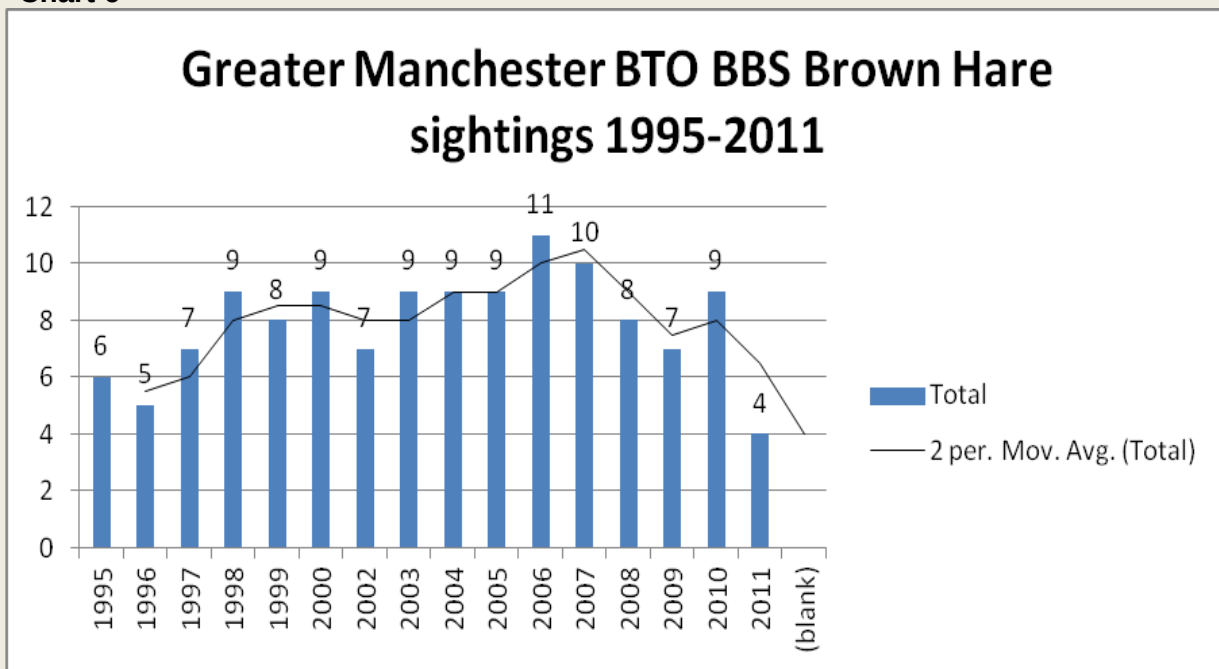
It should be noted that the sample sizes for both Merseyside and Greater Manchester are low, meaning that the potential for error with these figures is higher than South Lancashire.

Chart 5 Merseyside BTO BBS brown hare sightings 1995 - 2011



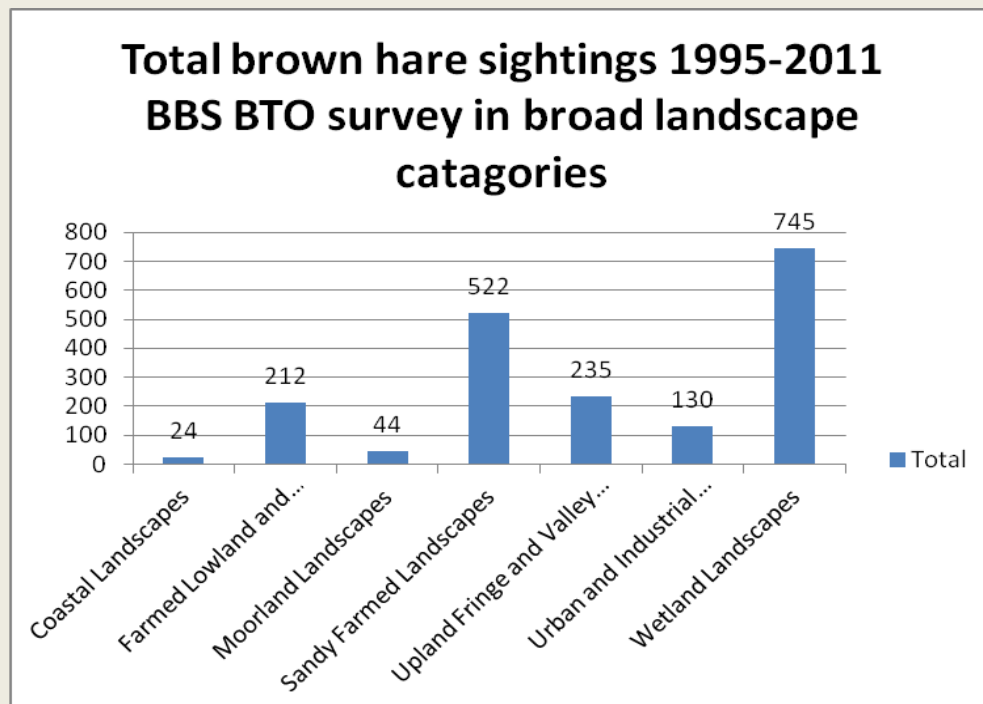
In Greater Manchester, from 1995 to 2006, brown hare sighting rose gradually (See chart 6. With the exception of 2011, brown hare sightings for Greater Manchester have remained fairly similar since, with a standard deviation of 1.84. The fall in 2011 may be explained by the cold winter temperatures experienced in late 2010.

Chart 6



Looking at the BTO BBS surveys stratified by broad landscapes, wetland and sandy farmed landscapes produced the most sighting (See chart 7). Moorland landscapes produced the least. There was a lack of coastal sightings because the BTO BBS is replaced by the Wetland Bird Survey in coastal areas. Stratified surveys are dealt with in more details in the main NWBHP survey.

Chart 7

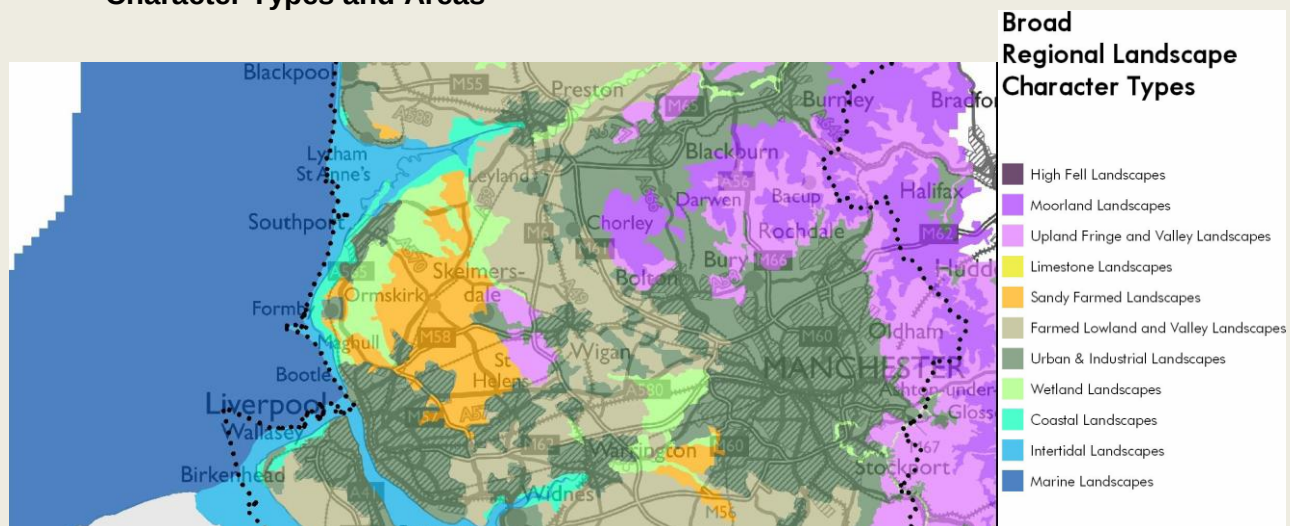


3.0 The North West Brown Hare Project Survey

3.1 Location

The initial study area was selected on the basis of previous hare records gathered by 3 local record centres, Merseyside Biobank (MBB), Lancashire Environmental Records Centre (LERN) and Greater Manchester Local Records Centre (GMLRC). The project chose to concentrate its efforts in the council boundaries of Bury, Bolton, Wigan, St Helens, Knowsley, Sefton, Chorley, South Ribble and West Lancashire. However, once the project was initiated, further records came to light which warranted an extension of the survey into Rochdale, Oldham and Tameside. At a landscape scale, the survey area was stratified according to the Natural England's North West Broad Landscape Character Areas (See Map 3). The North West Landscape Character Framework (NWLCF) is a map and associated database that describes the variation in landscape at a regional scale (Porter et al, 2009).

Map 3: North West Landscape Character Framework – Part 2: Regional Landscape Character Types and Areas



3.2 Survey Design

The survey methodology adopted by the NWBHP was the same as that used by the LWT for a survey of the West Pennine Moors (Skeltcher 2007) and was partly based on Harris and Hutchings national hare survey (Hutchings et al 1996). As with the national hare survey, the survey

methodology was chosen because of its ease of use and understanding by volunteers. It also allowed the NWBHP survey to be compared with previous surveys completed in the area. Night time spotlight surveys were rejected due to safety concerns over volunteers completing surveys at night.

3.3 Survey Method

Surveyors were initially offered a 1 km² map, with the option to survey more squares if their time allowed. Approximate site locations were selected by obtaining the surveyors preferred general area. Specific survey squares were selected using a combination of factors, taking into account, proximity to other squares already issued, broad landscape character type, previous hare sightings and the ability to cover the square by footpaths or permissions.

Unless the surveyor had indicated that they could have unlimited access, sites were selected that had footpaths running through them. Surveys along routes provide estimates of animal densities in the vicinity of the route, which may be unrepresentative of the survey region because of ease of access by poachers or due to greater disturbance (Buckland et al. 2001). Hares avoid the proximity to roads and prefer large non-fragmented areas over small isolated patches (Roedenbeck et al. 2008). However, the density of unpaved field tracks has a positive effect (on hare numbers), probably because vegetation along field tracks contributes to the diet spectrum (Roedenbeck et al. 2008). It was decided that sites with footpaths were to be selected due to the difficulty of obtaining landowner permission over such a wide area and in order to compare the results of the previous MBB and LWT surveys.

The transect within the square, was chosen by the surveyor on the ground and followed footpaths or open land that covered as much of the square as possible. The route taken was marked on the issued map along with any hare sightings. The hare's perpendicular distance from the footpath was recorded (changed to the minimum distance between the hare and the footpath for the spring 2012 survey). The time seen, behaviour, habitat, land use, weather conditions, start and finish time

and date of walk were also recorded. The distance walked by the surveyor (effort) was measured by transposing and measuring the route on the software package Google Earth.

4.0 North West Brown Hare Project Survey results and DISTANCE calculations

Table 2: Summary of NWBHP survey results spring 2011 in DISTANCE

	D	D LCL	D UCL	N	N LCL	N UCL	CV	ESW	ns	nh	Total Effort	Hares/ km sq
Wetland (mossland)	4.30	3.39	5.46	99	78	126	11.96	107.66	23	64	65.83	2.78
Urban and Industrial	0.92	0.43	2.00	13	6	28	30.77	80.45	14	6	40.49	0.43
Upland Fringe and Valley	0.80	0.43	1.21	16	9	30	28.24	110.31	20	12	62.04	0.60
Sandy Farmed	2.23	1.21	4.12	56	30	103	31.42	197.66	25	64	71.45	2.56
Moorland	n/a	n/a	n/a	n/a	n/a	n/a	n/a	325	14	1	49.24	0.07
Farmed Lowland and Valley	2.09	1.71	2.57	57	46	69	10.29	153.01	27	58	90.49	2.15
Coastal & Intertidal	3.15	1.98	5.01	38	24	60	22.93	145.65	12	34	30.56	2.83
Whole area	2.06	1.74	2.45	278	234	331	8.74	n/a	135	239	410.1	1.77

Table 3: Summary of NWBHP survey results spring 2012 in DISTANCE

	D	D LCL	D UCL	N	N LCL	N UCL	CV	ESW	ns	nh	Total Effort	Hares/ km sq
Wetland (mossland)	7.77	6.47	9.32	350	291	420	9.23	73.80	46	107	123.81	2.33
Urban and Industrial	0.57	n/a	n/a	6	1	36	42.44	104.77	11	3	24.92	0.27
Upland Fringe and Valley	1.96	1.17	3.29	41	24	69	24.18	52.38	21	11	24.92	0.52
Sandy Farmed	2.62	2.09	3.28	58	46	72	11.15	119.91	22	34	70.08	1.55
Moorland	n/a	n/a	n/a	n/a	n/a	n/a	n/a	325	12	1	31.34	0.08
Farmed Lowland and Valley	2.33	1.88	2.90	70	56	87	10.84	143.09	28	39	69.52	1.39
Coastal & Intertidal	5.02	3.82	6.60	60	46	79	13.45	139.26	3	8	6.77	2.67
Whole area	3.88	3.43	4.38	586	518	662	6.19	n/a	143	203	351.36	1.42

D = estimated density (per km square) calculated by *DISTANCE*

D LCL = Density lower 95% confidence limit

D UCL = Density upper 95% confidence limit

N = estimated abundance over pooled transects

N LCL = Abundance lower 95% confidence limit

N UCL = Abundance upper 95% confidence limit

CV = coefficient of variance;

ESW = estimated strip width (m) from transect line where the number of animals missed within is equal to the number of animals recorded beyond

ns = number of sample transects analysed by *DISTANCE*

nh = total number of hares recorded from pooled transects

total effort = total length of pooled transects (km)

4.1 Heaping

Heaping occurs when surveyors round distances to convenient values (e.g. 25m, 50m or 100m). In order to reduce the effect of heaping when fitting a model to the data, the data can be grouped. The cut points for the grouping can be selected so that the heaped values fall at the midpoint of the groups.

Both the 2011 and 2012 spring surveys have been grouped to allow for heaping. Cut points of 75m, 125m, 175m, 225m, 275m and 325m were selected.

4.2 Truncation

Data sometimes has outliers, where a few records are a lot farther away than the majority of the records. In order to increase accuracy of the density estimates, the data can be truncated to the right and these outlying observations removed.

Both the 2011 and 2012 spring surveys have been truncated to the right, with observations below 325m being removed.

4.3 Akaike's Information Criterion (AIC)

AIC provides a quantitative method for model selection (Buckland et al 2001). DISTANCE software selects models which are likely to produce the most accurate density estimates for a set of data. The model which receives the lowest AIC score is selected.

Both the 2011 and 2012 spring surveys used the half normal key function with cosine expansions. For more information the key function models and series expansion models, please refer to Buckland et al 2001.

4.4 DISTANCE results

The average densities of hares currently found in Britain are estimated to be between 7.12 km² for arable areas, 3.34 km² for Pastoral, 2.5 km² for Marginal upland and 0.97 Km² for Upland areas (Hutchings & Harris 1996).

Although the NWBHP survey is similar to the national survey in 1996, there are differences which mean that estimates from the NWBHP survey may be lower. In the 1996 national survey surveys 1 km squares were surveyed by strictly following routes 100 m within the perimeter of the square and

undertaking walks at mid-day during winter, so as to disturb resting hares, rather than searching for active hares in the morning or evening. Thus, walks followed routes which, in themselves, were entirely representative of the surrounding habitat and hares would be much more likely to be flushed on or close to the transect route than they would at greater distance.

Because most of the transects used public rights of way, the route itself will often be unsuitable hare habitat (e.g. tarmacked road), while hares may further avoid land in the near vicinity of the route where there is a high level of public activity. In addition, visibility close to the path may sometimes be obscured by walls, hedges, banks etc, while visibility into the distance across open fields may be extensive. Thus, in many cases, hares may be more likely to be seen at distance in the fields away from the survey route. These factors are likely to lead to an underestimate when using *DISTANCE* to calculate density. (Skelcher 2007). Conversely, the NWBHP survey was completed in the spring when hares are more active, which may improve survey sightings.

In 2011 over the whole project area, the density of brown hares calculated by total number of hares observed per 1km^2 surveyed was 1.77 Hares/ km^2 , while the estimated density (per km^2) calculated by *DISTANCE(D)* was 2.06 (LCL 1.74 & UCL 2.45).

In 2012 1.42 hares were observed per each 1 km^2 surveyed, yet the *DISTANCE* calculations produced a density estimate of 3.88 hares per km^2 (LCL 3.43 & UCL 4.38).

The difference in density estimates between 2011 and 2012 was due to more hares having been seen closer to the observer than further away in 2012 rather than 2011, leading the fitted model to produce a larger density estimate.

There may be a number of reasons for this. It maybe that surveyors are more experienced in the second year of surveying and so are able to identify hares and estimate distances with more accuracy.

Because there are no previous density estimates for these areas, the two figures should be considered base line data that can be used to measure future surveys again.

The stratification of the surveys produced identical results between 2011 and 2012 when comparing estimated densities. Wetland (former mossland) landscapes that have mostly been converted to arable agriculture and make up large parts of Merseyside and South Lancashire, produced the largest density estimates in 2011 (4.3 hares/km²) and 2012 (7.77 hares/km²). Assuming that the 2012 figures are more accurate, this density estimate is slightly higher than Hutching and Harris 7.12 km² density estimate for arable areas. Wetland landscapes also produced the most hare sightings in the BTO BBS data.

Coastal and intertidal landscapes produced the next highest density figures, in 2011 (3.15 hares/km²) and 2012 (5.02 hares/km²). These landscapes take in sites like RSPB's Marshside and Hesketh Outmarsh reserves.

Sandy farmed landscapes are mostly arable but do make up some pastoral areas and produced the third highest density figures in 2011 (2.23 Hares/km²) and 2012 (2.62 Hares/km²). Although these figures are not directly comparable with Hutching and Harris, it could be assumed that the densities observed for sandy farmland are lower than expected.

Farmed valleys and lowland landscapes are the closest comparison to Hutchings and Harris's pastoral estimate of 3.34 hares/km², with figures for 2011 (2.09 hares/km²) and 2012 (2.33 hares/km²). Again, these figures are lower than that 1996 estimates.

Upland Fringe and Valley landscapes produced density estimates in 2011 (0.80 Hares/km²) and in 2012 (2.23 Hares/km²). Harris and Hutchings estimated 2.5 Hares/km² in Marginal Upland landscapes, which is again higher than 2011 and 2012 survey estimates.

Because records were so low for moorland landscapes in the 2011 and 2012 surveys, DISTANCE estimates were not possible. The lack of sightings on moorland shows that this landscape was the least favourable habitat for brown hares and coincides with the BTO BBS figures.

Urban and Industrial landscapes did not have a comparable category with Hutching and Harris, but were also shown to be sub optimal for hares. This result has implications for continued development alongside brown hare habitat.

5.0 Discussion on distance results

A set of baseline data stratified against a measurable landscape scale is now in place. While it is too early to see any trends in population gains or losses, the survey has provided a much more comprehensive picture of hare distribution within the survey area. The work completed in 2011 and 2012 will mean that future surveys will be easier for volunteers to complete, can be repeated year on year with little time or cost to the organiser and cover a wide geographical area. Surveys by different organisation can now be compared with greater ease through the use of a common stratification using broad landscape characters.

It should be highlighted however, that a number of variables within the survey technique mean that the density estimates for the area are not likely to be a true representation of the actual density.

Large areas of land within a survey square may not be visible because of obstructions such as woodland or increased elevation. This is especially true for the upland fringe and valley regions and moorland regions. This effect means that the estimated strip width (ESW) should be lower than the figures produced in DISTANCE, with densities actually being higher than those reported by DISTANCE.

Hiby et al (2001) discussed the problems of using distance sampling along curved line transects for estimating abundance of populations. The survey is completed along a curving path which covers the whole square and not along one or a number of straight lines along the square. Because hares are recorded at such a long distance, this has the effect of brown hares being under recorded in relation to the amount of effort assigned. This is discussed in more detail in the DISTANCE sampling archives (JISCMail - DISTANCE-SAMPLING Archives. 2011)

Most of the transects have used footpaths to survey the sites. There is evidence that some animals will actively avoid paths, meaning that the transects routes may under represent the local population.

Surveyors are asked to complete the surveys as close to dusk or dawn as possible, in the hope that hares will be detected as they leave their forms in transit to feeding grounds or have already arrived to feed. However, it maybe that hares are still in their forms at the time of the survey and so will only be detected or flushed at close distances to the transect, which will again skew the density calculations.

5.1 Dusk/dawn vs night time surveys

Petrovan et al (2011) found line transects for hares carried out at night resulted in higher numbers of detections, had better-fitting detection functions and provided more robust density estimates with lower effort than those during the day, due primarily to the increased probability of detection of hares at night and the nature of hare responses to the observer.

As a small trial the NWBHP carried out a daytime and night time brown hare survey at RSPB Marshside. Night-time surveys gave an average population density of hares of 16.9km^{-2} whereas the day-time surveys gave an average population density of hares of 5.48km^{-2} (de Silva 2012 Unpublished). While this was only a small sample, the findings do support Petrovan's research. These results should be bore in mind when considering the density estimates that have been produced through the NWBHP survey and that while they can be used to compare year on year fluctuations in hare numbers, they are unlikely to provide an accurate estimate of brown hare densities.

Although night time spot light transects were rejected because of safety concerns for volunteers and the effort required to obtain permissions over such a large area, this method could be used when looking at more focused surveying of sites for habitat management.

When considering volunteer surveying, the ancillary benefits of the increase in the public's appreciation, knowledge and understanding of a species should be taken into account.

5.2 Behaviour

During the Spring 2011 and 2012 NWBHP surveys, of all hares with recorded behaviour at the moment of detection (n=525), 36% and 37% respectively, were observed running (See chart 8 & 9). This figure suggests that a proportion of the hares observed were detected further away from the surveyor than recorded. This again suggests that the estimates of density produced in DISTANCE are lower than the true value. However, because hares surveyed during the day can be recorded at varying distances, it may be that this behaviour is not a reaction to disturbance but just normal behaviour, especially if hares are travelling to/from their forms to feed.

During night time spot light surveys, Petrovan et al (2011) noted only 10% were observed running while the majority (58%) were observed feeding, standing (15%), crouched (6%) or involved in both feeding and social interactions (10%). This suggests that night time spot light surveys provide more accurate density estimates than daytime surveys.

One observation that was made carrying out spot light surveys at RSPB Marshside, was that the number of hares sighted after a hare was flushed, reduced. No figures were recorded for this interaction, but it suggests that the higher the percentage of hares recorded running, then more this is likely to effect the density estimate.

Care should be taken not to disturb hares, so as not to alert other hares in the area to the recorders presence.

Chart 8

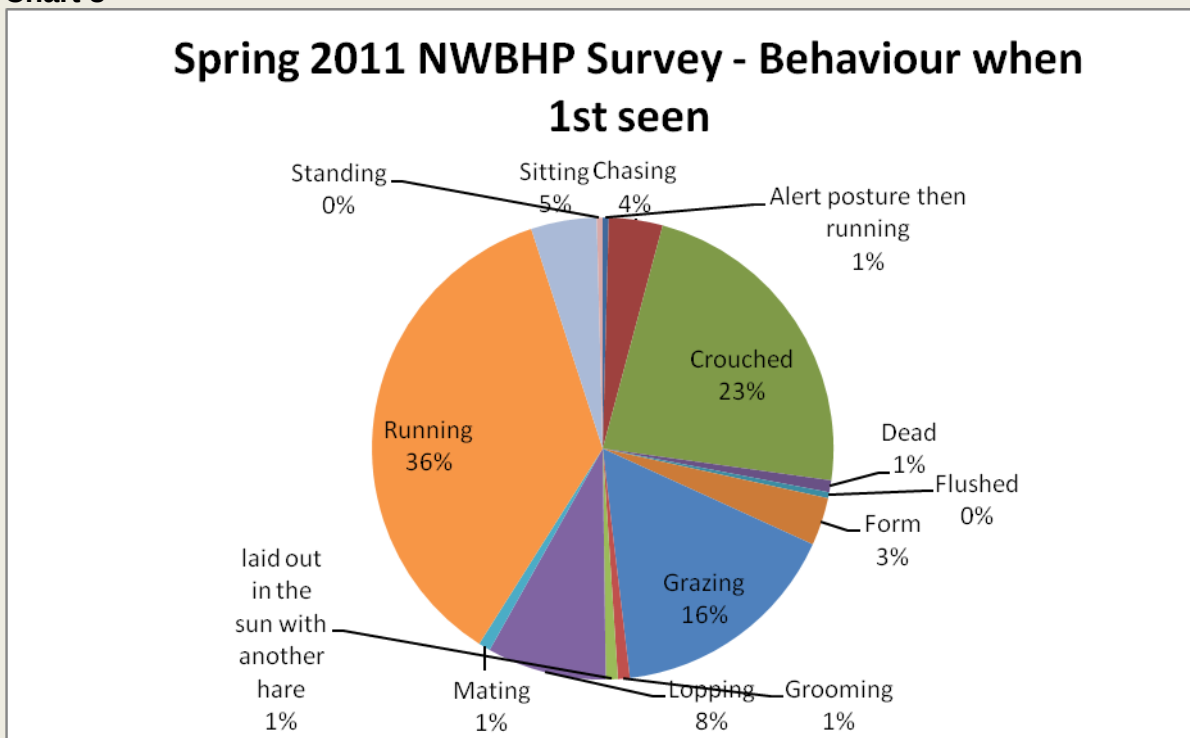
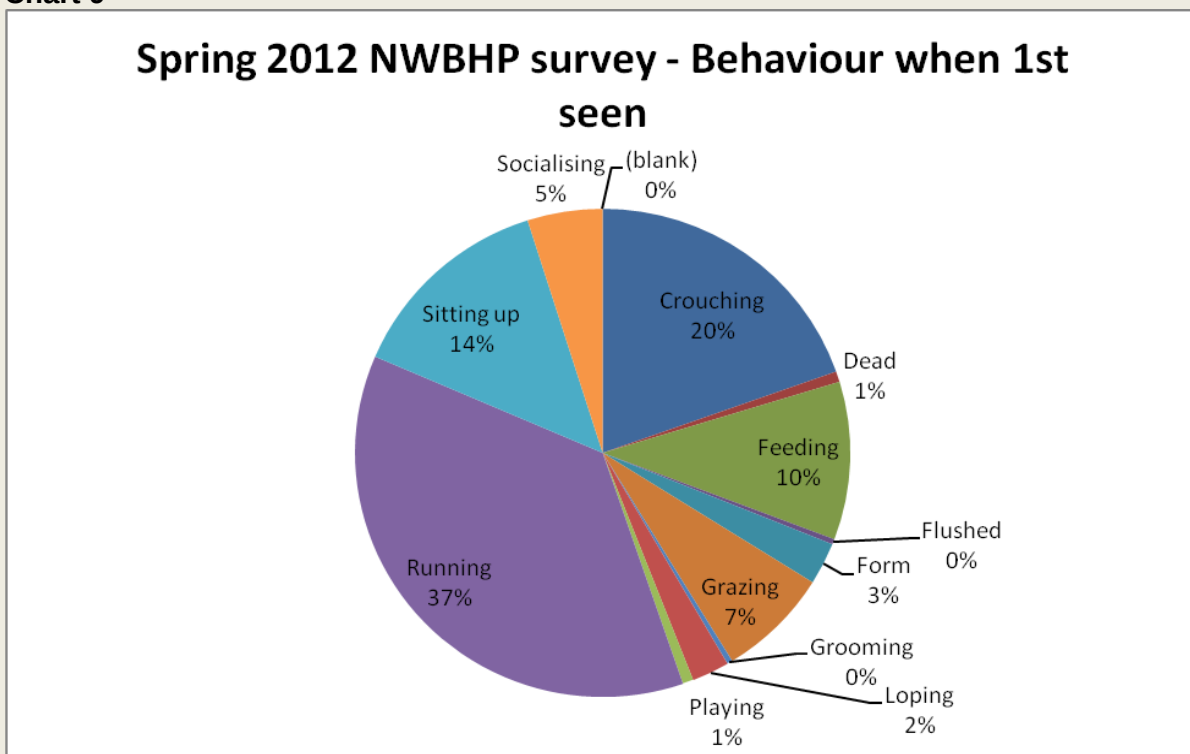


Chart 9



6.0 Regional Results from NWBHP

6.1 Greater Manchester

The Manchester Mosses area, that straddles Wigan and Salford, is the main stronghold for brown hare in Greater Manchester (See map 4 & 5). There are also small populations around the Pennine fringe areas of the West Pennine Moors and the South Pennines. Although some of the survey records don't support the existence of Pennine fringe populations, the adhoc sighting sent into the website and record centre do support this.

The denser heather, bilberry and purple moor grass of the moorland areas and rolling hills of the upland fringe and valleys mean that surveyors have poorer lines of sight compared to the flat expanses of arable farm land. Hares propensity to sit on top of hillocks and retreat to the other side when disturbed, is likely to make recording them more difficult in these topographically varied survey areas.

In addition, a brown hare survey has not been completed in Greater Manchester (GM) before and so the GM surveyors may not be as familiar with looking for hares or knowing where they are most likely to see them. The majority of surveyors in South Lancashire and Merseyside are into their 3rd or 4th year of surveying. Because the densities are generally higher in South Lancashire and Merseyside, surveyors will be more used to seeing hares and are therefore more likely to know what they should be looking out for.

6.1.1 Mountain hares

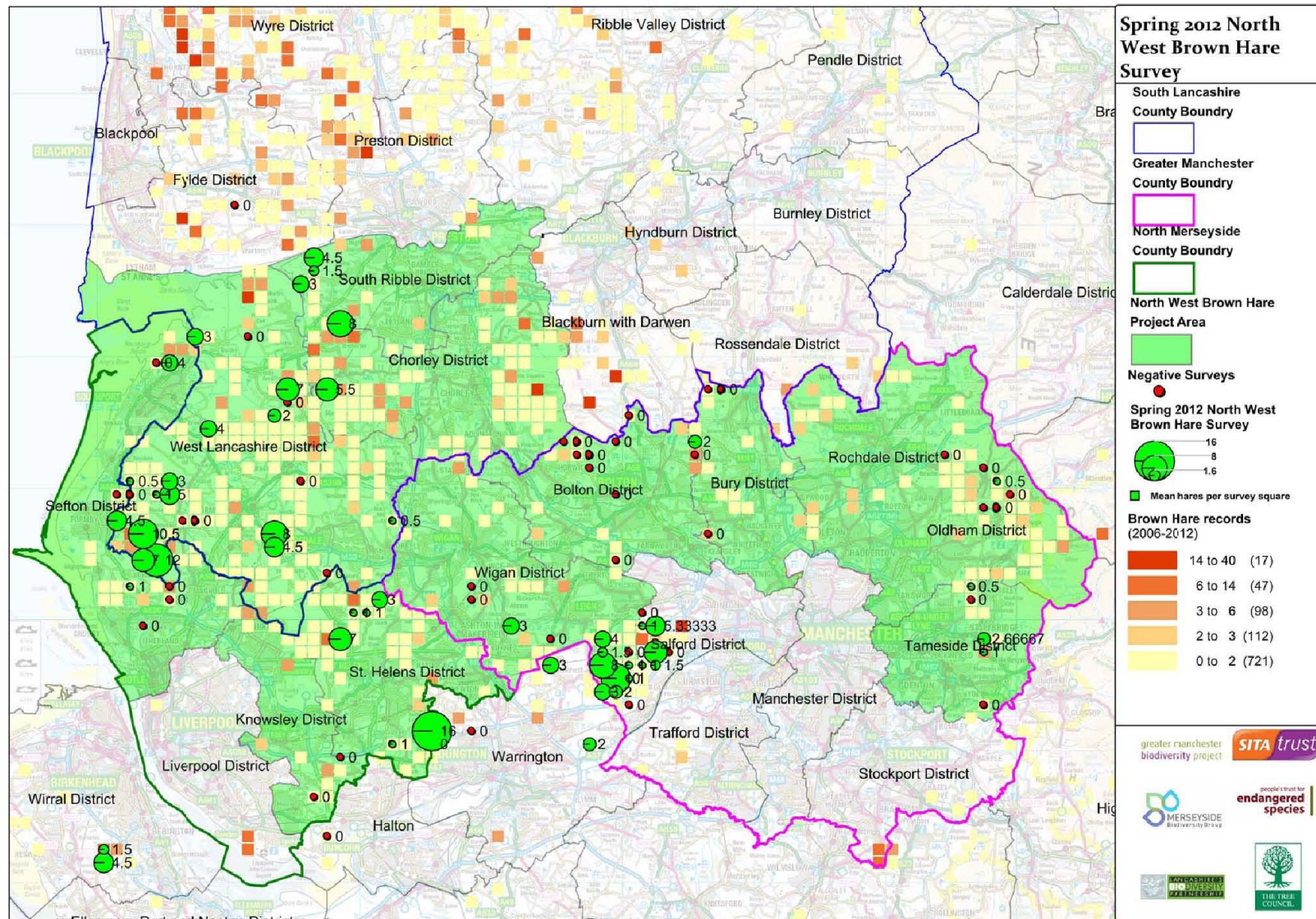
Greater Manchester also has a population of mountain hares that should not be over looked (See map 6). The population, which has moved in from the Peak District, straddles the South Pennine regions of both Oldham and Tameside MBCs. Although a large scale survey of the total English population was completed in 2000, it was mainly confined to Derbyshire and South Yorkshire. Some surveys and sightings were recorded during the project, however, there was not enough to

draw any real conclusion as to the range or size of the population. 89 mountain hare records were collected for Greater Manchester and passed to the NBN. The NBN previously held 2 records.

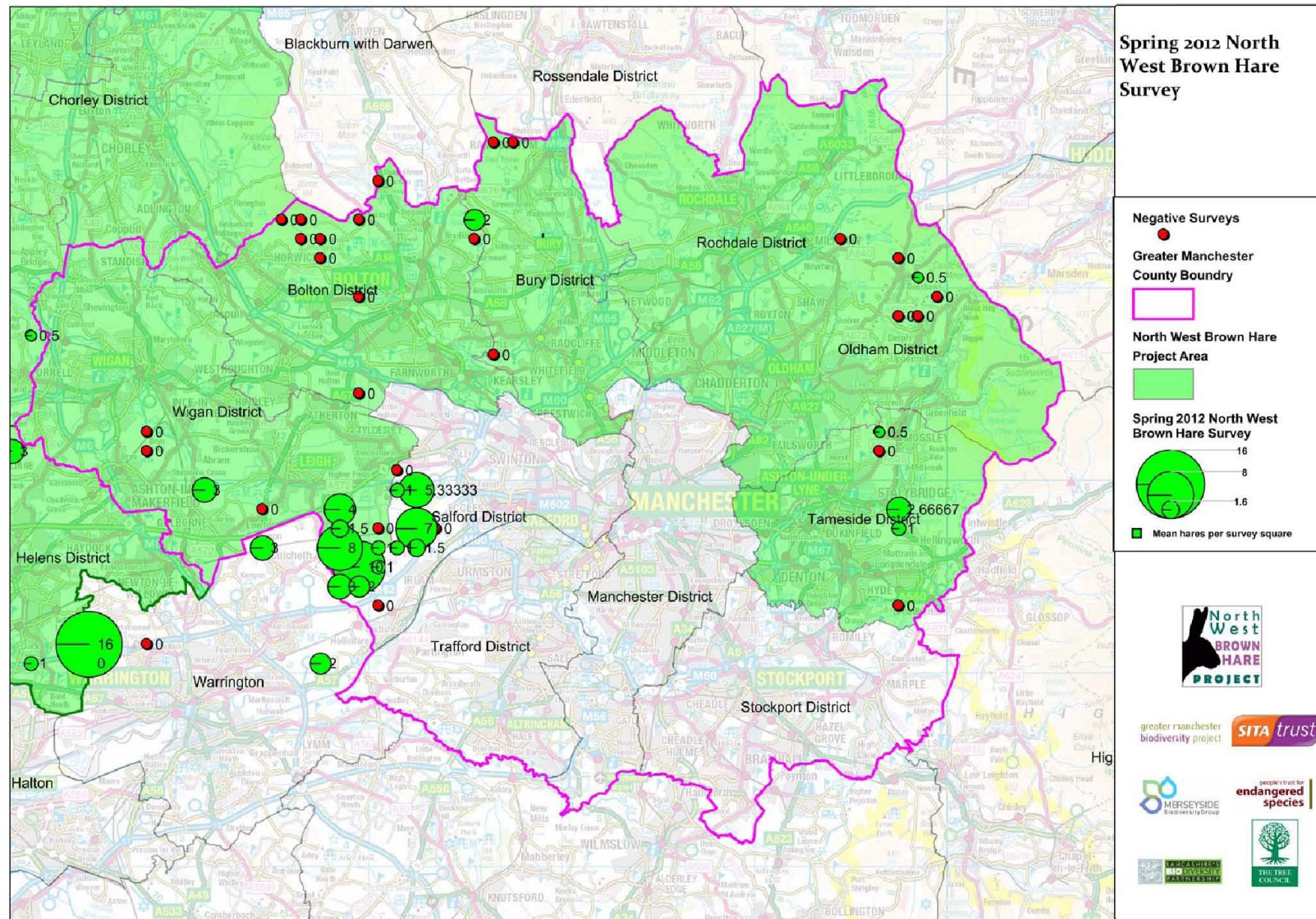
Two survey training courses were completed during the project and the RSPB has also completed some training. A full scale survey of the Greater Manchester population would help to see how far the population has spread up its northern range.

Recent habitat restoration carried out by the RSPB and United Utilities on the Dovestones Reserve is likely to have improved the foraging potential for mountain hares in the area.

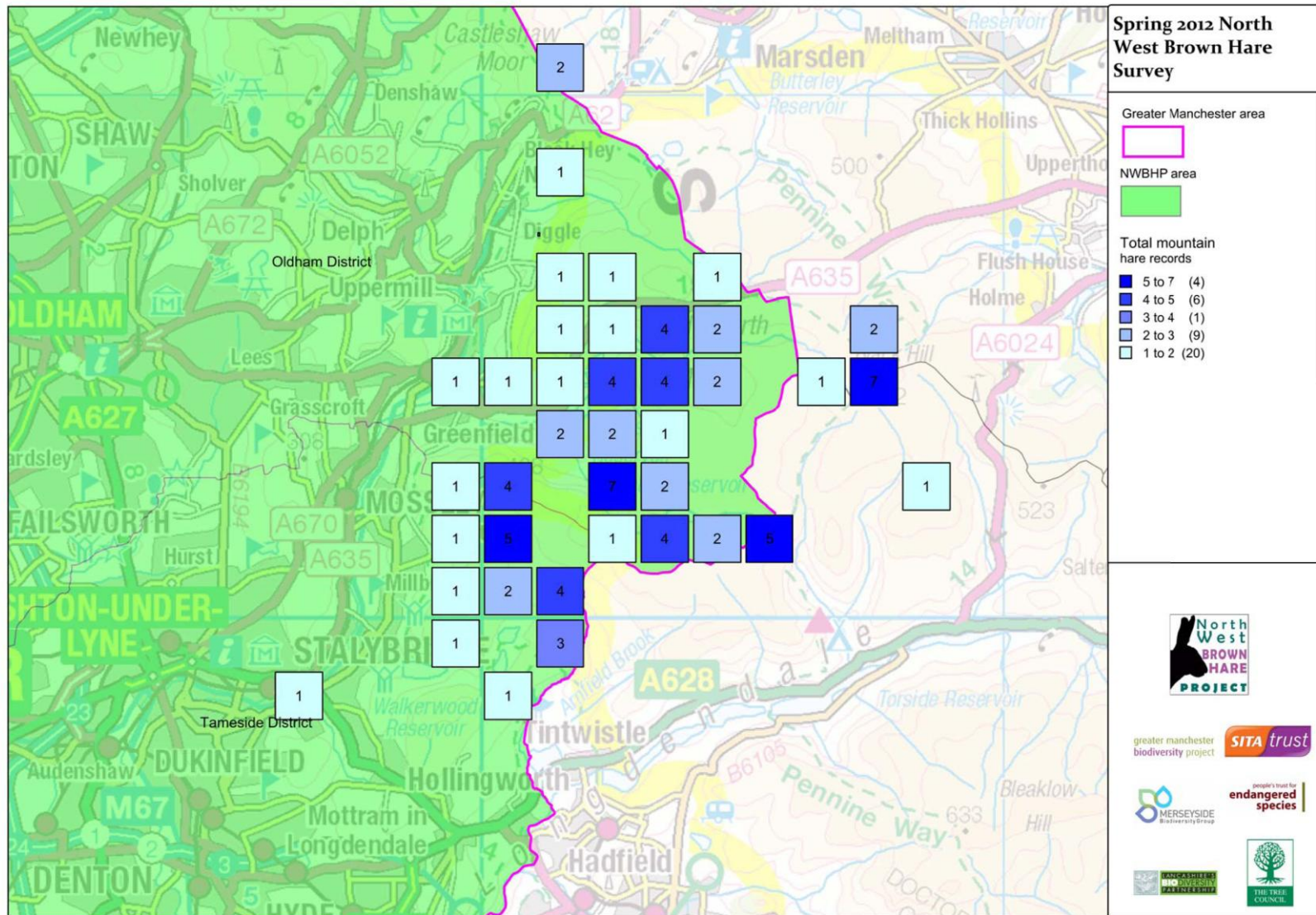
Map 4



Map 5



Map 6



6.2 Merseyside and South Lancashire

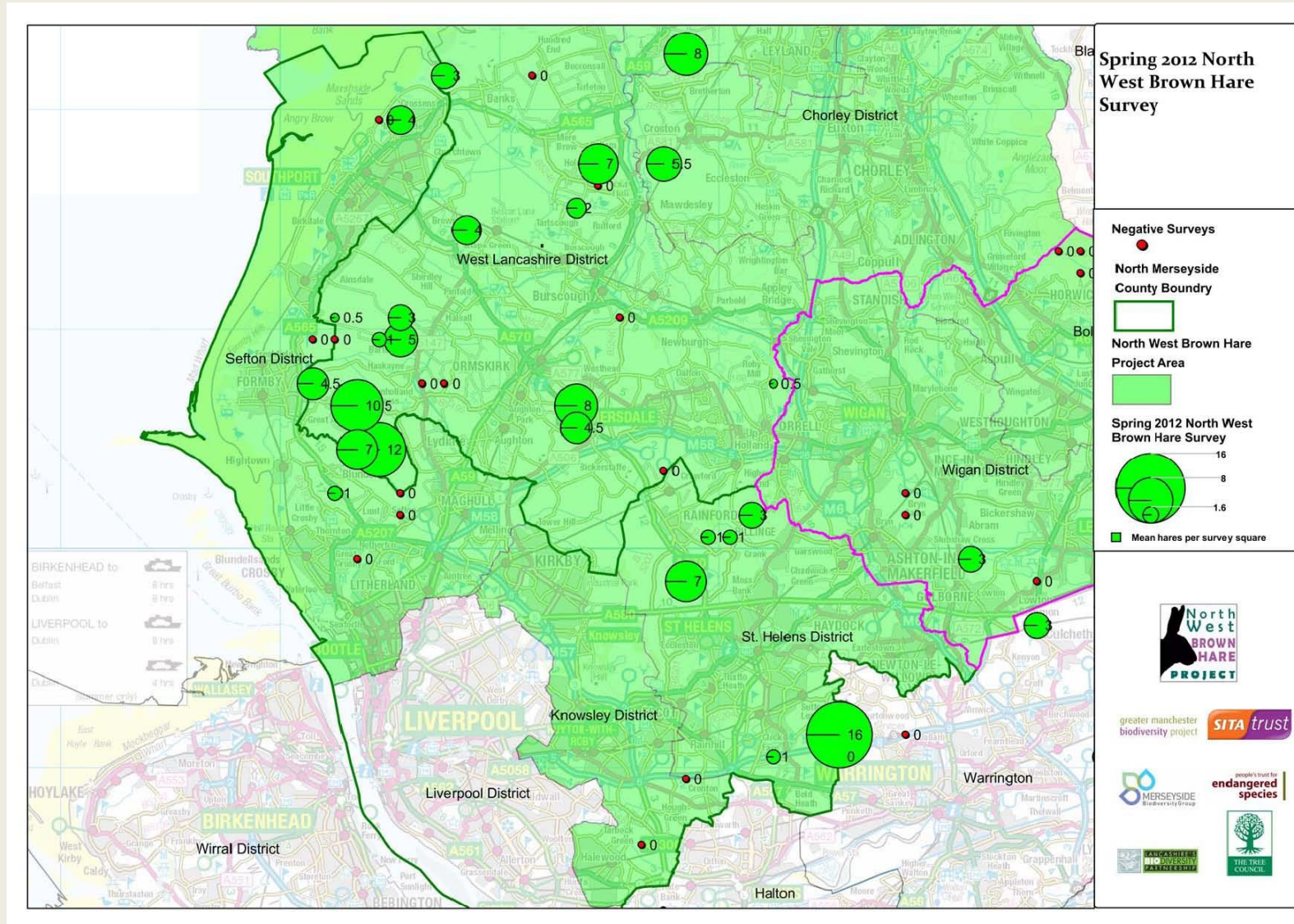
Results show that South Lancashire and Merseyside hare strongholds seem to be in the arable former wetland/mossland and flat sandy farmed landscapes, as described in the North West Landscape Character Framework (Porter et al, 2009).

The NWBHP survey produced similar results to the BTO BBS hare sightings. The greatest number of sightings were recorded in the sandy farmland and wetland landscapes of the Sefton Coast and South Lancashire (See Map 4 & 7). There are good brown hare populations throughout both Merseyside and South Lancashire, with arable farmland producing the most number of sightings. North Merseyside strongholds are found in the grade one agricultural belt that runs through the North of St Helens and in the proximity of Sefton. The RSPB's Marshside reserve also supports good numbers of hares.

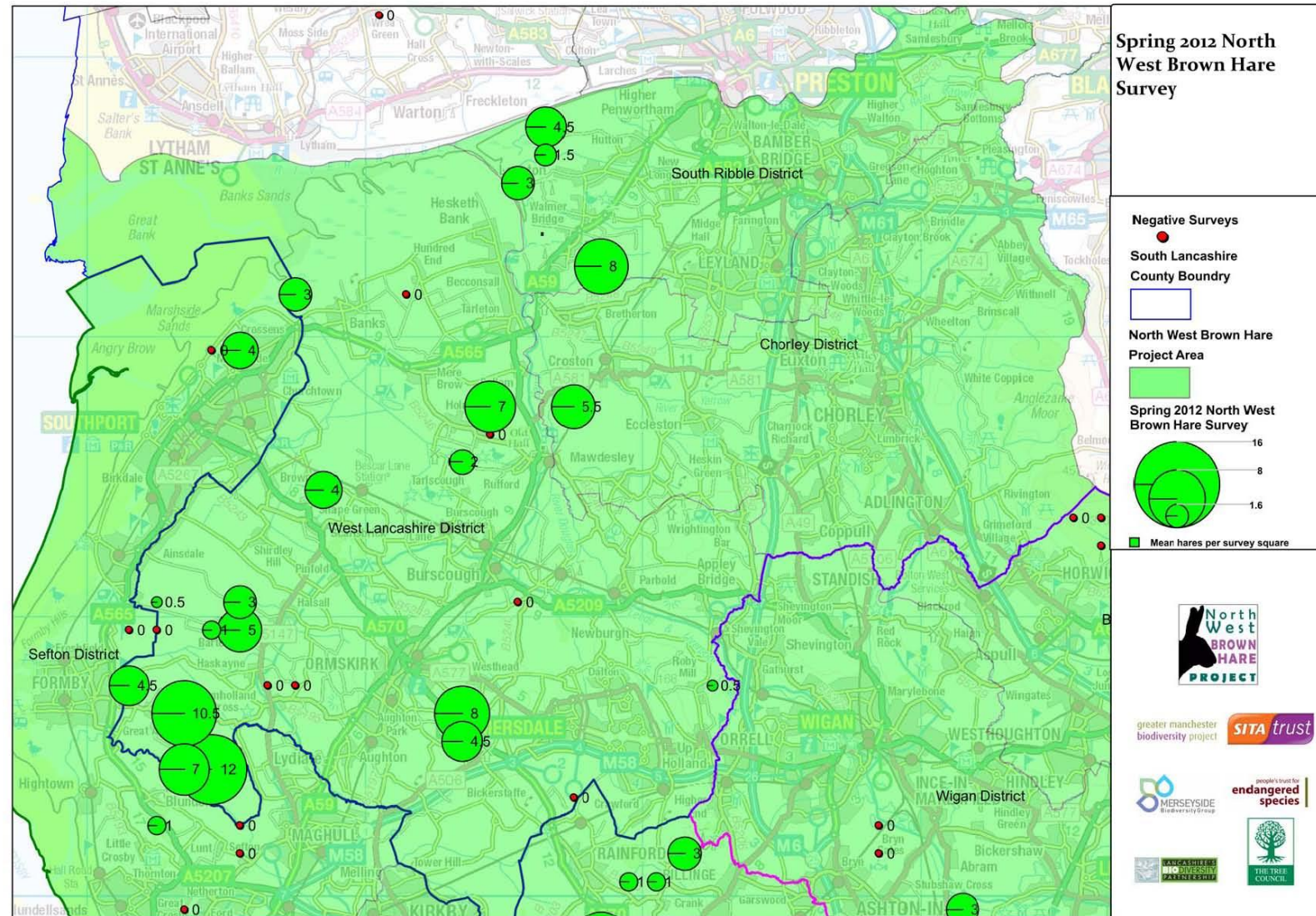
Apart from the grade one agricultural land, The Wildfowl and Wetlands Trust Martin Mere Reserve in West Lancashire also holds a large number of brown hare (See Map 4 & 8).

The surveys completed in Chorley and South Ribble form part of the LWT survey that covers North Lancashire and so have not been covered by this survey.

Map 7



Map 8



7.0 NWBHP further survey results

7.1 Best month to survey

Surveys in April produced the most positive surveys. Of the 99 April transects surveyed over the two seasons, 59.60% of surveys recorded one or more hares. May produced the second highest number of positive surveys, with 56.67%. These figures compare with an total average of 50.7% positive surveys (See table 4).

Table 4 NWBHP Survey 2011 & 2012 monthly total of negative and positive surveys

Spring 2011 & 2012 Count of negative and positive surveys				
Month surveyed	Negative	Positive	Grand Total	% of Positive survey
Feb	8	3	11	27.27
March	80	66	146	45.21
April	40	59	99	59.60
May	13	17	30	56.67
Grand Total	141	145	286	50.70

This would suggest that April and May would be the optimum months to survey for presence or absence of hares in the North West and any subsequent effort to initiate surveys should be focused on these two months.

7.2 Morning or evening survey

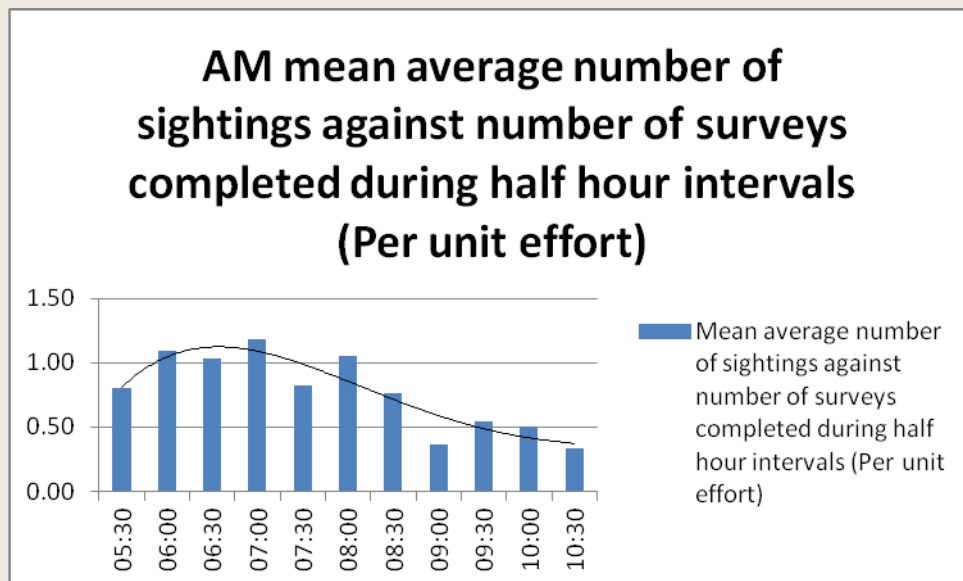
Of the 150 useable surveys for spring 2012, 70 were completed in the morning and 80 were completed in the evening.

No significant difference was found, when looking to see if more positive surveys were completed in the morning or in the evening. Of the 70 surveys completed in morning of spring 2012, 34 were positive and 36 were negative. In the evening of spring 2012, 80 surveys were completed with a 40 positive and 40 negative surveys.

7.3 The best time of the day to survey

Surveyors recorded time that a hare was seen, the start time of the survey and the finish time. This allowed the mean number of sightings to be calculated, taking into account the number of surveys that were completed during various half hour intervals. Both the 2011 and 2012 spring survey results were combined.

Chart 8

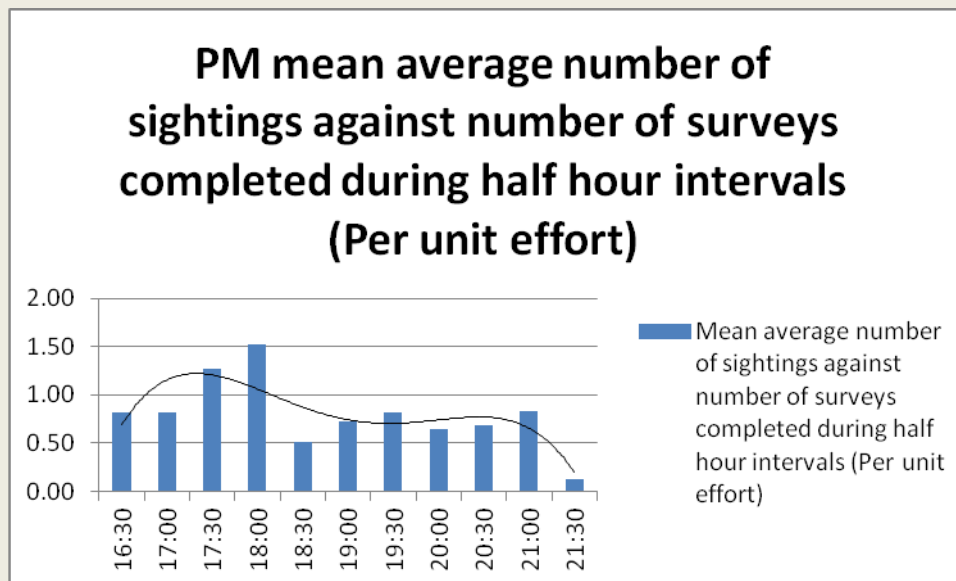


Surveyors recorded the time that a hare was seen, the start time of the survey and the finish time. This allowed the mean number of sightings to be calculated, taking into account the number of surveys that were completed during various half hour intervals. Both the 2011 and 2012 spring survey results were combined.

During the morning surveys, the period 7:00 am and 7:30 am produced the largest average number of sightings at 1.18. The mean average showed a decrease from this time onwards.

Based on these results, assuming there was enough day light, it would be best to start surveys as close to dawn as possible. This would give the surveyor enough time to complete the transect before the optimal survey period ended, around 8:30am.

Chart 9



The evening surveys produced a less uniform set of results. The period between 18:00pm and 18:30pm produced the largest average number of sighting, at 1.53. Other than between 17:30pm and 18:00pm, where there was an average of 1.26, the remaining half hour periods showed no real trend.

There was a drop off in average sightings between 21:30 and 22:00, however, I suspect this was due to a decrease in daylight available at this time. This may also explain why there are a smaller number of sightings after 18:30pm.

Because of the difficulty in timing a surveys completion just before sunset, it could be suggested that daytime surveys are best completed in the morning, rather than in the evening.

8.0 Discussion

8.1 Differing initiatives operating within the NWBHP broad landscapes

Based on survey data from the NWBHP survey and the BTO BBS data, the population of brown hare within the project area has been stable over the last 16 years, although there are marked differences in the presence and absence of brown hares within the project area and the initiatives that are taking place across the varying landscapes.

8.1.1 Moorland, Upland Fringe and Valleys

In the West Pennine Moors and South Pennines regions of Greater Manchester, United Utilities Sustainable Catchment Management Programme (SCaMP) is being implemented to provide investment for moorland restoration and improvement of water quality, with improved habitat management providing more optimal conditions for brown as well as mountain hares.

The RSPB Twite Recovery Project, working alongside Pennine Prospects, has also been working to restore hay meadow management in the uplands, which will increase the heterogeneity within the area. Both ScaMP and the Twite Project are assisting farmers to enter into Higher Level Stewardship in order to fund farmland habitat management options.

The LWT have also focused their efforts in habitat restoration in the West Pennine Moors and are currently in the process of applying for a Landscape Partnerships - Heritage Lottery Fund, which will also provide funds to enact hay meadow restoration.

The NWBHP has provided survey results and guidance to both the LWT and Oldham MBC in relation to the West Pennine Moors and Crompton Moor in Oldham.

As most of the habitat management guidance on brown hares is for arable areas, the NWBHP has produced notes of Upland Entry Level Stewardship options that may benefit hares, which has been passed to Natural England advisers who work in the uplands.

One area that the NWBHP's work will be carried on will be through the South Pennines Integrated Biodiversity Delivery Area (IBDA), headed by Natural England, through the Greater Manchester Ecology Unit and the other partners within the IBDA steering group. Brown and mountain hare issues will be considered as part of an overall strategy for the South Pennines.

8.1.2 Farmed Lowland and Valley

Not only has there been a shift away from hay meadow to silage production but there has also been an increase in stables and recreational horse use in farmed lowlands and valleys. Both activities have had the effect of reducing the heterogeneity of farmland for hares. This type of landscape seems to be over looked when countryside managers and conservationist target areas for habitat restoration. Within Greater Manchester, LWT have recently taken over the management of a site called Cutacre which is currently managed for sheep, cattle and horses. Guidance has been provided to LWT on entry level and higher level stewardship options for the site. Another group of sites within the farmed lowland and valley landscape that are currently being restored is Green Heart Farm in Wigan, which has just been entered into Higher Level Stewardship. Both these initiatives should have the effect of increasing hare numbers in this landscape within Greater Manchester. Both of these initiatives fall within the proposed Greater Manchester Mosses Nature Improvement Area. This landscape scale initiative will potentially have the effect of improving the connectivity between the farmed lowland and valleys and the Manchester Mosslands, linking two hare populations together and therefore improving the populations resilience.

8.1.3 Wetland (Mosslands) and Sandy Farmland

These two landscapes, which currently have the highest densities of hares in the project area, also have the most conservation effort directed to them at the moment. Wetland reserves have proven

to be safe havens for hares. RSPB's Marshside and Hesketh Out Marsh reserves and The Wildfowl and Wetland Trust's Martin Mere reserve all have good hare numbers present. The LWT's restoration of large parts of Little Woolden Moss and other sections of the Manchester Mosses adds to this group of exciting reserves.

The LWT are also restoring Lunt Meadows to a wetland site for wildfowl and wetland birds. Wetland sites have a complicated mosaic of habitats which provide cover and protection from predators and the elements. These sites also tend to border arable farmland and so add to the mosaic at a landscape scale.

Coupled with these sites, is a very active RSPB farmland bird adviser, who provides advice and assists to farmers in obtaining Higher Level Stewardship funding. Many of the stewardship options for farmland birds are also good for brown hares.

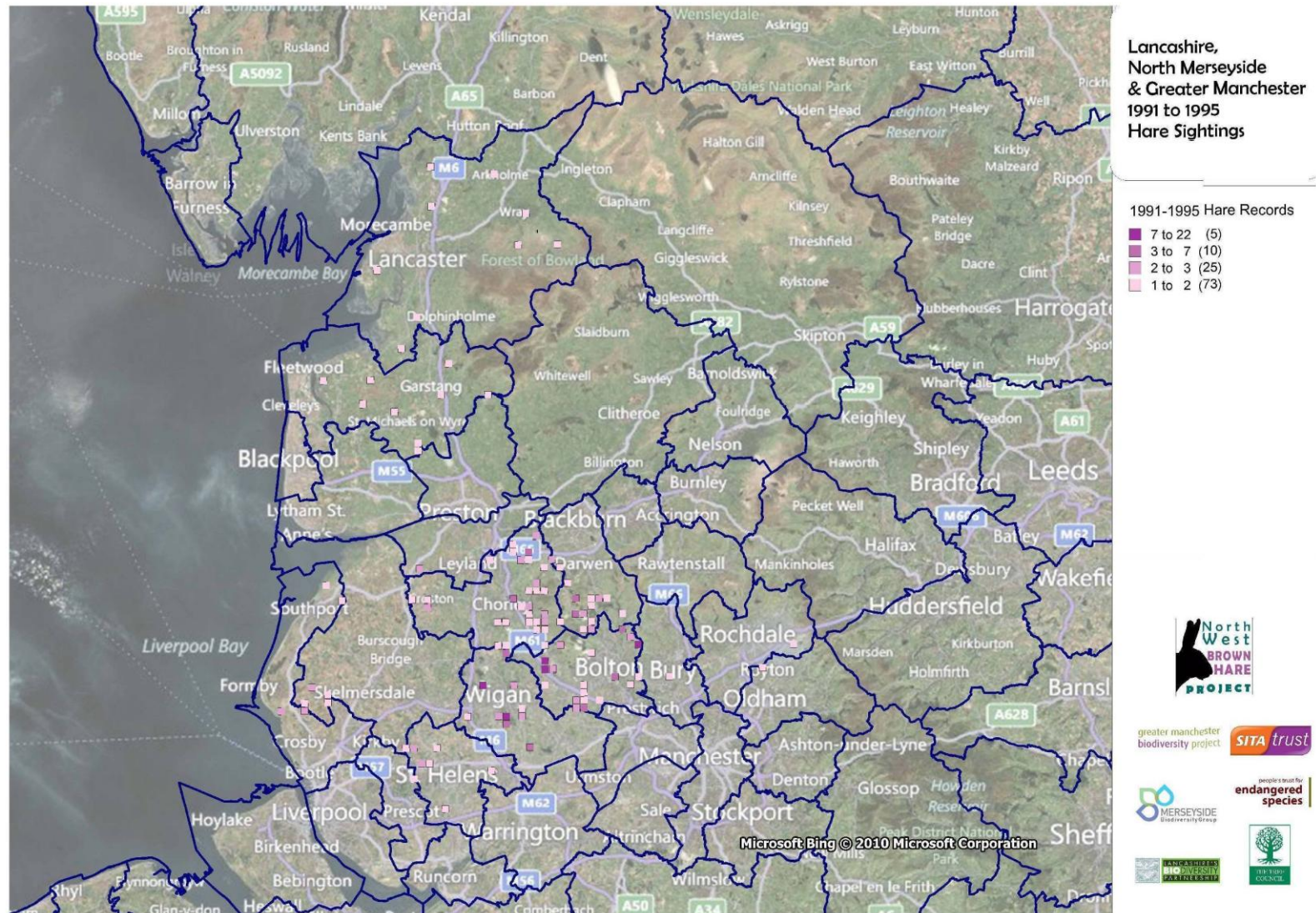
As a result of these factors and the fact the Natural England have targeted wetland and sandy farmland landscapes as a priority area for brown hare in the North West, brown hare are well catered for in this landscape.

9.0 Discussion on brown hares records for Lancashire, Greater Manchester and North Merseyside

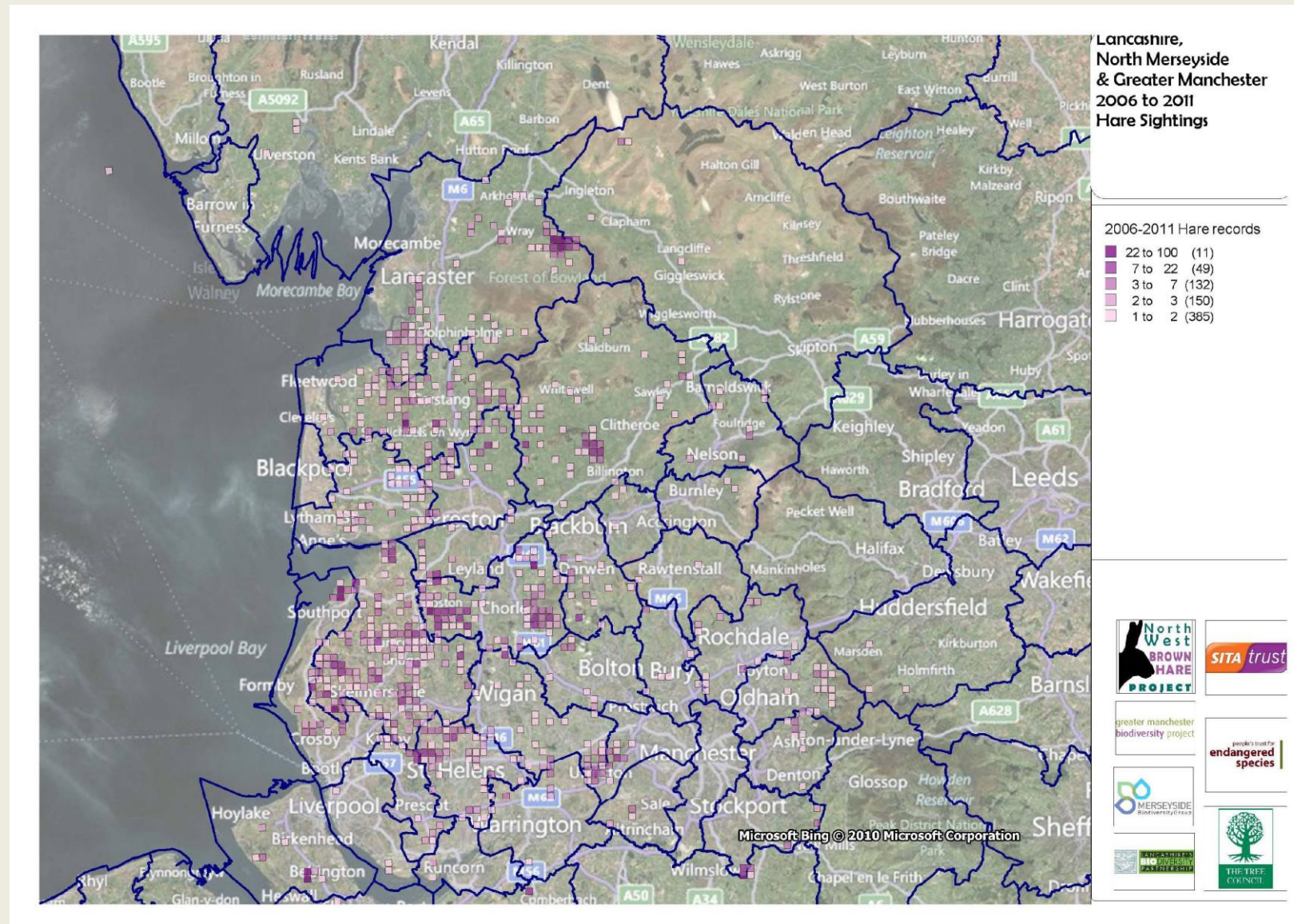
Between 1991 and 2000 (See Map 9) there have been 851 sightings of one or more hares passed to local record centres, between 2001 and 2010 (See Map 10) there were 2207 records provided.

This difference is unlikely to show an increase in hares, but is more likely to show an increase in recorders access to computers and the ease with which it is possible to record and send in biological records. Varying degrees of biological recording and effort between areas can provide misleading evidence of a lack of brown hare in certain areas. However, it should not be said that isolated records that come together to make up record centre data, have little use. Recent hare records have been very useful as a means of identifying populations and guiding survey effort for the NWBHP. Records can also provide a guide to past presence and absence.

Map 9



Map 10

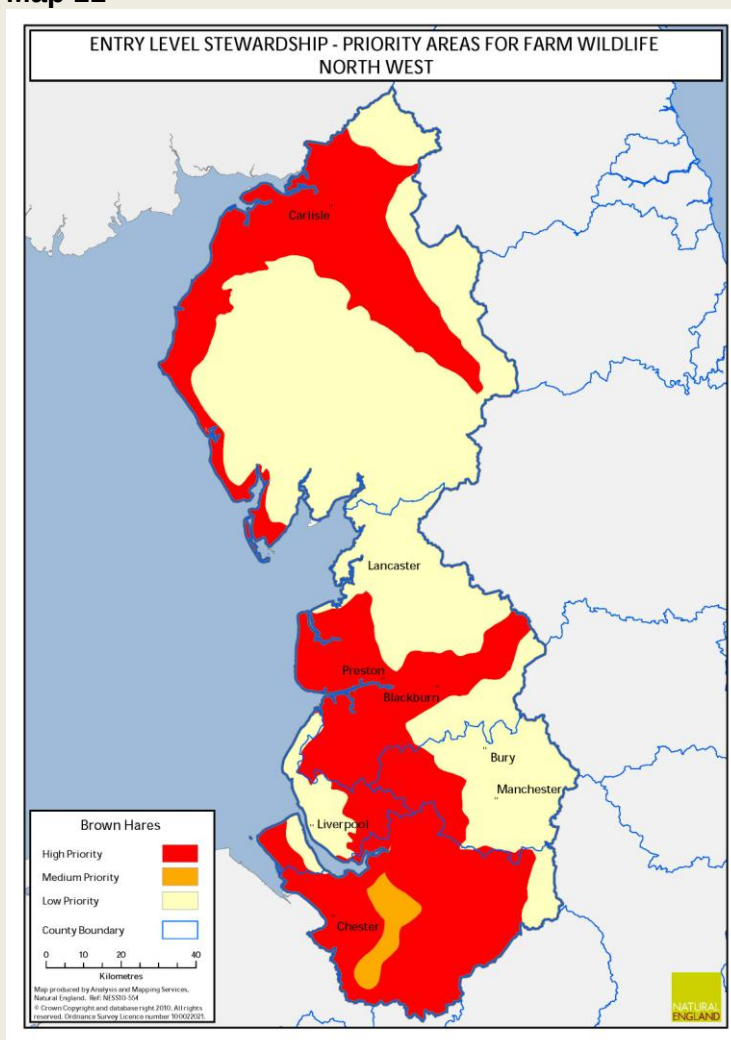


10.0 Factors effecting brown hares in the NWBHP area

10.1 Habitat Management

One of the best ways to improve farmland habitat for brown hares is to increase the take up of entry level and higher level stewardship. It is important that the suite of options that farmers choose is right to complement each other. New options are being introduced as part of a wider suite of changes designed to improve the environmental outcomes and value for money the schemes deliver.

Map 11



The changes are being implemented in response to Defra Ministers' wish to ensure ELS delivers more and better environmental outcomes (Anon 2012).

As part of this refocus, Natural England have recently included large parts of the North West of England as a focus area for brown hare and have produced a compatible set of stewardship options (See map 11).

It could be argued that these are the areas that should receive the least amount of focus, as brown hares can be found in good numbers here already. In Britain there is greater potential to increase hare numbers in pastoral landscapes than in arable landscape. Agri-environment schemes should target the regeneration of heterogeneity in pastoral landscapes, by encouraging changes such as an increase in fallow land and a reduction in livestock density (Smith 2004).

Conversely, pastoral areas are seen as sub optimal for brown hares and it could be better to focus resources into other areas, especially when there is a population of mountain hare in the South Pennines that could be considered a higher priority in that region.

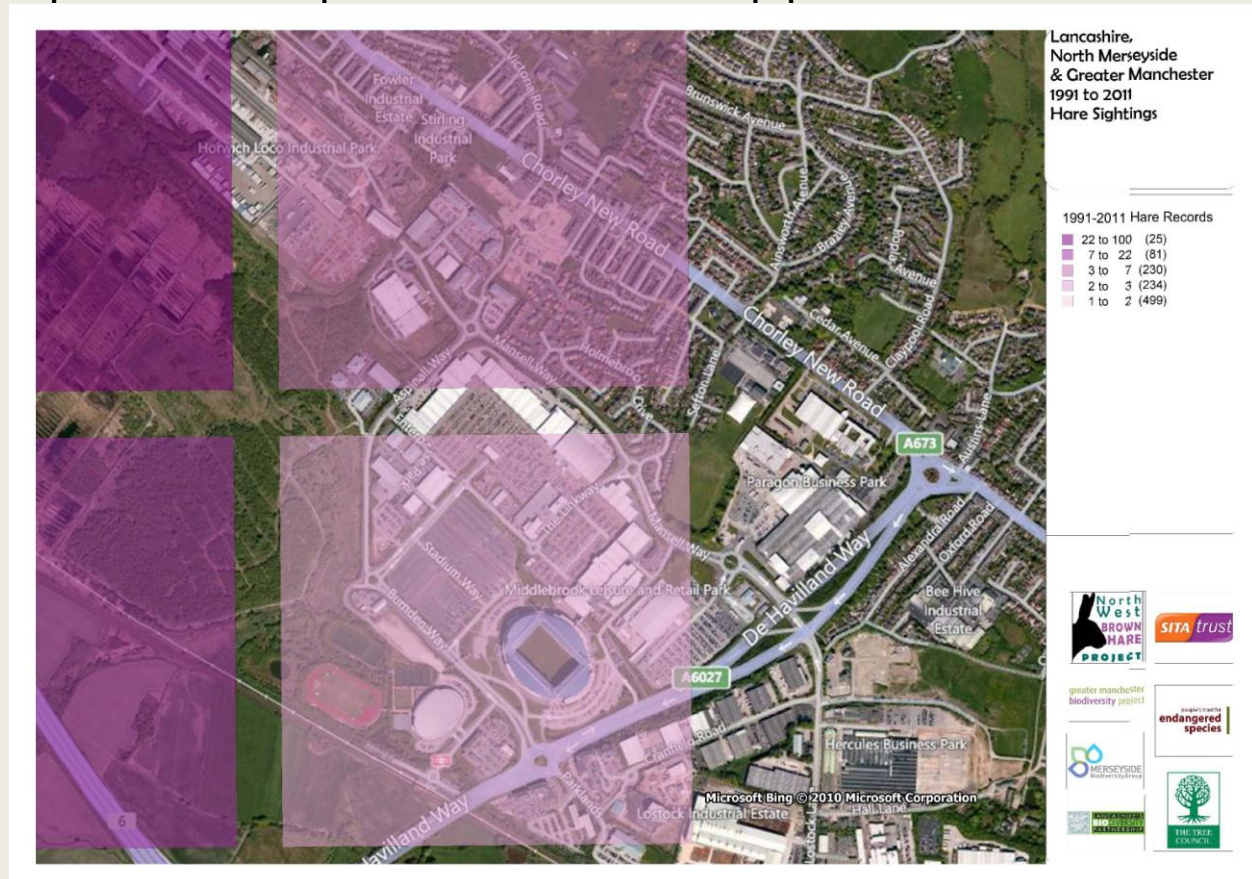
North Merseyside and South Lancashire have benefited from focused higher level stewardship Farm Environment Plans based around farmland birds, which have been produced by David Morris at the RSPB. Another argument for focusing attention into pastoral farmed lowland and valleys is that there is a lack of focused effort into these areas currently.

10.2 Development

Because of a lack of comparable, continuous records, it is difficult to compare year on year brown hare records. What is apparent from the records and is often over looked when discussing the reasons for hare decline, is the number of historic brown hare records that would now be recorded in built up areas. Changes in land management by farmers is often cited as the major cause of brown hare decline, yet habitat loss and fragmentation due to residential, commercial or industrial development is often over looked. Historic brown hare records shown on map 11, serve to illustrate

this point where historic hare records are overlaid on a modern area photograph showing urbanisation.

Map 12: Bolton development on site of a former hare population



10.3 Hunting and illegal lamping/poaching

One ongoing development is a closed season for shooting hares. Early Day Motion 2532 asserts that the shooting of hares during their breeding season is cruel and unnecessary and argues that a close breeding season is needed to protect nursing mothers and their dependent young. Richard Benyon, Parliamentary Under-Secretary for Natural Environment and Fisheries is still considering the proposal.

Throughout the project, many accounts came in from recorders and surveyors of illegal lamping and poaching. Any incidences reported were passed to the Wildlife Crime Officer. There was no

formal study completed into lamping or poaching and so no data is available to the extent of the problem.

White et al (2003) showed of 127 practitioners (farmers) interviewed 11 regarded hares as a pest on their land because hares encouraged poaching on their land and this may be a factor in the projects area. Further research is required in this area

10.4 Disease and infection

No studies on these factors were carried out over the duration of the project and no cases came to light.

11.0 Current activities and future of the North West Brown Hare Project

The NWBHP project will continue to operate through the Lancashire and Greater Manchester Mammal Group, which was set up at roughly the same time. The continuing aim of the project will be to develop an ongoing annual survey that will highlight trends in brown hare numbers across the project area and beyond into the rest of Lancashire.

Spring will see another round of surveying and an annual survey training event will take place at Bleasedale in Lancaster. The aim will be move all the survey forms into an electronic format, where surveyors can complete the surveys online. This will mean less time is spent putting the survey data together and will allow the data to be sent to the NBN more easily.

In the second year of the project, a Facebook page was set up in order to provide an outlet for volunteer's photographs of hares within the project area. This page, the website and an email list of over 500 contacts built up over the life of the project, will continue to promote the project and pass on any relevant information relating to hares within the project area.

All the survey data and hare records will be a passed to the NBN, local universities and the Mammal Society for their Mammal Atlas of Great Britain, which should be published in 2016.

More consultation with Universities at the outset of the project would have been useful. There were no formal or informal contacts made with any of the Universities when the project was being set up. Assistance in surveying and access to student's previous studies on brown hares within the project area would have been beneficial. This is something that the project will look to establish in the future.

12.0 Summary of the project aims

As mentioned at the start of the report, the success of the project can be measured against a specific number of aims put in place at the outset. A summary of how these aims were met can be found in this section.

- To collate and analyse current data to identify survey areas.

Brown hare records were collected from the three local record centres within the project area, Greater Manchester Local Records Centre (GMLRC), Merseyside BioBank (MBB) and Lancashire Environmental Network. (LERN). Brown hare records were also sourced from The Wildlife Trust for Lancashire, Manchester and North Merseyside, The National Trust, The Brown Hare Preservation Society, RSPB Farmland Bird Survey and the British Trust for Ornithology's Breeding Bird Survey mammal data.

When complete, the data base held 2969 individual records of one or more brown hare being sighted between 1991 and 2010.

- Provide training of volunteers to carry out surveys.

Over period of the project 15 training events were delivered, which equates to approximately 300 people taking part in training on brown hare ecology and surveying techniques.

- Promote project to landowners to encourage them to get involved and liaise with landowners to obtain permission to survey.

The project was promoted through a large number of different media. Television coverage was obtained through BBC North West Tonight and BBC Newsround. Radio coverage included BBC

Radio Manchester and Lancashire. Print media coverage came through Lancashire Life, NFU, Farmers Guardian, LWT and local newspapers. Talks to promote the project and habitat management for brown hare were given to West Lancashire Wildlife Group, Lancashire and Greater Manchester Mammal Group, The World Museum, Liverpool, The North West Bird Fair and Merseyside BioBanks Volunteer Fair.

- Analyse survey data to identify areas for habitat management, work with project partners to liaise with landowners to bring into positive management.

In total 418 transects were completed over the duration of the project. This breaks down to 134 in Spring 2011, 46 in Autumn 2011 and 152 in Spring 2012. With a further 86 surveys organised by LWT for the rest of Lancashire. Within the project area volunteers walked 1,159 kms, which is the same distance as a trip from Blackpool to Munich, as the crow flies.

The finding of the first seasons work was presented at the Mammal Societies Northern Conference.

Advice and assistance on brown hares was provided to The Fairfield Association with regards to a potential Urban Nature Reserve and to LWT with regards to the consultation over a potential closed season for brown hares in England.

Letters of support and guidance around brown hare were provided to the Friends of Crompton Moor, LWT's Heritage Lottery Application for habitat management on the West Pennine Moors, LWT's Greater Manchester Mosses Nature Improvement Area bid and LWT's heritage lottery application to fund the purchase of Little Woolden Moss.

Management guidance and reports were produced for LWT on Smithhills Moors, Oldham MBC on Crompton Moor and the wider Oldham Focus Area, LWT Lunt Meadows, LWT Cut Acre, Acornfield Plantation Consultation, LWT West Pennine Moors, Greater Manchester Wetlands NIA and Wigan Greenheart including Lightshaw Meadows.

- To promote best practice for habitat management by creating 'demonstration sites'.

Close ties were developed with Andrew Holland's arable farm in West Lancashire, The Wildfowl and Wetlands Martin Mere Reserve and Wigan LWT's pastoral Green Heart Farm. Each site has good examples of different Environmental Stewardship options that can be instigated to benefit brown hares. These sites and their insitu habitat options can be utilised in the future to show land managers habitat management in practice.

- Hold best practice events for landowners to promote positive management, this could be combined with other organisations such as FWAG, Natural England (LMAS/ADAS), RSPB and the Environment Agency.

A specific Upland and Higher Level Stewardship training course was jointly hosted with the RSPB's Twite recovery programme, attended by local farmers and Natural England Land Management Advisors.

A "Conservation Grade" introduction training event was run jointly with Conservation Grade and Jordans Cereals. Onsite surveying and habitat management advice was also given to the Friends of Martin Mere, Friends of Crompton Moor, Tameside Volunteer Rangers and the Friends of Werneth Low

- To promote wider use of the Brown Hare website for record submission www.brownhare.org.uk.

Between Jan 2010 and Dec 2012 343 volunteer recorders sent in 1417 individual records of one or more brown hare being sighted via the website or the local record centres. 20 years of brown hare records increase by 48% in under 2 years.

- Other outputs

89 mountain hare records were collected for Greater Manchester and passed to the NBN. The NBN previously held 2 records.

8 university students were given help with projects, with one contributing to this report.

2,000 leaflets with information about brown hares in Greater Manchester, South Lancashire and North Merseyside were sent around the all the libraries in the project areas, as was this report.

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15.0 Appendix

15.1 NWBHP data sheet

BROWN HARE DATA SHEET

✓ Logged 04/04

Please use a new data sheet for each walk and return the sheet for each walk even if no hares were seen.

Date of walk: 17/3/12 Time started: 1800 Time finished: 1920.

Recorders name and address: C. BUSHELL
172 LIVERPOOL RD
LONATON.
WANCIS PR4 5ZE

Brief description of the weather:
(e.g. RAIN = none, light, heavy, WIND = calm, light, breezy, VISIBILITY = good, moderate, poor) NO RAIN, CALM, GOOD VIS.

Grid Reference: (This will be on the grid square map given to you) SD 4525

Hare no. (to be marked on the map supplied)	Time	Minimum distance from hare to transect (in metres)	Behaviour when seen (e.g. running/crouching)	Habitats (see key)*	Detailed land use (e.g type of livestock, crop type)*
1	1810	100M	CROUCH	I	LIVESTOCK
2	1810	120M	"	I	"
3	1810	100M	"	I	"
4	1810	75m	"	I	"
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					

*Please complete even if no hares are seen.

15.2 NWBHP survey map

NORTH WEST BROWN HARE PROJECT - TRANSECT ROUTE MAP

Please draw your transect route (clearly marked with a black felt pen) onto the Ordnance Survey map below.
Please mark the locations of any hares seen on the map, with an arrow showing the direction of travel (if any).

1 km Square SD4525	Observer name C. BUSHALL	Notes 17/3/12	SCALE: 1:7500
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greater manchester
biodiversity project



people's trust for
endangered species



Notes and other wildlife sightings

Distance Covered 2.78

15.3 NWBHP survey guidelines

GUIDELINES FOR HARE SURVEY WORK

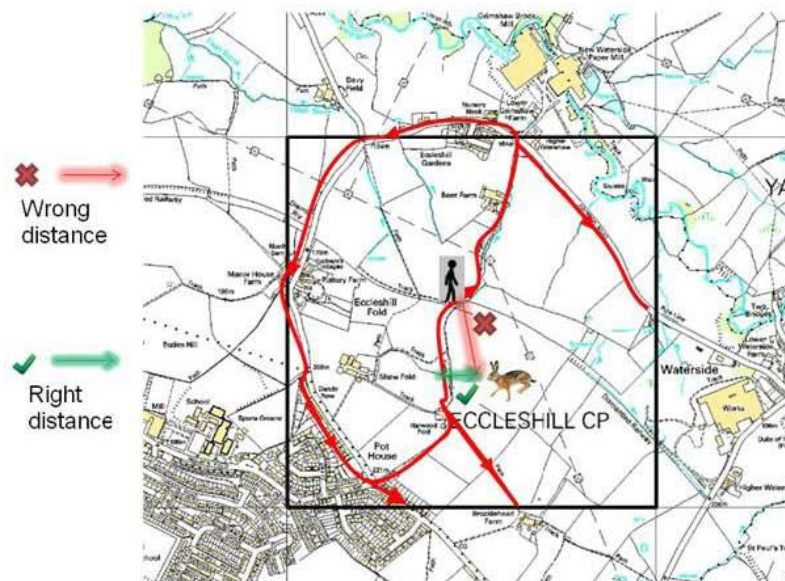
Equipment Checklist:

Map of your 1km square
Hare Data Recording Sheet
Introduction letter to the landowner
Habitat descriptions
Clipboard
Pencil
Rubber
Binoculars
Walking boots/ wellingtons
Watch

Conducting Your Survey

The following points should be kept in mind when walking your transect:-

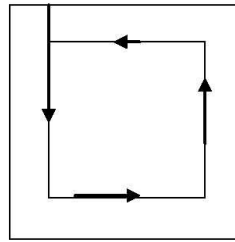
- Do not survey in wet or windy conditions or if the visibility is less than 200m because of mist/fog
- Try to time your walk so that it takes place as near to dawn or dusk as possible.
- Allow two hours to conduct the survey
- Do not wear bright clothes, make a lot of noise or take dogs with you
- Walk the transect at a slow but steady pace and stop regularly to scan in front of you and to your sides. In order to maximise your chances of seeing hares that are at rest it may be useful to get into the habitat of using your binoculars to scan around you, spending a few minutes observing the area carefully.
- A torch and/or walking pole/stick maybe be useful if you are venturing out or returning in the dark
- Conduct the survey twice on two separate maps and forms
- Complete survey by end of March, if possible.
- **Record the minimum distance between the hare and the transect not the distance between you and the hare (see below)**



The 'Transect':

The aim of the survey is to try and record the number of brown hares in your square. The best way to do this is to walk around a set route that crosses your square in such a way so that you get a good view of most of the land in the square. The route is known as a 'transect'. The basic idea is to walk the transect and mark on the map the locations of any hares you see within your square, filling in the hare data form as you go.

The ideal transect is around a one kilometre square and looks like the route on the right here:



However, we appreciate that it will be difficult (if not impossible) to walk around your square in this fashion while keeping to linear features on the ground. All we ask is that you plan a route that is as close to the 'ideal' as the terrain, rights of way, etc will allow. It may not be possible for you to keep your transect inside your square throughout, though do please try to stay inside your square where possible.

Observer

When you have decided on your transect route please mark it on your map. If you have to double back along a path i.e. you walk to the end of a path which is a dead end then have to return along it to continue your transect, can I ask that you only record any hares you see on your outward journey. This is to avoid counting the same hare twice.

Because hares are nocturnal, the ideal time to survey for hares is at night, however we realise this is not always possible or safe. Therefore, in order to obtain more accurate results, this year we are asking you to complete the survey twice. Completing the survey as close to dusk or dawn will also give you a much better chance of seeing hares.

Your Square:

Some people have volunteered to do a square that they have chosen themselves, usually on their own land or land that they manage or have an interest in. Others have offered to survey squares that we have chosen.

Unless you know the square very well it may be an idea to visit the area a few days before you walk the transect to decide on the route it should take. If possible, the transect should follow linear features such as footpaths, bridleways, roads, field edges, hedgerows, tracks through woods, riverbanks, etc. Avoid walking across the middle of fields especially if these contain crops.

If there are any areas of private land that you need to cross but which do not have public rights of way, then you should arrange permission to walk on these stretches of land.

The Brown Hare Project Officer will liaise with landowners to arrange permission for access onto land, where possible. If you are unsure if you have permission please check or ask the landowner. You will be issued with a letter that briefly explains what you are doing and if the landowner requires more information direct them to the Brown Hare Project Officer. We rely very much on the good will of farmers and landowners to conserve hare populations so permission should be obtained from relevant landowners before walking across an area where there is no public right of way.

Habitat Identification

When you conduct your survey you will need to identify what type of habitat you saw the brown hare in. You have been given a brief description of the features of the main types of habitat to help identification. The most common types of habitat will be improved grassland, semi improved grassland and arable or amenity grassland. If you are unsure about which habitat you saw a hare in, please write your own description or take a photograph of the area and send to the Brown Hare Project Officer. Gaining an idea of what type of habitat hares are found in is a vital part of this project. If possible, it would also very useful to know what type of crop or what stock was on the land. Again, if you're not sure, a brief description of what is there would be good i.e. "ploughed field", "cereal crop", "green leafed crop" etc.

Your Hare Data Recording Sheet

Please record details of each Hare sighting on your Hare Data Sheet. Mark the location of any hares you see on your map with a cross. If the hare is moving (which is more than likely!) mark where the hare goes by using an arrow from the cross like this:



Try to record each individual hare only once. (Hares sometimes circle around and so noting the direction in which they move off can be useful). **When you see a hare, the data sheet asks you to fill in the minimum distance between the hare and the your transect route. Please try to be as accurate as you can with this figure.** The sheet also asks you to record the time you saw the Hare, its behaviour and what habitat you saw it in. Please also fill in the time you start and end the transect, a brief description of the weather, the date and your contact details on the data sheet.

After the Survey:

Once you have gathered the data send a copy of your map (with the transect and sightings marked on it) and the Hare data recording form to:

Samuel Bolton - Project Officer,
North West Brown Hare Project,
Greater Manchester Ecology Unit,
Room 1.45 Tameside MBC Council Offices,
Wellington Road, Ashton Under Lyne.
OL6 6DL

It is VERY important to return your Hare data form even if you don't record any Hares. If you want to keep details for your own records don't forget to make a copy for yourself! Any queries telephone the Brown Hare Project officer on 0161 342 4409 or email.

Health and Safety

We want you to remain safe. Listed below are a wide variety of general hazards that you might encounter when working in the field along with precautions to reduce the risks:

- Undulating/rough terrain and steep slopes.

Select appropriate footpath/route. Wear appropriate footwear with good soles and ankle support.

- Weather.

Ensure you are aware of the forecast prior to your work. This is of particular importance in the winter or when visiting remote or high moorland areas.

- Dense vegetation.

May obscure hazards such as holes, burrows, tree stumps or fencing. Work with care in such conditions.

- Protruding stems.

Take care when bending to survey vegetation to avoid injuries to eyes.

- Cross streams or rivers only by footbridges or other purposely built structures. Avoid any structures that appear damaged or poorly maintained.

- Poorly maintained footpaths, stiles, etc.

Avoid these if possible and report to the appropriate agencies.

- Conduct survey work in pairs whenever possible.

- Secluded sites.

If in doubt err on the side of caution and do not walk alone. Inform another person of where you are going, your route and estimated time of return and arrange for them to contact the authorities if you do not contact them to say you have arrived back safely.

- 'People' Hazards. (Might include poachers, strangers in isolated sites, irate owner/occupier, people with dangerous dogs, etc.)

- (a) Exercise good judgement and assess the situation
- (b) Avoid confrontation and withdraw if threatened
- (c) Record incident and inform appropriate authorities
- (d) Carry mobile phone if possible
- (e) Operate lone working system
- (f) If in doubt do not work alone

- People with firearms.

If shooting is legal make yourself known audibly and visibly. If illegal, withdraw and report to authorities.

- Railways.

NO fieldwork on active railways.

- Hypothermia.

Wear appropriate warm and waterproof clothing. Carry extra clothing and high energy food (e.g. chocolate).