

The Irish Squirrel Survey

Michael Carey¹, Geoff Hamilton², Alan Poole³ and Colin Lawton⁴

¹ Email: careym1@eircom.net.

² Email: hamiltog@gmail.com.

³ Email: alanthomaspoole@gmail.com.

⁴ Corresponding author: Dr Colin Lawton, National University of Ireland Galway, University Road, Galway, Ireland.
Tel: +353-91-492335. Email: colin.lawton@nuigalway.ie.

COFORD, National Council for Forest Research and Development
Arena House
Arena Road
Sandyford
Dublin 18
Ireland
Tel: + 353 1 2130725
Fax: + 353 1 2130611
© COFORD 2007

First published in 2007 by COFORD, National Council for Forest Research and Development, Dublin, Ireland.

All rights reserved. No part of this publication may be reproduced, or stored in a retrieval system or transmitted in any form or by any means, electronic, electrostatic, magnetic tape, mechanical, photocopying recording or otherwise, without prior permission in writing from COFORD.

ISBN 1 902696 60 3

Title: The Irish squirrel survey 2007.

Authors: Michael Carey, Geoff Hamilton, Alan Poole and Colin Lawton.

Citation: Carey, M., Hamilton, G., Poole, A. and Lawton, C. 2007. The Irish squirrel survey 2007. COFORD, Dublin.

The views and opinions expressed in this publication belong to the authors alone and do not necessarily reflect those of COFORD or the Forest Service.

Front cover photograph: The native red squirrel (*Sciurus vulgaris*). © Niall Benvie (www.imagesfromtheedge.com)

Foreword

Ireland's afforestation programme has increased the range and frequency of a number of native mammals, particularly the pine marten and red deer. Red squirrels have also benefited, though in more recent years there has been a marked decline in their range and occurrence. This is mainly attributed to the expansion in the range of the more aggressive North American grey squirrel. Since its introduction in the early years of the 1900s, the grey's geographic range has extended year-on-year, while reds have disappeared from many parts of the country.

One of the principal factors associated with the recent expansion in grey squirrel numbers is the renewed emphasis on planting broadleaved forest, and the restoration of native woodland, under government grant aid schemes. Seeds of broadleaf trees are the predominant food source for grey squirrels, although they can also strip off the outer bark of the tree, possibly to supplement their diet. Such is the extent of this bark stripping that commercial broadleaf crops can be written off, and native trees left severely damaged. There is little doubt, that if left unchecked, the grey squirrel will severely curtail both commercial hardwood production and the conservation and expansion of native woodland cover in Ireland.

Work on ways to conserve red squirrel numbers and to control the grey is underway in number of projects funded by the Forest Service and the National Parks and Wildlife Service, in cooperation with conservation groups and landowners. Results and recommendations from this work are expected in 2008. In order to be effective the recommended measures need to be based on up-to-date information on the geographical extent and occurrence of both species of squirrel in Ireland. It was for this reason that COFORD funded a project that had the objective of determining the geographic extent and occurrence of red and grey squirrel in Ireland.

The Irish Squirrel Survey 2007 shows that there are still plenty of red squirrels in Ireland (the survey covered the Republic and Northern Ireland), with coniferous forests providing a particularly favourable habitat. However, they have disappeared from a number of counties - Meath, Westmeath, Carlow and Kilkenny - and are under threat elsewhere because of the presence of the grey squirrel. The grey has expanded dramatically over the past decade and is now present in 26 of the 32 counties, but in some counties its numbers have also fallen – and there is some evidence to suggest that this may be associated with the spread of the pine marten.

The results from the survey provide a renewed warning that planned and effective action is needed to conserve the remaining red squirrel numbers in the country, and protect a very significant state and private investment in broadleaf woodland. In this regard the survey results will enable better targeting of grey squirrel control, as well as providing the all-important baseline to judge the effectiveness of any measures that are put in place.

The project leaders, Dr Michael Carey and Geoff Hamilton, are to be congratulated for completing the survey in the allocated time, and in fully complying with the project objectives. In the acknowledgments they and their co-authors, Dr Colin Lawton and Alan Poole, rightly identify the pivotal role a number of voluntary and official organisations, in both the Republic and Northern Ireland, played in the survey, and how they contributed to its completeness and thoroughness.

In conclusion, I have no doubt that this work will contribute greatly to the conservation of a threatened native species, the red squirrel, while at the same time protecting and enhancing native trees and woodlands.

Dr Eugene Hendrick
Director

Brollach

Tá clár foraoisithe na hÉireann tar éis réimse agus minicíocht na mamach dúchais a mhéadú, go háirithe na cait crainn agus na fianna rua. Tá na hioraí rua tar éis leas a bhaint as chomh maith, cé gur tháinig laghdú suntasach ar a réimse agus a minicíocht le blianta beaga anuas. Cuirtear é seo i leith do leathnú réimse na n-ioraí glasa ó Mheiriceá Thuaidh leis seo, ioraí atá níos ionsaithí. Ónar tugadh isteach iad go luath sna 1990í, leathnaigh réimse geografach na n-ioraí glasa bliain ar bhliain, cé go bhfuil na hioraí rua imithe go hiomlán ó chodanna áirithe den tír.

Is é ceann de na fachtóirí is tábhachtaí a bhaineann le scaipeadh deanaí i líon na n-ioraí glasa ná an bhéim athnuaithe atá ar chur na bhforaoiseacha leathanduilleacha, agus athchóiriú na gcoillearnach dúchais, faoi scéimeanna cúnamh deontais an rialtais. Bíonn síolta na gcrann leathanduilleacha ina bpríomhfhoinsé bia do na hioraí glasa, cé go mbíonn siad in ann coirt sheachtrach na gcrann a bhaint chomh maith, le cur lena gothú is dócha. Tá baint na coirte seo chomh forleathan sin go mbíonn barra crainn leathanduilleacha tráchtála á scriosadh go hiomlán, agus déantar dochar tromchúiseach do na crainn dúchais. Is beag amhras atá ann ná go ndéanfaidh na hioraí glasa dochar mór do tháirgeadh an chrua-adhmaid tráchtála, chomh maith le caomhnú agus leathnú chlúdach na gcoillearnach dúchais in Éirinn, má fhágtar gan chosc.

Tá obair ar siúl faoi láthair i roinnt tionscadail éagsúla atá á maoiniú ag an tSeirbhís Foraoiseachta agus an tSeirbhís Páirceanna Náisiúnta agus Fiadhúlra, chun líon na n-ioraí rua a chaomhnú agus líon na n-ioraí glasa a smachtú, i gcomhar le grúpaí caomhnaithe agus tiarnaí talún. Táthar ag súil le torthaí agus moltaí ón obair seo i 2008. D'fhonn a bheith éifeachtach is gá go mbeadh na bearta molta bunaithe ar eolas atá cothrom le dáta maidir le leithead agus minicíocht gheografach an dá speiceas ioraí in Éirinn. Is ar an bhfáth sin a mhaoinigh COFORD tionscadal a bhfuil sé mar chuspóir aige measúnú a dhéanamh ar leithead agus minicíocht na n-ioraí rua agus glasa in Éirinn.

Léiríonn Suirbhé Ioraí na hÉireann 2007 go bhfuil go leor ioraí rua ann in Éirinn go fóill (baineann an suirbhé le Poblacht na hÉireann agus Tuaisceart Éireann), le foraoiseacha buaircíneacha ag tabhairt gnáthóga fabhracha dóibh. Tá siad imithe ó chontaetha áirithe, áfach – An Mhí, An Iarmhí, Ceatharlach agus Cill Chainnigh – agus tá siad faoi bhagairt in áiteanna eile mar gheall ar ioraí glasa. Tá na hioraí glasa tar éis scaipeadh go mór le leathscór bhliain anuas agus tá siad le fáil anois i 26 de na 32 contae, ach tá laghdú tagtha ar a n-uimhreacha chomh maith i gcontaetha áirithe – agus tá roinnt fianaise ann a thugann le fios go bhféadfadh sé seo a bheith bainteach le scaipeadh na gcat crainn.

Cuireann torthaí an tsuirbhé rabhadh athnuaithe ar fáil go bhfuil gá le gníomhú pleanáilte agus éifeachtach chun líon na n-ioraí rua atá fágtha sa tír a chaomhnú, agus cosaint a dhéanamh ar infheistíocht stáit agus phríobháideach araon i gcoillearnach leath uilleacha. Sa chaoi seo, ciallóidh torthaí an tsuirbhé seo go mbeifear in ann díriú níos fearr ar rialú na n-ioraí glasa, chomh maith le bonnlíne ríthábhachtach a chur ar fáil chun feidhmiúlacht na mbearta a chuirtear in áit a mheas.

Is gá comhghairdeachas a dhéanamh le ceannairí an tionscadail, an Dr Michael Carey agus Geoff Hamilton, as an suirbhé a chríochnú san am a bhí leithdháilte dó, agus as cuspóirí an tionscadail a chomhlíonadh go hiomlán. Sna hadmhálacha a rinneadh, d'aithin siad féin agus a chomh-údair, an Dr Colin Lawton agus Alan Poole, an ról lárnach a bhí ag roinnt eagraíochtaí deonacha agus oifigiúla sa tsuirbhé, i bPoblacht na hÉireann agus i dTuaisceart Éireann, agus an chaoi ar chuir siad lena chomhláine agus a chríochnúlacht.

Mar fhocal scoir, níl amhras ar bith orm ná go gcuirfidh an obair seo go mór le caomhnú an speicis dúchais atá faoi bhagairt, an t-iora rua, agus go gcosnóidh agus go bhfeabhsóidh sé na crainn agus na coillearnacha dúchais ag an am céanna.

Contents

Foreword	i
Brollach	ii
Acknowledgements	iv
Executive summary	v
Translated executive summary	vi
1. Introduction	1
Current state of knowledge and understanding of the problem: Squirrels in Ireland	1
Previous distribution surveys of the red and grey squirrel in Ireland	2
2. Methods and description of research work	7
Survey questionnaire	7
Circulation of the questionnaire	7
Compilation of the survey results	9
Role of NUI Galway	9
3. Results	11
4. Discussion	27
Ulster	27
Leinster	28
Connacht	29
Munster	31
5. Implications for policy and practice	33
6. Conclusions and recommendations	35
Conclusions	35
Recommendations	35
References	39
Appendix 1: Postal questionnaire used during course of survey (front)	41
Appendix 2: Postal questionnaire used during course of survey (back)	42
Appendix 3: Format of online survey on www.irishsquirrelsurvey.com	43

Acknowledgements

A large number of members of the public throughout the island of Ireland and organizations in both the Republic of Ireland and in Northern Ireland supported the squirrel survey, primarily through the return of questionnaires and through encouraging their members to do so. These included Birdwatch Ireland, Coillte, Crann, The Golfing Union of Ireland (each of the 411 golf clubs), National Parks and Wildlife Service, The Society of Irish Foresters, The Irish Timber Growers Association, The Forest Services of both the Republic of Ireland and Northern Ireland, Teagasc, The Mountaineering Council of Ireland, The Irish Wildlife Trust, The National Association of Regional Game Councils, The Irish Tree Society, The Irish Deer Society, The Wild Deer Society, Central and Regional Fisheries Boards, The Tree Council of Ireland, The Irish Landowners Association, Forestry Staff and Students at University College Dublin, GMIT and WIT, Staff and Students of NUI Galway, University of Limerick and Trinity College Dublin, Heritage Officers of County Councils, The Environment and Heritage Service Northern Ireland, The Ulster Wildlife Trust, Quercus, The Mourne Heritage Trust, The Biological Records Centre for Northern Ireland, Lord Hamilton and Lord O'Neill. The media in general expressed a strong interest in the survey and gave it wide and positive publicity. In particular, the project team would like to express special thanks to Alistair Pfeifer (Coillte), Elaine Khan (Coillte), Pat Neville (Coillte), Emma Benson (Coillte), Ferdia Marnell (National Parks and Wildlife Service), Richard Hyde (Northern Ireland Forest Service), Niall Benvie (Images From The Edge), Andy Rouse Wildlife Photography, Barry Hunter (nearby.org.uk), Sean Rooney (Central Fisheries Board), Joe Barry (Crann), Michael McGoldrick (Trinity College Dublin), John Rochford (Trinity College Dublin), Lauren MacLennan (COFORD), Eugene Hendrick (COFORD), Sandra Devaney (Dublin Zoo), Ian Montgomery (Queen's University Belfast), Edward Bayly, Joanne O'Neill (Republic of Ireland Forest Service), Christy O'Donovan (Republic of Ireland Forest Service), John Redmond (Republic of Ireland Forest Service), Michael Boyd (Republic of Ireland Forest Service), John Griffin (Northern Ireland Forest Service), John Milburne (Environment and Heritage Service Northern Ireland), Declan Looney (Environment and Heritage Service Northern Ireland), Sarah Fields (Irish Wildlife Trust), Barbara Henderson (Irish Wildlife Trust) and Karen Wilton (Northern Ireland Forest Service).

Grateful acknowledgement is extended to all concerned.

Executive summary

A survey of the present distribution of red squirrels and grey squirrels, based on a widely circulated questionnaire was carried out during the period January – May 2007. Some 5,000 hard copies of a carefully designed survey form were widely distributed in both the Republic of Ireland and Northern Ireland, supported by a dedicated website to enable the public to participate in the survey electronically if they so decided (www.irishsquirrelsurvey.com). The questionnaire also enabled those making returns to comment on pine marten sightings, to investigate any potential impacts this predator may be having on the two squirrel species. Overall some 1502 replies were received of which 612 comprised hard copies, 267 electronic returns from Coillte staff, 122 electronic returns from NI Forest Service Staff and 501 responses via the website. This was considered to be a highly satisfactory return, in both number and geographic coverage of the 32 counties.

In summary, the red squirrel may still be considered to be widespread and is still common in many areas of the country, particularly west of the River Shannon and in areas of extensive commercial coniferous forestry. Some spread by red squirrels was also noted in a few regions, notably north Offaly, northwest Kildare, southwest Cork and northeast Donegal. However, in many other areas, its habitat is now shared with the grey squirrel. Unfortunately, it may now be considered extinct in Meath and Westmeath, and has become particularly rare in Kilkenny, Carlow and Louth. Red squirrels in areas where greys are already established are under particular threat, while other populations just beyond the current grey squirrel distribution (such as Cork, Limerick, Kerry and NE Antrim, where significant areas of mature broadleaved woodland exist) may also be considered at risk. The speed of grey spread suggests that it could colonise these areas in 10-20 years.

Grey squirrels have expanded their range dramatically in the past decade, and are now present in 26 counties (the exceptions being Sligo, Mayo, Galway, Clare, Kerry and Cork). Most apparent is its spread in the eastern counties of Antrim, Wicklow and Wexford, which were predominantly devoid of greys at the time of the last survey. It is likely that they will continue to spread in many areas of the country in the coming years; they have breached the river Shannon in a few locations and so may begin to extend their range west of the Shannon; however, given the unsuitable habitat that the region presents, the extent of which this will occur and the rate at which it will happen is unclear. Close observation and further study of this region should take place in the coming years.

Pine martens have been recorded in many areas of the country, and appear to be spreading (presumably due to legislative protection and an increase in tree planting). Particular concentrations are found in the Clare, Laois-Offaly and Cavan-Leitrim-Fermanagh regions. The survey has found some evidence of the persistence of red squirrels in the latter two regions, and in some cases, the progressive decline of greys where these concentrations are located. However, it is difficult to say that this corresponds to the habitat preferences of the species concerned or if there is a direct relationship between the distribution of pine martens and the two squirrel species.

The results of the survey will be extremely valuable in the future for making recommendations regarding the conservation of the red squirrel and management of the grey. Furthermore they have formed an excellent baseline of digital data that any future surveys can be easily compared to.

Achoimre feidhmiúcháin

Rinneadh suirbhé ar dháileadh reatha na n-ioraí rua agus glasa le linn na tréimhse Eanáir – Bealtaine 2007, agus é bunaithe ar cheistneoir a scaipeadh go forleathan. Scaipeadh tuairim is 5,000 cóip chrua de fhoirm an tsuirbhé, a dearadh go cúramach, go forleathan i bPoblacht na hÉireann agus i dTuaisceart Éireann araon, agus é tacaíthe ag suíomh gréasáin tiomanta le cur ar chumas an phobail a bheith páirteach sa tsuirbhé go leictreonach má theastaigh uathu (www.irishsquirrelsurvey.com). Chuir an ceistneoir ar chumas na ndaoine a chuir tuairisceáin isteach ráitis a dhéanamh faoi chait crainn a chonacthas agus chun fiosrú a dhéanamh ar aon tionchar féideartha a d'fhéadfadh a bheith ag na creachadóirí seo ar dhá speiceas na n-ioraí. Fuarthas breis is 1502 freagra ar an iomlán as a raibh 612 cóip chrua i gceist, 267 tuairisceán leictreonacha ó fhoireann Coillte, 122 tuairisceán leictreonacha ó Fhoireann na Seirbhíse Foraoiseachta i dTuaisceart na hÉireann agus 501 freagra tríd an suíomh gréasáin. Bhíothas an-sásta leis an aischuir seo, ó thaobh na huimhreacha agus an clúdach geografach an 32 contae de.

Go hachomair, is féidir glacadh leis go bhfuil ioraí rua ann go forleathan go fóill agus go bhfuil sé ann go coitianta i go leor ceantair sa tír, go háirithe ar an taobh thiar d'Abhainn na Sionainne agus i gceantair ina bhfuil foraoiseacht tráchtála bhuaircíneach ann go forleathan. Tugadh scaipeadh ioraí rua faoi deara i roinnt réigiúin, go háirithe i dTuaisceart Uíbh Fhailí, Cill Dara thiar-thuidh, Corcaigh thiar-theas agus Dún na nGall thiar-thuidh. Ach, tá a ghnáthóg á roinnt le hioraí glasa anois i roinnt mhaith ceantair eile. Ar an drochuair, is féidir glacadh leis go bhfuil siad díothaithe sa Mhí agus san Iarmhí anois, agus nach bhfuil siad ann ach go fíor-annamh i gCill Chainnigh, Ceatharlach agus Lú. Bíonn na hioraí rua faoi bhagairt ar leith in áiteanna ina bhfuil na hioraí glasa fadbhunaithe ann, cé gur féidir glacadh leis go bhfuil daonraí eile atá taobh amuigh de scaipeadh reatha na n-ioraí glasa (ar nós Corcaigh, Luimneach, Ciarraí agus Aontroim Thoir-Thuidh, ina bhfuil ceantair choillearnaí móra leathanduilleacha aibí ann) faoi bhagairt chomh maith. Tá sé le sonrú ó scaipeadh na n-ioraí glasa go bhféadfaidís coilíniú a dhéanamh ar na ceantair seo taobh istigh de 10-20 bliain.

Tá na hioraí rua tar éis a réimse a leathnú go suntasach le leathscór bhliain anuas, agus tá siad le fáil anois i 26 contae (is iad na heisceachtaí ná Sligeach, Maigh Eo, Gaillimh, An Clár, Ciarraí agus Corcaigh). An rud is soiléire atá le sonrú ná go bhfuil a scaipeadh i gcontaetha an Oirthir ar nós Aontroim, Cill Mhantáin agus Loch Gorman, áiteanna nach raibh mórán ioraí glasa iontu nuair a rinneadh an suirbhé deireanach. Is dóchúil go leanfaidh siad le bheith ag scaipeadh i go leor ceantair sa tír sna blianta atá amach romhainn; tá Abhainn na Sionainne trasnaithe acu in áiteanna áirithe agus mar sin d'fhéadfaidís a réimse a scaipeadh siar ón tSionainn; ach, os rud é nach gnáthóg oiriúnach atá ann sa réigiún, ní léir leithead agus ráta an scaipthe seo. Ba cheart breathnóireacht ghéar agus staidéar sa bhreis a dhéanamh ar an réigiún seo sna blianta amach anseo.

Cláraíodh cait crainn i roinnt mhaith ceantair ar fud na tíre agus tá an chuma air go bhfuil siad ag scaipeadh (mar gheall ar chosaint reachtúil agus méadú ar chur na gcrann, is dócha). Tá siad le fáil go háirithe i réigiún an Chláir, Laoise-Uíbh Fhailí agus an Chabháin-Liatroma-Fhear Manach. Tá roinnt fianaise sa tsuirbhé faoi sheasmhacht na n-ioraí rua sa dá réigiún deireanacha sin, agus i gcásanna áirithe, dul i léig leanúnach na n-ioraí glasa, sna háiteanna ina bhfuil na comhchruinnithe seo ann. Ach, tá sé deacair a rá go mbaineann sé seo le roghanna gnáthóga an speicis atá i gceist, nó má tá gaol díreach ann idir scaipeadh na gcat crainn agus dhá speiceas na n-ioraí.

Beidh torthaí an tsuirbhé an-luachmhar amach anseo chun moltaí a dhéanamh maidir le caomhnú na n-ioraí rua agus bainistiú na n-ioraí glasa. Chomh maith leis sin, tá bonnlíne iontach de shonraí digiteacha cruthaithe acu, agus is féidir suirbhéanna todhchaíochta a chur i gcomparáid leis go héasca.

1. Introduction

Current state of knowledge and understanding of the problem: Squirrels in Ireland

There are two species of squirrel in Ireland; the native red squirrel (*Sciurus vulgaris*) and the alien grey squirrel (*Sciurus carolinensis*).

Though generally considered to be an indigenous Irish species (Fairley 1984), it is unclear whether any contemporary red squirrel populations have descended from native ones, as it seems they became extremely rare, if not extinct, by the end of the 17th Century, most likely because of their exploitation for skins and intensive tree felling at the time. At least 10 reintroductions of red squirrels took place in Ireland sometime between 1820 and 1856; these are detailed in Barrington's thorough dissertation on the matter (Barrington 1880). Recent genetic work indicates that the current Irish red squirrel population may be a mixture of native and translocated stock and relationships between Irish and European genetic samples supported a number of colonisation events of the island; furthermore, the source British stock for these introductions is now likely to be extinct on Mainland Britain (Finnegan, Edwards and Rochford in press).

The grey squirrel was introduced at Castleforbes, Co Longford in 1911. Over the following years the pest quickly became established and gradually began to spread out from this initial point at a rate equivalent to 3 km per year. The spread of the grey squirrel has been mirrored by a decline in red squirrel numbers and a contraction of its range. It appears the grey squirrel can out-compete the red squirrel and cause it to disappear from much of the woodland habitat that is available (Gurnell 1987). Various hypotheses have been put forward to explain this competitive advantage. These include taking advantage of the natural fluctuations that occur in red squirrel populations (Lloyd 1983) and the greater ability of the greys to neutralise the polyphenols found in acorns (Chung-MacCoubrey et al. 1997), thereby enabling it to exploit the food source before they are ripe enough for the red squirrel to digest. This leads to a reduction in recruitment of juveniles in red squirrel populations and thus to a progressive decline in numbers. In mainland Britain, grey squirrels are also responsible for the asymptomatic spreading of squirrel pox virus, which is highly contagious and pathogenic to reds. Outbreaks of this virus can cause catastrophic losses to red squirrel populations in a very short period of time. No such case in reds has yet been identified in Ireland, though greys screened in Northern Ireland were found to be positive for pox virus antibodies (McKay 2004). It could become a factor in the loss of red squirrels in Ireland.

Since the arrival of grey squirrels, the red squirrel has become increasingly confined to large blocks of coniferous forest, and many parts of their geographical distribution in Ireland now relate directly to the presence of commercial conifer plantations. Owing to the more secretive nature of red squirrels, they are less frequently seen by members of the public, many of whom are more familiar with the grey which now inhabits many of the urban parks and gardens in the eastern half of the country. Red squirrels feed mainly in the tree canopy on conifer cones and seeds as well as fruit, nuts, berries, fungi, bark and sappy tissues.

The only potential major predator of squirrels that occurs in Ireland is the pine marten (Halliwell 1997) though its distribution remains limited owing to persecution during the first half of the 20th Century. Now protected under the Wildlife Acts of 1976 and 2000, it has begun to rebuild its numbers in several parts of the country (Peter Turner pers. comm. and Declan O'Mahony pers. comm.).

Concern over the spread of the grey squirrel has arisen for three main reasons:

- Firstly, the spread of the species is threatening the existence and sustainability of the native red squirrel.
- Secondly, the pest causes serious damage to a wide range of broadleaf tree species through bark stripping.
- Thirdly, the presence of high density populations of grey squirrels has been implicated in the loss of wild bird populations (Brown 2006).

The Forest Service, Department of Agriculture and Food, is currently funding a project entitled *CRISIS (Combined Research and Inventory of Squirrels in Irish Silviculture)* that is aimed at developing operational guidelines that will enable woodland owners to protect their trees against the grey squirrel whilst promoting the conservation of the red squirrel. The project team is investigating grey squirrel damage and testing control options through field trials at sites based primarily in Co Meath.

The primary objective of this work will be to provide the Forest Service with information that will enable it to produce guidelines for the management of grey squirrels, the conservation of red squirrels and the protection of broadleaf woodlands from squirrel damage. These guidelines will subsequently be made available to landowners in order to enable them to protect their forestry investment and/or promote the survival of the red squirrel.

Furthermore, the All-Ireland Red Squirrel Action Plan, which is currently being drafted, recommends the imminent identification of woodlands that may be selected as Red Squirrel Preferred Areas (RSPAs). Both the Forest Service's ability to publish guidelines on a nationwide basis and any selection of RSPAs in Ireland are restricted by the lack of up-to-date distribution data for both species of squirrel.

Previous distribution surveys of the red and grey squirrel in Ireland

To date, 15 surveys of varying extent and intensity have been carried out on the distribution of squirrels in Ireland. They are detailed in Table 1.

Before the 1990's, relatively little information on the distribution of either squirrel species in Ireland was available. Barrington's 1880 survey is a comprehensive account of the known reintroduction sites for red squirrels during the 19th Century. Middleton's report in 1932 mainly concerned the spread of the grey squirrel in the UK and Ireland. The 1938 survey by Moffat was based mainly on anecdotal evidence and simply added to the records from the 1880 and 1932 publications. Damage by red squirrels to coniferous woodland in parts of Wicklow was also noted by Nisbet (1904).

The first actual field-based survey of squirrels in Ireland took place in 1968, and was in response to damage caused to trees by squirrels in commercial plantations. Observations were made by forestry personnel and Wildlife Rangers exclusively, which led to a somewhat restricted geographical representation of the actual

Table 1: Previous Irish squirrel distribution surveys.

Author	Year	Institution	Species	Scope	Region	Parties surveyed
Barrington	1880	Royal Dublin Society	R	Introductions Distribution Status	All Ireland	Voluntary observers
Middleton	1932	Oxford University	G	Distribution Status	UK & ROI	Voluntary observers
Moffat	1938	Royal Irish Academy	R & G	Distribution Status Data amalgamation	ROI	Voluntary observers
NPWS	1968	Wildlife Service	R & G	Distribution	ROI	Forestry & Wildlife Personnel
NPWS	1973	Wildlife Service	R & G	Distribution	ROI	Forestry & Wildlife Personnel
Crichton	1974	Biological Records Centre	R & G	Distribution Data amalgamation	ROI & NI	Forestry & Wildlife Personnel Biologists Voluntary observers
Ni Lamhna	1979	Biological Records Centre	R & G	Distribution Data amalgamation	ROI & NI	Forestry & Wildlife Personnel Biologists Voluntary observers
Hannan	1986	UCD	R & G	Forestry damage	ROI	Forest officers
UWT	1993	NI Department of Agriculture	R & G	Distribution Status Habitat preference	NI	Forest officers
Gettinby	1994	QUB	R & G	Distribution Habitat preference	NI	Selected woodlands surveyed
Reilly	1997	TCD	R & G	Distribution Habitat preference	ROI	Forestry & Wildlife Personnel Voluntary observers
O'Teangana	1999	QUB	R & G	Distribution Habitat preference	NI	All sites over 15 ha surveyed
Lawton	2000	Heritage Council	R & G	Distribution	Wicklow	Selected sites surveyed Voluntary observers
O'Neill	2003	QUB	R & G	Distribution	NI	Selected sites surveyed
Poole	2006	NUI Galway	R & G	Distribution Habitat preference	Western ROI	Selected sites surveyed Voluntary observers

distributions. This survey was repeated using the same protocol in 1973. The two subsequent reports produced by the Biological Records Centre in 1974 and 1979 further collated previously gathered data and updated the records for some regions, again based on reports from forestry workers and Wildlife Rangers.

Hannan's study in 1986 centred on mapping forest damage, and was the only significant work on squirrels carried out during this decade. The 1990s saw the initiation of several research projects on squirrels in Ireland which resulted in two major surveys that facilitated the mapping of the contemporary distributions of the two species, without relying on any of the previous studies. These two surveys by O'Teangana (1999) and Reilly (1997) were carried out between 1994 and 1996 using slightly different methodologies. The O'Teangana survey of Northern Ireland was based on field visits to all forest properties over 15 hectares in the six counties; in all 261 sites were sampled. The Republic of Ireland was predominantly surveyed through questionnaires circulated to NPWS and Coillte staff, with some anecdotal evidence also being gathered from the general public and its results were based on 293 returns. The 10 km square presence maps for the two species are shown in Figure 1.

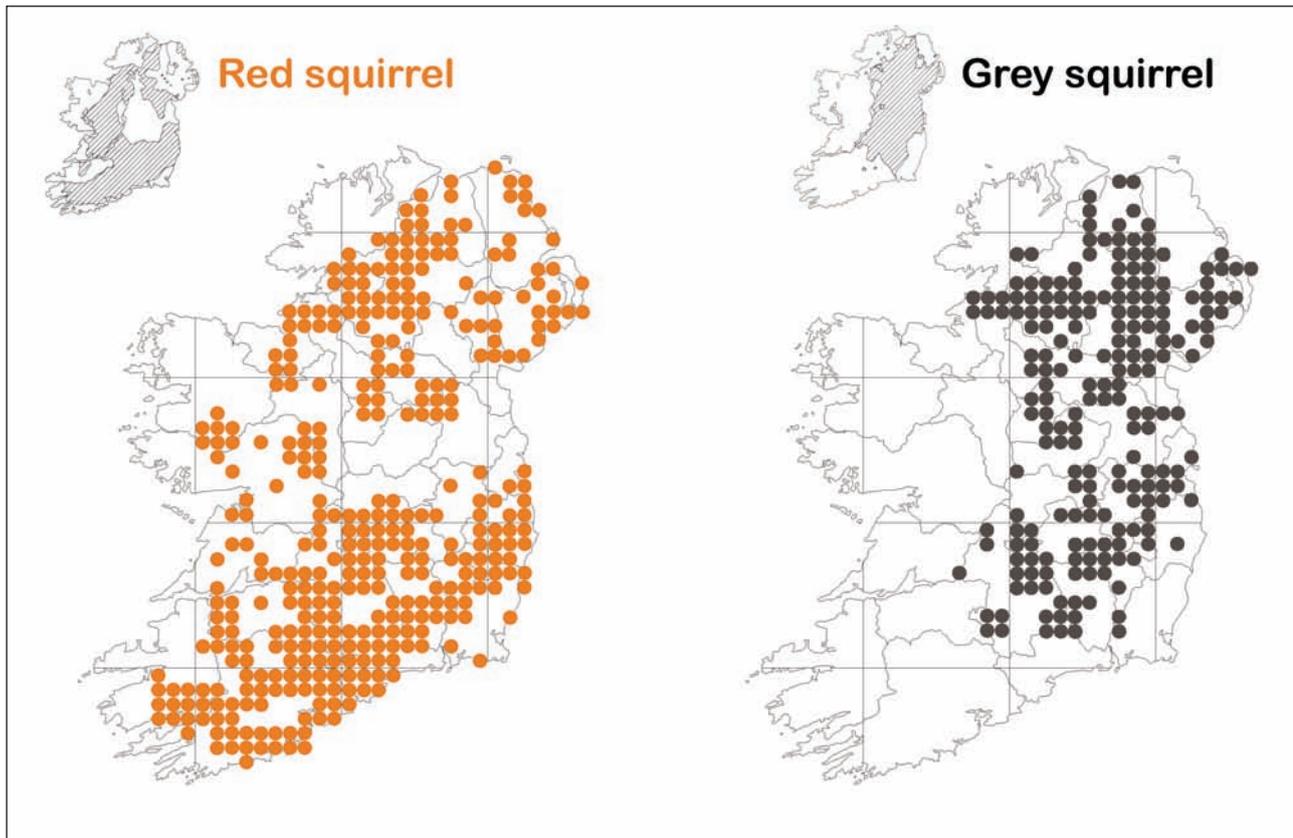


Figure 1: 1997 10 km square squirrel distributions (after Reilly 1997 and O'Teangana 1999). Extrapolated maps (O'Teangana et al. 2000) shown in top left corners.

The results of these two surveys, each part of the respective authors' Ph.D. theses, were amalgamated in a Mammal Review paper in 2000 to produce a distribution map for the entire island of Ireland for the two species (O'Teangana et al. 2000). Owing to the discontinuous nature of the data, especially in the case of the Republic of Ireland, where several areas were not sampled, some subjective extrapolation of the distributions was applied. It is these maps that are most frequently referred to in any contemporary publications on the subject of squirrels in Ireland; these are also shown as inserts in Figure 1.

However, as much of the surveying for these maps was carried out between 1994 and 1996, the depicted distributions are now at least 10 years out of date. Given that grey squirrels may disperse at a rate of up to 13.4 km per year, it is likely that significant change has occurred in the interim. For instance, Lawton's (2000) study, together with several anecdotal reports, indicated that the grey squirrel had spread down much of the east coast of Wicklow and from there had started moving up the river valleys. A map depicting the rate of spread of grey squirrels from the Mammal Review paper in 2000 allows one to gauge the degree to which the grey squirrel is likely to have spread in the past 10 years (Figure 2).

Conversely, other anecdotal reports have been collected from areas in the north midlands where grey squirrels, having been abundant 20 years ago, have recently diminished in number and in some instances been replaced by red squirrels. Whether this is a short term fluctuation, or a more long-term trend, possibly related to the spread of the recovering pine marten population of Ireland, needs to be investigated. At present the geographical range of the pine marten remains unclear although a

survey is currently underway (Declan O'Mahony pers. comm.). O'Neill's (2003) survey in Northern Ireland revealed further contraction in red squirrel distribution, being replaced by greys in several regions of the province. Such an update to the records for both species across the remaining 26 counties is clearly a necessity, if any geographically-targeted recommendations for red squirrel conservation and grey squirrel management are to be relevant.

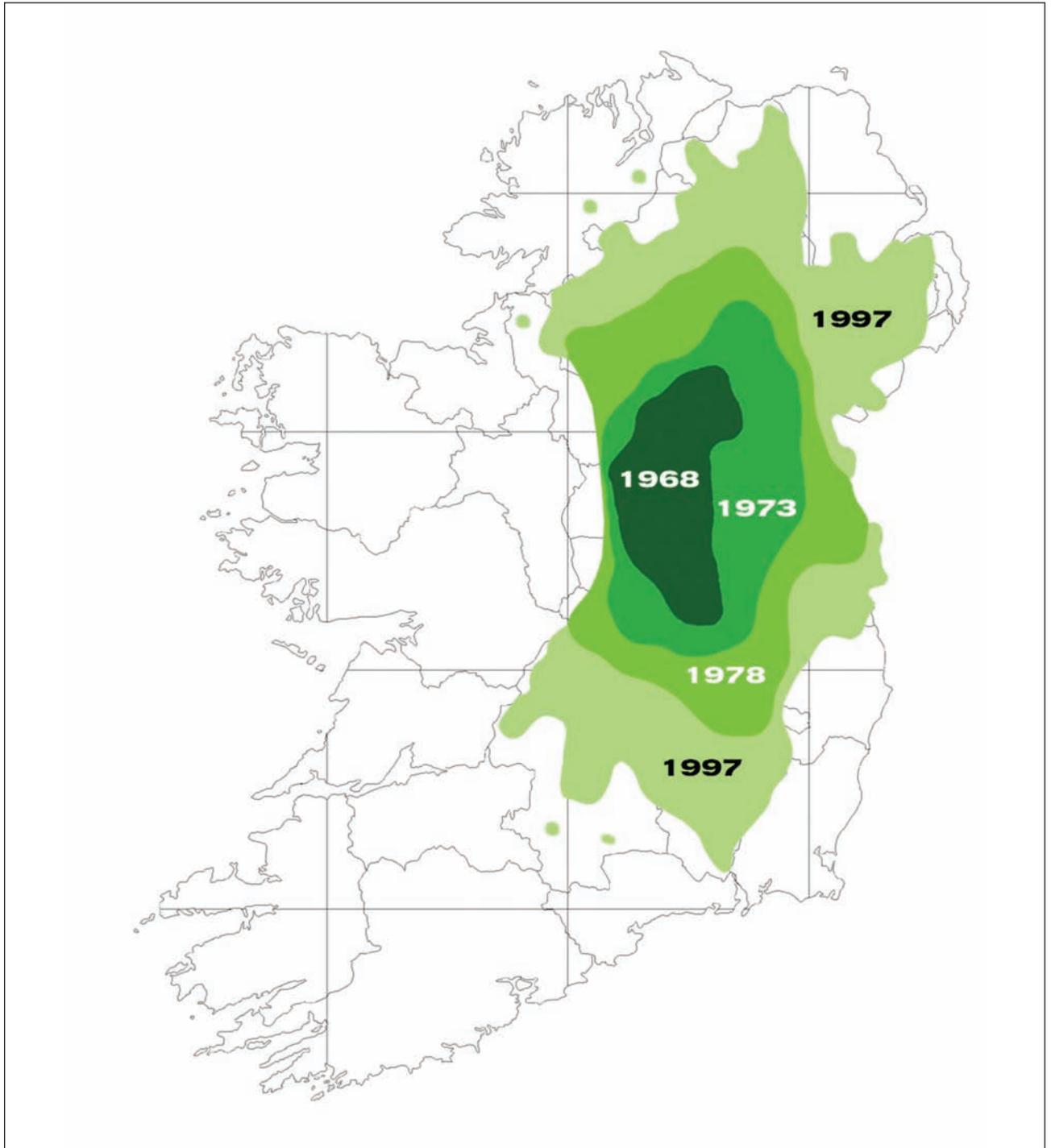


Figure 2: Spread of the grey squirrel (after O'Teangana et al. 2000).



▲ Grey squirrel (*Sciurus carolinensis*).

Photo: Geoff Hamilton

2. *Methods and description of research work*

Practical techniques for surveying and monitoring squirrels are discussed by Gurnell, Lurz and Pepper (2001). The five main surveying methods include: Visual surveys, Hair-tube surveys, Feeding transects, Drey counts and Whole maize bait.

Only the first two methods listed are capable of distinguishing the two species of squirrel. Hair tubes are more suited to small-scale local monitoring of squirrel numbers and movement, leaving visual surveying as the most suitable method for a large-scale distribution study. This approach was adopted in the present survey.

Survey questionnaire

Following consultation with a number of interested individuals and groups a questionnaire was drawn up and circulated to a large number of organizations and individuals in January / February 2007 requesting that they be filled in as accurately as possible and returned to a central location. The questionnaire used a simple tick-box format (See Appendices 1 and 2) regarding:

- Squirrel species present;
- Year in which either species was first seen or last seen;
- Location of sighting;
- Size, age and composition of woodland where sighting took place;
- Existence of damage to trees;
- Presence of pine martens;
- Existence of any control measures;
- Contact details of party reporting sighting.

In order to apply some degree of quality control, reports were followed up (phone, e-mail, site visits) where the species of squirrel or the habitat type was not clearly indicated, or when a sighting originated from an unusual location for either species that would not have been predicted from previous distribution surveys. This is a typical limitation of a questionnaire based survey such as this, but if rigorous screening is applied to the returned sightings, then the output of any analysis will be highly robust and resilient to scrutiny.

Circulation of the questionnaire

Three initiatives were used in order to ensure a wide distribution of the questionnaires and level of response that would enable reliable distribution maps to be prepared for both species of squirrel. These included:

- ▶ Distribution of hard copies of the survey questionnaire to relevant organisations and individuals. 5,000 hardcopies of the survey questionnaire were distributed through a variety of channels including: The Golfing Union of Ireland (each of the 411 golf clubs), National Parks and Wildlife Service staff including 60 Rangers, Coillte staff throughout the country, Society of Irish Foresters members, Irish Timber

Growers Association members, Crann members, Forestry Inspectors, Teagasc Forestry Advisors, NARGC officers at County level, Irish Tree Society members, Irish Deer Society, Wild Deer Society, Central and Regional Fisheries staff, Tree Council of Ireland, The Irish Landowners Association, Forestry Staff and Students at University College Dublin, GMIT and WIT, Staff and Students of NUI Galway, TCD, and University of Limerick and Heritage Officers of County Councils. Copies of the questionnaire were also posted to leading organizations and individuals in Northern Ireland including the Forest Service, EHSNI, Ulster Wildlife Trust, Quercus, The Mourne Heritage Trust, The Biological Records Centre for Northern Ireland and a number of private influential individuals – Lord Hamilton and Lord O’Neill. In order to ensure a good response was obtained to the request to return questionnaires, separate reminder e-mails and /or phone calls were sent/made to each golf club in Ireland, all of the Rangers in NPWS and each Walking club associated with the Mountaineering Council of Ireland (110 clubs). After discussion with Coillte regarding the best approach to gather data from its forests the company added a version of the questionnaire to its in-house IT system in order to gather information from all relevant staff. A similar interface was put in place for the Teagasc IT system. The Northern Ireland Forest Service also agreed to collate data from their staff and submitted a spreadsheet of recent sightings in their forest properties.

- ▶ A website, www.irishsquirrelsurvey.com, was constructed for the survey (see Appendix 3). This enabled the public to return a questionnaire and any comments they might have to the Survey Coordinator electronically. Sightings reported in this manner were printed out and added to the returned postal copies.
- ▶ The survey was widely advertised through participation in a number of TV and radio interviews and articles in newspapers and magazines. These included: 15 minute interview of Geoff Hamilton and Michael Carey on *Today with Pat Kenny* (RTE Radio 1 on 5/2/07), participation by Geoff Hamilton and Michael Carey on *Ear To The Ground* on 15/2/07, Radio interviews on East Coast Radio (15/2/07), Shannonside Radio (19/2/07) and Northern Sound Radio on 22/3/07- Newspaper articles included the *Farmers Journal* 24/2/07, *The Irish Times* 31/3/07 and 5/4/07, *The Meath Chronicle* 14/4/07, *The Daily Mail* 7/2/07 and 16/4/07. All articles listed the survey website. A number of organizations have also included articles about the survey and its relevance and/or reminders of the survey in their respective journals. These included CRANN, The Irish Wildlife Trust, Birdwatch Ireland, Irish Timber and Forestry, The Farmers Monthly, The Local Planet and The Irish Mountain Log. The project team also had the opportunity to publicise the survey at Dublin Zoo’s Native Species Weekend on the 14th and 15th of April.

Response to the above publicity was very positive and increased usage of the website was clearly discernible after any such promotion of the survey. In order to encourage individuals to return the questionnaire (or reply through the dedicated web site) it was agreed at the start of the survey to award two prizes (weekends for two at the Druids Marriott hotel in Wicklow), valued at €650 each, to the winner of a raffle after all the returns had been compiled. This raffle took place at the COFORD offices in Sandyford on August 24th 2007 in the presence of Dr Eugene Hendrick, Director of COFORD, Dr Michael Carey, Project Manager and Mr Geoff Hamilton, Survey Coordinator respectively, Irish Squirrel Survey 2007.

Compilation of the survey results

Recorder 6 software was purchased and used to digitise the information provided on survey returns. This program facilitated the compilation of a database of records containing species and location information and allowed the data to be presented in a map format showing the distribution pattern for red and grey squirrels and the pine marten. This approach ensured future-proofing of data and compatibility with the National Biological Records Centre, at Waterford Institute of Technology (WIT). DMAP software was subsequently purchased which facilitated the generation of high resolution distribution maps for publication purposes.

Role of NUI Galway

Data regarding the current distributions of red and grey squirrels in Connacht was collected via a questionnaire survey carried out by Alan Poole (NUI Galway) as part of his IRCSET-funded Ph.D. thesis from 2003 – 2007. It was agreed when the new all Ireland survey was being scoped that the data already collected during this work would be incorporated into the new survey, thereby eliminating the need to re-survey much of the aforementioned region. Alan Poole and Dr Colin Lawton also agreed to distribute and collate additional survey forms in Connacht to supplement the current records for use in this survey. They were also responsible for any follow-up work in the Connacht region. Dr Lawton provided significant input into the design of the survey questionnaire, and offered to assist in the publicity of the survey in the print and audio-visual media. Both also contributed significantly to the creation of this report, particularly in relation to the analysis of the results in Connacht and Munster, and in providing recommendations for red squirrel conservation.



▲ The native red squirrel (*Sciurus vulgaris*).

Photo: © Niall Benvie (www.imagesfromtheedge.com)

3. Results

The main results of the survey are depicted in the geographic distribution maps (Figures 4 - 15). A summary of the survey reports is shown in Tables 2 and 3, the first of which lists county, number of returns, ratio of red to grey squirrels and percentage forested area; data shown exclude electronic returns from Coillte and the NI Forest Service, which were not indexed by county. Table 3 documents the major contributors to the survey and the number of returns received from each. Data from the West of Ireland survey is also not reflected in either table. The overall findings of the survey indicate that the grey continues to spread rapidly throughout the country, while the red is becoming increasingly marginalised to areas of coniferous forest. Greys have furthermore been confirmed west of the River Shannon, in small numbers in north Roscommon.

The spread of greys is most notable through the southeast counties of Wexford and Wicklow, from where they were predominantly absent at the time of the last survey. Greys have advanced approximately 50 km in the past 10 years in this region. The same is true for the northeast in County Antrim. Grey squirrels have consolidated their distribution in the south Midlands and have spread steadily through Tipperary and into east Limerick, while in the northwest they appear to have expanded around Ballyshannon and have begun to move northward. Evidence also exists that greys are using riparian habitat alongside rivers as major dispersal corridors, this being particularly noticeable in Wicklow.

Red squirrels are still widespread in many areas, with some enlargement of their range being noticeable in west Cork, Donegal, Laois and Offaly. However, they are now absent from Meath and Westmeath and have been reduced to one or two isolated populations in Carlow, Kilkenny and Louth. Numerous local extinctions have also been noted by contributors to the survey, where reds have been replaced by greys in the past 5 to 10 years. Reds continue to exist in reasonable numbers in the north midlands and have even been reported from Castleforbes Estate where the grey was introduced. (It is understood that there are also some grey squirrels still present at this estate). Several returns from this region reported areas where grey squirrels were numerous 20 to 30 years ago, but have since all but disappeared. Similar reports were submitted from Laois and Offaly. Reds were only occasionally reported from urban locations, in contrast with greys, which were frequently sighted in parks and gardens in numerous towns around the country.

Returns indicating the absence of both squirrel species were predominantly from the west of the island, where historically there existed a lack of suitable forest habitat to support squirrel populations. Planting in the latter half of the 20th Century has resulted in the contemporary existence of substantial stands of forest in the region, but these remain inaccessible to squirrel populations due to a lack of dispersal corridors between such plantations.

The distribution of the pine marten appears to be somewhat fragmented, with the major concentrations being located in Clare, Laois-Offaly and the Cavan-Leitrim-Fermanagh regions.

Table 2: Summary of results by county¹ (electronic returns from Coillte and Northern Ireland Forest Service excluded).

County	No. of returns	Red sightings	Grey sightings	Red:Grey ratio	% of county forested	% broadleaf ¹	% conifer
Antrim	36	11	31	0.26:0.74	4.2	0.88	3.33
Armagh	6	0	6	0:1	2.6	1.03	1.55
Down	30	13	20	0.39:0.61	2.5	1.19	1.36
Fermanagh	18	10	8	0.56:0.44	10.3	1.97	8.31
Londonderry	15	6	11	0.35:0.65	6.2	1.80	4.42
Tyrone	24	7	22	0.24:0.76	6.3	1.64	4.71
Carlow	18	2	17	0.11:0.89	6.69	1.36	5.33
Cavan	25	14	7	0.67:0.33	6.85	2.52	4.34
Clare	24	20	0	1:0	13.46	3.29	10.17
Cork	90	88	0	1:0	9.28	1.88	7.40
Donegal	26	14	3	0.82:0.18	10.60	1.92	8.69
Dublin	220	37	194	0.16:0.84	4.33	1.30	3.04
Galway	22	19	0	1:0	8.85	1.88	6.97
Kerry	27	22	0	1:0	8.53	1.97	6.56
Kildare	38	8	30	0.21:0.79	5.43	3.34	2.09
Kilkenny	28	5	22	0.19:0.81	7.84	2.25	5.60
Laois	19	14	7	0.67:0.33	13.05	3.37	9.69
Leitrim	11	6	1	0.86:0.14	12.94	2.72	10.22
Limerick	34	26	8	0.76:0.24	7.43	1.14	6.29
Longford	4	1	2	0.33:0.67	7.30	2.13	5.17
Louth	14	1	13	0.07:0.93	2.45	0.98	1.47
Mayo	8	2	0	1:0	7.95	1.30	6.66
Meath	35	0	34	0:1	4.15	2.41	1.73
Monaghan	12	5	10	0.33:0.67	4.33	2.00	2.33
Offaly	29	22	7	0.76:0.24	9.84	3.74	6.10
Roscommon	12	8	1	0.89:0.11	7.46	1.69	5.77
Sligo	18	18	0	1:0	9.48	1.68	7.80
Tipperary	54	38	23	0.62:0.38	9.84	2.11	7.73
Waterford	31	28	4	0.88:0.13	12.25	4.07	8.19
Westmeath	18	0	17	0:1	5.64	2.33	3.32
Wexford	44	22	28	0.44:0.56	5.36	1.95	3.41
Wicklow	137	59	106	0.36:0.64	15.31	3.76	11.55
Total	1127	526	632				

Table 3: Summary of source of returned questionnaires and responses via www.irishsquirrelsurvey.com.

Source	No. of returns
Coillte	318
ROI Forest Service	9
General Public and other organisations	971
Golf Clubs	39
NI Forest Service	118
NPWS	20
Teagasc	27
Total	1502

¹ Percentage broadleaf cover in Northern Ireland also includes total area of mixed woodland.



Figure 3: Reference map of Ireland showing Counties.

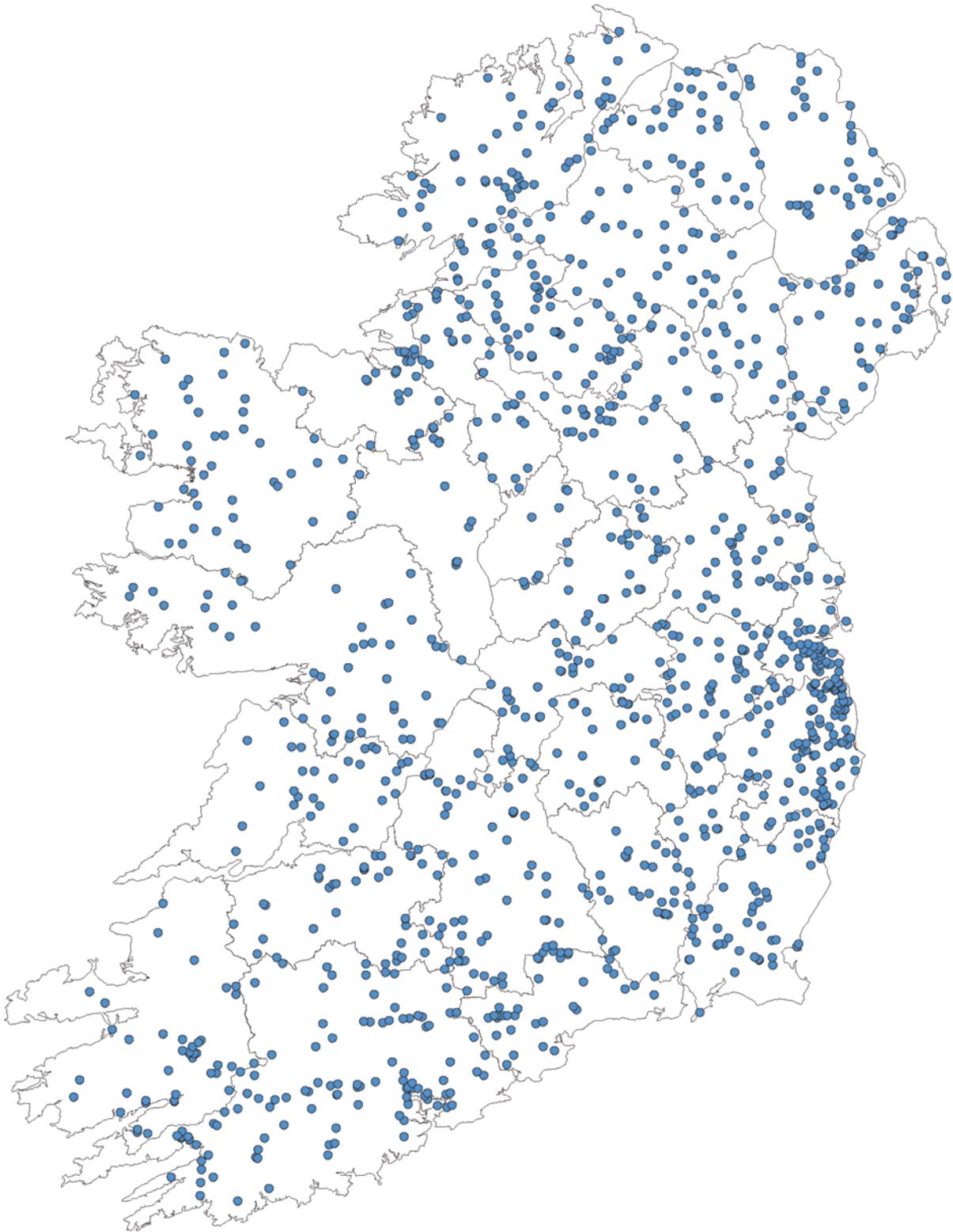


Figure 4: Individual locations of all survey returns.

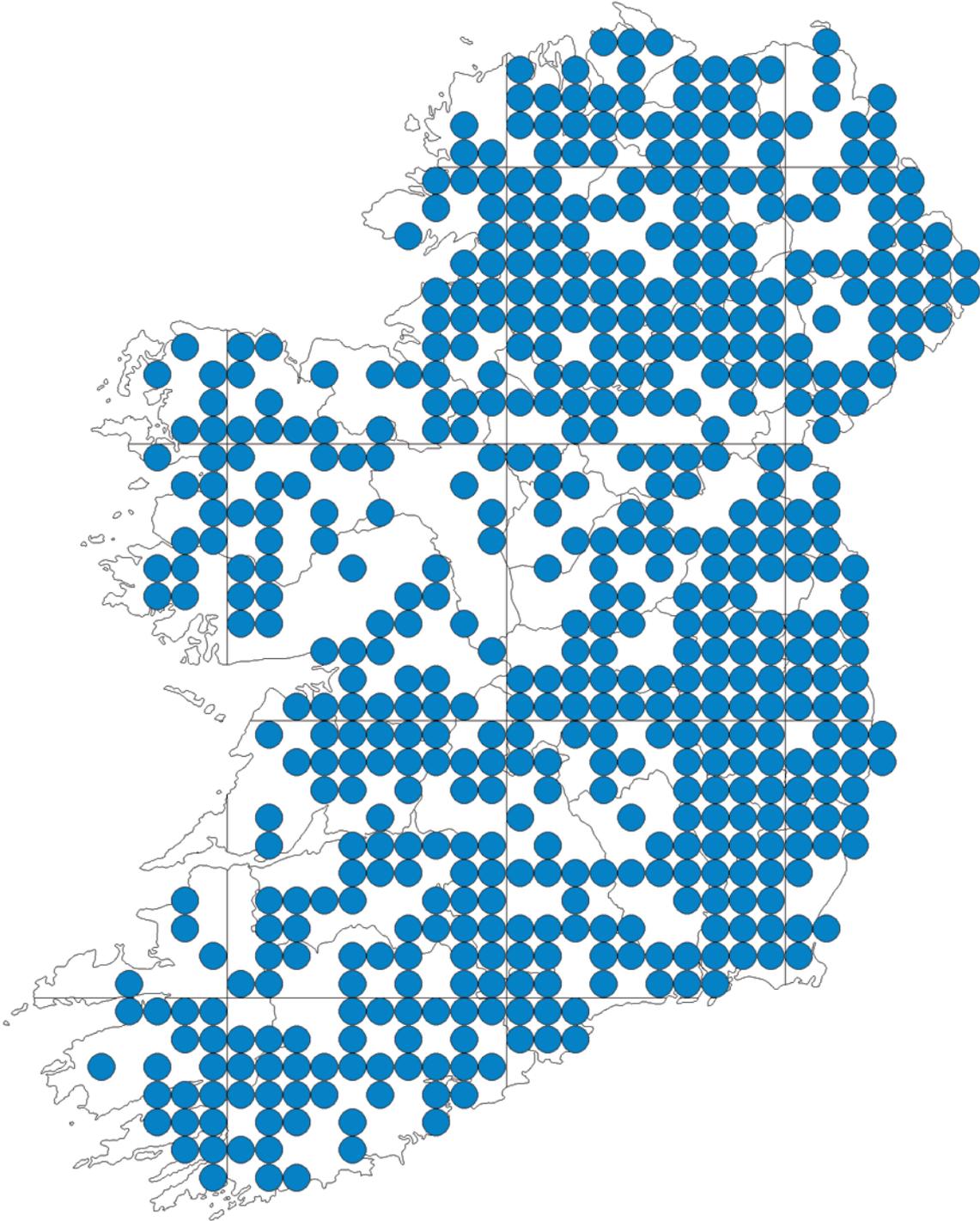


Figure 5: Locations of all 10 km squares sampled.

Points to note:

Many of the areas for which no questionnaires were returned reflect 10 km squares with little or no woodland. This is important in relation to the strip of land west of the Shannon, as it will inhibit the spread of grey squirrels that have managed to cross the river.

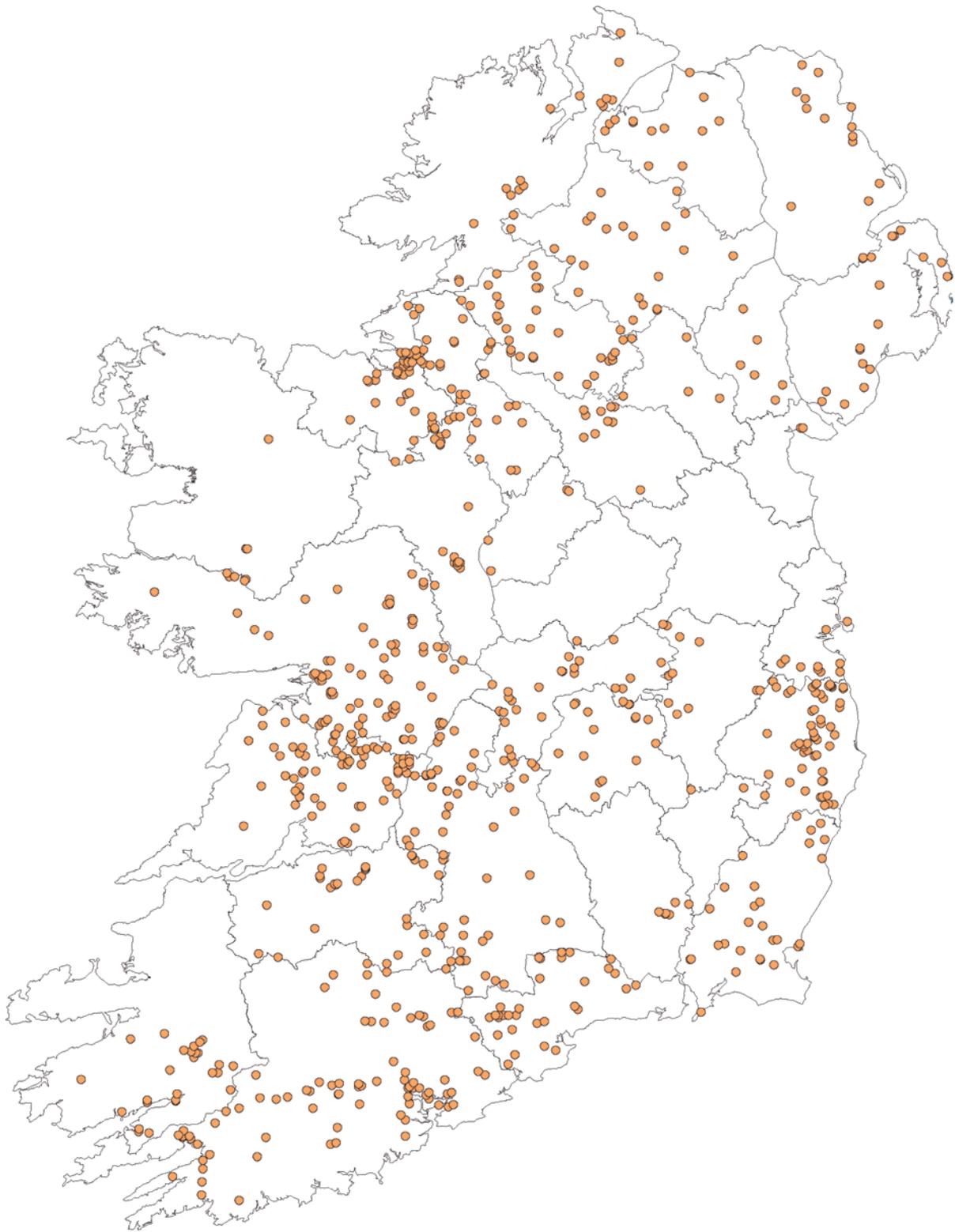


Figure 6: Locations of all red squirrel sightings.

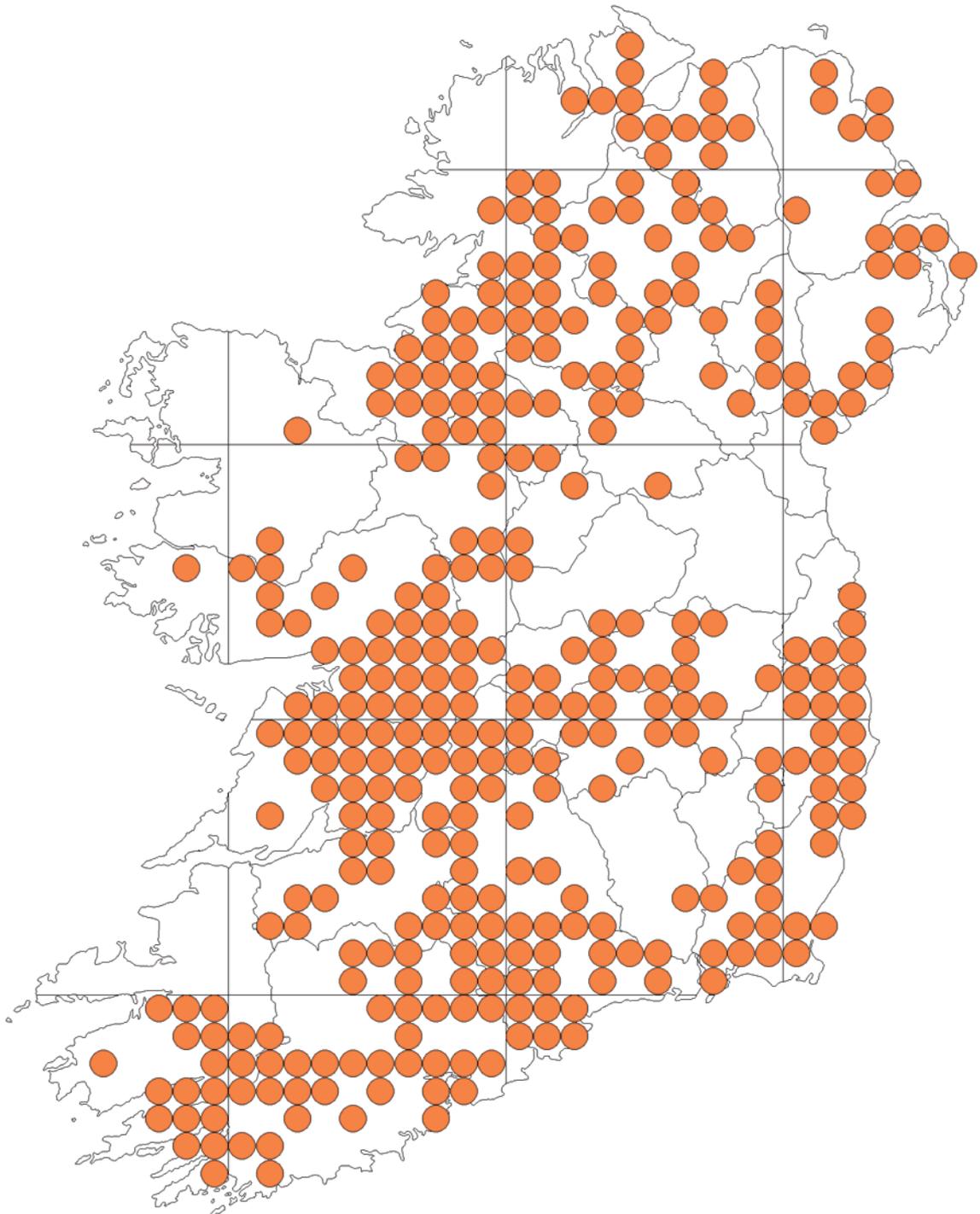


Figure 7: Locations of 10 km squares with red squirrel sightings.

Points to note:

Reds remain widespread in the many areas of the country, but further reduction of distribution in north Meath, west Louth and Dublin in the past 10 years is apparent. Even more prevalent is the loss in East Tipperary, Kilkenny and Carlow. Conversely, an expansion of red squirrel distribution appears to have occurred in Offaly, Laois and west Kildare. Red populations continue to thrive where grey squirrels are absent, with some expansion also noted in several areas, including southwest Cork.



Figure 8: Locations of all grey squirrel sightings.

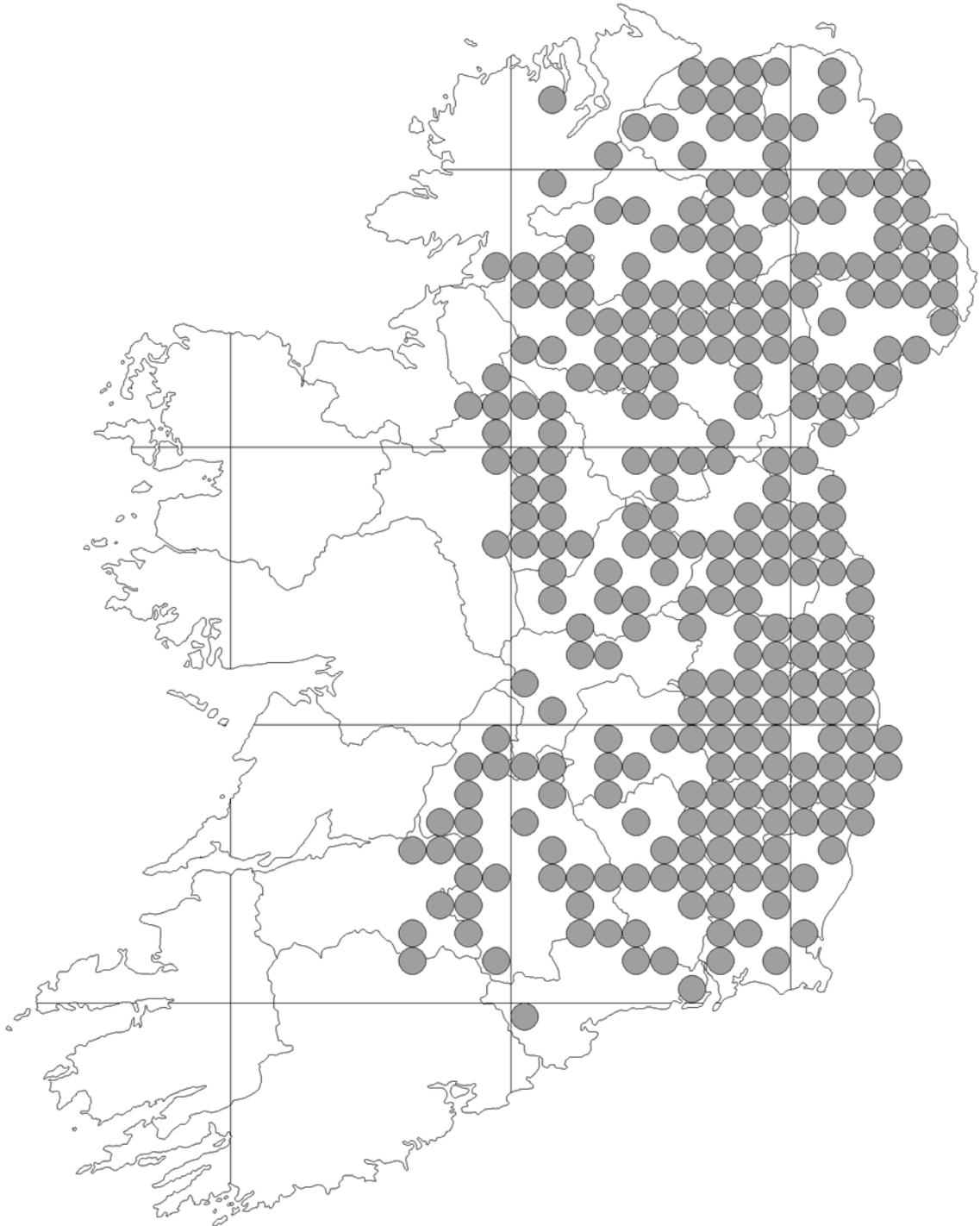


Figure 9: Locations of 10 km squares with grey squirrel sightings.

Points to note:

Greys in the north of the island have spread significantly, particularly in Londonderry, Antrim and to a lesser degree in Donegal. Greys have now been confirmed west of the River Shannon in Leitrim and Roscommon, though they remain predominantly absent from this region. There has been a notable southward spread into Limerick, Waterford and south Tipperary. A major incursion into Wicklow and Wexford has also taken place in the East.

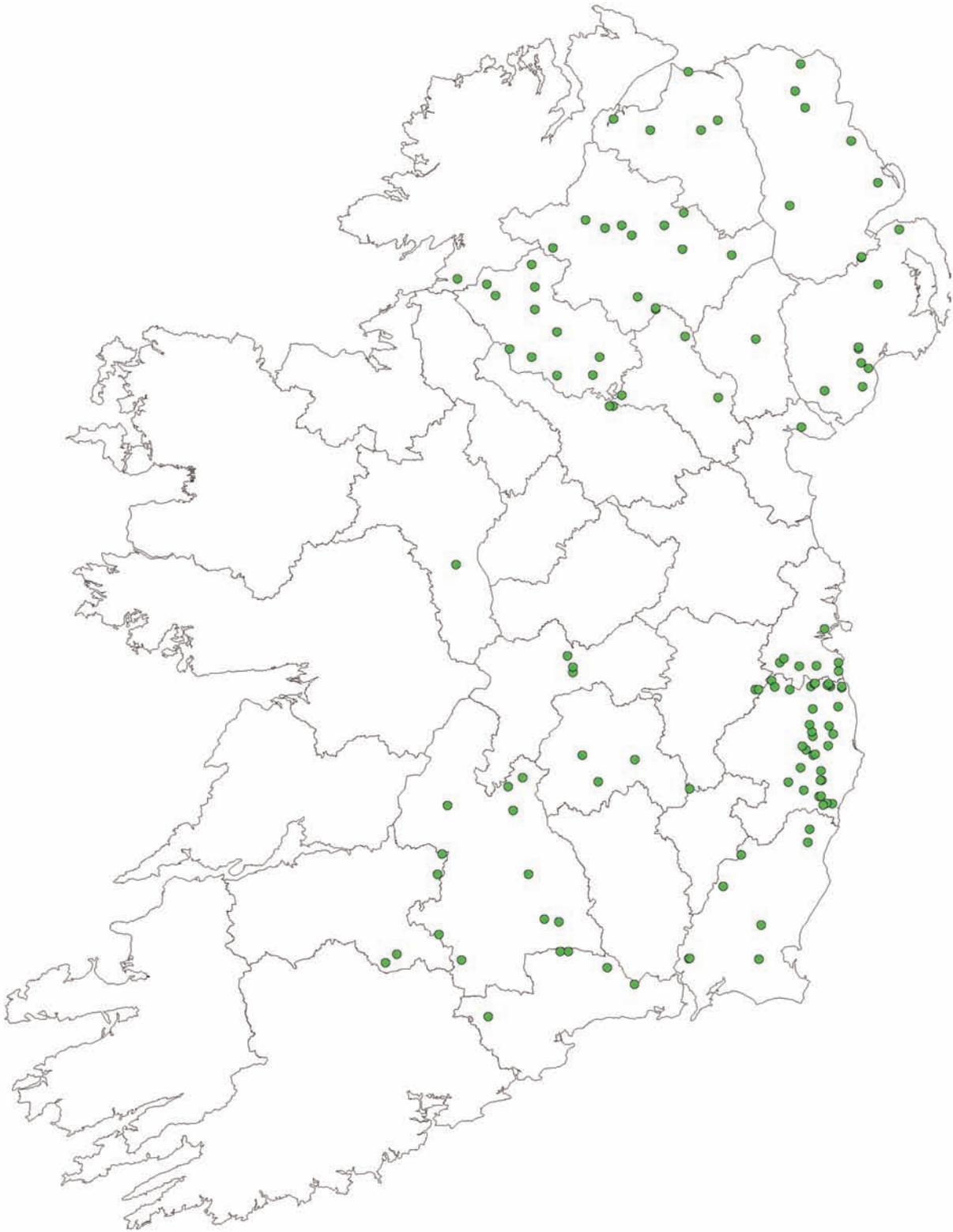


Figure 10: Locations of sites with both species of squirrel resident.

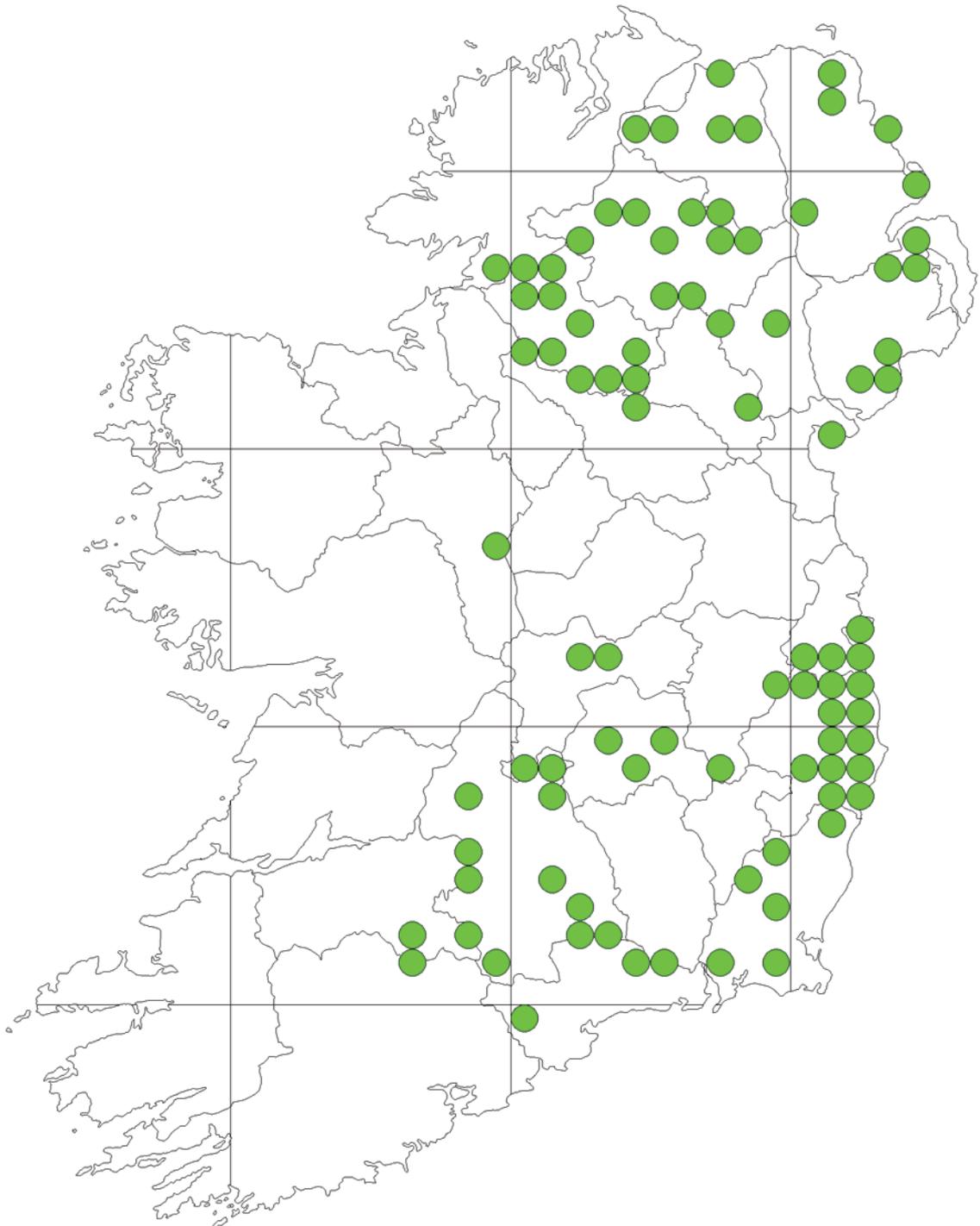


Figure 11: Locations of 10 km squares containing sites with both species of squirrel resident.

Points to note:

Significant areas of the region where greys have been established longest are devoid of reds. The almost complete replacement of reds by greys in Kilkenny and Carlow has been very fast, only occurring in the past 10 years. Reds in large coniferous plantations in Wicklow and other areas may be able to withstand invasion to a greater degree.

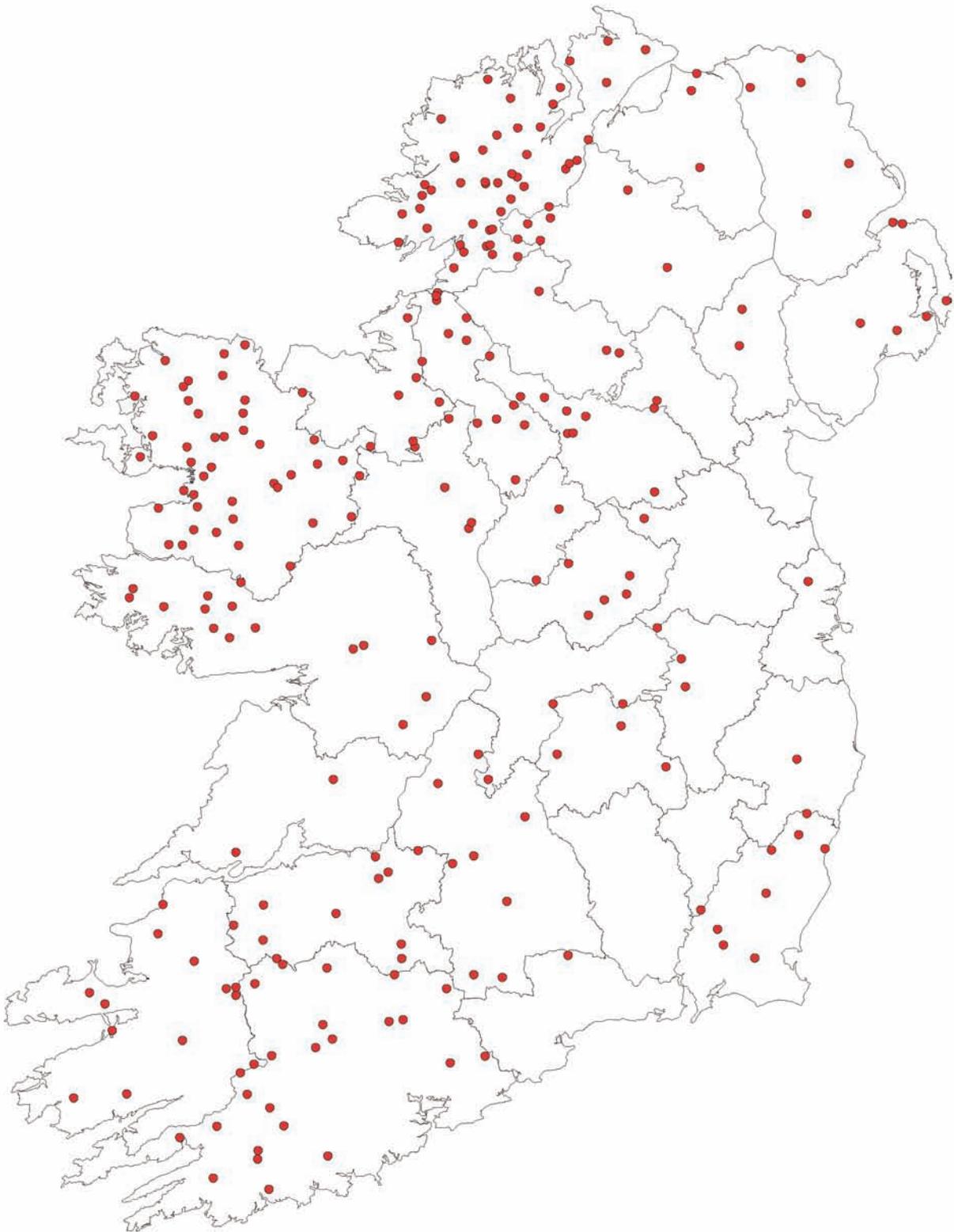


Figure 12: Locations of individual sites with no squirrel sightings.

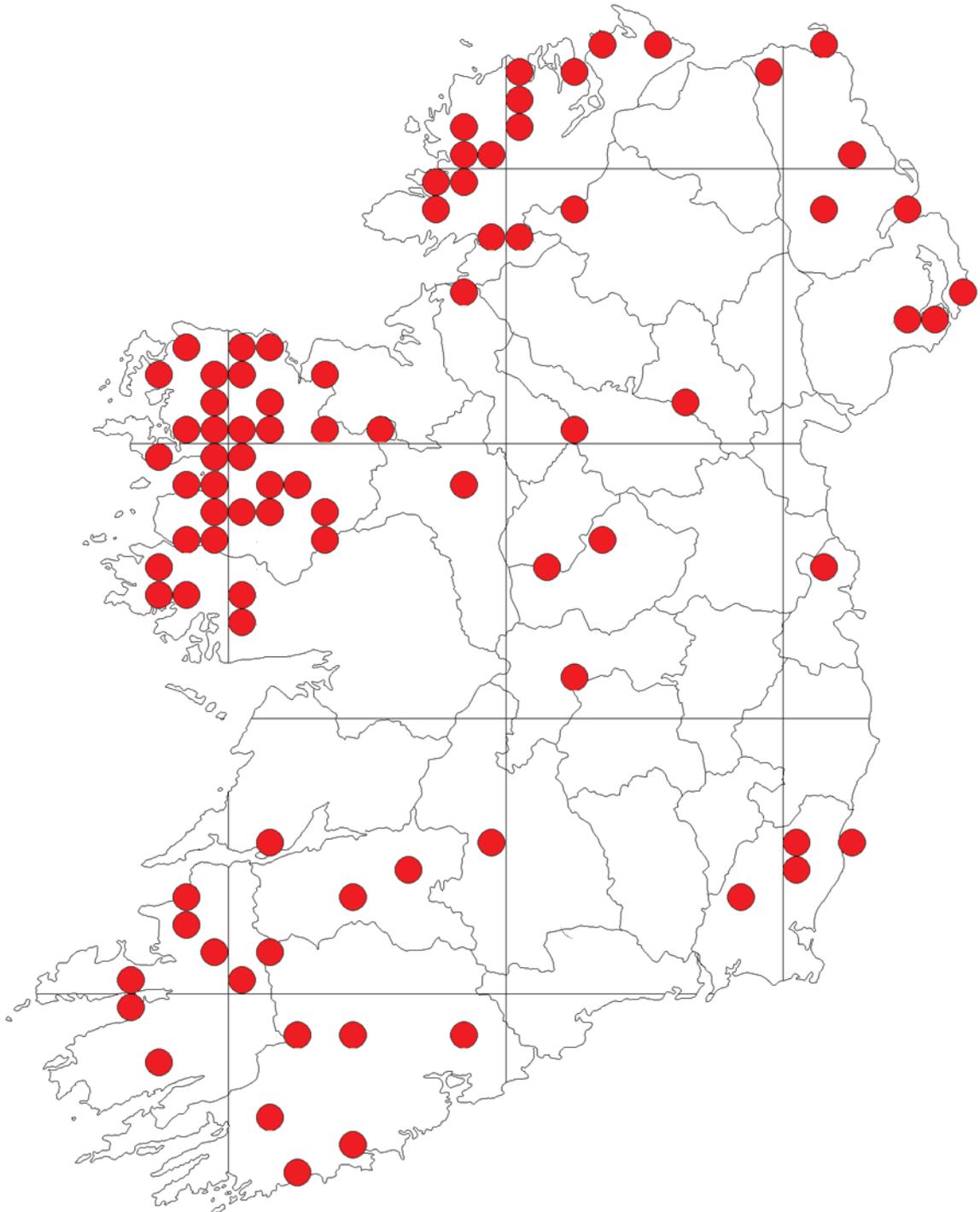


Figure 13: Locations of 10 km squares with no squirrel sightings.

Points to note:

Historically reds have not been able to colonise the regions in the far west and northwest owing to lack of suitable habitat corridors. In theory, these areas will also remain difficult for the grey to colonise. Other negative squares in the country predominantly reflect areas with little or no woodland.

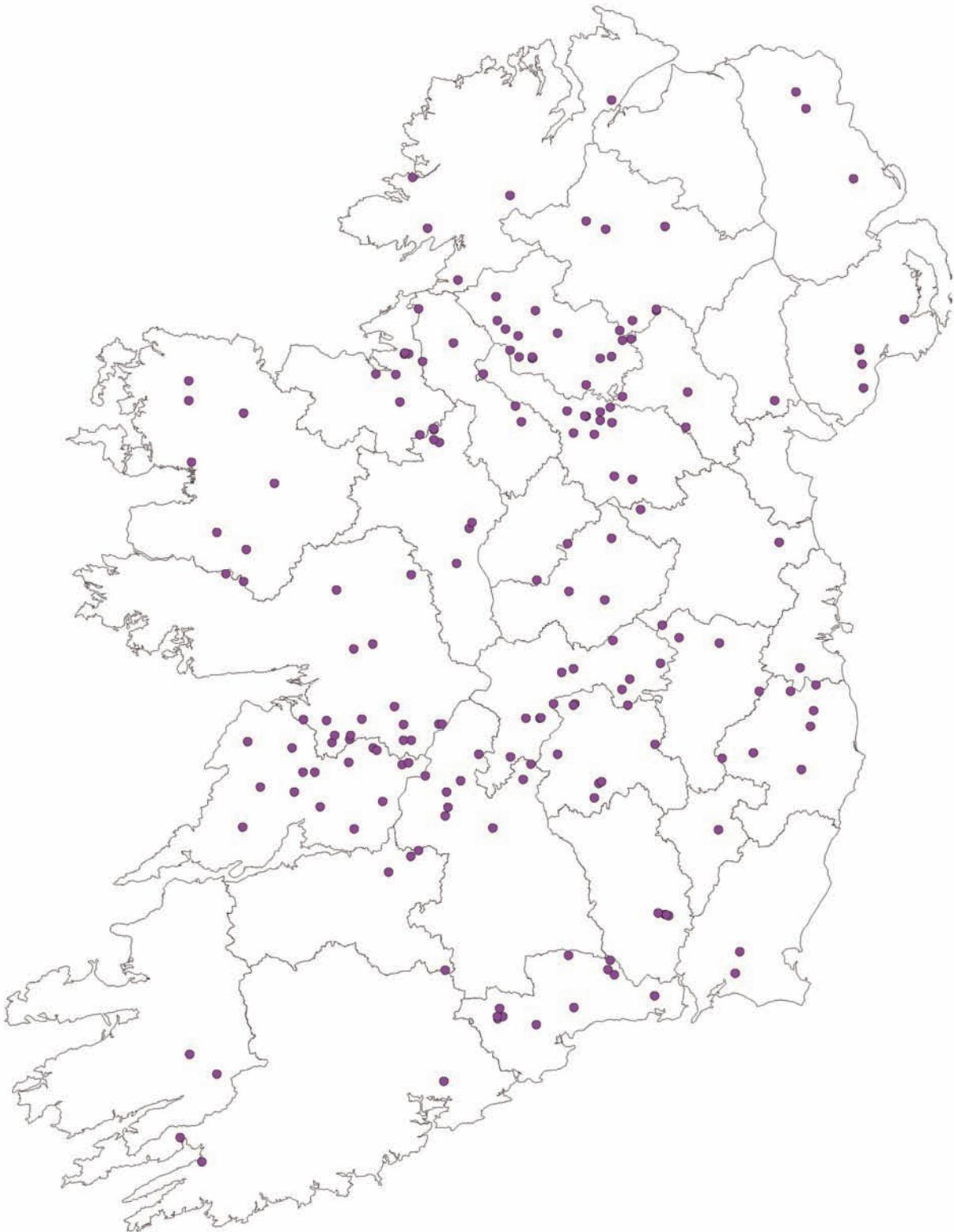


Figure 14: Locations of all pine marten sightings.

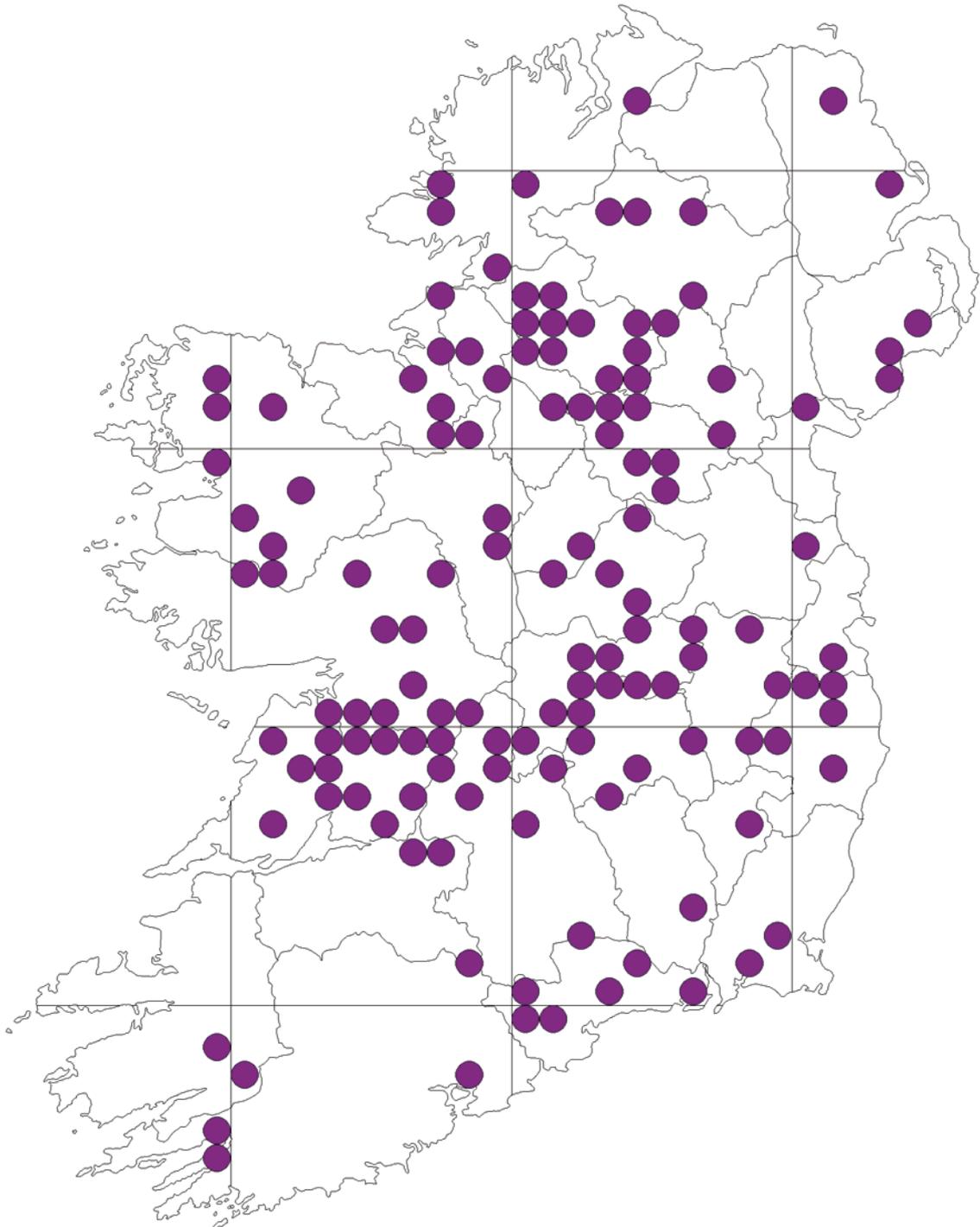


Figure 15: Locations of 10 km squares with pine marten sightings.

Points to note:

Areas of pine marten concentration (Laois, Offaly, north Tipperary, Fermanagh, north Cavan and Leitrim) seem to coincide with those where reds appear to be less vulnerable to replacement by greys. Not definitive, but the pattern suggests that further study on this interaction is needed. Overall, the pine marten appears to be spreading steadily throughout many areas of the country.

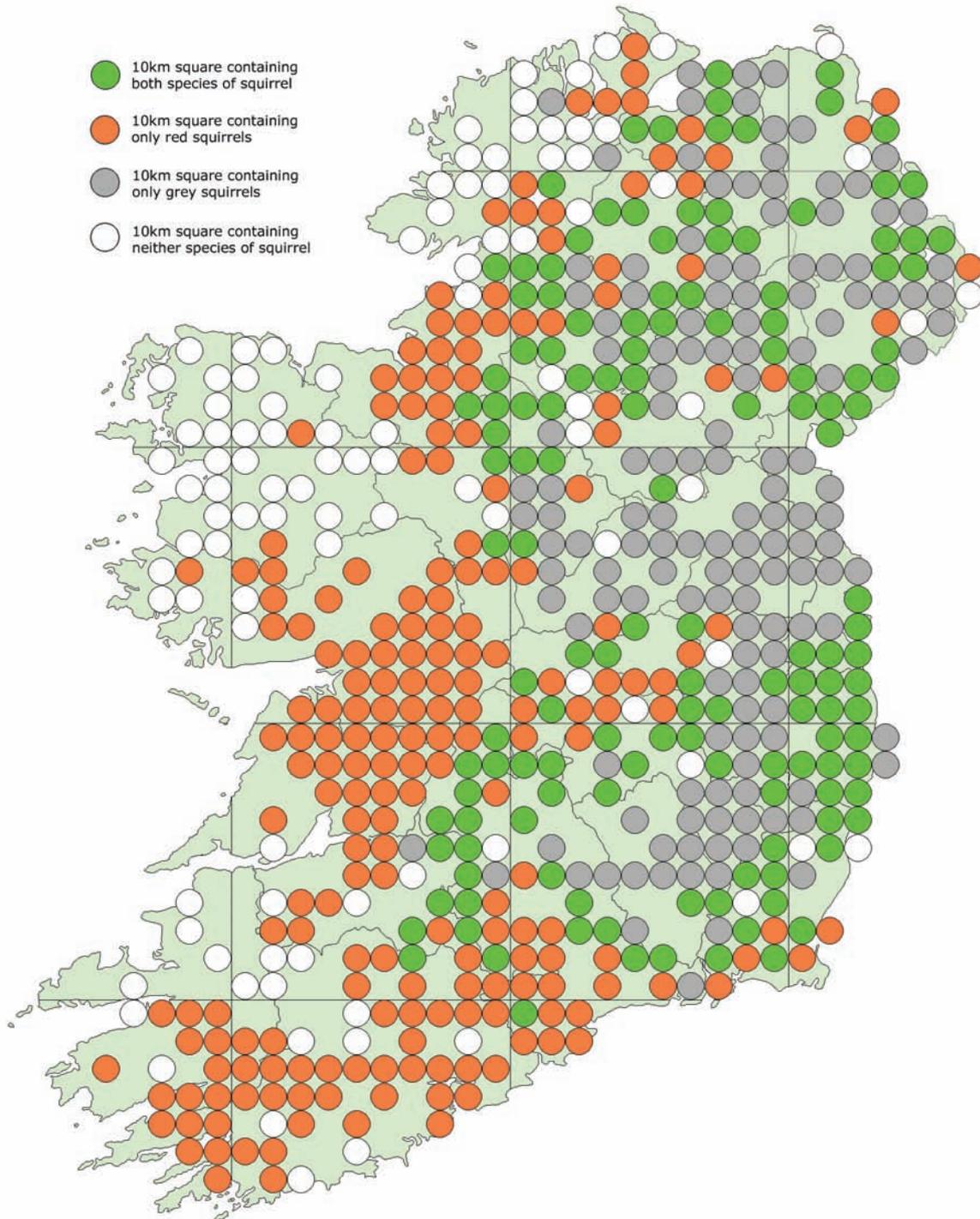


Figure 16: Summary map of survey results showing distribution of both squirrel species and their overlap zones.

Points to note:

There remain only a few 10 km squares in the eastern half of the country where red squirrels are found exclusively, these being focused in and around the Slieve Bloom mountains, and along the southeast coast. 10 km squares containing only grey squirrels are much more numerous than at the time of the last survey. The frontier of grey squirrel spread is particularly clear in Kilkenny, Carlow, Tipperary and beyond towards East Limerick.

4. Discussion

Ulster

Since the last major survey of squirrels in Northern Ireland grey squirrels have undergone continued range expansion, replacing red squirrels in many areas of the province. Of most significance is the numerous records of grey squirrels in Antrim; O'Teangana's (1999) survey indicated that Antrim in 1997 remained the only Northern Irish county without a major grey squirrel population. The River Bann, which would have been a major barrier to the spread of the greys (having only seven bridges) appears to have been crossed at least once, with grey squirrel populations now found in most of the county. Only the northeast of the county (i.e. the Glens of Antrim) remains to be colonised, and this area still supports several populations of red squirrels. Greys are encroaching on this area from all directions, but particularly from north of Belfast. Grey spread has also been pronounced in the northwest of Northern Ireland, and much of Londonderry now has resident populations of greys; areas such as Limavady have seen major incursions in the past decade.

Red squirrels may still be found in isolation, or with grey squirrels in several conifer-dominated areas such as the Sperrins, the Mourne and in west Fermanagh. Reds may still be considered locally common in the western counties of Northern Ireland, though a significant number of returns from these areas indicate that they are often found in woodlands with grey squirrel populations also. It is notable that red and grey squirrels have been found in the same areas in Fermanagh for several decades, as the habitat associations of the two species appear to differ (Tangney and Montgomery 1995); no apparent decline in red squirrel distribution in the past 10 years in this region has been documented by this survey. There still exist some isolated red squirrel populations in Mid-Ulster, such as in Loughgall and Randalstown, but these remain under constant threat from grey squirrel replacement, as may have been the case at Shane's Castle, Antrim, where reds have not been seen for over a year.

At the time of the last survey, very few sightings of either species of squirrel occurred in Donegal, all of which were close to the border with Northern Ireland in areas like Ballybofey and Stranorlar. This survey has confirmed the presence of several populations of red squirrels in Donegal, particularly on the Inishowen peninsula. It is feasible that such populations have recently spread northward onto the peninsula from Londonderry (as coniferous planting in the area has provided more suitable habitat), but it may also be the case that such populations were simply not recorded in the previous survey due to small sample size. Sightings of greys in Donegal remain relatively rare, but an animal shot 5 km northwest of Letterkenny confirms that a population exists in the county, if only in small numbers. An isolated population of red squirrels at Ards Forest Park in the northwest of the county which existed in the 1970s now appears to be extinct. However, this may be a suitable site for future translocation of red squirrels.

Cavan and Monaghan both continue to have resident red squirrel populations, with the former having twice the number of red sightings than grey. Several returns from this region contained anecdotal reports of the progressive decline in grey squirrel numbers, such as at Hilton Park and Cloverhill. A cluster of red squirrel sightings in the middle of Co Cavan, all from sites where grey squirrels are currently absent, corresponds with a region with an apparently thriving population of pine martens (see Figure 16). Conversely, red squirrels appear to have significantly declined in the

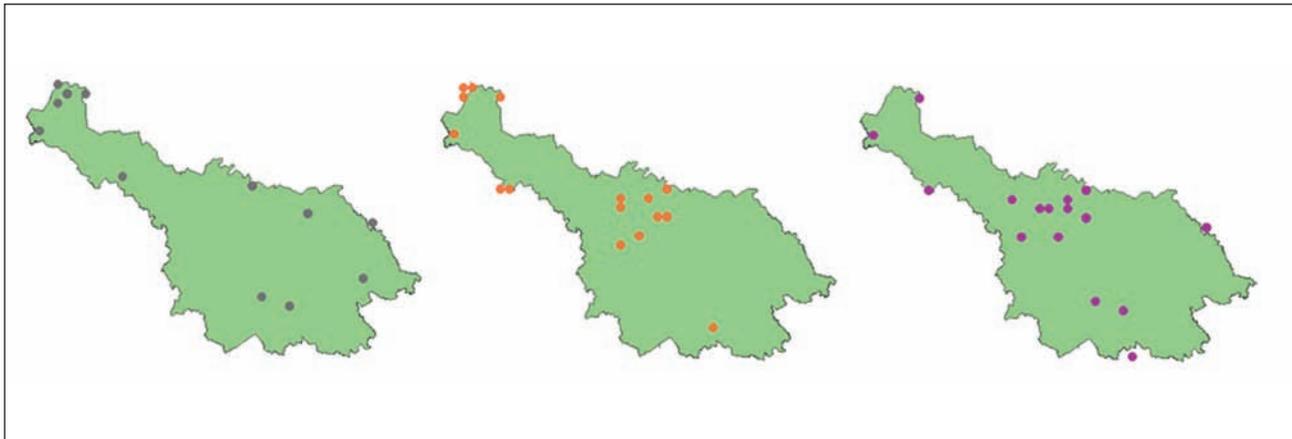


Figure 16: Example of clustering of red squirrel and pine marten sightings in areas devoid of grey squirrels in Cavan.

southeast of Cavan, where they were contiguous with populations in northwest Meath at the time of the last survey.

Leinster

In Leinster, the grey squirrel is clearly more common than the red, being the only squirrel species present through several large areas of the province. The red may now be considered extinct in Meath and Westmeath, counties in which it could still be found during the survey in the 1990s.

Reds are also now very rare in Louth (one report), Carlow (two reports) and Kilkenny (small cluster near Inistioge). Replacement in these counties has been extremely rapid, as red squirrels were considered relatively common in these areas at the time of the last survey. Red squirrels are still common in the commercial plantations of Wicklow and the Laois-Offaly region; in the case of the latter some northerly geographic spread appears to have occurred since the last survey.

The distribution of the grey has increased significantly along the eastern seaboard, from where it was predominantly absent at the time of the last survey. It is now very plentiful in East Wicklow and Wexford. The rate of spread by grey squirrels in this area is estimated at about 5 km/yr, and in Wexford it is probable that in the near future a convergence of two grey squirrel populations, spreading south from Wicklow and east from Kilkenny, will occur. A pattern of grey squirrel spread along river valleys was especially noticeable in Wicklow, where numerous sightings were spread along the Glencree, Avonmore and Vartry rivers. The riparian habitat of mature broadleaf trees found in these valleys forms ideal corridors for grey squirrel dispersal.

Reds have become increasingly marginalised in Dublin, having been replaced in the Botanic Gardens and are now only found in increasingly isolated pockets in the Raheny-Sutton-Howth and Killiney-Shankill areas. However, they are still frequently seen in the woodlands along the Dublin-Wicklow border, though often in sympatry with grey squirrels. A report from Shankill of two red squirrels displaying myxomatosis-like symptoms is of some concern, as these are traits similar to those seen in red squirrels in the UK that have contracted squirrel pox virus, carried asymptotically by greys. Unfortunately the animals were euthanised and disposed of and so could not be sent for testing.

There was an overall low number of returns from Longford where both species are still extant, though reds are restricted to only three locations. Greys are relatively more common, but reports suggest that they too are significantly less numerous than they were around 20 years ago. This apparent decline has even been noted by staff at the Castleforbes Estate where the grey was originally introduced.

Jackson (1961) reported the existence of grey squirrels in Wicklow in the 1930s. This was confirmed during the course of the survey when the project team was shown a stuffed grey shot at Ballyarthur Estate in 1936. This suggests that other introductions/translocations of grey squirrels may have occurred at this time. However this Wicklow introduction failed to establish itself, most likely due to the negative genetic effects of small founder populations.

Numerous reports of pine martens were submitted from the Laois-Offaly region, an area which does not show the same replacement of reds by greys as is apparent in neighbouring Kilkenny and Carlow. Indeed, the spread of reds into north Offaly indicates that the presence of pine martens here may disrupt the usual pattern of displacement that is seen elsewhere.

Connacht

The red squirrel remains widespread throughout much of the eastern half of the province of Connacht. The cluster of squares of red squirrels in counties Sligo and Leitrim correspond to an area containing a high proportion of coniferous woodland. In south county Galway and in much of county Clare the red squirrel is also widespread. In this area the red squirrel is utilising two main habitats. The first is commercial conifer forest, dominated by Sitka spruce and lodgepole pine. The second habitat is natural hazel scrub in the Burren limestone region. Apart from these two areas, the distribution of the red squirrel in the remainder of the region west of the river Shannon is patchy, or entirely absent. The red squirrel records to the west of Lough Corrib represent four fairly isolated and small populations, one of which, the furthest west in Derryclare, county Galway, is a population recently translocated from Portumna Forest Park in an NUI Galway study.

The river Shannon has been breached by grey squirrels in three locations; sightings were received from close to Leitrim town and Drumshambo, county Leitrim, and at Mote Park in county Roscommon. Apart from this, the grey squirrel is restricted to the eastern side of the river Shannon. The greatest distance the grey was recorded west of the Shannon was approximately eight kilometres, despite one respondent reporting that they were on the eastern bank of the river at Drumshambo fifty years ago, and a number of anecdotal records of grey squirrel breaches of the Shannon in the past. At these most westerly points, greys were only seen occasionally, while reds were seen regularly. Given the fact that the grey squirrel has a mean dispersal rate of 1.94 km/yr in Ireland (O'Teangana et al. 2000), that it is a good swimmer (Koprowski 1994) and that it has breached other large rivers in Ireland (most recently the River Suir in county Waterford and the River Bann in Northern Ireland), it is difficult to understand why it has not crossed the river Shannon at more locations and become more firmly established on the western side. Traditionally the river Shannon has marked the western boundary of the grey squirrel and it has been assumed that the river acted as a barrier. It may be, however, that it is the suitability of the habitat to the west of the river Shannon rather than the river itself which has held back the grey squirrel.

There is a lack of deciduous woodland immediately to the west of the river, with the exception of north county Roscommon. When grey squirrels succeed in crossing the

river, they do not find suitable woodland in which to establish strong populations from which they can spread further. Forests that are present are small, isolated or unsuitable for squirrels as they consist of young conifers or small seeded broadleaves. In the centre of the province and in west county Clare, woodland is also scarce (many of the squares marked as unsampled (Figure 5) did not contain any suitable woodland).

Hedgerows are important to squirrels both as a corridor for dispersal, and also as a food source if they adjoin a woodland (Wauters et al. 1994). Figure 17 maps the composition of field boundaries in Ireland, while Figure 18 maps the suitability of these boundaries for supporting dispersal by squirrels. Tall vigorous hedges with abundant trees are the most favourable. Hedges with thorn, ash and gorse, and low hedges of gorse with some native oak have been amalgamated to form the moderately favourable group. The final group, the unfavourable, is an amalgamation of willow dominated hedges, limestone walls and unenclosed peat and upland areas. The vast majority of land on the western side of the River Shannon is unfavourable for squirrel dispersal, while the land on the eastern side is generally moderately or highly favourable.

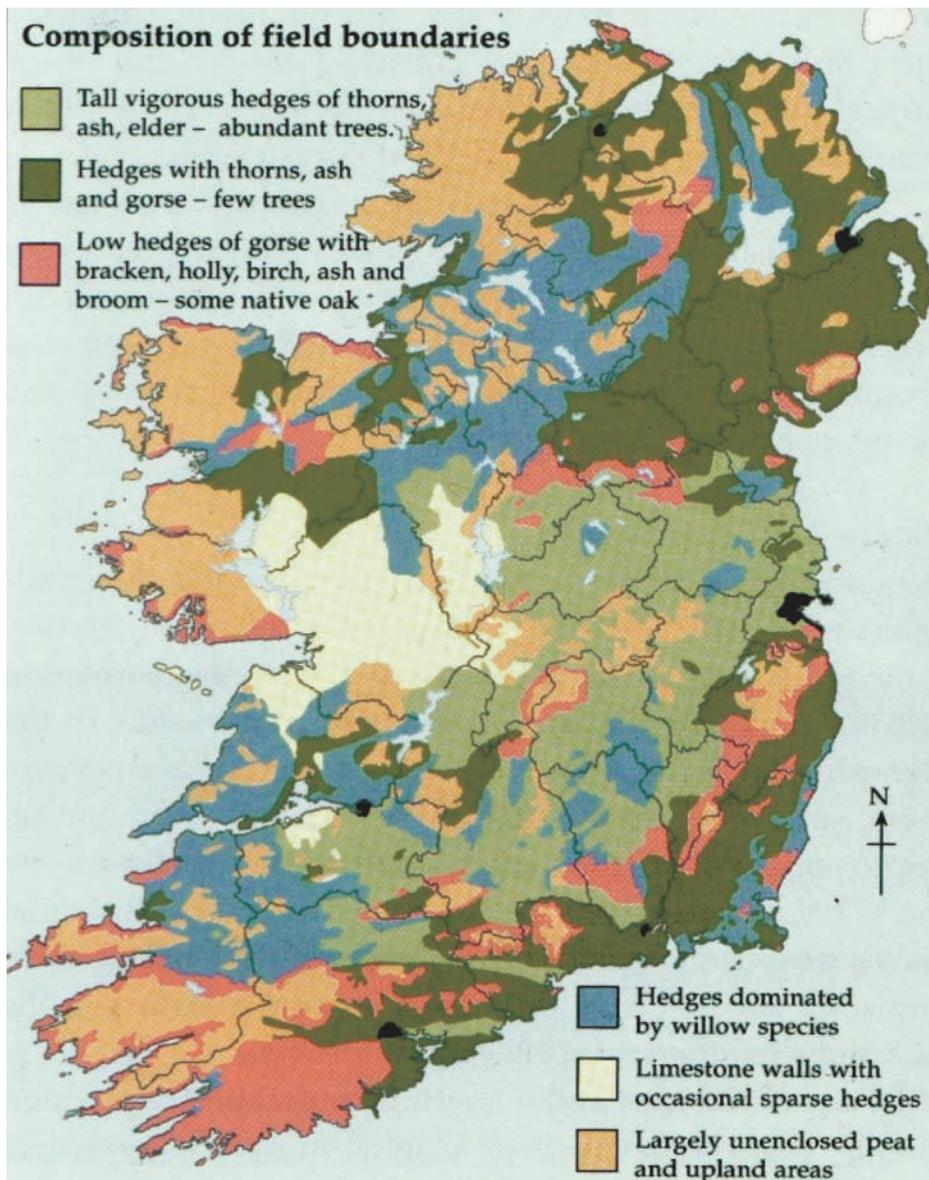


Figure 17: The composition of field boundaries on the island of Ireland as mapped by O'Sullivan and Moore (1979).

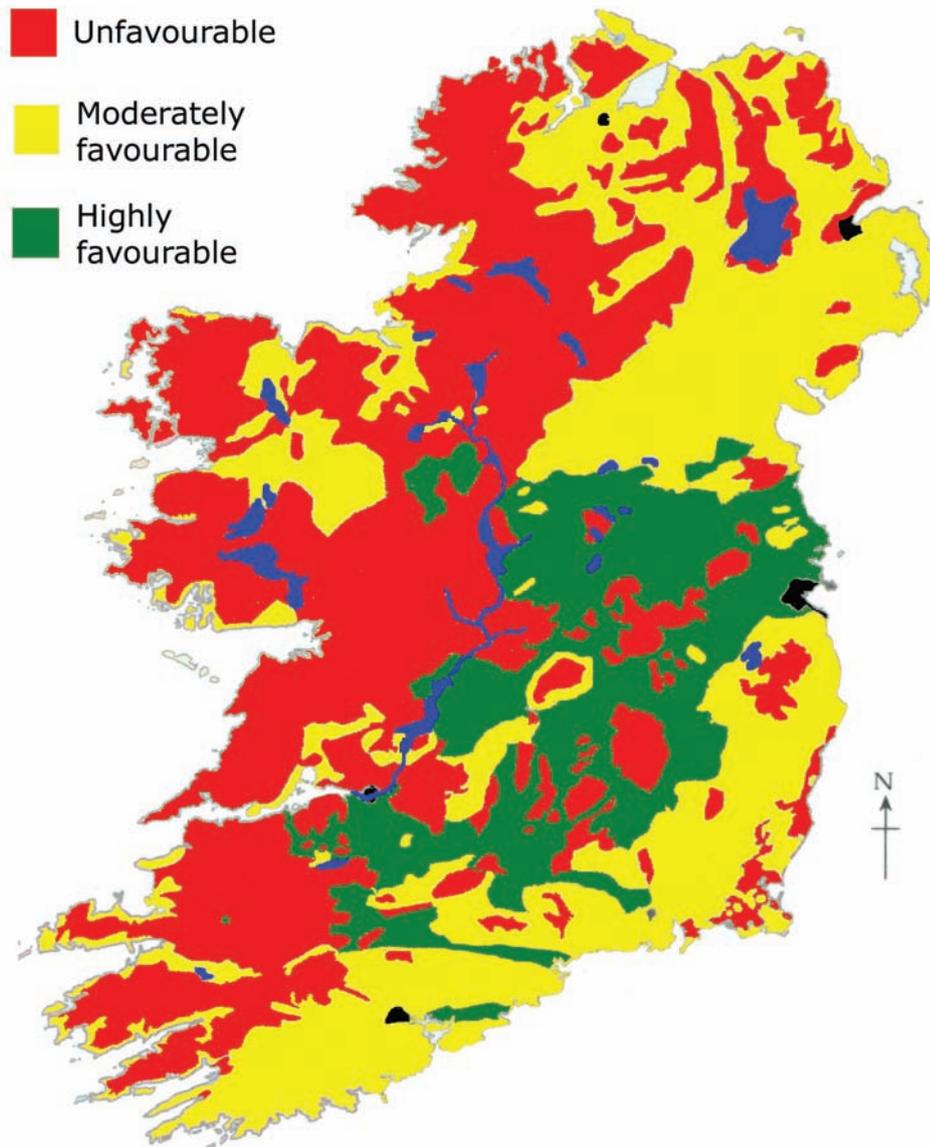


Figure 18: The composition of field boundaries by O'Sullivan and Moore (1974) adapted to illustrate the favourability of boundaries for squirrel dispersal.

The poor suitability of this region for squirrel dispersal is further underlined by the lack of red squirrels in the west of counties Galway and Mayo. This area contains a large amount of forestry, planted in the last 50 years. Natural barriers such as open peatland, lakes and mountains and the lack of suitable corridors have prevented the red squirrel from colonising these woodlands. Unoccupied woodlands in the centre of the province are also isolated, although not to the same extent as the woods further west. Efforts are being made to translocate red squirrels to these woodlands, as these areas are likely to remain isolated from grey squirrels for longer than any other region of the country.

Munster

The red squirrel continues to thrive throughout Munster, with large regions containing red squirrels in Clare (contiguous with the east Galway population), south Tipperary/Waterford, east Cork and west Cork/south Kerry. These populations are

threatened by the south-western frontier of grey squirrel spread, with grey squirrels now found throughout Tipperary, Waterford, east Limerick and are within close dispersal distance of north Cork. This represents considerable spread on the part of the grey squirrels which were almost completely absent from the province in Reilly's (1997) survey. There are a number of areas in Tipperary and Waterford where both species can be found. It is likely that these populations are in the lag period before the replacement of one species by the other; between the arrival of the grey and the disappearance of the red.

The populations of red squirrels in Co Clare are not under pressure from grey squirrel invasion, and providing grey squirrels are not translocated into the region, this county is likely to remain grey squirrel free for some time to come. It is protected to the east and south by large bodies of water (the River Shannon and Shannon estuary respectively). To the north grey squirrels will need to move through large areas of inhospitable habitat before they reach this county (see Connacht discussion). As such the red squirrel population of Co Clare is of considerable importance in the conservation of the species on the island.

The corridors available for spread become less suitable as the grey squirrel moves further into Munster. The populations in Kerry and west Cork are fairly well protected due to the Derrynasaggart and Boggeragh mountains, and the poor quality field boundaries in the region (Figure 18). The populations in east Cork, Limerick, Tipperary and Waterford are in much greater danger as the spread of the grey squirrel into these regions can be expected to continue in the same vein as the spread through the east of the country.

5. *Implications for policy and practice*

The results show that there is a clear threat to the continued existence of the red squirrel in Ireland, particularly in Ulster, Leinster and Munster. Red squirrel populations west of the River Shannon may be more secure. The increased broadleaf planting programme will inevitably result in the general habitat becoming more favourable for squirrels, but in areas where both species overlap, it is likely that it will accelerate the replacement of reds by greys. Red squirrels will become increasingly confined to large areas of coniferous forest such as those present in Wicklow and the Slieve Blooms where greys have less competitive advantage; however, even small amounts of broadleaf planting in such coniferous blocks may facilitate their colonization by the grey squirrel.

Broadleaf planting schemes are at risk from grey squirrel bark stripping damage unless some control regimes are implemented. This has consequences for timber and energy production, recreation etc. in the future.

Tree species selection in planting schemes can impact red squirrel populations where grey squirrels are present; coniferous planting being beneficial, while more broadleaf is deleterious. This has implications for future planting schemes in areas where red squirrel conservation is to be promoted.



▲ Damage caused by squirrels to the trunks of broadleaved trees.

Photo: Geoff Hamilton



▲ Pine marten (*Martes martes*).

Photo: © Andy Rouse (www.andyrouse.co.uk)

6. *Conclusions and recommendations*

Conclusions

The red squirrel may still be considered to be widespread and is still common in many areas of the country, particularly west of the River Shannon and in areas of extensive commercial coniferous forestry. Some spread by red squirrels was also noted in a few regions, notably north Offaly, northwest Kildare, southwest Cork and northeast Donegal. However, in many other areas, its habitat is now shared with the grey squirrel. Unfortunately, it may now be considered extinct in Meath and Westmeath, and has become particularly rare in Kilkenny, Carlow and Louth. Red squirrels in areas where greys are already established are under particular threat, while other populations just beyond the current grey squirrel distribution (such as Cork, west Limerick, Kerry and northeast Antrim, where significant areas of mature broadleaved woodland exist) may also be considered at risk. The speed of grey spread suggests that it could colonise these areas in 10-20 years.

Grey squirrels have expanded their range dramatically in the past decade, and are now present in 26 counties (the exceptions being Sligo, Mayo, Galway, Clare, Kerry and Cork). Most apparent is its spread in the eastern counties of Antrim, Wicklow and Wexford, which were predominantly devoid of greys at the time of the last survey. It is likely that they will continue to spread in many areas of the country in the coming years; they have breached the Shannon in a few locations and so may begin to extend their range west of the river, however given the unsuitable habitat that the region presents, the extent of which this will occur and the rate at which it will happen is unclear. Close observation and further study of this region should take place in the coming years.

Pine martens have been recorded in many areas of the country, and appear to be spreading (presumably due to legislative protection and an increase in tree planting). Particular concentrations are found in the Clare, Laois-Offaly and Cavan-Leitrim-Fermanagh regions. The survey has found some evidence of the persistence of red squirrels in the latter two regions, and in some cases, the progressive decline of greys where these concentrations are located. However, it is difficult to say that this corresponds to the habitat preferences of the species concerned or if there is a direct relationship between the distribution of pine martens and the two squirrel species.

Recommendations

It is recommended that the data be forwarded to the Biological Records Centre in WIT for permanent storage where it may be accessed and used as part of any future surveys.

The hard copies of the questionnaires and printouts of the emails should be archived by COFORD for future reference, as not all information (such as comments) supplied therein was entered into the Recorder 6 database.

The results should be utilised within the framework of the Forest Service-funded CRISIS project; objectives of the project include promoting the conservation of the red squirrel and recommending methods whereby landowners may protect their broadleaf plantations for grey squirrel damage.

NPWS, Coillte, Forest Service (ROI and NI) and EHSNI staff should be involved over the coming couple of years in supplementing the baseline data, in particular attempting to gather data from the 10 km squares where no returns were received and to increase the resolution of data in areas where feedback was low.

The results of the survey should be made available immediately to all parties responsible for the drafting of the All Ireland Red Squirrel Species Action Plan, as the findings will be significant in the identification of any possible Red Squirrel Protection Areas (RSPAs) or translocation source / target sites. It is feasible that entire regions may be identifiable as such RSPAs, as opposed to individual forest blocks; areas may include:

- The entire region west of the River Shannon
- The Wicklow and Slieve Bloom mountains
- Southwest Munster, i.e. Cork, Kerry and Limerick
- North Donegal
- The Glens of Antrim

Funding should be made available by an appropriate sponsor to facilitate a Ph.D. or M.Sc. research project investigating the interaction between pine martens and red and grey squirrels in their interface areas of the country.

It is recommended that funding also be made available by an appropriate sponsor for the data to be applied to a GIS model assessing the possible degree of spread by the grey squirrel in Ireland over the next few decades. Work like this has recently been carried for greys in northern Italy (Lurz et al. in press). It may be also useful for a smaller study to be carried out comparing this data to a GIS database of forest cover in Ireland, such as those utilised by Coillte and FIPS (the Forest Inventory and Planning System). The habitat associations of the two species of squirrel may be better analysed in this way.

A continued effort should be made to keep the public aware of the conservation issues at hand, through the media and education systems. Particular publicity should be given to monitoring red squirrels for signs of pox infection.

Red squirrels can be protected by the combination of a number of conservation techniques that have been shown to protect and boost their populations. Areas with large populations of red squirrels coincide with regions with significant areas of coniferous forest, and this habitat is recognised as one in which red squirrels can persist even in the face of grey squirrel invasion. These areas include Wicklow, the Slieve Blooms (Laois and Offaly), the Slieve Aughty's (south Galway and north Clare), Sligo and Leitrim, north Cork, and west Cork and Kerry. Conversely areas where the reds have very quickly been replaced have no large blocks of coniferous woodland, and are predominated by broadleaved areas. A move away from the current policy of 30% broadleaf planting in all woodlands, to one of 30% broadleaf planting on average for the country as a whole, would be of obvious benefit to the red squirrel. There is a tipping point at which woodlands go from being red squirrel suitable to grey squirrel suitable, and a blanket policy on broadleaved planting will move all woodlands towards the grey squirrel suitable category.

Grey squirrel control remains one of the most important and beneficial conservation measures available. This needs to be carried out in conjunction with other conservation measures that promote the red squirrel. The greys should be controlled in a targeted fashion, concentrated in areas where they threaten current red squirrel populations,

and bearing in mind knowledge of grey squirrel ecology to anticipate periods of dispersal and breeding. Grey squirrel control can still be conducted in grey squirrel only regions in order to protect woodland from bark stripping damage, but this is of less benefit to red squirrel populations.

In regions designated as Red Squirrel Protection Areas, the squirrels should be considered when planning woodlands, in order to provide the optimum habitat for the animals. Supplementary feeding is very useful for boosting populations and improving survival through the winter. This can involve the general public and schools and help to publicise the plight of the red squirrel. This should obviously only be conducted in areas where the grey squirrel is absent, as they would also benefit from the supplementary food. Specially designed hoppers that exclude one species but not the other, have proved of limited success, and are quite expensive to procure.

Translocations of reds to suitable forests where both species are absent is another conservation technique currently under review. Any such action must be carried out under licence from the National Parks and Wildlife Service and in strict coherence with the IUCN guidelines on reintroductions and translocations.

The presence and extent of squirrel pox virus in the country must be examined immediately, as it has a major bearing on the future rate of loss of red squirrels as the greys spread. Without this knowledge it is not possible to predict with any accuracy the future trends of grey squirrel spread and red squirrel demise in Ireland.



▲ Conifer habitat.

Photo: Geoff Hamilton

References

- Barrington, R.M. 1880. On the Introduction of the Squirrel into Ireland. *Scientific Proceedings of the Royal Dublin Society*, vol. 2, pp. 614-631.
- Brown, R. 2006. *A Review of the impact of Mammalian Predators on Farm Songbird Population Dynamics*. Songbird Survival Report.
- Chung-MacCoubrey, A. L., Hagerman, A. E. and Kirkpatrick, R. L. 1997. Effects of tannins on digestion and detoxification activity in gray squirrels (*Sciurus carolinensis*). *Physiological Zoology* 70(3): 270-277.
- Crichton, M. 1974. *Provisional distribution maps of amphibians, reptiles and mammals in Ireland*. Folens/Foras Forbatha, Dublin.
- Fairley, J.S. 1984. *An Irish Beast Book*. Blackstaff Press, Belfast.
- Finnegan, L.A., Edwards, C.J. and Rochford, J.M. In press. Mitochondrial phylogeography of the Irish red squirrel population: what can it reveal of the postglacial colonisation of Ireland? *Conservation Genetics*.
- Gettinby, C.H. 1994. The ecology and distribution of the Red Squirrel (*Sciurus vulgaris*) and the Grey Squirrel (*Sciurus carolinensis*) in Northern Ireland. Unpublished M.Sc. thesis, Queens University of Belfast.
- Gurnell, J. 1987. *The natural history of squirrels*. Christopher Helm Ltd, London.
- Gurnell, J., Lurz, P.W.W. and Pepper, H. 2001. *Practical techniques for surveying and monitoring squirrels*. Forestry Commission Practice Note 11. Forestry Commission, Edinburgh.
- Halliwell, E.C. 1997. Red squirrel predation by pine marten in Scotland. In: J. Gurnell and P. Lurz (eds). *The conservation of red squirrels (Sciurus vulgaris)*, 39-47. London. Peoples Trust for Endangered Species.
- Hannan, M. J. 1986. *The influence of forests and forest practices on the behaviour of mammals*. University College Dublin.
- Jackson, J.S. 1961. Two records of grey squirrel, *Sciurus carolinensis* Gmelin, shot in counties Armagh and Monaghan. *Ir. Nat. J.* vol. 13, pp. 262-263.
- Koprowski, J.L. 1994. *Sciurus carolinensis*. *Mammalian Species* 480, 1-9.
- Lawton, C. and Rochford, J. M. 2000. *Red squirrel distribution and habitat use in north County Wicklow*. Heritage Council Report.
- Lloyd, H.G. 1983. Past and present distribution of red and grey squirrels. *Mammal Review* vol. 13, no. 2/3/4, pp. 69-80.
- Lurz, P.W.W., Rushton, S.P., Wauters, L.A., Bertolino, S. Currado, I. , Mazzoglio, P. and Shirley, M. D. F. in press. Predicting grey squirrel expansion in North Italy: a spatially explicit modelling approach. *Landscape Ecology*.
- McKay, F. D. 2004. The seroprevalence of squirrel poxvirus in grey squirrels (*Sciurus carolinensis*) in Northern Ireland in relation to red and grey squirrel distribution and habitat. M.Sc. Thesis, Royal Veterinary College, London.

- Middleton, A.D. 1932. The Grey squirrel (*Sciurus carolinensis*) in the British Isles. *Journal of Animal Ecology* 1, 166–167.
- Moffat, C.B. 1938. *The Mammals of Ireland*. Proceedings of the Royal Irish Academy, vol. 44, no. B, pp. 61-90.
- Ni Lamhna, E. 1979. *Provisional distribution maps of amphibians, reptiles and mammals in Ireland*. Folens/Foras Forbatha, Dublin.
- Nisbet, J. 1904. *Interim Report regarding inspection of woods and plantations in County Wicklow*. Dublin, Department of Agriculture and Technical Instruction. Internal Report.
- NPWS 1968. *The distribution of red and grey squirrels in Ireland*. Unpublished internal report, Office of Public Works, Dublin.
- NPWS 1973. *The distribution of red and grey squirrels in Ireland*. Unpublished internal report, National Parks and Wildlife Service.
- O'Neill, K. and Montgomery, W.I. 2003. *Recent changes in the distribution of red squirrels in Northern Ireland*. Environment and Heritage Service, Belfast.
- O'Sullivan, A. and Moore J. 1979. *The Composition of Field Boundaries*. In: *Atlas of Ireland* (Ed. J. P. Houghton), RIA, Dublin.
- O Teangana, D.M., Reilly, S., Montgomery, W.I. and Rochford, J. 2000. Distribution and status of the Red Squirrel (*Sciurus vulgaris*) and Grey squirrel (*S. carolinensis*) in Ireland. *Mammal Review* vol. 30, no. 1, pp. 45-55.
- O'Teangana, D. 1999. The distribution and ecology of the red squirrel (*Sciurus vulgaris*) and grey squirrel (*Sciurus carolinensis*) in Northern Ireland. PhD thesis, The Queens University of Belfast.
- Poole, A. 2007. An investigation of translocation as a technique to conserve the red squirrel (*Sciurus vulgaris*) in Ireland. PhD Thesis, NUI Galway.
- Reilly, S. 1997. Aspects of the ecology of the red squirrel, *Sciurus vulgaris*, in commercial conifer forests. Ph. D. thesis, Trinity College Dublin.
- Ulster Wildlife Trust and Forest Service, DANI 1993. *Northern Ireland mammal survey*. Ulster Wildlife Centre, 3 New Line, Crossgar, BT30 9EP.
- Wauters, L., Casale, P. and Dhondt, A.A. 1994. Space use and dispersal of red squirrels in fragmented habitats. *Oikos* vol. 69, pp. 140-146.

Appendix 1

Postal questionnaire used during course of survey (front)



IRISH SQUIRREL SURVEY 2007

Coordinated by COFORD, Project CRISIS and NUI Galway



Thank you in advance for filling out this survey – extra sheets are available on request.
You may be contacted again for the purposes of collecting further information on squirrels in your area.
Please note that information about areas without any squirrel sightings whatsoever is just as valuable!

Respondents will be entered in a draw for one of two weekend breaks in the Marriott Druids Glen Hotel and Country Club.

Respondent Details *Information given here will be treated as confidential and will only be used for the purposes of following up sightings in certain areas. Your details will not be passed on to any third parties.*

Name: _____

Postal address: _____

Contact Phone Number: _____

E-mail address: _____

Location

Name of forest/woodland/townland: _____

Name of closest town/village/Post Office: _____

Ordnance Survey reference: _____
(e.g. N 342 621)

Woodland type: Broadleaf Coniferous Mixed

Animal sightings
For an identification guide, please see overleaf

Have **squirrels** been seen in or near this location? Yes No (Please return survey, even if answer is 'No')

If so, what species are they? Red Grey Both Unsure

When was the most recent sighting of:

Red squirrels:	Within the last 3 months <input type="checkbox"/>
	3-12 months ago <input type="checkbox"/>
	Over a year ago <input type="checkbox"/>
Grey squirrels:	Within the last 3 months <input type="checkbox"/>
	3-12 months ago <input type="checkbox"/>
	Over a year ago <input type="checkbox"/>

Type of squirrel sighting:
(e.g. Personal observation of live animal, roadkill etc.) _____

Have **pine martens** been seen in this location? Yes No

Type of pine marten sighting:
(e.g. Personal observation of live animal, roadkill etc.) _____

Any further information you think may prove useful or interesting...
e.g. land use of surrounding area; human activities in forest, existing control programmes, damage to trees etc.

<p>Please return completed survey sheets to:</p> <p>National Squirrel Survey FREEPOST 14 Grange Advisory Centre Dunsany Co. Meath</p>	<p>Contact information:</p> <p>Survey coordinator: Geoff Hamilton Phone: 087 3156077 email: irishsquirrels@gmail.com</p>
--	--

Feel free to contact us to request extra survey sheets to report sightings from other locations.

Appendix 2

Postal questionnaire used during course of survey (back)

Identification guide - Squirrels

It is not always easy to distinguish red and grey squirrels by visual appearance alone, even though adult grey squirrels are about a third larger than red squirrels. In particular, general fur colour is not a reliable guide.



Red squirrel

- Coat: above – russet red to grey brown; below – white or off-white
- Tail: red, red with black tinges (may be white-tipped)
- Ears: Large tufts prominent in winter; red-brown to white
- Length: 18 – 24cm
- Weight: 220 – 430g
- They eat flowers, buds, tree seeds, particularly hazel & pine
- More likely to be seen in trees than on the ground



Grey squirrel

- Coat: above – grey in winter, grey with chestnut in summer; below – white
- Tail: brown and black with white fringe
- Ears: Never develop tufts – more closely resemble those of rats and mice
- Length: 24 – 29cm
- Weight: 400 – 720g
- They eat nuts, seeds, fungi, fruit & tree bark
- Native to America; introduced to Ireland in 1911
- More likely to be seen on the ground than in trees

Identification guide – Pine martens

The elusive pine marten is a medium-sized member of the mustelid family, being related to stoats, otters, mink and badgers. The majority of its diet is made up of small rodents, berries, birds and their eggs, fungi, beetles and worms. They are known to prey on squirrels in Scandinavia, but the existence of any such predation in Ireland is still unclear.



Pine marten

- Coat: chestnut brown fur with a creamy-yellow throat and chest (bib)
- Tail: bushy, same colour as coat
- Length: around 60 to 65cm from nose to tip of tail, about the size of a domestic cat
- Ears: distinctive half-moon shape, forward facing
- Long claws make them excellent climbers
- Move with a characteristic loping/bounding gait that helps to distinguish them from cats

If you would like further information on the identification of these animals, please feel free to contact the survey team via the details overleaf.

The Irish Squirrel Survey 2007 is being carried out in association with An Taisce, Birdwatch Ireland, The Central Fisheries Board, Coillte, Countryside Alliance, CRANN, ESI Ireland, The Forest Service, The Golfing Union of Ireland, The Irish Deer Society, The Irish Farmer's Association, The Irish Landowners Association, ISPCA, The Irish Timber Growers Association, The Irish Tree Society, The Irish Wildlife Trust, NARGC, NPWS, The Society of Irish Foresters, Teagasc, The Tree Council, The Wild Deer Association and Woodlands of Ireland.

Appendix 3

Format of online survey on www.irishsquirrelsurvey.com


IRISH SQUIRREL SURVEY 2007

Online Survey Form

Thank you for taking the time to fill in this survey. For a squirrel identification guide, [click here](#).

Please note that information supplied here will be treated as confidential and will only be used for the purposes of following up animal sightings in certain regions. *Your details will not be passed on to any third parties.*

Please fill in as many boxes as possible to allow us to accurately pinpoint your squirrel sighting.

Your Name:

Postal address:

Contact Phone Number:

Email address:

Name of forest / woodland / townland:

Name of closest town / village / Post Office:

Ordnance Survey reference (if known):

Woodland type: (Please tick an option)
 Broadleaf
 Coniferous
 Mixed

Have squirrels been seen at this location?
 Yes
 No

If so, what species are they?
 Red
 Grey
 Both

When was the most recent sighting of Red squirrels?
 Within the last 3 months
 3 months to a year
 Over a year ago

When was the most recent sighting of Grey squirrels?
 Within the last 3 months
 3 months to a year
 Over a year ago

Type of squirrel sighting (e.g. personal observation, roadkill etc.):

Any further information you think may prove useful or interesting (e.g. surrounding land use, presence of pine martens in area)::



▲ Grey squirrel (*Sciurus carolinensis*).

Photo: Geoff Hamilton