

Results of the squirrel monitoring programme, spring 2016



Red squirrel captured on a trail camera during monitoring at Penrith Beacon, April 2016

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Summary

This report details the results of red and grey squirrel range monitoring organised by Red Squirrels Northern England (RSNE) in spring 2016. The aim of this standardised monitoring is to collect a dataset over time that will help demonstrate the impact of red squirrel conservation activity on the distribution of red and grey squirrels. The results of standardised surveying in 293 woodland sites are detailed here, together with additional data collected from a variety of sources to provide a current snapshot of red and grey distribution across northern England.

Monitoring in spring 2016 found that the number of sites with red squirrels was very similar to the result in 2015. Red squirrels were detected in 128 out of the 293 sites, an occupancy of 43.6%. In 2015, they had been observed in 127 out of 290 sites; an occupancy of 43.7%. In contrast, the number of sites with grey squirrels dropped significantly, with site occupancy dropping from 46.5% in 2015 to 36.8% in 2016.

Analysis for spring 2016 looked at the site occupancy of red and grey squirrels across the whole project area, but also looked at the performance of the red squirrel reserve and stronghold areas compared to survey sites in the wider landscape (sites outside of the strongholds but within current red squirrel range). Red squirrels were found in 49.1% of survey sites within strongholds, and in 36.1% of sites outside of stronghold areas. Grey squirrels were recorded in 31.5% of surveys located within strongholds, and in 44.2% of surveys within the wider landscape.

Proportionally red squirrels occupied more survey sites within strongholds than in the wider landscape. In contrast, grey squirrels occupied more survey sites within the wider landscape than in the strongholds. There was much variation in red and grey squirrel site occupancy between the different stronghold areas, with results showing that red squirrels were more frequently recorded in some strongholds, with grey squirrels dominating in others.

The results for sites surveyed within 16 red squirrel reserves were also analysed. Red squirrels were detected in 13 of these reserves, and grey squirrels in six. There were 72 survey sites in total within reserves. Reds were present in 59.2%, and grey squirrels were present in 23.6% of all surveys within reserves. 10 of the reserves were red squirrel only. Both species were observed in three of the reserves. Three of the reserves were grey squirrel only.

Maps were created using all data recorded between March and May 2016 from standardised surveys, conservation activity records and public sightings submitted directly to RSNE or via Northern Red Squirrels (NRS). These maps provide a snapshot in time of the distribution of both species. Red squirrels were recorded in 379 tetrads and grey squirrels were recorded in 459 tetrads during this three month window.

Community involvement made the delivery of this monitoring programme possible, with over 140 people involved. 26% of surveys were carried out by RSNE staff, with the remaining 74% carried out by a wide range of organisations and individuals.

Acknowledgements

Fieldwork on this scale would not have been possible without the vast number of volunteers and staff who contributed their valuable time and energy to making this happen. In addition, we greatly appreciate access granted to woodlands by land managers throughout the project area. We would also like to praise the contribution of hundreds of red squirrel conservationists who contributed additional records during the survey window, helping us to document current red squirrel range in northern England.

Contents

Summary

Acknowledgements

1	Introduction	6
2	Results	8
	2.1 Standardised monitoring	8
	2.2 Compiled records: Conservation activity records & public sightings	12
	2.3 Comparison of overall monitoring results between spring 2015 and spring 2016	13
	2.4 Spring monitoring results 2012 to 2016	14
	2.5 Reserves and strongholds 2012 to 2016	15
	2.6 Community involvement	19
3	Discussion	19

Appendices

1 Introduction

The aim of the annual monitoring programme is to collect a standardised, long-term dataset that will show changes in red and grey squirrel range over time. This data should also provide evidence to help demonstrate the impact of red squirrel conservation activity on the distribution of both species.

Data is collected in the same locations, using the same methods each time, recording both positive and negative data based on detection or non-detection of squirrels at fixed points and along survey routes. By standardising the way that the surveys are carried out and the data recorded, it is possible to look at changes in distribution over time with confidence that we are documenting change.

In the Red Squirrels Northern England (RSNE) Monitoring Strategy, written in 2012, a minimum sample of 200 monitoring tetrads was identified as necessary to be able to reasonably detect changes in squirrel populations over three years. We also aimed to use all available records collected concurrently with the standardised monitoring to produce maps of the current distributions of red and grey squirrels. These records include public sightings submitted directly to RSNE, or via the Northern Red Squirrels (NRS) network of local community groups. The majority of other records included in these maps come from conservation activity data recorded by RSNE, NRS and other sources.

It is important to monitor squirrel distributions in a standardised way. Grey squirrel control records, red and grey squirrel monitoring data (where methods are not standardised and repeatable) and public sightings are often difficult to use for comparisons over time because of the huge variation in annual effort. Additional records are invaluable, however, for providing a far more complete picture of the distributions of red and grey squirrels than would be possible with standardised monitoring alone. Maps presented in this report are assembled from these different data sources, and these methods are described below.

Standardised monitoring took place between 1st March and 31st May, as in previous years. Conservation activity records and sightings that fell within the same period were also used to ensure that the maps illustrate the most up-to-date distributions of both squirrel species.

All the survey work and data compilation was focused in those geographical areas within the recently known range of red squirrels in England. No standardised monitoring was carried out in east Lancashire, other parts of Yorkshire or lowland County Durham as there is no current evidence of red squirrel occupation in these regions, therefore it should be noted that grey squirrel range represented here is grey squirrel range within feasible red squirrel range only. We assume that greys are widely present in other areas of northern England.

Standardised monitoring

The three squirrel survey methodologies are described in detail on the RSNE website, available to download as pdfs at: <http://rsne.org.uk/squirrel-monitoring-programme>.

In brief, within each tetrad (2 x 2km square), one survey was carried out during a 15 day period, using one of the following methods: baited trail camera, baited visual transect or observed feeder. The survey takes place in the same location each year, and the survey method is kept the same each year wherever possible to enable comparisons over time. There were a small number of changes to methods or exact locations this year, for example where recent felling made it impossible to survey in the same place, or using the same method.

Conservation activity records

Conservation activity includes grey squirrel control and non-standardised red and grey squirrel monitoring (monitoring that does not adhere to the same methods used in the RSNE monitoring programme).

Records of squirrels trapped, shot or observed are collected by the RSNE team of Red Squirrel Rangers, by local voluntary red squirrel conservationists (mostly operating within the network of NRS groups) and by individuals working for other conservation organisations or private estates, some of which receive funding for this work via Forestry Commission English Woodland Improvement Grants. These records are submitted periodically to RSNE using standardised recording forms. All records submitted to RSNE by June 30th 2016, documenting red squirrel conservation activity between 1st March and 31st May 2016, were used in the compilation of distribution maps included in this report.

Public sightings

Sightings of red squirrels are submitted directly to RSNE via the sightings page on the RSNE website, <http://rsne.org.uk/sightings>. Sightings of both red and grey squirrels are also compiled by the NRS local groups and by other organisations. These are then submitted to RSNE, and verified as far as possible. Verification of public sightings is generally limited to a check to ensure the place names submitted match the map location selected by record submitters on our website, followed by a check of the fit with known recent red squirrel range. Unusual sightings are followed up to seek additional information, such as a description and photograph. Public sightings failing these verification checks (e.g. from South Yorkshire and parts of Lancashire) have not been included in this analysis.

Red squirrel reserves and strongholds

In 2006, 17 red squirrel reserves in England were selected by the government for protection as safe havens. The red squirrel reserves consist of coniferous forestry plantations where red squirrels were thought to be at less of a competitive disadvantage to grey squirrels than in the surrounding landscape. Around these reserves, the Forestry Commission designated buffer zones in which landowners were

able to apply for English Woodland Grant Scheme (EWGS) funding to carry out control of grey squirrels. This scheme closed in 2014, and has now been replaced by Countryside Stewardship. Red squirrels are listed as a priority species under the new scheme and as such are eligible for funding not just within these previously designated areas, but across northern England wherever the species occurs.

The reserve and buffer zones are collectively referred to as 'strongholds'. These strongholds are still important areas for red squirrels, and because of the historical investment of both time and money in conserving reds in these areas, it is appropriate for us to continue to look at these geographical areas to continue to assess whether they function as well as or better than other non-designated areas.

Several of the strongholds merge together, forming seven different strongholds and stronghold complexes that are geographically connected: (i) Kyloe, (ii) Harwood and Raylees complex, (iii) Kielder complex, (iv) Slaley complex, (v) North Lakes complex, (vi) Yorkshire Dales complex and (vii) Sefton Coast) (see Appendix for map).

The wider landscape

Red squirrels are present throughout northern England in areas outside of the designated strongholds. These areas are referred to in this report as 'the wider landscape'. The opening up of funding eligibility for red squirrel conservation across the species' range in northern England now recognises the importance of these populations, and the need for conservation effort wherever red squirrels still occur. For the purpose of this report, results will, as in previous years, be broken down into reserve, stronghold and wider landscape, to help assess the functionality of these different zones.

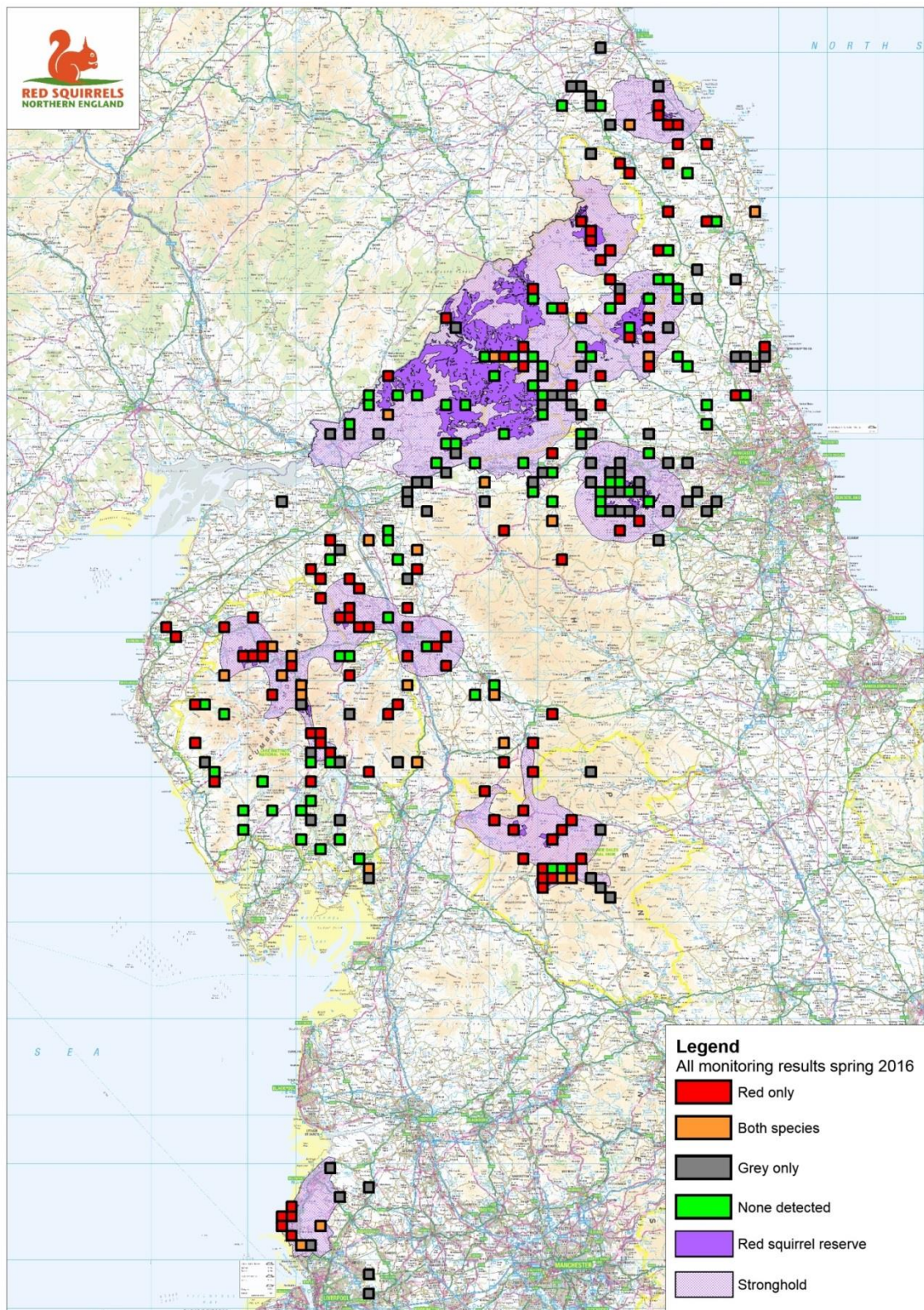
2. Results

2.1 Standardised monitoring

The results of 293 surveys were available at the time of preparation of this report. This is once again a very similar total to previous years, with 289 and 290 surveys completed in the preceding two years. The breakdown of methods used per survey site is as follows: 231 trail cameras surveys, 42 visual transects and 20 observed feeder surveys.

Red squirrels were detected in 43.6% of surveys (128 out of 293), and grey squirrels were observed in 36.8% (108 out of 293) of the total number of surveys. 35.4% of sites were red only (104/293), 28.6% were grey only (84/293) and both species were detected at the same site in 8.1% of surveys (24/293) (Fig. 1). Additional maps showing red and grey squirrel detection and non-detection are included at the end of the report (Figs. 7 and 8).

Fig. 1. Survey results for all 293 tetrads spring 2016



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171 surveys were located within red squirrel strongholds, and 122 were distributed across the wider landscape (Table 1).

Table 1. Results of systematic monitoring in spring 2016, broken down into red squirrel strongholds and the wider landscape.

Result	Strongholds	Wider landscape	Total
Red squirrels only	70 (40.9%)	34 (27.8%)	104
Red & grey squirrels	14 (8.2%)	10 (8.2%)	24
Grey squirrels only	40 (23.4%)	44 (36.1%)	84
No squirrels	47 (27.5%)	34 (27.9%)	81
Total number of tetrads	171	122	293

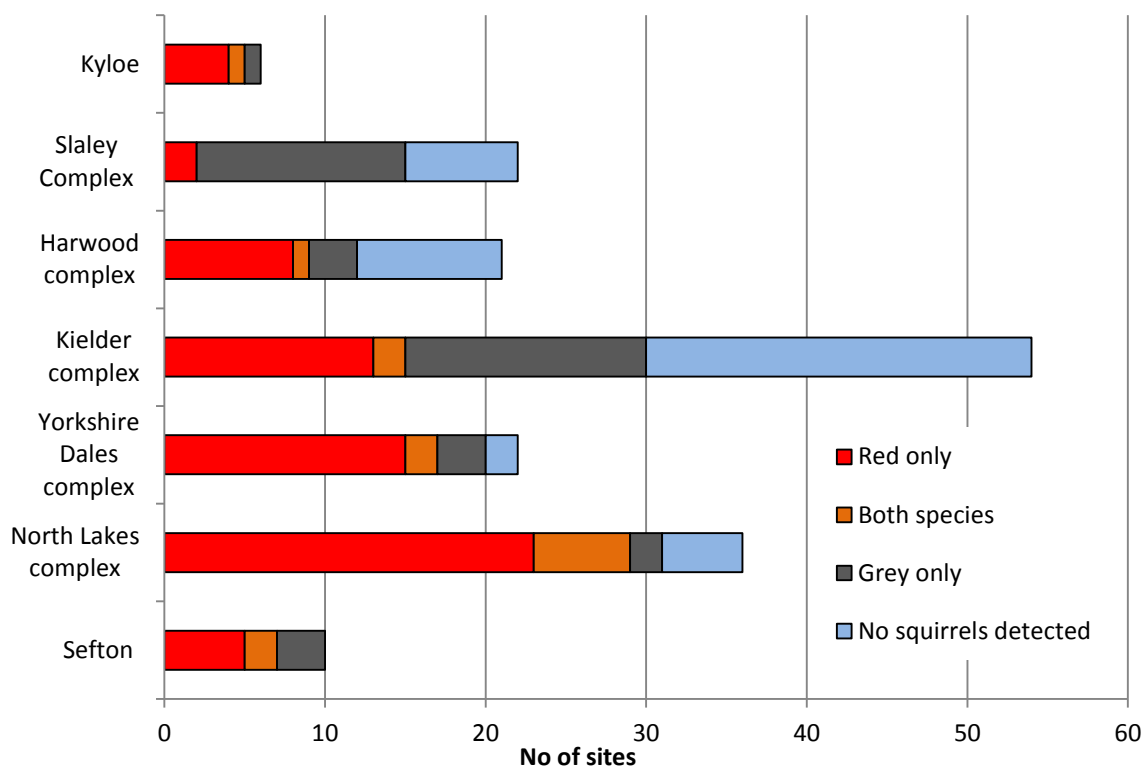
Red squirrels were detected in more sites within the stronghold areas than grey squirrels, with reds detected in 84 (49.1%) surveys, compared to 54 sites (31.5%) where grey squirrels were observed. Outside of strongholds, in the wider landscape, grey squirrels were detected in more sites than reds, with greys detected in 54 (44.2%) of surveys, compared to 44 sites (36.1%) where red squirrels were observed.

Proportionately, red squirrels were detected in a higher percentage of stronghold sites (49.1%) compared to wider landscape sites (36.1%). In contrast, grey squirrels were detected in a higher percentage of wider landscape sites (44.2%) compared to stronghold survey sites (31.5%). However this is a somewhat coarse comparison between designated and non-designated areas. In reality, the likelihood of encountering red or grey squirrels varies greatly geographically, both within strongholds and in the wider landscape.

Results show that there is much variation in the status of the strongholds, with some functioning better than others as red squirrel areas. Fig. 2 illustrates the performance of the seven stronghold complexes, showing the number of tetrad surveys completed in each area, and the result of these surveys. The number of surveys in each complex varies greatly, reflecting the difference in size of these areas.

Red squirrels were detected in 83.3% of sites in Kyloe, the highest percentage of all the complexes; however this stronghold also has the lowest number of survey sites (6). Sefton also performed well, with reds observed in 70% (7/10) sites, although again there are a low number of survey sites in this stronghold. Results for the North Lakes complex were excellent, with red squirrels detected in 80.6% (29/36) of sites. Results for the Yorkshire Dales complex were similar, with reds detected in 77.2% (17/22) of sites. Grey squirrels were detected in a fairly low number of sites within these two complexes. They were observed in 22.2% (8/36) of surveys in the North Lakes, and in 22.7% (5/22) of surveys in the Yorkshire Dales.

Fig. 2. Systematic monitoring within the seven stronghold complexes in spring 2016, showing number of sites and results within each complex.



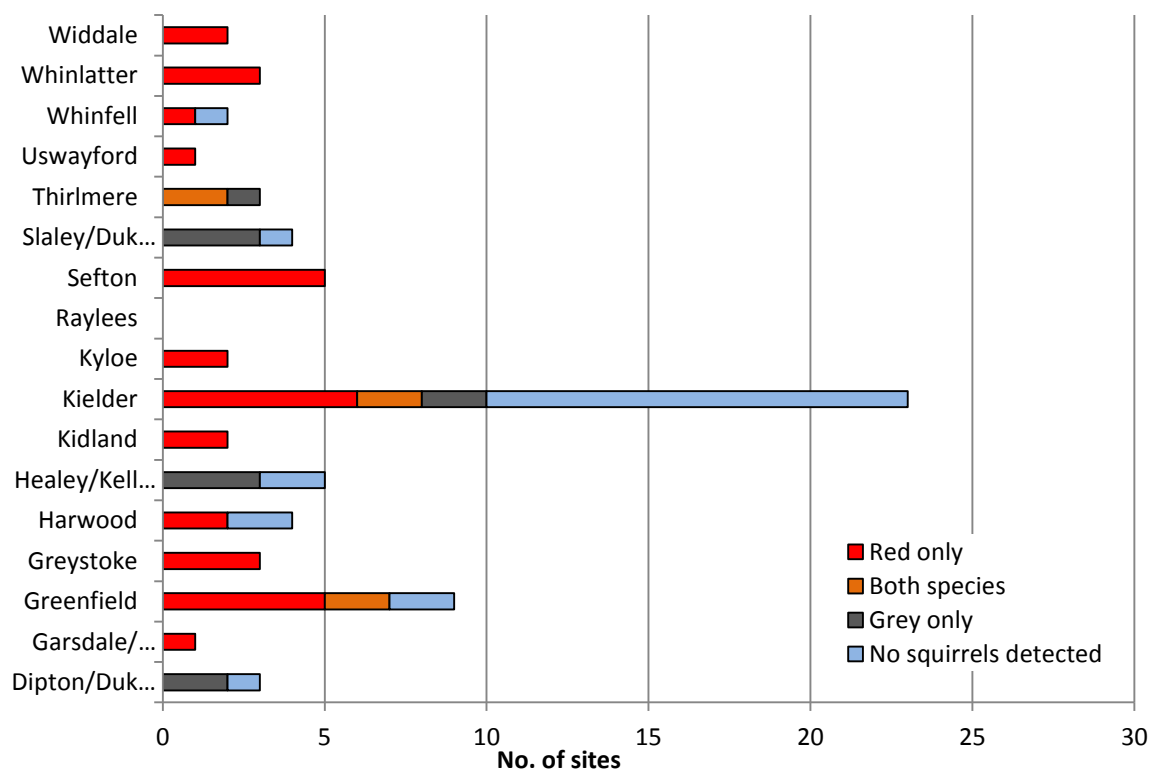
Detection of red squirrels in survey sites within the Harwood complex was fairly low, with reds observed in 42.9% (9/21) of sites. Harwood had the lowest grey squirrel detection rates of all seven complexes, with greys observed in 19.0% (4/21) of sites. Results for Kielder were slightly disappointing, with no squirrels detected in 44.4% (24/54) of surveys. Grey squirrels were detected in slightly more surveys than reds, with greys observed in 31.5% (17/54) of sites, and reds in 27.8% (15/54).

Results were poor for the Slaley complex. Red squirrels were only detected in 9.1% (2/22) of survey sites. In contrast, grey squirrels were fairly regularly observed, in 59.1% of sites (13/22).

72 survey sites were located within the designated 17 red squirrel reserves, however only 16 of the reserves were surveyed this year as no surveys were carried out in Raylees. Red squirrels were detected in 13 out of 16 of the reserve woodlands. Grey squirrels were detected in 6 out of 16 reserves. Reds were present in 54.2% (39/72) of all surveys within reserve woodlands, and grey squirrels in 23.6% (17/72) of reserve surveys. Several of the reserves were red squirrel only: Widdale, Whinlatter, Whinfell, Uswayford, Sefton, Kyloe, Kidland, Harwood, Greystoke and Garsdale.

There were a high number of sites within Kielder where neither species were detected. Results were disappointing at Thirlmere, where greys were detected in all three of the surveys, with reds observed in two out of three sites. Grey squirrels were present in all three of the reserves within the Slaley complex: Slaley/Dukesfield, Healey/Kellas and Dipton/Dukeshouse. No red squirrels were observed in any of these three forests.

Fig. 3. Results of systematic monitoring in the 17 red squirrel reserves in spring 2016.



2.2 Compiled records: Conservation activity records & public sightings

Separate distribution maps for red and grey squirrels are included at the end of this report (Figs. 9 and 10). These maps were put together by combining the information from conservation activity records and public sightings between the dates of 1st March and 31st May 2016 with our standardised monitoring results. The contribution made by the addition of control and sightings records submitted to RSNE is detailed in Table 2.

Additional data helped to document red squirrel presence in a further 251 tetrads. Grey squirrels were recorded in an additional 351 tetrads over the same period. This vast demonstration of red and grey squirrel range, recorded over a relatively short time period, highlights the scale of the conservation effort across northern England. Practical conservation and the documentation of this effort continue to grow. It is worth noting that much of the grey squirrel distribution data comes from the documentation of grey squirrel control. Crucially, these additional records help us to demonstrate red range in areas where they were not detected during standardised monitoring, or in areas where there are no existing standardised survey sites.

Table 2. The number of tetrads with recorded red and grey squirrel presence for the period March to May 2016. This data was combined to produce compiled distribution maps (Figs. 9 and 10).

	Number of tetrads		
	Standardised monitoring	Conservation activity records & public sightings	Total
Red squirrel	128	251	379
Grey squirrel	108	351	459

Conservation activity records and public sightings have again filled in many of the gaps in red squirrel range, although it is still only a snapshot of true range. There are many areas where there is no documented search effort, where red squirrels may well be present. We have been able to document recorded red squirrel range well beyond that of the monitoring programme, for example in many parts of west Cumbria, Carlisle and other parts of north Cumbria and south east Northumberland around Cramlington and Ashington to highlight but a few areas.

Although not detected during standardised monitoring in the reserves of Slaley and Kellas, these additional records enabled us to confirm that reds are present in these woodlands, despite the fact that they have rarely been observed in these sites in the five years that the programme has been running (see Table 4).

There were also several parts of the stronghold complexes where red squirrels were not detected during monitoring, however the additional records have helped confirm that red squirrels are present within the same tetrads: for example in the Kielder stronghold around Wark, at the western edge of the Kyloe stronghold, and at the southern edge of the north Lakes stronghold, around Ambleside.

The number of tetrads with confirmed red squirrel presence, from all data, was very similar compared to 2015. In 2015 we were able to confirm that red squirrels were present in 378 tetrads. In 2016 the number was 379. In contrast, the number of tetrads with confirmed grey squirrel presence decreased considerably, from 552 tetrads in 2015 to 459 in 2016. Although we cannot read too much into this decline because of variations within this overall dataset (for example variations between years in effort, in recording or reporting of this work), this nevertheless may provide further evidence of a comparative decline in greys.

2.3 Comparison of overall monitoring results between spring 2015 and spring 2016

290 tetrads were surveyed in 2015, and 293 in 2016. The breakdown of these results is provided in Table 3. The number of tetrads in which red squirrels were detected was very similar (127 in 2015 and 128 in 2016). In contrast, the number of tetrads in which grey squirrels were detected dropped considerably between years (135 in 2015 to 108 in 2016). This maintenance of the number of red squirrel occupied sites is welcome

news following the decline in the number of red squirrel occupied sites reported last year, compared to previous years.

Table 3. Comparison of overall results between spring 2015 and spring 2016.

Result	Number of tetrads & percentage of total number of sites		
	Spring 2015	Spring 2016	Change
Red only	90 (31%)	104 (35.4%)	+14
Both red and grey	37 (12.7%)	24 (8.1%)	-13
Grey only	98 (33.7%)	84 (28.6%)	-14
No squirrels	65 (22.4%)	81 (27.6%)	+16
Total red occupancy	127 (43.7%)	128 (43.6%)	+1
Total grey occupancy	135 (46.5%)	108 (36.8%)	-27

2.4 Spring monitoring results 2012 to 2016

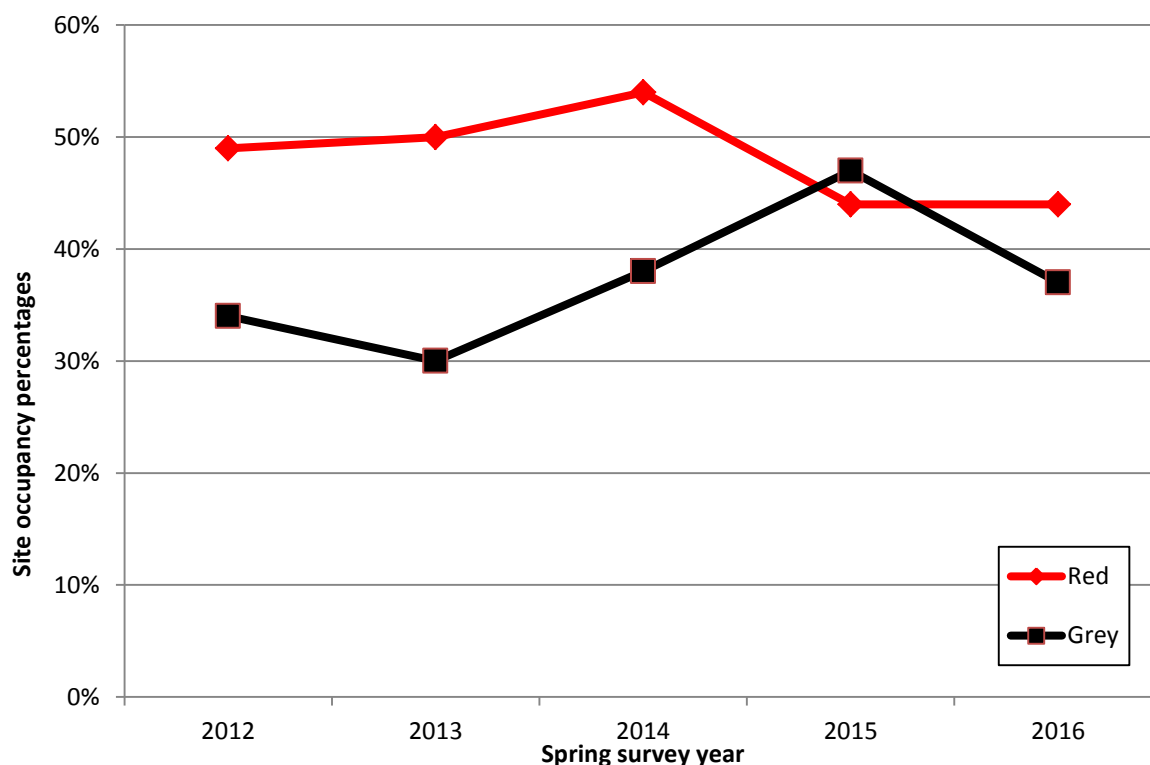
The survey programme has now been running since spring 2012, providing systematic monitoring for five years. In-depth analysis of these results is beyond the scope of this report, however, to place the results in context, some comparison of results each year for spring 2012 to 2016 is presented here (see Fig. 4). For the purpose of this comparison, results of the two autumn survey rounds (2012 and 2013) are not included. Spring 2012 is the baseline for the programme: however it is worth noting that there were considerably fewer surveys (255) carried out in this initial year. Following this, the number of surveys completed was remarkably similar in each of the following years.

In 2012, red squirrels were detected in 48.6% of surveys (124 out of 255) and grey squirrels were detected in 34.1% (87 out of 255 surveys). In 2013 there was a slight increase in site occupancy, with reds detected in 50.3% (146 out of 290 surveys). Grey squirrel site occupancy decreased, with greys detected in 30.3% (88 out of 290 surveys), although it should be noted that the overall number of surveys in 2013 increased by 35, which may have influenced these percentage changes.

In 2014, following a mild winter and an excellent natural food supply, red squirrel site occupancy increased to 53.6% (155 out of 289 surveys). Similarly grey squirrel site occupancy increased to 38.4% (111 out of 289 surveys). This increase continued for grey squirrels in 2015 following a consecutive year in which environmental factors helped create the right conditions for the species to thrive, in particular with a bumper broadleaved seed crop. This is likely to have given grey squirrels a temporary advantage over reds, as their ability to outcompete red squirrels in broadleaved woodlands is well documented. Grey squirrel site occupancy jumped to 46.5%. This is in stark contrast to red squirrel occupancy, with reds detected in 43.7% of surveys, representing a considerable decline between 2014 and 2015.

This year's results do suggest some stabilisation in red squirrel site occupancy, with reds detected in 43.8% of sites. Although this number is similar to 2015, it is still down on previous years, particularly when compared to 2013 and 2014 results. The decline in the number of sites occupied by grey squirrels from 46.5% in 2015 to 36.8% in 2016 is a welcome one, and comes as some relief. Grey squirrel site occupancy has dropped to a figure slightly lower than the level in 2014 (Fig. 4.)

Fig. 4. Red and grey squirrel site occupancy for all spring surveys 2012-2016. Site occupancy is shown as a percentage of the total number of surveys completed each year.



2.5 Reserves and strongholds 2012 to 2016

It is worth looking at overall monitoring results for each of the 17 reserves since the start of the programme in 2012 so that we can consider the worth of these forests as designated red squirrel areas. Table 4 details the overall result for each of these reserves between 2012 and 2016. It should be noted that the number of survey sites per reserve varies considerably, for example Garsdale/Mallerstang has only a single site due to the small size of this forest. In contrast, Kielder reserve has up to 25 survey sites therefore there is more chance that we will encounter both species. Nevertheless, Table 4 provides a useful snapshot of reserve performance over time.

Grey squirrels have never been detected during surveys in several of the reserves; Garsdale/Mallerstang, Greystoke, Harwood, Kidland, Kyoie, Sefton, Uswayford, Whinlatter and Whinfell. Healey/Kellas is the only reserve where red squirrels have never been detected during surveys. Both species are regularly detected in some of the reserves (for example Thirlmere) although it is worth highlighting that this does not necessarily mean both species are equally abundant. A good example would be

Greenfield, where red squirrels are the most populous species, but greys are present in low numbers from time to time.

Table 4. Overall combined result per red squirrel reserve for spring surveys 2012-2016. The result is represented by the following colours: Red = red only, Orange = both species, Grey = grey only.

	Overall result per reserve per year				
Reserve	2012	2013	2014	2015	2016
Dipton/Dukeshouse	None				
Garsdale/Mallerstang					
Greenfield					
Greystoke					
Harwood				None	
Healey/Kellas					
Kidland		None			
Kielder					
Kyloe	None				
Raylees	None	None	None	None	No survey
Sefton					
Slaley/Dukesfield					
Thirlmere					
Uswayford	None	None			
Whinfell					
Whinlatter					
Widdale					

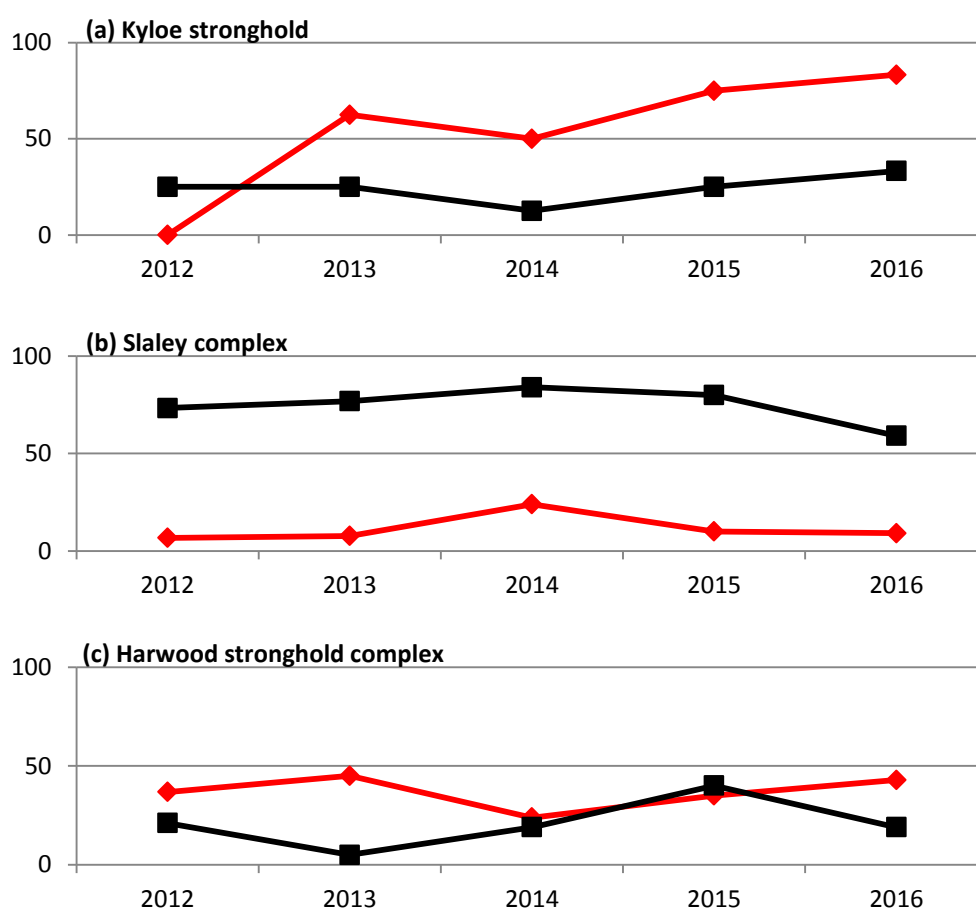
Monitoring results for the seven stronghold complexes between 2012 and 2016 are shown in Fig. 5. In the majority of complexes, red squirrel site occupancy is higher than grey squirrels. The difference between red and grey occupancy is most obvious in the North Lakes where reds were detected in 80.6% of surveys, and greys in 22.2% of surveys in 2016 (Fig. 5f). Red squirrel site occupancy in the North Lakes has remained fairly stable over the five year period, whereas grey squirrel occupancy percentages dropped considerably, from 43.2% in 2015 to 22.2% in 2016. Similarly, results for the Yorkshire Dales complex (Fig. 5g) show a considerable difference between red and grey site occupancy each year, with the exception of results for 2015, when red site occupancy dropped to 69.6% following a high of 90.9% the previous year. Grey squirrel site occupancy has remained fairly stable, at a low rate, for the duration.

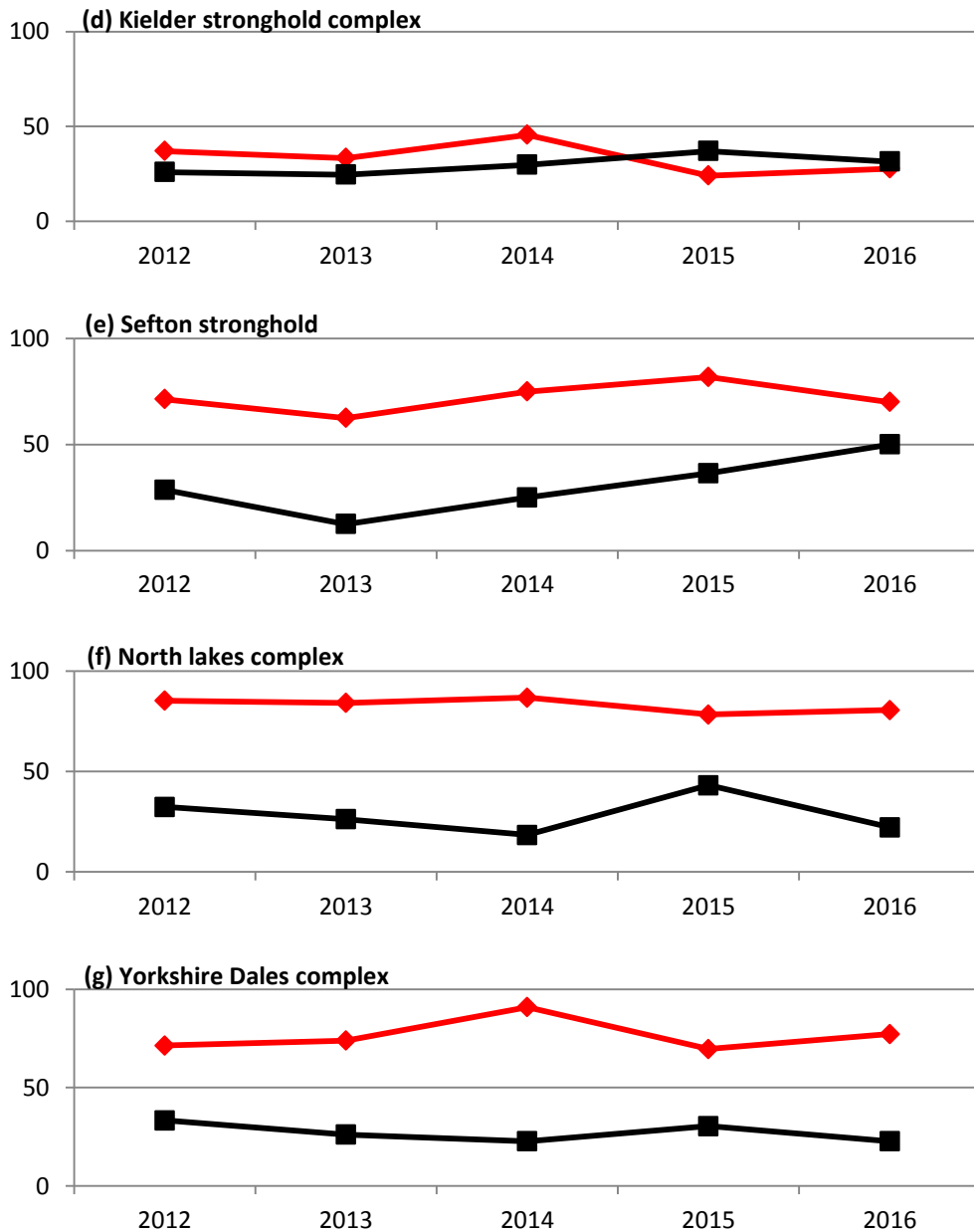
Red and grey squirrel site occupancy over time has remained fairly stable in the Kyloe stronghold (Fig. 5a) with a slight increase each year for both species over three years between 2014 and 2016, although again the low sample size means even the slightest change appears more pronounced than it is in reality. Results over time in the Sefton stronghold (Fig. 5e) are positive, with red site occupancy remaining around or above the 70% mark, with a slight dip in 2013 (62.5%). Although the graph suggests a

significant increase in the percentage of sites occupied by greys to 50% in 2016, the low sample size means that we can have less confidence in interpreting this result, as any changes appear more extreme the lower the number of sites. The addition of a small number of new sites in 2015 around Sefton is also likely to have affected the result, as grey squirrels were detected in these sites. Table 4 showed that the reserve woodlands in Sefton have remained grey free for the duration of the programme, highlighting the fact that the real battle lies within the surrounding landscape.

Detection rates remain fairly low for both species in the Harwood (Fig. 5c) and Kielder (Fig. 5d) complexes, with detection rates remaining below the 50% mark over the five year period for both areas. This year's results for Harwood show a significant drop in the number of sites where greys were detected, with greys observed in 19% of sites compared to 40% in 2015. The result was also 19% in 2014. In the same complex, red squirrel site occupancy has continued to increase since a low of 23.8% in 2014, and 2016 saw the second highest occupancy percentage for reds in the Harwood complex of 42.9% (45% in 2013).

Fig. 5. Red and grey squirrel site occupancy in all stronghold complexes for all spring surveys 2012-2016. Site occupancy is shown as a percentage of the total number of surveys completed each year. Red line = red squirrel. Black line = grey squirrel.





The Kielder complex has by far the highest number of survey sites, with over 50 sites surveyed each year. This larger sample size at Kielder increases our confidence in the result. Red squirrel site occupancy peaked in 2014 at 45.6%. This dropped considerably to 24.1% the following year, and this year shows a slight increase to 27.8%. Although grey site occupancy has dropped this year in the Kielder complex from a high of 37% in 2015 to 31.5% in 2016, it is concerning that grey squirrels were detected in slightly more sites than reds. This highlights the need for a greater concentration of conservation effort in and around the UK's largest red squirrel reserve.

Results continue to highlight the scale of the problem within the Slaley complex (Fig. 5b). This is the only complex where grey squirrel site occupancy rates have consistently ranged above 50%, with a peak in 2014 of 84.0%. There is some relief this year in the drop in occupancy percentage to 59.1%. However results for reds remain poor, with reds detected in only 9.1% of sites. This low level is fairly consistent across the five year period, with the exception of 2014 when red occupancy percentage peaked at 24.0%.

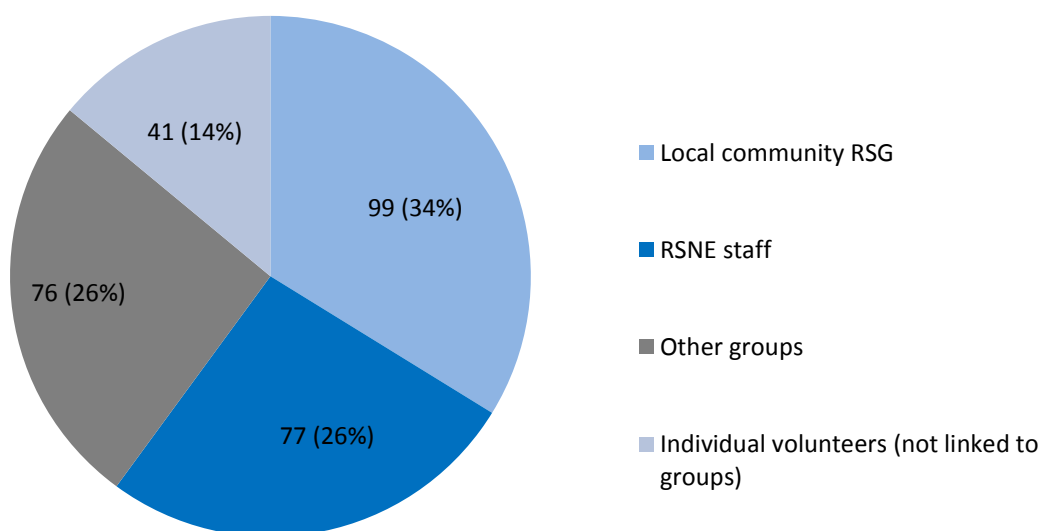
2.6 Community involvement

The monitoring programme would not be possible without the help of so many volunteers who each year are willing to help carry out surveys. Over 140 people were involved in the delivery of the surveys, with many more helping with other tasks such as camera analysis, arranging access or delivering equipment. The fact that the number of surveys completed surpassed that of last year is testament to the commitment of both long term and newly recruited volunteers.

99 surveys were carried out by 19 different local community red squirrel groups operating under the umbrella of Northern Red Squirrels. 77 surveys were carried out by RSNE staff or contractors. 76 surveys were completed by 18 other interest groups, including staff or volunteers from the northern Wildlife Trusts, conservation organisations such as National Trust and RSPB, National Park staff and volunteers, and staff working on private estates. A further 41 individual volunteers not linked to groups contributed the remaining 41 surveys.

We are extremely grateful once again to all groups and individuals involved.

Fig. 6. Community involvement: the contributions of different groups to the overall delivery of the spring 2016 monitoring programme out of a total of 293 surveys.



3. Discussion

Thanks to the efforts of a great many volunteers and staff, the monitoring programme was once more a real success, with the number of surveys surpassing the total completed in 2015. The ambition for the programme has always been to continue long into the future to ensure that red and grey squirrel distribution is documented, and any changes to this measured. Patterns are emerging, and, as reported last year, the programme is proving that populations of red and grey squirrels across northern England fluctuate. The factors that are likely to influence this fluctuation include

environmental variation (natural food supply, weather) and human conservation intervention (the suppression of grey squirrel numbers through control).

Last year's results were disappointing, and for the first time since the programme began in 2012, we documented a change in fortunes, with the number of sites where grey squirrels were recorded surpassing the number of sites where reds were observed. The results for 2016 are altogether more encouraging. Although site occupancy for red squirrels did not increase, it did stabilise following the previous year's decrease. In contrast, results show a decline in grey squirrel occupied sites, down to 36.8%, a figure just below that of 2014 when they occupied 38.4% of sites. In 2016, red squirrels once again occupied more survey sites than greys, as they had done prior to 2015.

It is difficult to assign this change to any one thing; however a number of factors are likely to have influenced these results. We reported last year that mild autumn/winters in 2013/14 and 2014/15, coupled with super-abundance of nut crops (particularly beech mast in late summer and autumn 2014) was likely to have favoured grey squirrels, as their ability to outcompete reds in broadleaved woodlands is well documented. Just as we might have predicted an upturn in fortunes for grey squirrels in spring 2015, so we might have expected a different outcome in spring 2016. There were almost universal reports of poor natural food sources in autumn 2015, in particular of oak and beech. This, coupled with extremely wet weather, may have influenced over-winter survival rates in grey squirrels, and is certainly likely to have impacted on their ability to successfully breed in some areas. The results imply that red squirrels have not been affected to the same extent, although one important additional factor- the suppression of grey squirrel numbers through control- is likely to have contributed towards the results.

Many anecdotal reports suggest that grey squirrels have been harder than usual to find in many woodlands in the first half of 2016. Results showed an increase in the number of sites where no squirrels of either species were detected, up to 27.6% of sites compared to 22.4% in 2015. There were numerous blanks in woodlands that last year were occupied by high numbers of greys, for example in areas of south Cumbria. Environmental factors, as well as consistent local grey squirrel management may well have influenced this result.

However, caution should be exercised, and once again we encourage all of those involved in red squirrel conservation not to drop their guard. We are beginning to see, through the monitoring programme, that both species will fluctuate. What must not fluctuate is the conservation effort. This year's result should offer a note of real positivity; that, despite the perfect conditions in 2014/15 that allowed grey squirrels to thrive, results show that the tide has not turned in favour of greys, and in fact we are seeing red squirrel range maintenance. We cannot quantify the impact of grey squirrel control on red range maintenance in this report, but suffice to say we can only imagine how difficult it might have been for reds to persist in some areas if it were not for the sustained management of grey squirrels.

From the analysis detailed in this report it is clear that the status of some of the red squirrel reserves and strongholds is questionable. Surveys within much of the Slaley complex continue to produce poor results, despite continued grey control effort, although there is some encouragement to be taken from the fact that additional records have helped us document areas of this complex where reds are persisting. Some of the strongholds remain as strong as ever, and of particular note are North Lakes, Yorkshire Dales, Kyloe and Sefton. Harwood and Kielder remain slightly disappointing as a whole, although monitoring results in and around Harwood have improved this year.

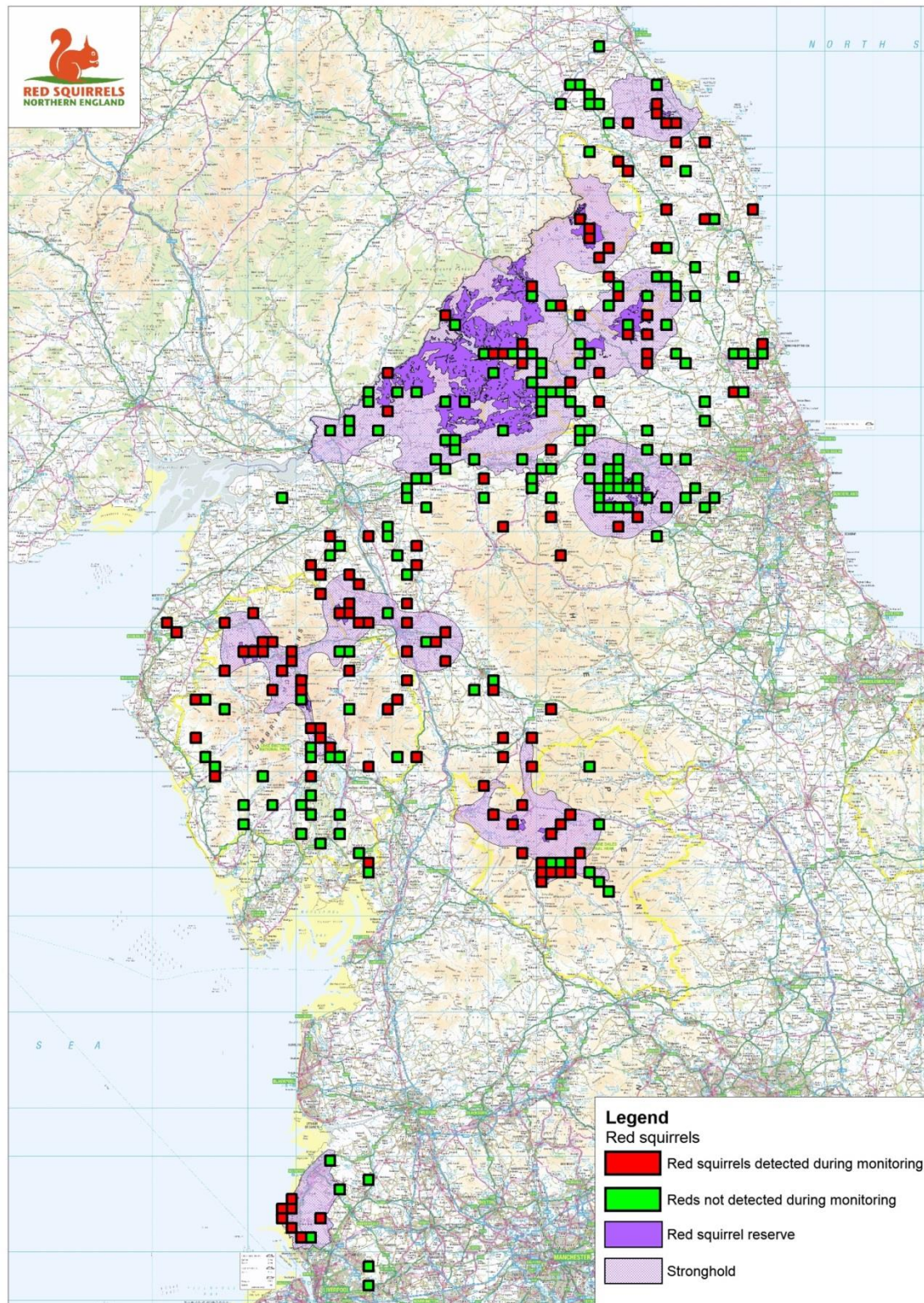
The presence of grey squirrels during surveys at Kielder, the largest red squirrel forest in northern England, is concerning. Results from monitoring sites close to, and, in some cases, around the fringes of Kielder, show that grey squirrels are very much on the doorstep. The fact that grey squirrels were detected in slightly more sites than reds within the Kielder complex is a real concern. This brings into sharp focus the need for increased effort in these areas to push back the threat. RSNE's involvement with Red Squirrels United, a new, UK-wide initiative will deliver some much needed extra resources, providing a strategic approach involving early warning monitoring systems designed to detect grey squirrels at an early stage, as well as the ability to react swiftly to remove this threat.

Indeed as resources become tighter, with uncertainties over future funding, including the value of Countryside Stewardship to red squirrel conservation, the importance of the monitoring programme increases. Results are our best way of demonstrating gains, losses, and areas where the status quo is being maintained. It provides a focus that may help organisations involved in red squirrel conservation to make informed decisions when purse strings continue to tighten.

Finally, it is worth celebrating the completion of the spring 2016 monitoring programme as a huge achievement. It was an exercise in organization, logistics, and in personal commitment for all those involved. Surveying almost 300 sites in a three month period is a huge task, one that is perhaps unparalleled in scale in UK mammal conservation. To repeat this effort on an annual basis shows the passion and dedication of a huge number of people.

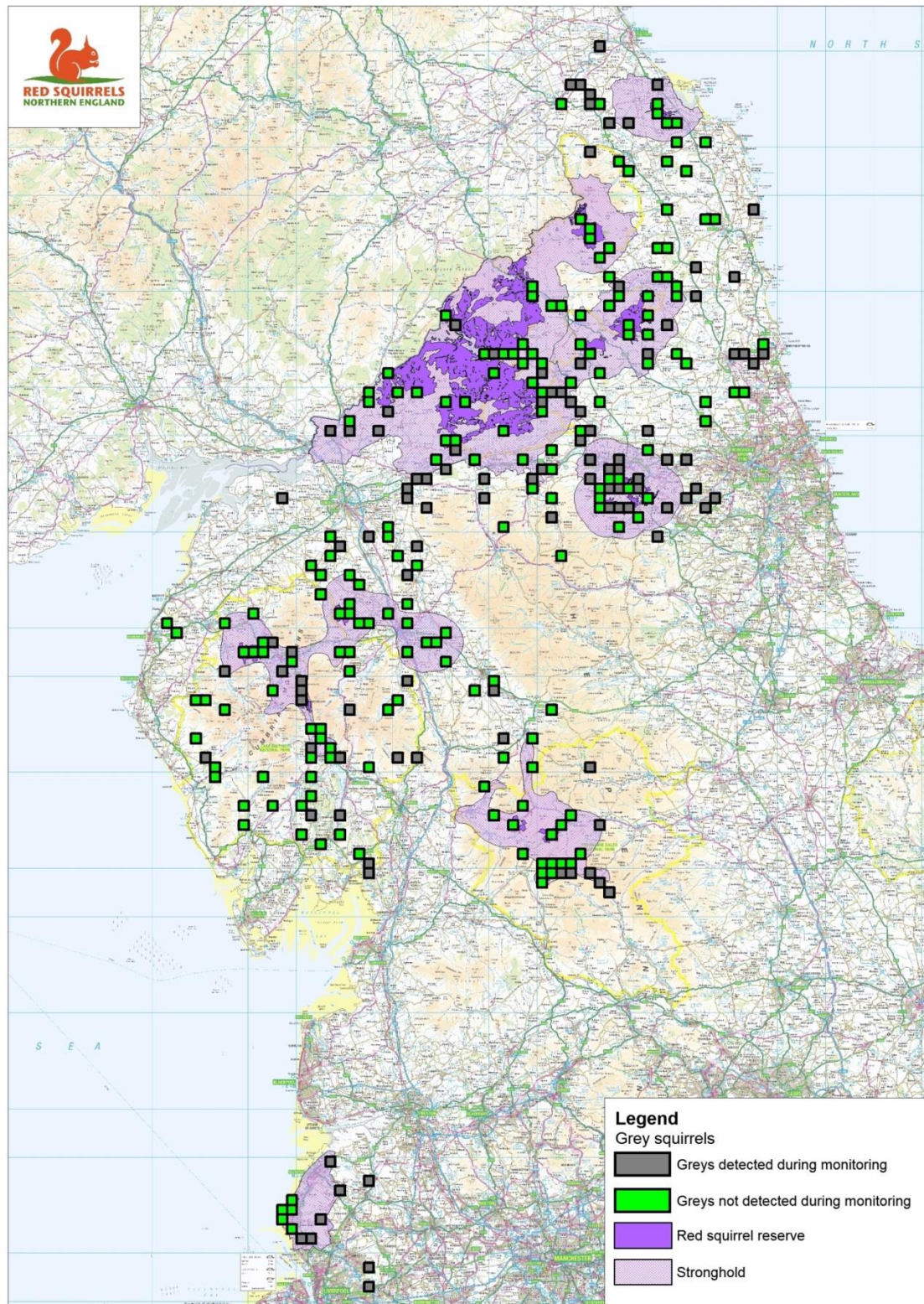
The compilation of range maps would not be possible without the documented contribution of hundreds of red squirrel conservationists working tirelessly to help red squirrels across the northern counties, and we would like to praise those people for carrying out this fieldwork and recording it. We must also highlight and praise the work put in by all of those responsible for compiling and submitting these records, as without their commitment, we would not be able to produce these maps.

Fig. 7. Tetrad locations where red squirrels were detected or not detected during spring 2016 surveys.



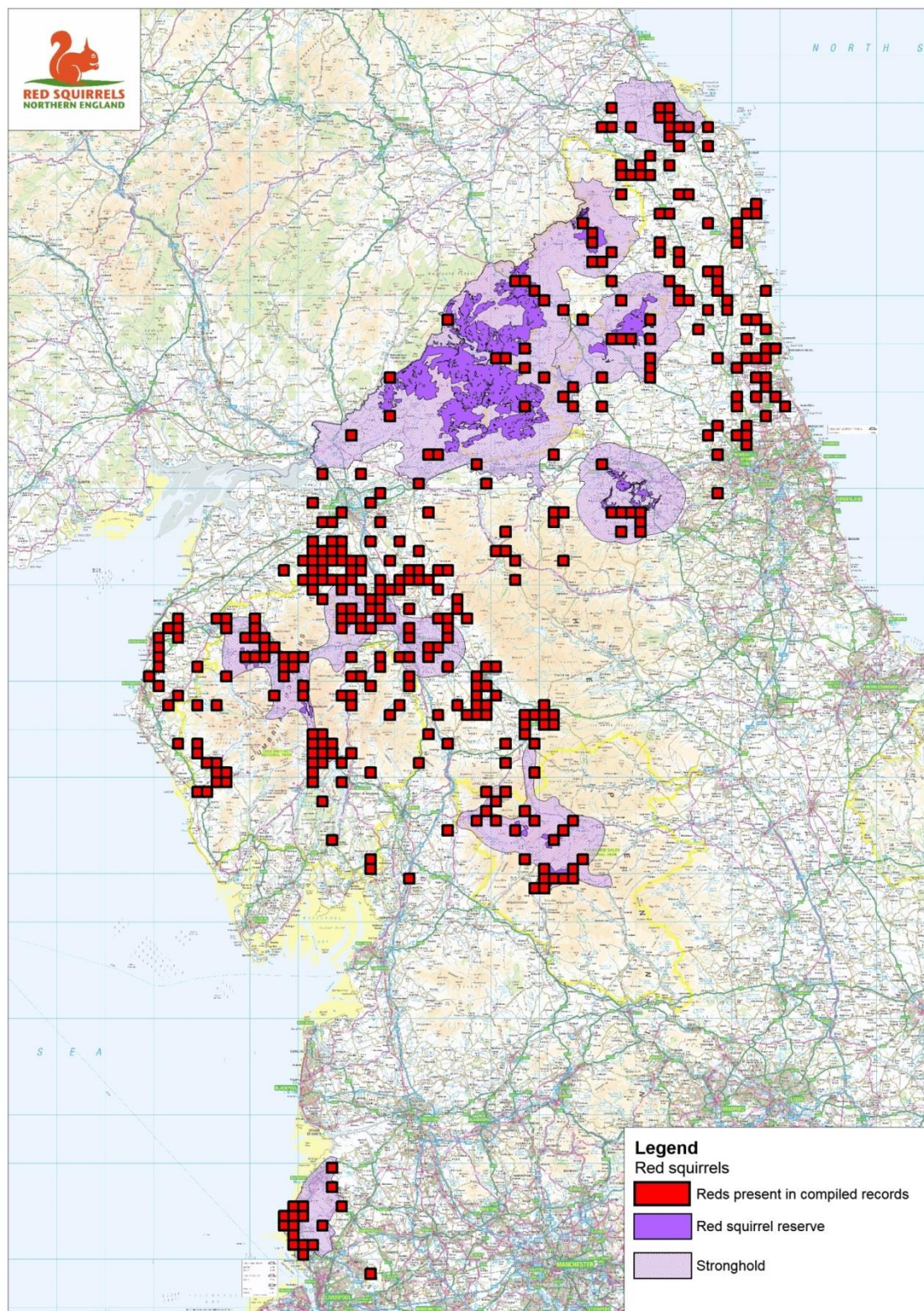
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Fig. 8. Tetrad locations where grey squirrels were detected or not detected during spring 2016 surveys.



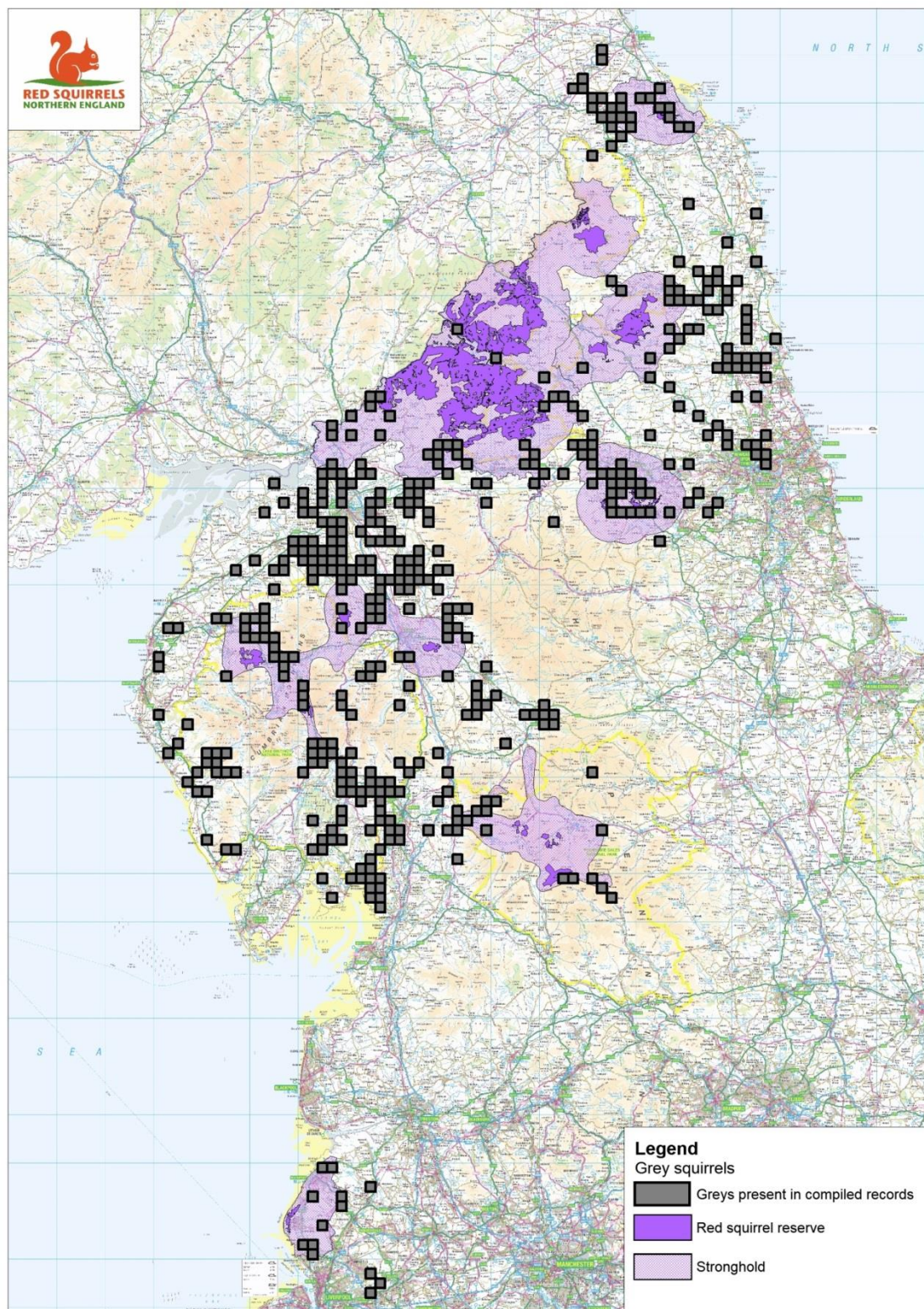
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Fig. 9. Distribution of red squirrels recorded March – May 2016 in tetrads across northern England. Records compiled from standardised monitoring, conservation activity records and public sightings submitted to RSNE directly or via NRS groups.



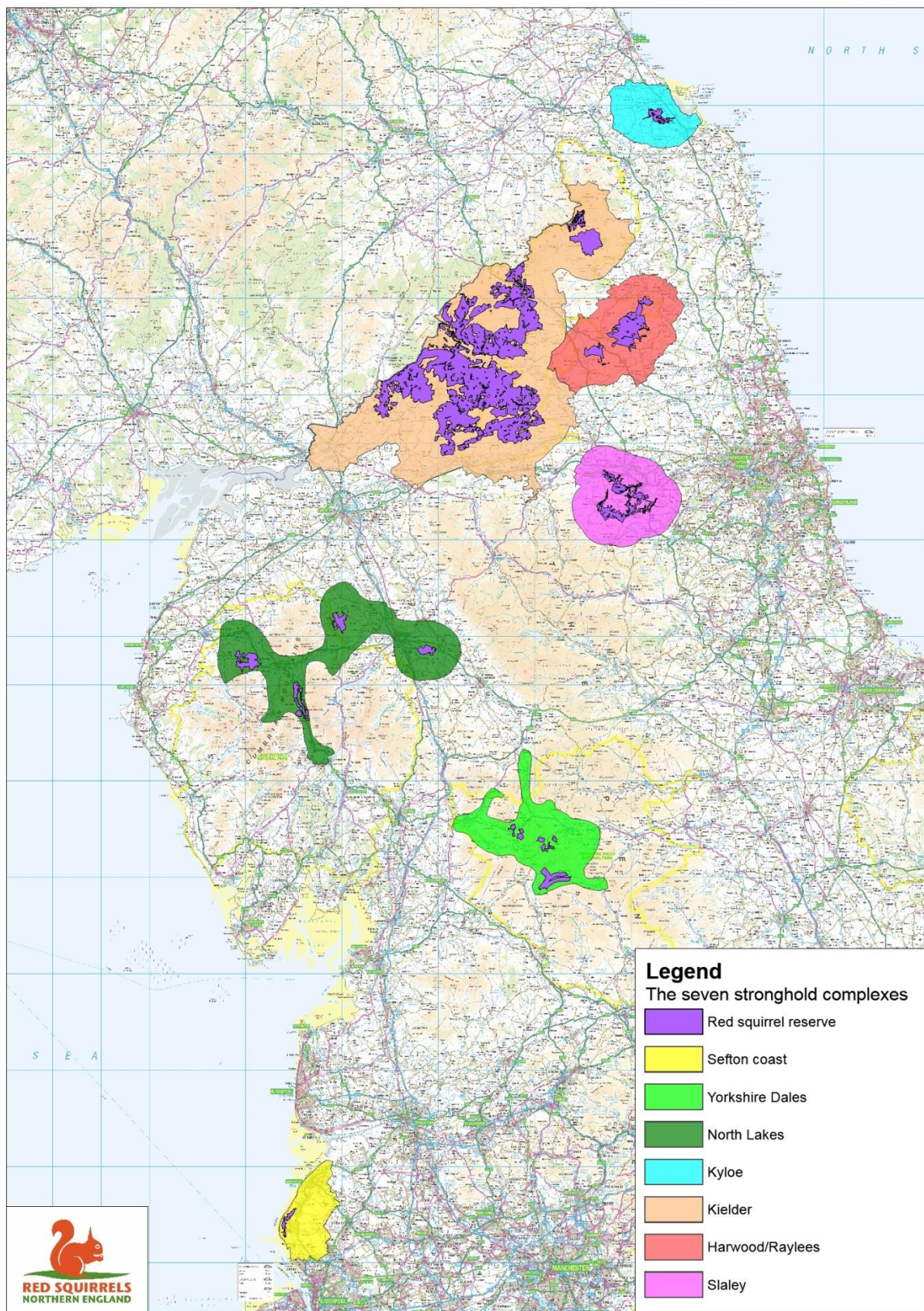
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Fig. 10. Distribution of grey squirrels recorded March – May 2016 in tetrads across northern England. Records compiled from standardised monitoring, conservation activity records and public sightings submitted to RSNE directly or via NRS groups.



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Appendix: Map of the seven stronghold complexes: The 17 strongholds are grouped together where there is geographical connectivity forming seven 'stronghold complexes'.



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