thedeer initiative

Research Report 11/3

# Monitoring reported deer road casualties and related accidents in England to 2010

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HIGHWAYS AGENCY

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## *Report to The Highways Agency*

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**Deer Initiative Research Report 2011/3**
**December 2011**



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## Monitoring reported deer road casualties and related accidents in England to 2010

### Key Messages

1. Our core data sources show a persistent increase in deer vehicle collisions (DVCs) from 2001 until 2007 and have begun to level off since (Fig. C-1). There is no obvious single reason for this identifiable from the data, but the coincident slight decline in national road traffic volumes since 2007 may have contributed to that trend. Distribution of DVCs across England is very uneven, with South East and East of England region together accounting for over 65% of DVCs per year across all road types, as well as over 50% of those recorded on the strategic trunk road network (Fig. M-6).

2. Localised districts where some of the clearest DVC reductions have occurred include a number of areas where increased landscape level deer management and awareness campaigns have been undertaken by the Deer Initiative (in particular at Dinmore Forest in Herefordshire and Ashridge Forest in the Chilterns).

3. Within the trunk road network the highest number of DVCs recorded since 2007 include several sections of the M3 and M27 in Hampshire, A12-M25 links, M40 east of Oxford, and M11 and A12-M25 in Essex (see overview Fig. M-3b). Overall DVCs on trunk roads contribute in the region of 11% to 13% of all DVCs occurring in England.

4. The incidence of recorded DVCs shows notable peaks in May and/or October in all areas. The seasonal patterns are however most apparent by far when considered separately by road class. In England over 52% of all DVCs on motorways and 48% of those on A-class Trunk roads were recorded in the three months from April to June (Fig. C-8). The very pronounced patterns found emphasise that a very high proportion of the risk of DVCs on English trunk roads may be addressed through short-term mitigation during mid-April to mid-June, for example by running targeted DeerAware campaigns.

5. The economic 'value of prevention' even for our low-end estimate of 350 human injury DVCs across all road types in England per year is calculated at £24 million; but lies near twice that level if accounting for the finding that fewer than 70% of non-fatal injury accidents tend to be reported in national road accident statistics. We estimate that over 11,500 vehicles in England (>14,000 in UK) will incur significant damage as a result of DVCs, imposing further costs in England near £16 million over and above the £24 million to £50 million incurred through human injury DVC accidents alone. Further substantial economic losses not included in the above estimates arise through traffic delays, dealing with injured and removal of dead deer from the roadside, as well as the extensive impact of DVCs in terms of animal welfare.

6. Since 1999 reported human injury road accidents overall have fallen by close to 30% across Britain, but no similarly significant decline is apparent among numbers of injury road accidents in which deer are implicated.

7. Recording the majority of all DVCs occurring annually in England is unlikely ever to be achievable. To monitor future changes at a countrywide and regional basis, the two core data sets which in combination would be likely to continue to provide at least an index based on large and widespread sampling but requiring only comparatively limited resources are:

    - deer road casualty reports and carcass uplifts requests on the trunk network reported to HA National Command and Control centres and/or trunk road managing agents.

    - requests received by RSPCA to arrange dispatch or treatment of live deer injured in traffic collisions

## Summary

i. The second half of the 20th century has been period of extensive proliferation of road networks, rising traffic volumes and speeds throughout Europe. At the same time deer densities have also increased in most European countries (Gill, 1990; Apollonio et al., 2010), as has the frequency of road traffic accidents involving deer and other wildlife. In many countries numbers of reported deer-vehicle collisions (DVCs) have increased by more than 50% since 1996 (Table 11) and most recent reviews indicate that near one million DVCs occur per annum in Europe (Langbein, et. al. 2011) and over 1.5 million in North America (IIHS, 2008). Aside from the inevitable cost in animal suffering and material damage, DVCS are the cause of several hundred human fatalities and tens of thousands of human injuries across Europe each year.

ii. In Great Britain, following a short-term review commissioned by the Highway Agency (HA) in 1996 (SGS, 1998) the first comprehensive countrywide assessments of DVCs were set up by The Deer Initiative in 2003 with support of HA in England and Scottish Executive in Scotland. The aim of these projects was to develop a database based on substantial widely distributed sampling of known deer road casualties and related traffic collisions each year, as a baseline to enable long term trends in the scale and distribution of the problem to be monitored countrywide and local areas of particularly high incidence of DVCs to be identified.

*Scope of database assembled*

iii. During the initial three-years from 2003 a database of over 30,500 DVC reports for the period 2000-2005 was accrued through a very wide range of source organisations and individual contributors, with over 80% of these incidents reported on trunk and non trunk roads in England. On basis of data to 2006, it was estimated that each year there were around 42,000 and possibly up to 74,000 DVCs in Britain, including between 400 to 700 resulting in human injuries.

iv. In England DVC data collection from key sources was maintained to the end of December 2010 to enable national and regional trends to be monitored, as well as local areas of relatively high DVC occurrence to be identified. Data collection in Scotland also focussed on collection of information from a more limited set of data sources (Langbein, 2011) remains on-going. There has been no formal data collection in Wales, however incidental data has been collected and is available from the Deer Initiative.

v. Despite the reduction in data sources over 36,000 further records for England from both truck and non trunk roads have been added to the data base since 2006. The full DVC database for 2001 to 2010 now contains >60,500 records for England and >12,500 from parallel studies in Scotland, of which over 83% have been ascribed to grid references for mapping and GIS analysis.

*National trends*

vi. Total numbers of DVC records obtained from among our core data sources show a persistent increase from 2001 until 2007 and have begun to level off since (Fig. C-1). Numbers of records of deer casualties reported on the trunk road network have increased throughout that period, but here improved recording and abstraction of data may have contributed. Requests for RSPCA to attend injured deer at the roadside increased steadily until end 2007 but have declined significantly since, unexplained by any changes in recording (Fig.C-3). The timing of that decline coincides with the first recorded fall in total annual traffic volumes in Britain in over 50 years, which have continued to fall by 1% year on year since 2008 (DfT, 2011). A much greater decline (by on average over 25%) has occurred in reported personal injury road accidents overall in most local authorities, but our samples of deer-related PIAs do not show any clear evidence of such a general trend. Indeed compared to other contributory factors the proportion in which deer are believed implicated has thus actually increased (Figure C-7).

*Variation between regions and DVC hotspots*

vii. Distribution of DVCs across England is very uneven, with South East and East of England region together accounting for over 65% of DVCs per year overall as well as over 50% of those recorded on trunk roads (Fig. M-6). This is only in part attributable to the fact that these regions also have greatest share of road traffic (40%). DVC rates calculated *per driven vehicle mile* to account for differences in traffic remain highest overall in East of England followed by Southeast and Southwest Region (Table 7), which is likely to reflect also higher average densities of deer in these regions rather than merely differences in traffic.

viii. Comparison between regions over time show that any such reductions since 2007 (see vi. above) are largely confined to SE, SW, and East of England, where highest overall tolls of DVCs continue to be recorded. In North West England by contrast both RSPCA and trunk road agent reports show an increase over recent years (Fig. M-6), with most notable increases around Preston, Bolton and Bury including along the M6, M65, M61, as well as the M62 corridor from South Lancashire to the East Coast. Localised districts where some of the clearest DVC reductions have occurred include a number of areas where increased landscape level deer management and awareness campaigns have been undertaken by the Deer Initiative (in particular at Dinmore Forest in Herefordshire and Ashridge Forest in the Chilterns).

ix. Within the trunk road network the highest number of DVCs recorded since 2007 include several sections of the M3 and M27 in Hampshire, A12-M25 links, M40 east of Oxford, and M11 and A12-M25 in Essex (see overview Fig. M-3b). However, in view of wide differences between network areas in road type and levels of traffic, consideration of priority locations for potential mitigation or further investigation is more appropriately confined to within separate HA Management Areas, where the manner of recording animal road kills will also be most directly comparable. Separate maps showing the relative distribution of DVCs for 2003-6 and/or 2007-2010 for each of the 12 HA Areas and 13 DBFO and PFI schemes are provided on the CD included with this report.

*Human injuries*

x. Although differing types of wild animals involved in reported personal injury road accidents (PIAs) are not distinguished in national statistics, mean samples of 130 PIAs per year in which deer were implicated were obtained via individual police forces or local authority road safety teams, drawn from 38 different local authorities with six to twelve years data available for each (accounting for approximately 46% of any PIAs in England). Extrapolation of these data (see 5.2.5) indicate that around 350 deer related PIAs arising on trunk and non trunk roads will be reported per year to police for the whole of England, and a further 65 to 70 in Scotland. However as National Travel Survey data (DfT, 2011) indicate that only 26% to 32% of all injury road accidents are logged as such by police, the actual number of PIAs involving deer in England alone may well be as high as 1100 to 1350 per year. These figures are significantly higher than the upper bounds of estimates proposed in our 2007 report, but are not unrealistic in the context of other countries; for example 2200 PIAs annually with deer reported in Germany (DJV, 2010).

*Road class and interaction with seasonal effects*

xi. Based on our sample of around 1800 human injury records, which of all our DVC data are likely to have least if any inherent reporting bias to particular road types, 12.2% occurred on trunk roads, 39.3% on non-trunk A-roads and 48.5% on minor roads (48.5%). These figures closely reflect the proportion by road type among all types of reported human injury accidents in England (Table-10). Among our wider DVC samples from RSPCA and other sources (but excluding trunk agent data to avoid sample bias) also close to 11% occurred on trunk roads, with a somewhat higher proportion (55%) on non-trunk A-class roads and fewer (34%) on minor roads. However, the earlier figures derived from PIA data alone are more likely to reflect the true breakdown by road class.

xii. The incidence of recorded DVCs overall shows notable peaks in May and/or October in all areas. The seasonal patterns are however most apparent by far when considered separately by road class. In England over 52% of all DVCs on motorways and 48% of those on A-class Trunk roads were recorded in the three month from April to June (Fig. C-8), falling to less than 30% in case of non-trunk A-roads and minor roads. Additional seasonal variation occurs between species, with autumn peaks most pronounced where fallow, red or sika deer predominate. The very pronounced patterns found emphasise that a very high proportion of the risk of DVCs on English trunk roads may be addressed through short-term mitigation action during mid-April to mid-June (e.g. using seasonal VMS signage or other methods), whereas mitigation limited to that same period on non-trunk roads is less likely to be (cost) effective.

*National toll and economic impacts*

xiii. The human costs of DVCs arising on trunk and non trunk roads vary widely between a low percentage that lead to human injuries and fatalities (est. <1.5% and 0.05% respectively), and the great majority of others that cause at least some minor damage, and in a quarter to a third of cases more significant material damage leading to insurance claims. The economic 'value of prevention' even for our low-end estimate of 350 human injury DVCs in England per year is calculated at £24 million (using government figures for assessing economic impact of road accidents, DfT 2011); but lies near twice that level if accounting for the finding that fewer than 70% of non-fatal injury accidents tend to be reported in national road accident statistics (DfT, 2011).

xiv. Based on annual sample totals of insurance claims mentioning deer provided by AGEAS (formerly Fortis Group), we estimate that over 11,500 vehicles in England (>14,000 in UK) will incur significant damage (i.e. above common insurance claim excess of £250) as a result of DVCs, imposing further costs in England near £16M over and above the £24 million to £50 million incurred through human injury DVC accidents alone. Further substantial economic losses not included in the above estimates arise through traffic delays, dealing with injured and removal of dead deer from the roadside as well as the extensive impact of DVCs in terms of animal welfare.

*Future monitoring and other further work*

xv. Complete or even near-complete recording of the majority of all DVCs occurring annually in England is unlikely ever to be achievable or maintain year on year countrywide. On the other hand, results from this study show that despite having focussed data collection on improved recording from a smaller number of main data source categories than in the previous 2003-2005 study, the total number of records obtained has been possible to maintain as high or higher in most years. More importantly the geographical coverage of records obtained now provides much more even sampling, less skewed by superior recording in some areas than others.

xvi. To monitor future changes at a countrywide and regional basis, the two core data sets which in combination would be likely to continue to provide at least an index based on large and widespread sampling but requiring only comparatively limited resources are:

- deer road casualty reports and carcass uplifts requests on the trunk network reported to HA National Command and Control centres and/or trunk road managing agents.
- requests received by RSPCA to arrange dispatch or treatment of live deer injured in traffic collisions.

Ideally however the latter should be supplemented by a) records from wildlife rangers in the eight or so major (case study) forests where by contrast to the wider countryside RSPCA receive only a minority of known requests to deer injured in DVCs; b) records from several recently developed countywide police led DVC deer dispatch call-out schemes which may become relatively under-sampled in future by RSPCA data alone.

## Contents:

# Glossary :

The Highways Agency is an Executive Agency of the Department for Transport (DfT), and is responsible for operating, maintaining and improving the strategic road network in England on behalf of the Secretary of State for Transport.

The Deer Initiative : is a broad partnership of statutory, voluntary and private interests dedicated to ensuring the delivery of a sustainable, well-managed wild deer population in England and Wales.

## Glossary of other Terms and Abbreviations:

| | |
|---|---|
| DBFO | Design, Build, Finance, Operate Project |
| DI | The Deer Initiative |
| DVC | Deer-Vehicle Collision(s) - any collisions of road vehicles with deer or accidents occurring through swerving to avoid deer, including reported deer road casualties indicative of a collision with a vehicle having taken place. |
| FC | The Forestry Commission |
| HA | The Highways Agency |
| LA | Local Authority |
| MAC | Managing Agent Contractor (relating to HA trunk network) |
| NCC | National Command & Control Centre |
| NGO | Non-Governmental Organisation |
| PFI | Public Finance Initiative |
| POST | Parliamentary Office of Science and Technology |
| RCC | Regional Command & Control Centre |
| RSPCA | The Royal Society for the Prevention of Cruelty Against Animals |
| SNH | Scottish Natural Heritage |

**This work was commissioned by the Deer Initiative for the Highways Agency.**
**The views contained in this report are those of the author and do not necessarily reflect those of the Deer Initiative or the Highways Agency.**

# 1 INTRODUCTION

## 1.1 Past and Current Research

1.1.1 Collisions of motor vehicles with deer have escalated over the past five decades in most countries across Europe. Early studies initiated by the Highways Agency (Smith & Langbein, 1997) and the Deer Commission for Scotland (Staines et al. 2001) recommended a comprehensive assessment of the national scale of deer vehicle collisions (DVC). In 2003 the Highways Agency commissioned the Deer Initiative to develop a national DVC database to assess the scale and distribution of DVCs in England, and investigate contributing factors. A parallel project for Scotland also commenced later during 2003.

1.1.2 Based on findings of the parallel studies in England and Scotland (2003-2005) it was estimated that the annual number of DVCs in Britain is over 42,500 and may be as high as 74,000, of which 400 to 700 lead to human injuries as well as several human fatalities every year. Full reports on that initial phase of the work can be found at the Highways Agency Knowledge Compendium and DI DeerCollisions project web-sites, including for Scotland (Langbein and Putman, 2006) and for England (Langbein 2007, and Deer Initiative 2007).

1.1.3 The highest proportion (>80%) of DVCs in Britain are recorded in England, with around a further 18.5% in Scotland and less than 1.5% in Wales. The relatively low proportion of DVCs in Wales may be explained by comparatively low although now also increasing deer density across much of Wales. The wide disparity in total numbers of recorded DVCs between England and Scotland may seem surprising in view of most available estimates of overall deer population numbers being of similar magnitude in these two countries at around ~550,000 to 750,000 (POST, 2009; Deer Initiative 2003, Ward et. al. 2010; Putman & Ward, 2010). However, as the annual total volume of road traffic in England amounts close to nine-fold the traffic volume in Scotland (DfT, 2011), deer in England inevitably are on average exposed to a significantly greater risk of being hit by vehicles, even though the risk to individual vehicle drivers or riders per driven mile of being involved in a DVC is at least as high or higher in Scotland.

1.1.4 From 2006 – 2010 further assessments on DVCs in England continued to be supported by the Highways Agency. In this period this has included a number of follow-on contracts, including continuation with a scaled down version of maintaining a DVC database to monitor DVCs countrywide. A national DVC database was established with the aim of recording an annual large and widely distributed sample of known deer road casualties and related traffic collisions to :

- enable trends in the relative scale and distribution of the problem to be monitored countrywide for trunk as well as non-trunk roads,
- to enable clusters or hot spots of particularly high incidence of DVCs to be identified in differing regions.

This data collation work has been complemented by a number of parallel projects to investigate practical roadside mitigation techniques, as well as efforts to raise public awareness using the *DeerAware* campaign developed by The Highways Agency in association with the Deer Initiative Partnership.

## 1.2 Approach and sources of data

1.2.1 During the initial phase of the project from January 2003 to December 2004 an extremely wide range of potential source organisation and individuals were

approached for past information and/or asked to record DVCs in more detail henceforth, in attempt to build as comprehensive a picture of all DVC incidents in Britain as possible. The main data source categories are outlined in **Table-1** (for a fuller listing and discussion of data sources – see also Appendix III & IV in Langbein, 2007).

1.2.2 A number of data source categories included in earlier work, for example, district council or unitary authority road cleansing departments and police control room logs, while potentially able to provide information on large numbers of reported deer road kills in some areas, in reality produced consistent and useable data input for only around 10% of all local authorities in England. In addition there was great variation in data quality. Similarly individual contributors, such as independent deer stalkers or naturalists, provided very high quality and consistent data in some areas, but only rather variable or intermittent recording in others. Post-2005 data collection for the project was therefore progressively restricted to focus on those source categories able to provide the most consistent input year on year, with least regional recording biases towards particular parts of the country.

| **Table-1:** Main Database Source Categories | |
|---|---|
| UT | Trunk Road deer casualty uplift requests or accidents involving deer (recorded by HA Area MAC teams, DBFOs and/or via HA National Command & Control) |
| R | Rescue requests to RSPCA to treat or humanely dispatch 'live' injured deer road casualties |
| ST & St-dam | Recorded road traffic collisions leading to human injury reported to have involved deer; plus some damage-only [St-dam] RTCs where these also recorded in similar detail by regional Police Forces or LA Road Safety Teams. |
| D | Records from 'deer-wise' contributors (esp. FC rangers countrywide plus other deer managers, biologists and naturalists – sampling from latter post 2005 mostly restricted to 'Case Study Forests' (such as The New Forest, Forest of Dean, Cannock Chase, and Ashridge, Ashdown, Dinmore, Epping, Halden, Thetford and Wyre Forest). |
| IC | Motor Insurance Claims sample (FORTIS Insurance; latterly re-named AGEAS |
| UC | District or Unitary Council road cleansing departments requests to uplift dead deer [predominantly for non-trunk road incidents] |
| P | Police Force Control Room logs of reported of deer road casualties or deer RTCs (only available for some forces in some years). |
| G | General Public occasional contributors (via web-site, email or direct contact) |

*(All records in the DI DVC database are allocated to one of the above nine main data categories and various sub-categories, to enable independent abstraction and evaluation of potential overlap between datasets. Greatest uncertaity regarding potential duplication as well as lack of countrywide coverage and data quality concerned UC + P records, with therefore less emphasis placed on collection of these in more recent years of the study. Yellow highlights show the '**core data sources**' from which records have been collected as widely as possible throughout England in all project years since 2003-2010; for sources highlighted in green wide spread comparable coverage of recording is also available for most though not all years, whilst for those shown in grey only rather more adhoc samples are available for some regions and years).*

1.2.3 On the above basis further data collection for England since 2006 has been focussed primarily on five broad source categories from which most consistent information had been obtained across all or at least the majority of all local authority areas across England during the initial study (highlighted yellow or green in **Table-1**). In view of a significant reduction in funding available to allocate to the DVC database project from April 2009 onwards, officially commissioned data collection and collation was restricted further to just three core source categories (R; UT; ST).

1.2.4 DVC reports received from among categories D and IC, and also those volunteered by organisations and individuals from among the other source categories, including any submitted via an on-line form at the project web-site, have continued to be collated and incorporated into the database if they could be gathered with limited additional resources of time and in a format near ready for direct inclusion in the database. As records from these other sources are less consistently available across years or geographical coverage, they are mostly not suitable for inclusion in overall assessments of trends through to 2010, or for comparisons between local authorities or other regions. They nevertheless provide wider context valuable also for verification of other data and add to the overall records available for assessment at specific localities.

## 1.3 Purpose and objectives of this document

1.3.1 A comprehensive earlier report (Langbein, 2007) provides detailed information on much of the background to this study, methodology of data gathering and development of the database in England, as well as discussion and analysis of all DVC records available for up to 2005/6. Further developments and specific findings for more recent years have also been presented in a number of later interim reports, conference proceedings and published articles (e.g. see Langbein, 2008, 2010a,b; Langbein et al. 2011).

1.3.2 The present report aims to:

- review results of the more focussed monitoring of DVC reports based on collection of data from the core data sources (R, UT, ST) retained post 2008.
- compare results with the previous five to seven years to identify countrywide and regional trends in the scale and distribution of DVCs in England.
- provide an overview of DVC trends across the trunk network and local information on relative distribution for regional HA staff for sections of the network on sections with relatively high or low DVC incidence.
- provide a perspective of the extent of occurrence of human injury accidents on and off the trunk network.
- make recommendations for future monitoring, emerging issues, and future research needs.

# 2 OVERVIEW AND TRENDS IN DVC DATA BY SOURCE 2001 - 2010

## 2.1 Volume and breakdown by sources of DVC records collated to 2010

2.1.1 Systematic data collection for the initial phase of the DI DVC database project began in January 2003 and together with subsequent follow-up contracts it has now been possible to gather information on close to 60500 reported DVC occurring on trunk and non trunk roads in England during the period 2001 to 2010. On average 6400 records (range 5919 – 7461) are available for assessment per project year since 2003, with in addition several thousand further records also obtained retrospectively for 2001 & 2002. [In addition to these 60500 records assembled for England, another 12500 have been obtained for the same time period during parallel studies for Scotland (Langbein, 2011); Wales has not officially formed part of either assessment, though small numbers of incidental reports totalling around 300 Welsh records are currently also available].

2.1.2 It is important to note that the large numbers of records obtained remain merely limited *samples* drawn from a much larger (most likely >5 fold) number of actual DVCs occurring each year, as the majority of deer road kills and related vehicle collisions continue to go either unreported or are not recorded in a readily retrievable manner. For example, many insurance companies may log that an animal was involved but keep no record of the type of animal; while similarly many police control rooms will not store detail of calls regarding deer on roads in any standard manner unless human injury is involved, though even in case of the latter there is no requirement to record types of wild animal concerned. In addition in numerous incidents deer will run off after colliding with vehicles, with either minor injuries or to die some way off the carriageway, where drivers neither report nor may know the type of animal concerned.

2.1.3 The figures in Section 2.1.1 are therefore given to provide an indication of the base of information accrued and available for analysis of the distribution, incident hot spot mapping and changes across years; and do not represent estimates of the total numbers of incidents occurring. Estimation of the true annual total of incidents occurring was not a formal objective for the present study, and remains difficult to ascertain as the proportion of all DVCs captured by any of our sample sources remains unknown. Tentative estimates of the overall national toll of DVCSextrapolated on the basis of likely proportions captured by differing sources are nevertheless discussed further in the Section 7 of this report.

2.1.4 As in most previous project years, a very high proportion of records of incidents for the final complete year of study (2010) were not received until during late 2011, with many organisations who voluntarily submit records to the project often unable to do so until around six and sometimes nine months after year end. In addition a number of our core source organisations offered to repeat a further computerised search of their records for earlier years back to 2001 using wider sets of keyword search criteria, as for reasons outlined later in this report, it was suspected that in some cases a significant proportion of deer related records may previously have been missed at source during some but not other data years. As a result, whilst only around <5000 records had been expected to be submitted and require processing during the final project year, in the event over 9,000 records were received. The present report has therefore been held back to allow incident records relating to 2010 to be included fully, as well as incorporating as far as possible the numerous additional records received for earlier years at least in case of core data sources.

2.1.5 An overview showing the breakdown by year of the samples of DVC incident reports on which information is now available for the period 2001 to 2010 in the DI Database collated for differing source categories is provided in **Table-2**.

2.1.6 During the initial study commenced in 2003 a total sample of just under 15,000 DVC records were obtained for England for the main three study years (2003 -2005) as well as 10,000 records for the three previous years (2000-2002). Since completion of that work, in excess of 30,800 further new records have been obtained for the 2006 – 2010 period; despite the fact that follow-on contracts to maintain DVC monitoring post 2006 have progressively been restricted to focus on collection of data from smaller number of 'core data sources'. Furthermore, near 5,000 additional pre-2006 records have become available during this final study year, adding substantially also to the overall sample of data available for those earlier years.

2.1.7 Among the 60,485 incidents currently accumulated for the DVC England Database 2001 - 2010, OS map references have been allocated to over 50,888 (~84%) of those received with adequate location details. All of these have been uploaded to a GIS (Geographic Information System), to enable ready extraction and analysis of sub-sets of data for specific time periods, road sections, region, local authority or other area within England.

**Table-2: Breakdown of DI DVC database records 2001 to 2010 for ENGLAND by source categories**

| Source Type | | Year | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Geo* | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | Total |
| **Core data Sources** | | | | | | | | | | | | |
| **Trunk Road Uplifts UT** | GIS | 67 | 334 | 430 | 522 | 512 | 507 | 514 | 975 | 1037 | 1163 | 6061 |
| | n/m | 5 | 36 | 114 | 175 | 259 | 173 | 140 | 169 | 256 | 40 | 1367 |
| | **tot** | **72** | **370** | **544** | **697** | **771** | **680** | **654** | **1144** | **1293** | **1203** | **7428** |
| | | | | | | | | | | | | |
| **RSPCA R** | GIS | 2266 | 2769 | 2544 | 2755 | 2788 | 3272 | 3524 | 2930 | 2790 | 2602 | 28240 |
| | n/m | 521 | 370 | 537 | 385 | 409 | 339 | 305 | 455 | 527 | 484 | 4332 |
| | **tot** | **2812** | **3165** | **3096** | **3161** | **3222** | **3637** | **3843** | **3398** | **3326** | **3103** | **32763** |
| | | | | | | | | | | | | |
| **Human Injury RTC ST19** | GIS | 110 | 142 | 164 | 203 | 175 | 165 | 165 | 140 | 113 | 120 | 1497 |
| | n/m | 0 | 1 | 1 | 5 | 9 | 9 | 8 | 8 | 6 | 6 | 53 |
| | **tot** | **110** | **143** | **165** | **208** | **184** | **174** | **173** | **148** | **119** | **126** | **1550** |
| | | | | | | | | | | | | |
| **Other data Sources** | | (less consistently available across all years or areas) | | | | | | | | | | |
| Deer-wise contributors D | GIS | 562 | 706 | 1603 | 1610 | 1051 | 1199 | 883 | 866 | 679 | 546 | 9505 |
| | n/m | 16 | 41 | 42 | 77 | 28 | 148 | 120 | 51 | 63 | 24 | 610 |
| | **tot** | **578** | **747** | **1645** | **1687** | **1079** | **1347** | **1003** | **917** | **742** | **570** | **10315** |
| | | | | | | | | | | | | |
| Police logs P (+inc. St-dam) | GIS | 123 | 258 | 450 | 463 | 97 | 26 | 40 | 9 | 62 | 80 | 1608 |
| | n/m | 1 | 29 | 70 | 90 | 16 | 0 | 0 | 3 | 25 | 48 | 282 |
| | **tot** | **124** | **287** | **520** | **553** | **113** | **26** | **40** | **12** | **87** | **128** | **1890** |
| | | | | | | | | | | | | |
| Insurance (AGEAS) IC | GIS | 111 | 186 | 256 | 266 | 0 | 247 | 0 | 0 | 0 | 0 | 1066 |
| | n/m | 58 | 68 | 38 | 46 | 294 | 49 | 0 | 595 | 634 | 509 | 2291 |
| | **tot** | **169** | **254** | **294** | **312** | **294** | **296** | **0** | **595** | **634** | **509** | **3357** |
| | | | | | | | | | | | | |
| Local Authority uplifts UC | GIS | 127 | 189 | 485 | 461 | 218 | 59 | 48 | 24 | 2 | 0 | 1613 |
| | n/m | 2 | 5 | 10 | 19 | 7 | 22 | 1 | 0 | 0 | 0 | 66 |
| | **tot** | **129** | **194** | **495** | **480** | **225** | **81** | **49** | **24** | **2** | **0** | **1679** |
| | | | | | | | | | | | | |
| Other Gen. Public G | GIS | 6 | 19 | 194 | 348 | 146 | 78 | 47 | 37 | 47 | 46 | 968 |
| | n/m | 0 | 2 | 4 | 15 | 10 | 162 | 110 | 106 | 104 | 83 | 596 |
| | **tot** | **6** | **21** | **198** | **363** | **156** | **240** | **157** | **143** | **151** | **129** | **1564** |
| | | | | | | | | | | | | |
| **Summary totals:** | | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | Total |
| **Core Sources** | | **2994** | **3678** | **3805** | **4066** | **4177** | **4491** | **4670** | **4690** | **4738** | **4432** | **41741** |
| **Others sources** | | **1006** | **1503** | **3152** | **3395** | **1867** | **1990** | **1249** | **1691** | **1416** | **1336** | **18805** |
| **Overall Sample** | | **4000** | **5181** | **6957** | **7461** | **6044** | **6481** | **5919** | **6120** | **6354** | **5768** | **60546** |

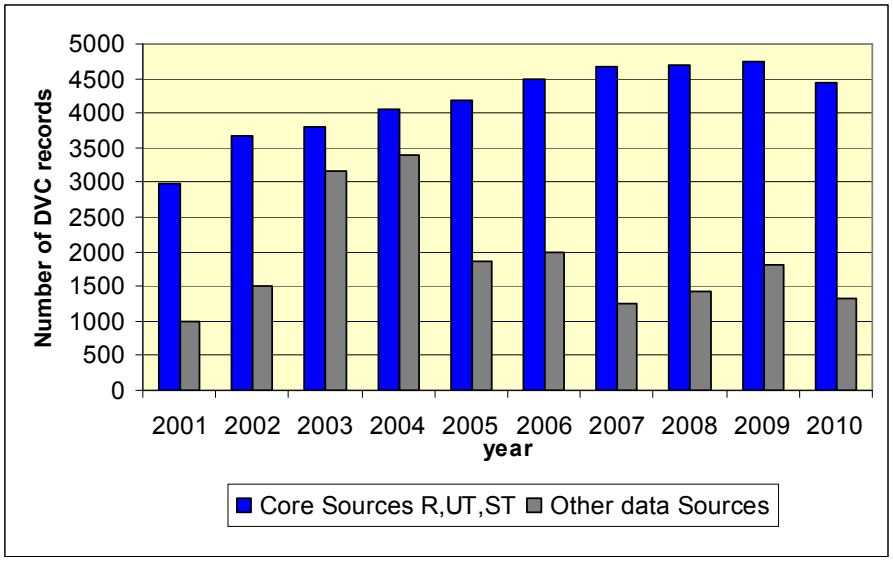
*Geo: GIS = nos. of records mapped and used in GIS analyses; n/m = records not yet fully mapped mostly as submitted with only vague location detail. Records pre-2003 study start available less widely. (based on database as at Nov. 2011).

## 2.2 Broad trends in overall samples obtained per year

2.2.1 Figures as summarised in **Table-2** are intended in the first instance to provide an overview of the sample sizes of records from different sources currently available for analysis and mapping. In considering apparent changes in these data across years it is important to bear in mind that with exception of data from our 'core sources' shown at the top of the table, sampling effort and processing (e.g. mapping) for the 'other sources' has been reduced in later project years. This is illustrated further in **Figure C-1** showing trends in overall sample size from all 'core' sources combined and likewise for all 'other' sources.

2.2.2 Most importantly **Figure C-1** shows that, although project constraints have led to reduced sampling effort overall, the total numbers of records obtained from across our three core data source categories have nevertheless steadily increased ever since commencement of the study; a slight levelling off of that trend in the final year is likely to be due in part to some individual sources who have had not yet submitted all their data for 2010.

***Figure C-1:*** *Total number of DVC records collated from among the three 'Core' data categories combined (R, UT, ST) and 'Other' sources by year of occurrence.*




2.2.3 Submissions from the 'Other Sources' in view of no longer actually soliciting data from most of the organisations concerned were expected to fall rather more than they have done since 2006. However, an unexpected recent submission of over 2400 insurance claims records for 2008 to 2011 extracted for us by AGEAS Insurance (formerly FORTIS) has added greatly to the total volume of records from the 'other sources' category, although as received well after official end of the project in late 2011, most of these have only been possible to incorporate into the database in raw form without allocation of map references.

2.2.4 For the three core data categories (UT, R, ST), **Table-2** indicates an increasing pattern ever since start of the study though a rise in particular from 2008 onwards, whereas samples of R and ST records appear to level off or show a declining trend after 2007. Changes in annual data received from among each of these individual source categories are examined in further detail in the following section, to explore the extent to which trends shown are likely to reflect real changes in DVC occurrence on the road network, taking into account possible influences of changes in recording intensity.

# 3 DEER CASUALTIES AND RELATED ACCIDENTS REPORTED FOR THE STRATEGIC TRUNK NETWORK IN ENGLAND

## 3.1 The trunk network and main contributors of DVC records 2001 –2010

3.1.1 The trunk road network managed by the Highways Agency (see **Map Figure M-1**) in England extends to around 4440 miles of motorways and major A roads (DfT,2011) that are considered of national strategic importance. These trunk roads contribute just 2.4% of total road length but carry one third of all road traffic in England (c. 80 billion vehicle-miles) and two thirds of all heavy freight traffic. In view of the strategic importance of these routes particular emphasis has been placed throughout all project years on obtaining DVC information available for the trunk road network.

**Figure M-1: Area Map – HA trunk network 2010 (areas as August 2011)**


Figure reproduced from HA Publication PR52/11 (Highways Agency 2011).
[Maps giving more detail of the national network and routes within each HA Management division can be found at the following link: http://www.highways.gov.uk/aboutus/139.aspx ]

3.1.2 From 2003 until 2007 majority of information on deer incidents for trunk roads was obtained by us through individual requests to a) the 14 (latterly 12) differing MAC (Managing Agent Contractor) companies responsible for day to day maintenance of trunk roads in differing regions of England, plus b) around 11 DBFO (Design, Build, Finance, Operate) companies operating a number of additional specific trunk routes. Since January 2008 records of calls relating to 'dead deer on carriageway' for the majority (though not quite complete coverage) of the HA network have in addition been possible to obtain from c) HA National Control Centre (NCC) including input to there from Regional Control Centres (RCC). The latter more consistent recording made available via NCC in comparable manner across the majority of the network has led to lesser reliance during recent project years on MAC & DBFO data (which have tended to be rather variable in availability and quality from one operating company to another, with at times gaps in recording also when procedures and staff altered during changeover to new contractors). MAC records of deer uplift requests have nevertheless continued to be incorporated for this project where these provided significant numbers of additional reports and or added better detail and coverage than available to us via NCC alone.

3.1.3 During the initial 2003 to 2005 study contact was established with all of the MAC and DBFO companies to request provision of information on any incidents related to deer road casualties, including any retrospective records available for 2001 & 2002. Although some MAC companies were able to provide very comprehensive and useful records even at the outset, a number of others and many of the DBFOs could provide only much more limited records in some but not others of these initial years, and often without sufficient marker post or other detail to enable map references to be allocated.

3.1.4 Contact with MAC companies and some DBFOs continued to yield majority of useable records for the DVC database to end 2007. Discussion with data analysts in South RCC during late 2008 indicated that improvements on how computerised records of incidents were being maintained (in particular since roll out of the Highways Agency Traffic Officer (HATO) scheme in July 2006 across all motorways and parts of the all purpose trunk network) would increasingly allow extraction of a high proportion of all deer related incident requests centrally. It was initially expected that records obtainable via NCC would only give quite restricted coverage for trunk roads other than motorways. The first full year for which NCC records were obtainable was 2008. In the event these records and those for subsequent years have consistently covered incidents not merely for motorways and 'patrolled' all-purpose trunk roads, but also input to NCC from other regional (RCC) centres (e.g. for all of Area 1, even though it does not form part of the HATO patrolled network).

## 3.2 DVC trends for the HA network, region and management areas

3.2.1 Numbers of non duplicate DVC reports obtained via trunk MAC or DBFO companies in England totalled around 550 – 750 per year from 2003 to 2007. It was estimated during previous studies that there were likely to represent at best a third to half of all deer road kill on the network (Langbein, 2007; Langbein, 2010), partly as data were not consistently available for some MACs and several DBFOs, but also as it is evident from road side surveys (e.g. Langbein & Putman, 2006, Enterprise Mouchel, 2011, Langbein, 2011) that a large but unknown proportion of deer hit on trunk roads are not reported, including if injured animals die even a short distance away from the verge concealed by roadside shrub or woodland cover or behind embankments.

3.2.2 Figures presented in **Table-2** for the last three years (2008-2010) show a large rise in DVC records obtained via HA agents or NCC to around 1100 to 1300 per year, compared to an average of 650 for the previous five years. A significant part of this increase is likely to be associated with the improved coverage of data achieved for some sections of network where no uplift records had been possible to obtain previously. However, aside from such improvements in recording achieved for the network as a whole, increases are apparent also for a number of those HA management areas for which data of comparable quality and coverage have been available ever since 2003 or before.

3.2.3 The above changes are presented in more detail in **Table-3** and **Figure C-2** for different parts of the trunk network. Among those nine HA Areas for which highest total numbers of DVCShave been logged since 2003 and with comparable data available across all years through to 2010, a clear increasing trend is apparent for seven area, with more stable numbers for the remaining two (see also Figure C-2). Comparison of the mean annual totals per area for the first three years of study (2003-5) with the mean for the most recent three years (2008-2010) shows an average increase among these nine areas over that period by 64%.

3.2.4 From **Figure C-2** the steepest rises in DVC logs appear to have occurred in HA Areas2 [Somerset, Avon, Wiltshire, Gloucestershire] and Area 6 [East Anglia] between 2005 - 2007. In case of Area 6 a much higher number (264) of reports were received again in 2009 than in any previous year, but unfortunately the MAC agents for here have so far been unable to supply their records us for 2010; however, records for 2011 have been provided for 2011 (up to November), and confirm a further toll of at least 220 separate incidents for that latest year after official conclusion of data collection for the present study.

3.2.5 Whilst even for those nine areas where DVC records have been consistently available throughout the study some small parts of the increase noted may possibly be due to improved computerisation of record keeping, it is clear from the figures overall that DVCs on the trunk network have continued to rise throughout most of the 2003 to 2008 period. For the remaining HA areas and DBFOs where DVC records were less consistently available during the early years of study, figures in **Table-3** do also indicate some further increases over the last three years (2008 to 2010) in most cases (with possible exception of Area 8); however, continued improvements in recording and data abstraction via NCC may also have contributed.

Table 3 :

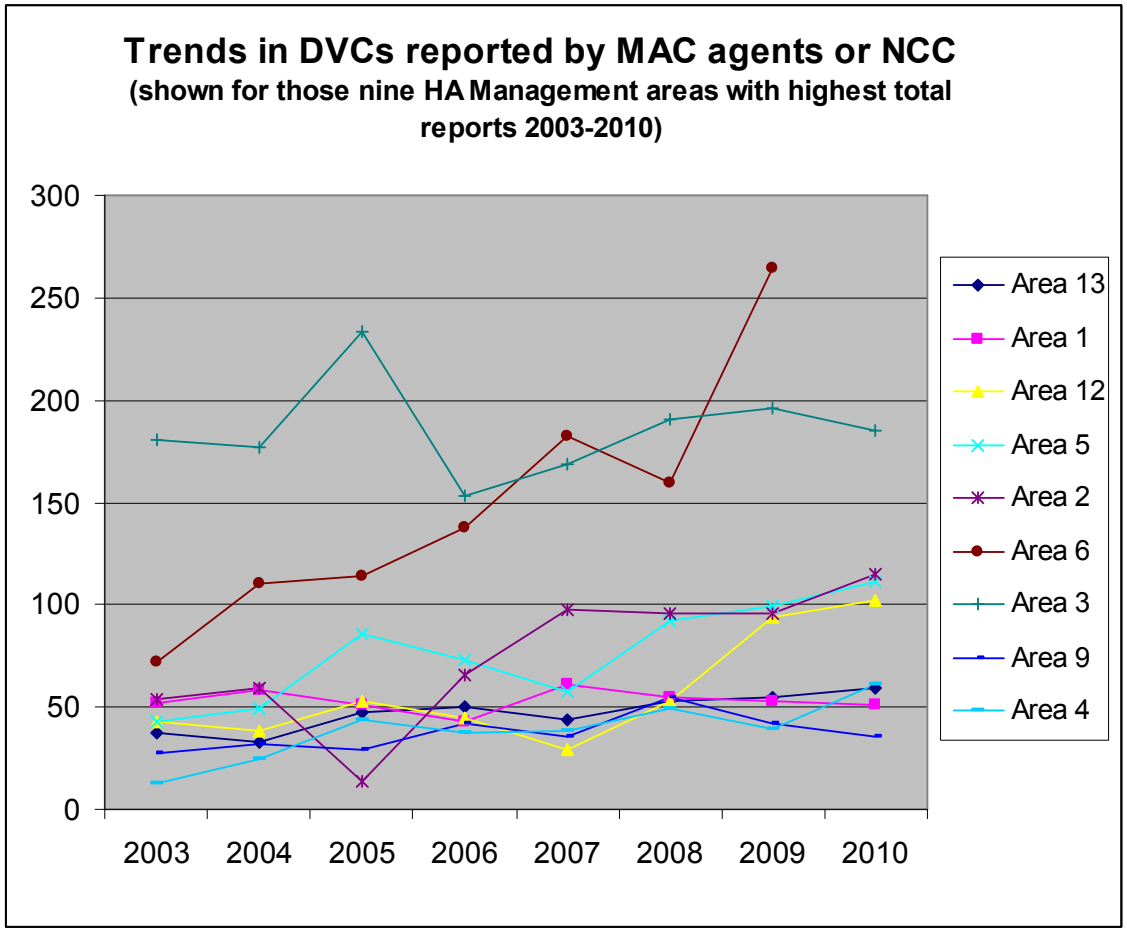
Deer uplift records (UT) provided by HA agents or HA National Control Centre by year and HA management areas.

| Trunk Management Unit | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| ***HA MAC Areas*** | | | | | | | | | | | |
| Area_3 | 15 | 231 | 181 | 177 | 233 | 153 | 169 | 191 | 196 | 185 | 1684 |
| Area_6 | *nd* | 13 | 72 | 110 | 114 | 138 | 182 | 160 | 264 | *67 | 1120 |
| Area_2 | 47 | 41 | 54 | 59 | 14 | 66 | 98 | 96 | 96 | 115 | 686 |
| Area_12 | *nd* | 4 | 43 | 38 | 53 | 45 | 29 | 53 | 94 | 102 | 461 |
| Area_1 | *nd* | 3 | 52 | 58 | 51 | 43 | 61 | 55 | 53 | 51 | 427 |
| Area_13 | *nd* | 0 | 37 | 33 | 47 | 50 | 44 | 53 | 55 | 59 | 378 |
| Area_9 | *nd* | 11 | 27 | 32 | 29 | 42 | 36 | 55 | 42 | 36 | 310 |
| Area_4 | *nd* | *nd* | 13 | 25 | 44 | 37 | 38 | 49 | 39 | 61 | 306 |
| Area_8 | *nd* | *nd* | *nd* | *nd* | 67 | *nd* | *nd* | 80 | 81 | 51 | 279 |
| Area_14 | *nd* | *nd* | 10 | 66 | *nd* | 25 | *nd* | 34 | 50 | 59 | 244 |
| Area_10 | *nd* | *nd* | 3 | 26 | 5 | *nd* | *nd* | 48 | 65 | 81 | 228 |
| Area_7 | *nd* | *nd* | 2 | 12 | 13 | 8 | *nd* | 35 | 21 | 53 | 144 |
| ***DesignBuildFinanceOperate*** | | | | | | | | | | | |
| Area_5 (M25 DBFO) | 0 | 4 | 43 | 49 | 86 | 73 | 57 | 92 | 99 | 111 | 614 |
| Area_25 (A69 DBFO) | 1 | 3 | 4 | 0 | 3 | 0 | 0 | 0 | 0 | 2 | 13 |
| Area_26 (A19_TyTun) | *nd* | *nd* | *nd* | *nd* | *nd* | *nd* | *nd* | 4 | 14 | 4 | 22 |
| Area_27 (M1_A1link) | *nd* | *nd* | *nd* | *nd* | *nd* | *nd* | *nd* | 12 | 29 | 11 | 52 |
| Area_28 (A50_A564) | *nd* | *nd* | *nd* | *nd* | *nd* | *nd* | *nd* | *nd* | *nd* | *nd* | 0 |
| Area_29 (A1M Alc_Pet.) | *nd* | *nd* | *nd* | *nd* | *nd* | *nd* | *nd* | 7 | 9 | 5 | 21 |
| Area_30 (M40 DBFO) | 8 | 4 | 11 | 6 | 10 | *nd* | *nd* | 61 | 76 | 86 | 262 |
| Area_31 (A419/A417) | *nd* | *nd* | *nd* | *nd* | *nd* | *nd* | *nd* | 3 | 14 | 6 | 23 |
| Area_32 (A30_A35) | 1 | 17 | 28 | *nd* | *nd* | *nd* | *nd* | 10 | 9 | 13 | 78 |
| Area_33 (A1M Dar_Dis.) | *nd* | *nd* | *nd* | *nd* | *nd* | *nd* | *nd* | 25 | 16 | 16 | 57 |
| Area_34 (A249_M2) | *nd* | *nd* | *nd* | *nd* | *nd* | *nd* | *nd* | *nd* | *nd* | *nd* | 0 |
| ***PrivateFinanceInitiatives*** | | | | | | | | | | | |
| PFI_Severn Crossing | *nd* | *nd* | *nd* | *nd* | *nd* | *nd* | *nd* | 0 | 0 | 1 | 1 |
| PFI_M6 TOLL | *nd* | *nd* | *nd* | *nd* | *nd* | 0 | 0 | 1 | 2 | 17 | 20 |
| HACC_unallocated | 0 | 0 | 3 | 6 | 2 | 0 | 0 | 14 | 16 | 11 | 52 |
| Total | 72 | 330 | 584 | 697 | 771 | 680 | 714 | 1138 | 1293 | 1203 | 7482 |

Notes : HA Areas based on trunk network map as at July 2009; uneven input across years affected to some extent by Area boundary changes / amalgamation of area.
*=In 2010 Mac_6 data not available , and present records restricted to NCC logs
HA NCC deer records became available from Jan 2008 giving wider network coverage
Where higher volume of records available via MAC than NCC, latter have not been counted for calculating year totals except where unlikely to be 'duplicate' reports.
Records included in this Table restricted to those provided by trunk (UT) sources.

(*nd = no data available*)

**Figure C-2:**




## 3.3 Reported deer casualties and DVC rate by region and traffic

3.3.1 Records presented in **Table-3** and **Fig. C-3** show that the total number of deer road kills (as reported by maintenance contractors) varies very widely between HA Areas, from over 200 reports in some (e.g. Area 3 and 6) to fewer than 50 or even 10 in many others. In evaluating these differences it is important to take into account that there are large differences amongst the HA MAC Areas as well as among the DBFO and PFI roads in total road length, and in particular very wide differences in the amount of traffic carried.

3.3.2 **Table-4** shows the average number of DVCs reported by trunk operators 2008 to 2010, and traffic, region and area, and resulting rate of reported DVCs (per $10^8$ vehicle miles). The average annual number of DVCs recorded for the network as a whole for this period (1226) produces an approximate figure of just over 1 reported DVC per 4 miles of the length of the trunk road network per year. Taking into account traffic volume the average rate of DVCs 'recorded' by trunk operators was 1.43 DVC per 100 million vehicle miles[1]. As discussed later in the report (5.2) it is likely that those DVCs reported represent less than 25% to 50% of all deer actually hit by vehicles on the network.

[1][Although the concept of vehicle miles may be unfamiliar and difficult to visualise for general readers, it is commonplace for Road Safety reviews to compare casualty rates - be it usually for human injury collisions - in terms of such rates in either millions or billion vehicle miles. By way of context, the rate of collisions causing one or more human injuries on the trunk network during 2010 was 13.6 collisions per $10^8$ vehicle miles (Highways Agency, 2011)

3.3.3 From this, in **Table-4** it can be seen that whilst the annual numbers of deer casualties reported in, for example, HA Area 3 and Area 5 in the Southeast are two to threefold greater than those in Area 1 in the Southwest, the latter actually has the higher casualty rate per driven mile. This comparison of road kill rates emphasises the significance of traffic volume on numerical overall toll of DVCs. That the average risk for individual deer becoming a victim of road collisions rises in regions where they are exposed to greater road density and higher traffic levels is almost inevitable. Comparison of casualty rates however demonstrates that the risk to individual drivers of hitting a deer is no lower for example in Southwest England than in the Southeast where overall higher totals of DVCs are recorded.

3.3.4 The individual HA MAC areas with the highest rates of reported DVCs per driven mile over the last three years are Area 6, Area 1 and Area 3 respectively (in each case recording rates at least 50% above average for the network). A number of DBFOs also show similarly high rates per vehicle mile (e.g. M40, A30_A35; A1M; M1/A1 link) but are in these case unavoidably assessed over only far shorter total road length.

3.3.5 On pooling records obtained for all trunk routes for each of the seven much larger Highways Agency Regions in turn (see Table-4), the regions with highest deer casualty rates in relation to traffic area are (from highest to lowest):

**East > Southwest > Southeast > Yorkshire & North East**
and rates below the overall average in :
**Northwest > West Midlands > East Midlands**.

**Table-4 :** Reported DVCs and traffic by Highways Agency region and area

| HA Region | HA Management Area | 2008-10 average reported DVC | Traffic ($10^8$ vehicle miles) | DVC rate |
|---|---|---|---|---|
| South West | Area 1 | 53.0 | 18.6 | 2.85 |
| | Area 2 | 102.3 | 60 | 1.71 |
| | A30/A35 DBFO | 10.7 | 4.2 | 2.54 |
| | A417/A419 DBFO | 7.7 | 4.3 | 1.78 |
| | S.Severn Cross. | 0.3 | 0.7 | 0.48 |
| **SW Total** | | **174.0** | **87.8** | **1.98** |
| South East | Area 3 | 190.7 | 84.6 | 2.25 |
| | Area 4 | 49.7 | 45.6 | 1.09 |
| | A249 DBFO | 0.0 | 1.1 | 0.00 |
| | M25 DBFO | 100.7 | 83.8 | 1.20 |
| **SE Total** | | **341.0** | **215.1** | **1.59** |
| East | Area 6* | 212.0 | 47.5 | 4.46 |
| | Area 8 | 70.7 | 41.2 | 1.72 |
| | A1M DBFO | 7.0 | 3 | 2.33 |
| | M40 DBFO | 74.3 | 24.4 | 3.05 |
| **E Total** | | **293.3** | **116.1** | **2.53** |
| East M'lands | Area 7 | 36.3 | 79.7 | 0.46 |
| | A50 DBFO | 0.0 | 5.5 | 0.00 |
| **EM Total** | | **36.3** | **85.2** | **0.43** |
| West M'land | Area 9 | 51.0 | 98.7 | 0.52 |
| | (incl. M6 Toll) | (6.3) | | |
| **WM Total** | | 51.0 | **98.7** | 0.52 |
| North West | Area 10 | 64.7 | 92.9 | 0.70 |
| | Area 13 | 55.7 | 29.1 | 1.91 |
| **NW Total** | | **120.3** | **122** | **0.99** |
| Yorks & North East | Area 12 | 83.0 | 58 | 1.43 |
| | Area 14 | 47.7 | 23.3 | 2.05 |
| | A1(M) Dar_Dis DBFO | 19.0 | 8.5 | 2.24 |
| | A19 DBFO | 7.3 | 11.9 | 0.62 |
| | A69 DBFO | 0.7 | 3.2 | 0.21 |
| | M1/A1 DBFO | 17.3 | 6 | 2.89 |
| **Y&NE Total** | | **175.0** | **110.9** | **1.58** |
| **Total** | | **1226.3** | **836** | **1.43** |

Ann.Traffic measured in $10^8$ vehicle miles; Rate in *reported* DVC per $10^8$ vehicle miles
M6 Toll DBFO included in Area 9 traffic. *Area 6 DVC based on 2yr 2008-09 average.

## 3.4 Distribution and hotspots within individual network management areas

3.4.1 A national overview of the relative distribution of DVCs recorded across the trunk road network 2003 to 2010 is provided for northern and southern England in **Figure M-2a** & **M-2b**. For purpose of mapping in relation to the trunk network, all those DVC reports geo-referenced on or within no more than 150 metres to either side of a trunk road have been allocated to 2km by 2km cells based on the Ordnance Survey grid overlaid on the network; with the totalled frequency obtained per cell shown represented by squares of different colours.

3.4.2 It is readily evident from the overview map (**Fig. M-2b**) that the great majority of locations in the highest DVC frequency category (shown as red on the map) are concentrated within parts of the trunk network in the Southeast and East of England, with some but much fewer locations with equivalent levels of DVC density in the other regions. However, it is clear from discussion in the previous section [3.3 above] that although rather higher overall tolls of DVCs are recorded in Southeast and East of England Regions, annual rates of deer casualties in relation to traffic are in fact not dissimilar to those in Southwest and Yorkshire & Northeast Region. Gross national comparisons based on DVC numbers alone are therefore of rather limited value, not least in terms of identifying priority areas where risk to vehicles of being involved in collisions with deer is likely to be greatest, and where limited resources to mitigate the problem would best be targeted.

3.4.3 The most appropriate assessments of relative DVC frequency on the network are therefore likely to be ones confined to within separate HA Management areas, where aside from similar traffic volume the manner of recording dead deer uplifts and related incidents during this study will be most directly comparable. To facilitate closer inspection of recorded DVC distribution and identification of any hotspots within each of the 12 main HA Management Areas and 13 other DBFO and PFI routes, individual maps for each of these 25 areas have been prepared and are presented in Appendix I.

3.4.4 Each of these management area maps has been produced along similar lines to the national overview (Figure M-2) to show relative frequency of trunk road DVCs per grid cell overlaid on the network. Only those records mapped within 150m or less of the trunk roads are taken into account for the frequencies in the grid overlays; the great majority of these (>75% overall, and >87% of 2008 – 2010 records) are records provided by trunk agents or HA control centres (UT), with up to 9% from RSPCA (R), and small number from other sources. Locations where other DVCs have been recorded away from the network on local authority roads are shown plotted in a different colour, if located within a buffer zone of no more than 6.2 miles (10km) around the trunk routes in each area. This helps to show trunk DVC hotspots in the context of aggregations of incidents in the wider area, as well as indicating areas where DVC potential may be relatively high even if to date few such incidents have been logged on the nearby trunk roads.

3.4.5 The purpose of the Area maps is foremost for Highways Agency regional staff, their Managing Agents and other interested parties to:

- allow ready review of DVC information for their area held in the national DVC database;
- highlight significant concentrations or DVC 'hotspots' on trunk roads that may be worthy of closer local investigation;
- assist assessment of any emerging or declining locations of trunk DVC occurrence by comparison of mapped 2003–06 and 2007-06 distribution;

- enable feedback regarding corrections or possible missing past data not yet available to us that agents may be able to contribute in future.

3.4.6 A previous series of similar DVC maps by HA management area, based on all mapped DVC records for the entire 2003 to 2009 period was made available on-line1[2] during early 2011. A new series of maps, presented on in Appendix [II] on the CD accompanying this report, has been updated to incorporate data also for 2010 and other additional records not previously available for earlier years. For most areas two separate maps have been prepared this time showing data separately for a) 2003 to 2006 and b) 2007 to 2010, so as to enable assessment of changes in DVC frequency and distribution between these periods. The detailed area maps will not all be reviewed individually in turn in this report; instead a few examples only are drawn on below to illustrate some general points.

3.4.7 Summary overview maps of DVC distribution in Southeast of England (showing network Areas 3, 4, 5 (now M25 DBFO), 6, and parts of M40 DBFO) are shown in **Figures M-3a** & **M-3b**. By comparing the two maps it may be noted that:

i. In case of the majority of areas – (such as e.g. for much of the M25 sphere and Area 4) – the relative distribution of incidents has remained quite similar; with most high-incidence locations shown on the 2003-06 map persisting also as hotspots in 2007-10, but generally being shown up more clearly in the later when increased numbers of records are available in most cases.

ii. In addition many new emerging hotspots not noted in the earlier study period are apparent; for example, from Figure M-3b, leading from the M25 along the M11 towards Stansted and along the M40 to Oxford. Many of the more detailed management maps (Map Appendix 2) also now show more noticeable hotspots than before for parts of Northern England, including amongst others i) A1 north of Newcastle (Fig. HA-14), ii) M6/M65 Preston & Blackburn (Fig. HA-13), M1 Sheffield and Leeds (Fig. HA-12 & HA-27) and M1 Nottingham (Fig. HA-7). As in much of southern England, many of these emerging hotspots are located on the fringes of major cities and towns, where relatively high traffic levels contribute to deer (even if occurring at similar density to elsewhere) being at inevitably greater risk of being involved in collisions with traffic.

iii. By comparison a fall in DVC incidents is noticeable in case of only rather few trunk road hotspots that were identified for the first four years of study. However, one example where a very significant fall has occurred is along the A49 at Dinmore Hill in HA Area 9 (see Figure HA-9a,b) Here over 30 DVCs were recorded within a 3 mile section of road during 2003 to 2006, but have since fallen to fewer than 10 records in the following 4 years, including only one or two in each of the last two years. This is one of only few examples where a very clear reduction in DVCs has been demonstrated following the introduction from 2006/7 of substantially increased culls of the fallow deer population at the landscape scale fro a number of years, in association with the Deer Initiative. In addition, parallel research work on roadside deterrents in the area showed inconclusive results, although verge vegetation clearance undertaken as part of this work may also have contributed. However, the major factor in reducing that blackspot is believed to relate to having brought a burgeoning local fallow deer population under closer control and maintained since at more moderate levels.

[2] (HA Area DVC Maps 2003 – 2009 are available at : http://www.deercollisions.co.uk/pages/latest3.html )

iv. A very high proportion of all ‘hotspots’ in either period appear to be located near major intersections (e.g. M25 Junctions with: A12, M23, A1M, M4; M3 Junctions with: M27, A34, A303). It was thought initially that such patterns may appear mainly as result those logging incidents possibly tending to use Junction numbers in preference to marker posts as reference points, as well as longer overall road length including slip roads at junctions. **Figure M-4** provides a closer view of three hotspots at M3 intersections, as well as two others along the M27. A recent study looking in more detail of DVCs specifically in Area 3 was undertaken during early 2011 via the local management agents (Enterprise Mouchel 2011) n conjunction with the author of the present report. This included walk-over surveys to ground truth these and a number of other DVC hotspots identified. Findings from that work showed that deer commonly make use (in some cases throughout the year or else seasonally) of the quite substantial ‘island habitats’ of scrub and woodland that are present between link and slip roads at such interchanges. Such areas, despite high levels of traffic noise tend to be subject to very infrequent disturbance by humans on foot. Deer may seek out such ‘undisturbed’ locations not least during spring calving time and most abundant food supply in such locations; with inevitably a heightened risk of involvement in DVC.

v. As outlined above (3.4.5) the purpose of the DVC incident maps prepared for each area is mainly to serve as working documents for maintenance agents and HA staff to review local DVC issues, identify gaps in information, and provide a baseline where further more detailed investigations (e.g. along lines of those described in above for Area 3) and / or DVC mitigation are being considered.

**Figure M-2a** : Relative incidence of DVCs on trunk roads – Overview Midlands and Southern England 2003 to 2010

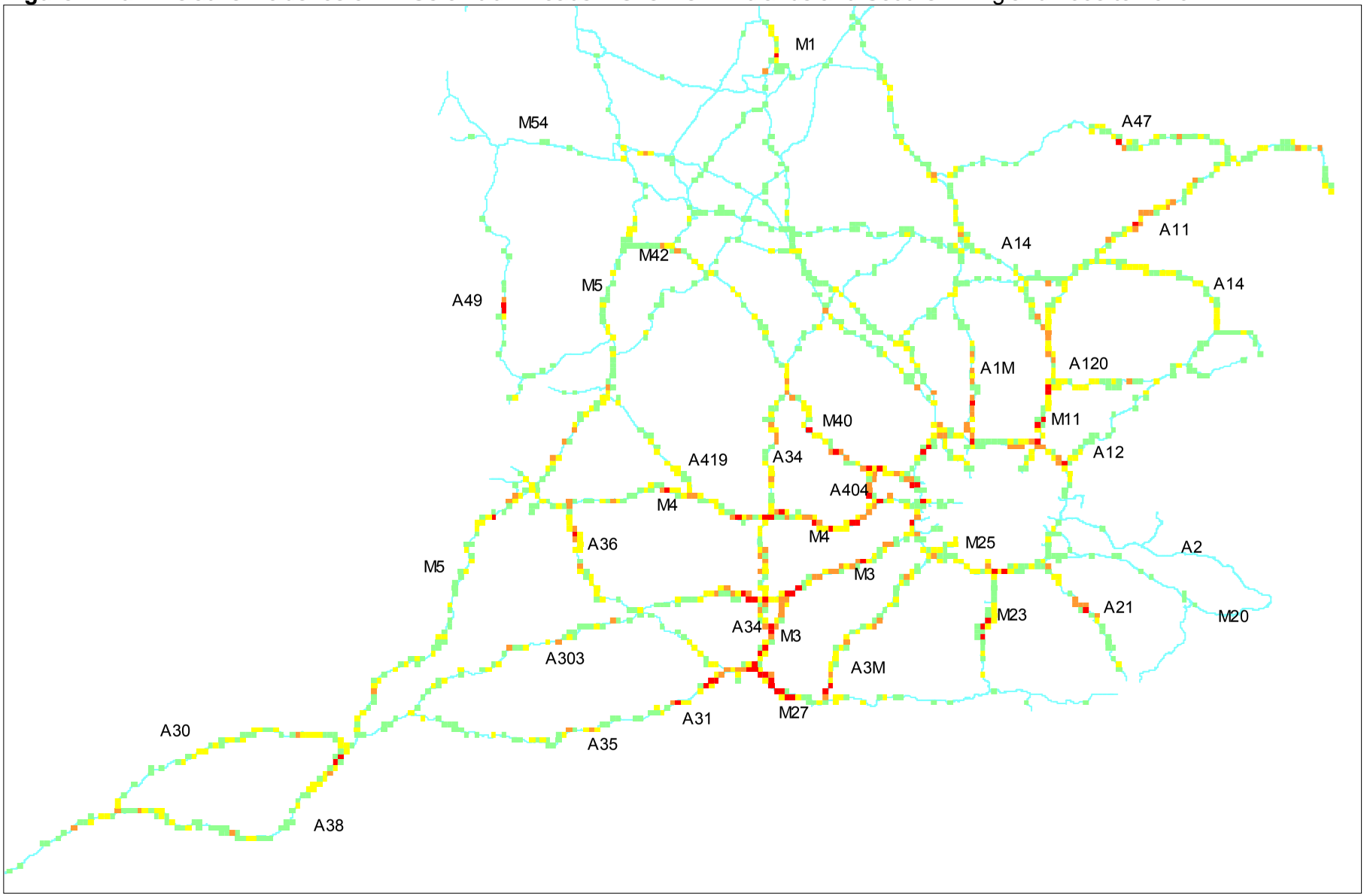
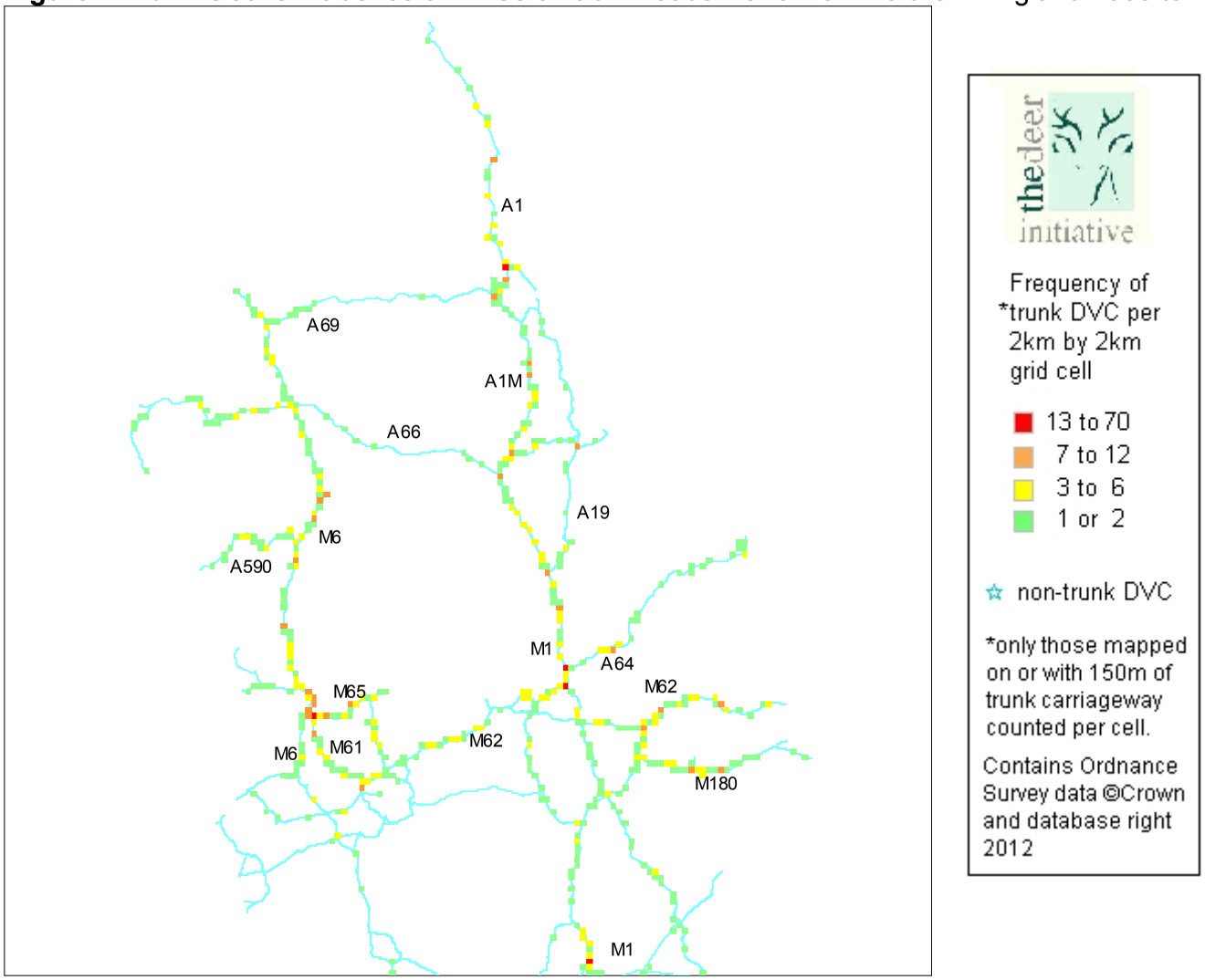


**Figure M-2b :** Relative incidence of DVCs on trunk roads - Overview Northern England 2003 to 2010




thedeer initiative

Frequency of *trunk DVC per 2km by 2km grid cell

- 13 to 70
- 7 to 12
- 3 to 6
- 1 or 2

☆ non-trunk DVC

*only those mapped on or with 150m of trunk carriageway counted per cell.

**Figure M-3a :** Overview SE England 2003 to 2006 - Relative incidence of DVCs on trunk roads (Red highest – green lowest ; light blue = non-trunk)

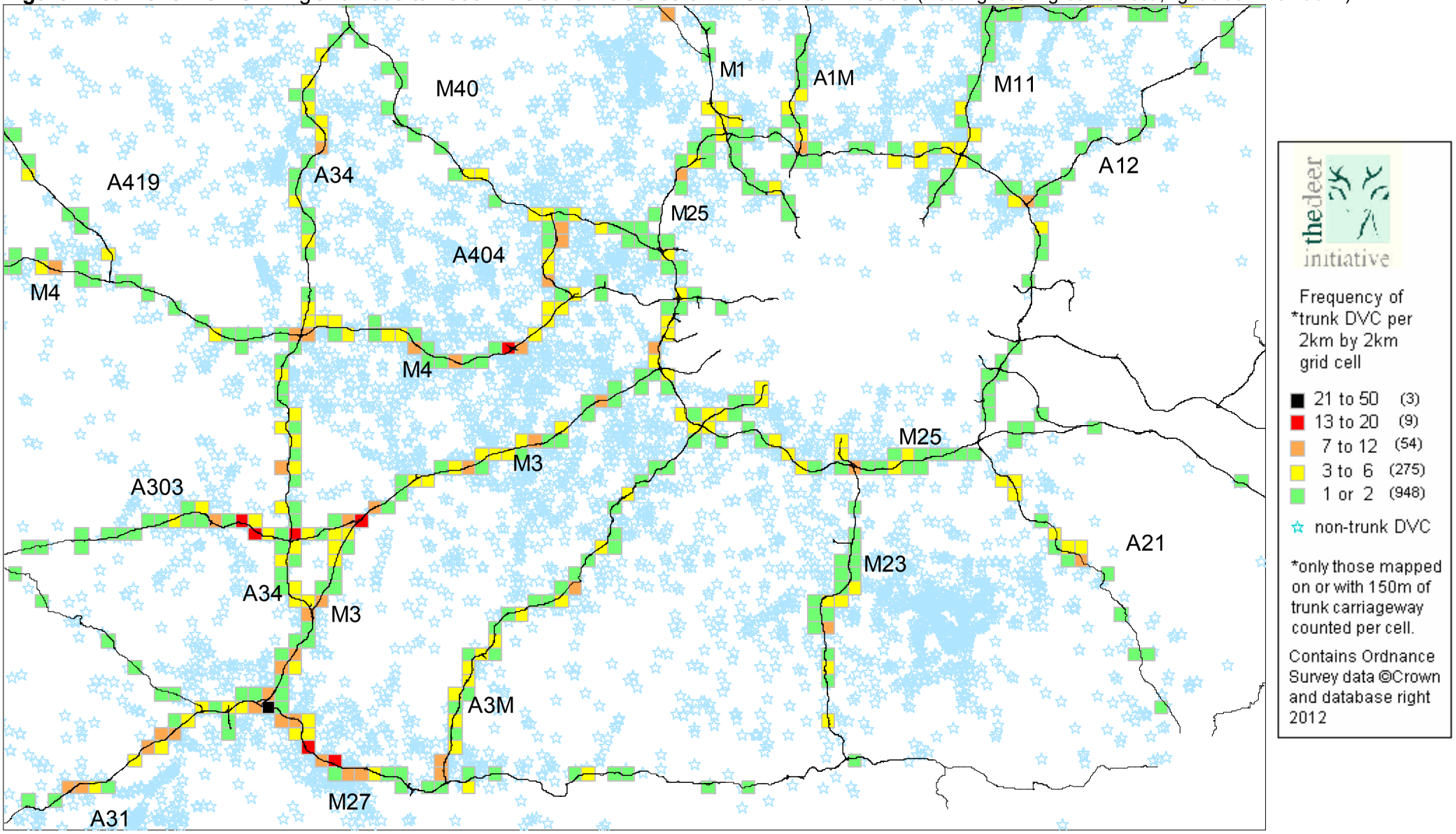


**Figure M-3b:** Overview SE England 2007 to 2010 - Relative incidence of DVCs on trunk roads (Red highest – green lowest ; light blue = non-trunk)

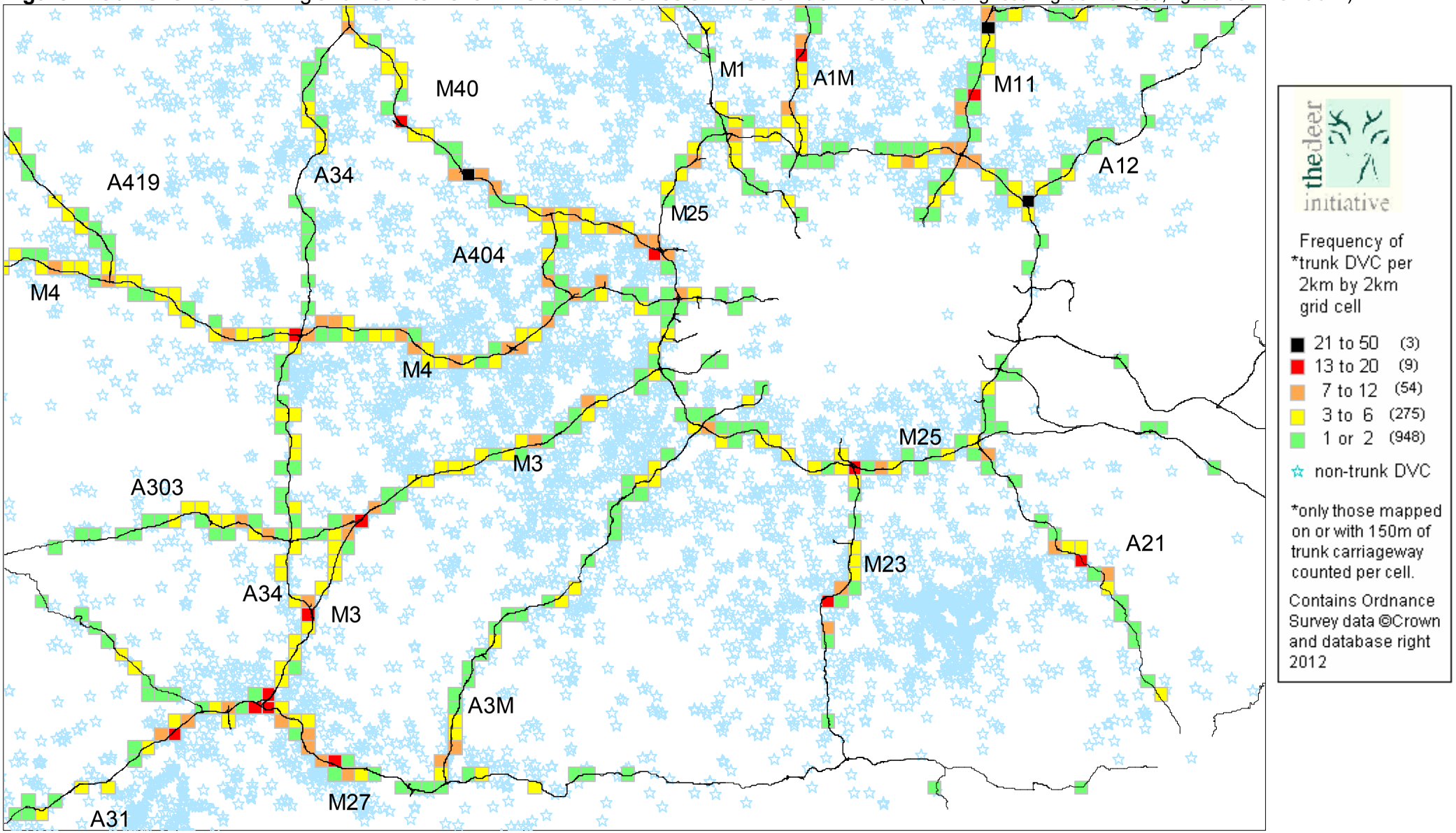
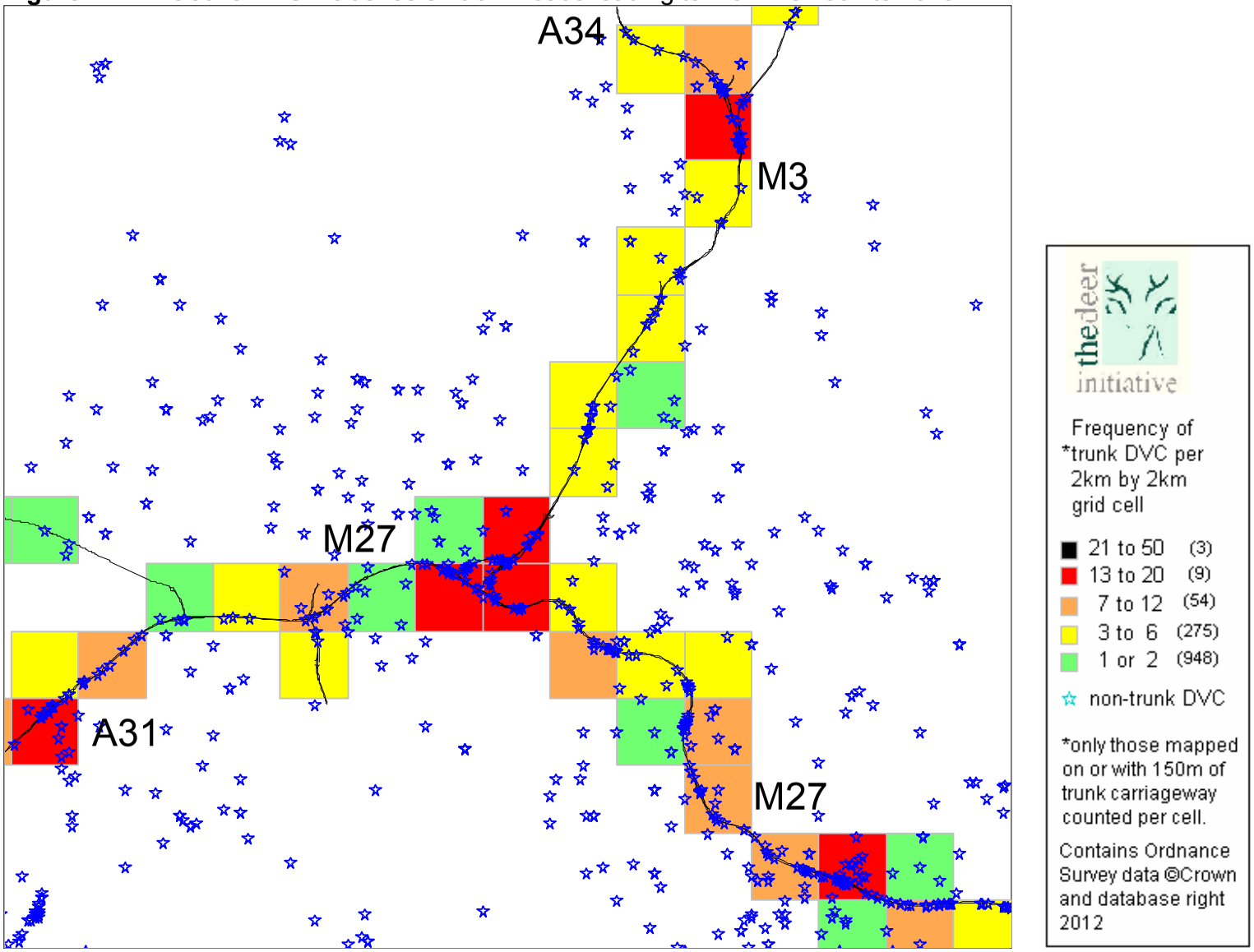


**Figure M-4**: Relative DVC incidence on trunk roads leading to M3 links 2007 to 2010



# 4 DVC trends and countrywide distributions based on long term data from RSPCA and others attending to injured deer at the roadside

## 4.1 Scope and quality of RSPCA and other complementary data sources

4.1.1 In terms of overall numbers of DVC incident reports the single most extensive set of annual records of deer casualties on trunk and non trunk roads in England received by the project has been provided by the RSPCA. Overall RSPCA records now make up just over half of all records in our database relating to England for the period 2001 to 2010; and close to 57% (c. 28,400) of all those for which map references are available. Aside from the large volume of records contributed overall, the RSPCA data are of particular value to the study as they provide regular large annual samples of DVCs covering all parts of the road network in mainland England (as well as for Wales). **As such they constitute the best currently available data for assessing not only long term countrywide trends, but differences by region, local authority, district or smaller divisions**.

4.1.2 Even at conclusion of the initial phase of the DVC monitoring project, the RSPCA had provided close to 9,800 records for the period 2001 – 2005 (Langbein, 2007). Since that time, over 22,000 further records have been received from the RSPCA, including 17000 for the most recent five years, as well as several thousand additional records discovered since for earlier years during a retrospective internal re-assessment during 2010/11 by RSPCA of their national TAILS database (see also section 4.2.3 below).

*Benefits and limitations of RSPCA data, and supplementary ranger data in major forests*

4.1.3 The great majority (>90%) of the records received from the RSPCA are drawn merely from that portion of all deer road casualties which survive for some time after collision with a vehicle; and for which the general public, police or other organisations may the have contacted the RSPCA to assist with treatment or human dispatch of the animal. (The RSPCA as a rule will only attend to live deer casualties, but are by no means the only organisation to do so, with in some areas forest rangers, deer managers, and other wildlife rescue organisations dealing with many additional similar incidents; whereas dead animal uplifts are generally the responsibility of the local road authorities or trunk road agents). These incident records involving attendance to live deer records are mostly referenced as 'rescue or collections' in the RSPCA logs (see **Figure C-3**). In addition a much smaller annual portion of 'advice' calls that mention involvement of deer following a collision have also been extracted for us, for which the RSPCA may not have attended or arranged help (if for example it turned from the call that the animal was already dead, had run off, or someone else was already attending to it etc.).

4.1.4 Aside from their wide distribution, advantages of records from the RSPCA include that they tend to be recorded in a standardised manner, with mostly good detail on location, often road numbers, and for about one third of records information on the deer species. The main limitation of the data at present is that location / map references (which although mostly provided at source) for a proportion of records are of rather limited accuracy. This arises from the fact that grid references have at times been allocated retrospectively from only partial (4 character) rather than full postcodes, after other parts of the incident location details had been purged (for data protection issues; as other non-wild animal records in the same database may often be private addresses). Whilst grid references allocated from 4 character postcode 'locales' can still give quite good location accuracy in towns and villages, in more rural location it can lead to mis-mapping error of one to two miles.

4.1.5 Whilst RSPCA data are regularly available in just about every district throughout England, a few areas where ironically DVCs are particularly prevalent are known to be relatively under-sampled by RSPCA data. This pertains mostly to a number of major Community Forest areas, where in view of a long history of common (weekly if not daily) occurrence of deer casualties, the local forest wildlife rangers tend to be widely known to police and general public as the first point of contact for dealing with live deer casualties; with consequently relatively few though still some calls directed there to the RSPCA. The main areas where this applies include several Forestry Commission Forests (The New Forest, Forest of Dean, Cannock Chase, Thetford and Wyre, Halden and Kielder Forest) as well as Ashridge, Epping and Ashdown Forests (managed by National Trust, City of London Corporation, and Ashdown Conservators respectively). Countryside rangers and individual private deer managers also deal with numerous call-outs to dispatch deer road casualties elsewhere across much of the rest country. However, aside from the 'case study forests' (CF) with longstanding major DVC incidence, in the wider countryside a significant and more representative proportion of calls will commonly be attended by or initially directed to the RSPCA.

4.1.6 Considering the above, despite the much more restricted resources possible to allocate to data collection in the present project, records have continued to be obtained as far as possible for those main case study forests; i.e. via Forestry Commission wildlife rangers' nationwide cull records, as well as for any DVCs attended by the non-FC rangers teams at Ashridge, Epping and Ashdown Forests. The total numbers of currently mapped records provided by RSPCA, and separately those from the above wildlife ranger teams, are shown in **Table-6** (Appendix 1) for each county or unitary authority in England. For purpose of illustrating relative distribution patterns countrywide (**Figure M-5**), the data from both these source types have been combined as "RSPCA + d-CF", and will be discussed further in Section 4.3.

## 4.2 Trends in DVC occurrence 2001 to 2010 based on RSPCA records

4.2.1 As discussed in more detail above (4.1.1) RSPCA records provide the by far largest single dataset available to the study, which is also the most representative in terms of countrywide coverage for all of England and Wales; and as such offers the best basis as an indicator of national and regional trends.

4.2.2 Findings already from the initial DI DVC project (Langbein, 2007) showed that annual numbers of RSPCA rescue calls to attend deer road casualties increased year on year from 2001 through to 2006. However, during the last two years of the present work it became apparent that numbers of records received from RSPCA had begun to decline in 2008 and dropped again in 2009 (see **Figure C-3**). That decline was at the time thought surprising, not least as on closer inspection it was found that the reductions did not relate to just some area, but occurred at very similar levels across the majority of English counties. Therefore, before looking into other likely explanations for reversal of the previously upward trend in DVC, it is important to consider first whether possibly changes in how RSPCA records are recorded and extracted might have affected that pattern.

*Potential effects of changes in recording*

4.2.3 A fall in DVCs in just some areas but not others would have been less surprising and explainable by local changes such as increased culls, public awareness or other local mitigation initiatives. However, to ensure that the more general reductions in RSPCA

DVC incidents noted were not merely an artefact caused by possible changes in how such incidents are recorded via the national helpline, we asked RSPCA during 2010 to help us look into that possibility further.

4.2.4 One outcome of this re-assessment was that significant number of additional deer collision related 'rescue or collection' incidents were extracted for our project, which had not previously been coded as RTC (road traffic collision) in the TAILS database. Secondly, using keyword searches for e.g. "road", "collision", "car" etc. among all those records mentioning deer any way, it was noted that in most years there were also many 'advice' calls (calls for which no attendance for treatment or rescue was required - all of which category had been excluded from previous RSPCA submissions to the project), which based on reading text descriptions could also be identified as being related to collisions of deer with traffic. Overall several thousand extra DVC records spanning 2001-2010 not previously available to us were extracted through the above re-assessment. However, the numbers of further records added were not hugely variable from year to year (range c. 400 to 700 per year). Overall therefore, while the extra records discovered had the effect of slightly dampening down the decline in DVCs noted post 2007, a significant decline nevertheless remains apparent among the new total numbers of RSPCA records available (**Figure C-3**). We may conclude therefore that this decline is very likely to be real rather than merely being the result of changes in recording.

*Correspondence of DVC trends with changes in road traffic 2000 to 2010.*

4.2.5 The first questions often posed by people regarding DVCs is whether this is an issue that has been increasing in recent times; and secondly if increases are largely attributable to the perceived rise in deer numbers over recent decades. The graph **Figure C-3**, based on the countrywide records from RSPCA throughout the past decade does provide a clear indication that DVCs have increased, although possibly peaked in 2007 and have been levelling off or declining since. However whether this pattern reflects changes in deer numbers is much more difficult to answer, as inevitably the numbers of vehicles, and density of roads and traffic are also key elements affecting incidence of any DVC. This in very general terms inevitably leads to countries with deer populations of not dissimilar size (e.g. England vs. Scotland with approximate deer population sizes of 600,000 to 800,000 each; or Sweden and Spain with deer numbers between with 1.0 to 1.5 million, Appolonio et. al 2010]) to incur very widely differing annual tolls of DVCs (estimated at 42500, 10,000, 61,000 and <5000 in these four countries respectively (see Langbein et.al. 2011).

4.2.6 Although here in England it is now widely accepted that there has been a considerable expansion in the distributional range of most our deer species over the last 30 years (Ward, 2008; POST 2009, Watson et. al 2011), there remains a lack of quantitative information to underpin this; both of a) the actual extent to which deer numbers have increased over recent years; and b) the (relative) number of DVCs which were occurring in previous decades for comparison to results from this first systematic attempt at recording DVCs nationwide . What is **known** is that traffic volumes on roads in Britain have doubled over that same period overall, and in the case of rural roads have nearly trebled. Therefore, even if deer numbers had not increased over last 30 years, the annual incidence of DVC would very likely still have increased substantially throughout the UK.

**Figure C-3** Change in annual numbers of DVC related records from RSPCA 2001 to 2010 ('rescues' relate almost exclusively to live deer casualties requiring treatment or humane dispatch; advice calls may include other live or some dead casualties where no attendance for animal welfare needed).

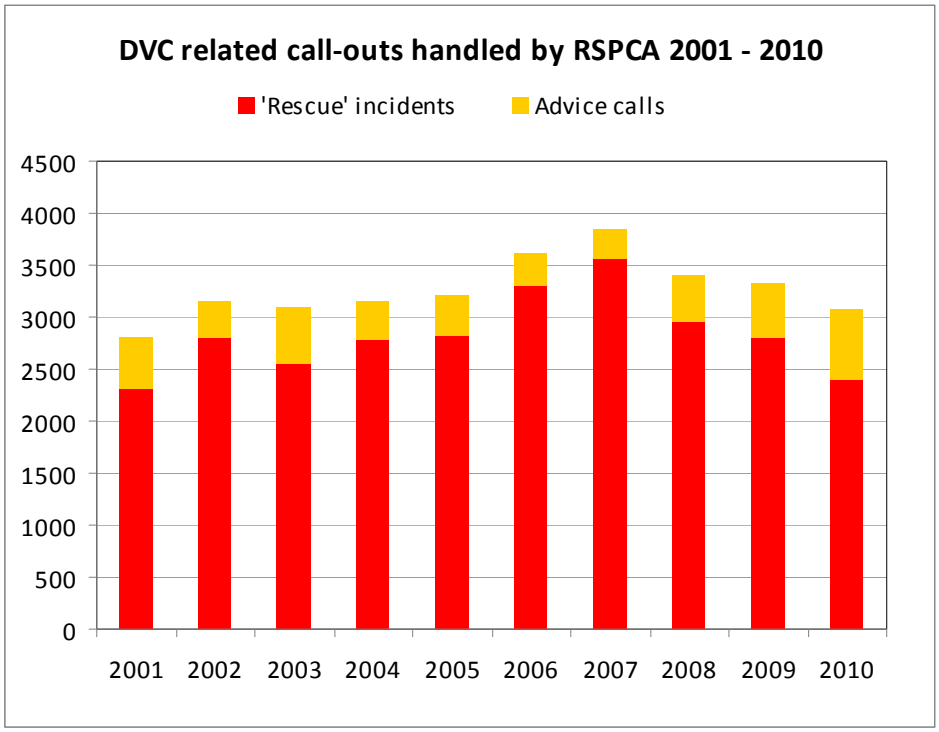



**Figure C-4** : Change in Road traffic by road class in Great Britain 2000 - 2010

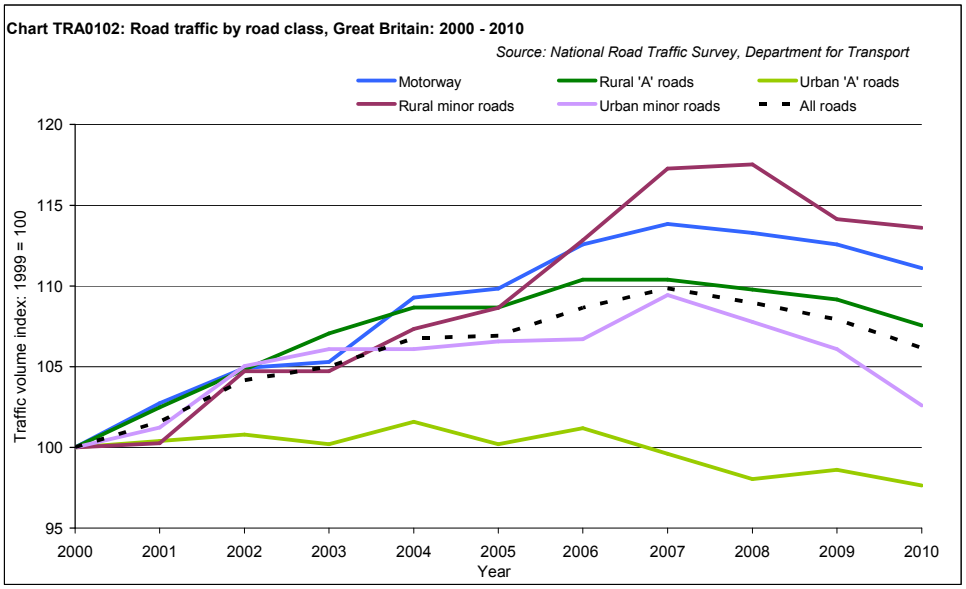



**Table-5 : Road Taffic in Britain 2006 - 2010 (in billion vehicle miles)**

| | 2006 | 2007 | 2008 | 2009 | 2010 |
|---|---|---|---|---|---|
| England | 270.7 | 273.5 | 271.2 | 268.5 | 264.3 |
| Wales | 17.4 | 17.6 | 17.6 | 17.4 | 17.0 |
| Scotland | 27.3 | 27.6 | 27.5 | 27.3 | 26.8 |
| Great Britain | **315.4** | **318.8** | **316.2** | **313.2** | **308.1** |

*(source : DfT National Road Traffic survey, June 2011 update)*

4.2.7 The first year ever since the 1950s that a reduction in total traffic in Britain has been recorded was 2008 (**Figure C-4**). That reduction of around 1% year on year has continued since for 2009 and 2010, with the similar trends on both minor as well as major roads. Comparison of Figure C-3 and Figure C-4 show an almost uncanny match of the patterns of RSPCA DVC reports with the changes in recorded traffic flow. The particularly close fit here may be partly fortuitous, as clearly other factors (including not least deer abundance, but for which no good estimates of extent of change over this period are available) will also be likely influence the overall incidence of DVC. Nevertheless, the co-incidence with changes in traffic does provide one possible explanation, and indication that DVCs may be falling overall even though quite possibly deer numbers are still thought to be increasing.

4.2.8 Nearly 86% of the overall road traffic in Britain occurs in England, but similar reductions averaging just under 1% per year have also been recorded in Scotland and Wales (see Table-5), though less clear here until 2009. Recent findings from our parallel DVC research in Scotland (Langbein, 2011) do also show some indication that based on incidents from the Scottish SPCA, which doubled between 2005 (151) to 2008 (322), may have starting to level off since (2009 :295; 2010: 349) although a clear persistent decline is not yet apparent there.

## 4.3 Relative abundance of DVC records by region and local authority areas

4.3.1 The national distribution of DVC reports collated from among each of the many differing data source types drawn on during the initial five years of the project were presented and discussed in some detail in previous reports (Langbein, 2007; 2010a; Deer Initiative, 2007). One drawback at this stage was that for many data categories much better information was available for some regions and/or year than others, limiting their suitability for comparison across regions and monitoring changes. In the present report it is the intention instead to focus assessment on the more restricted range of data source categories that, on their own or in combination, can provide the most extensive sampling across most of the road network throughout England; with at the same time least potential for regional or temporal bias of recording.

4.3.2 As discussed in earlier sections (and see 4.1.5 above), our most extensive and best stratified data set across England, for which input is available throughout all of the past ten years consist of “RSPCA+CF” records (i.e. RSPCA records supplemented by forest ranger records for that small number of case study forests where, in view of traditionally high numbers of DVCs the local wildlife rangers rather than RSPCA tend to receive majority of initial call-out requests to live injured deer). **Table-6** (Appendix 1) shows the number of (mapped) DVC records available from both these sources for each of 120 separate County or Unitary Council areas for England, presenting for comparison separate totals for the first four years (2003-2006) and last four years (2007-2010) of the study. Also shown broken down by Local Authority areas in **Table-6** are the numbers of DVC records obtained from our other core data source category – UT (Trunk road agents and/or NCC). These latter records also still provide wide coverage across much of England over the past decade, but are less directly comparable across all local authorities; i.e. as some are traversed by only comparatively short lengths of trunk road, whilst on the other hand recording of DVCs in fact tends to be rather better for trunk than non-trunk roads. [Full tabulation broken down further into the 300+ district / unitary and borough council areas is will be made available on-line at the project web-sites.

*Differences in RSPCA DVC call-out frequency at regional level*

4.3.3 Records from the RSPCA are shown re-summarised by region[3] in Figures **C-5** and **C-6**. Figure **C-5** illustrates well that although (as discussed above in section 4.2, and see also Fig C-6) average annual tolls rose substantially up until 2007, the proportion recorded in each region has remained very consistent.

**Figure C-5**: RSPCA DVC reports in England by Region and study periods

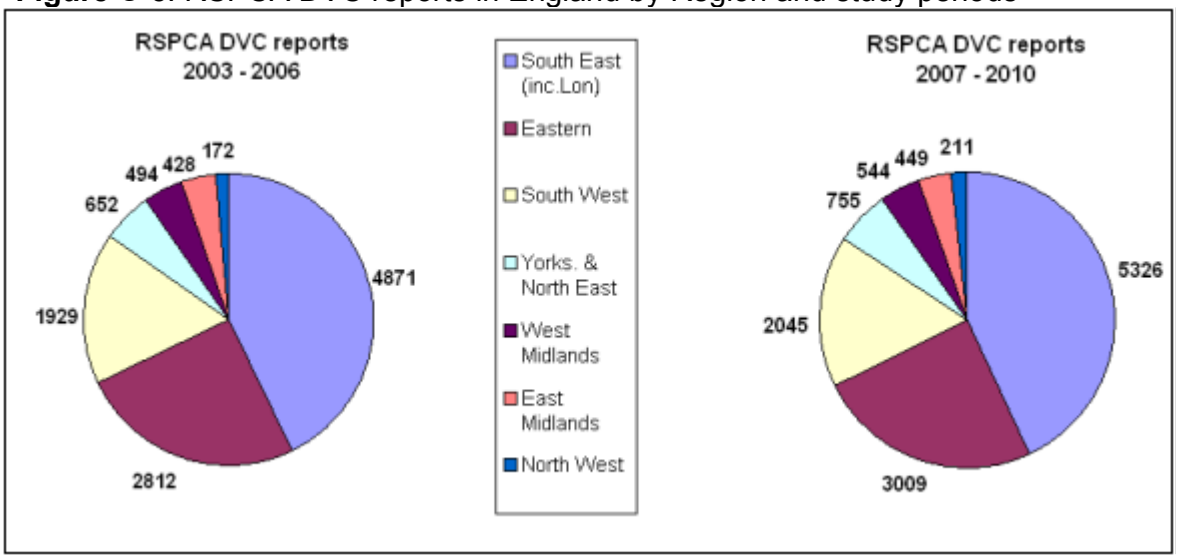
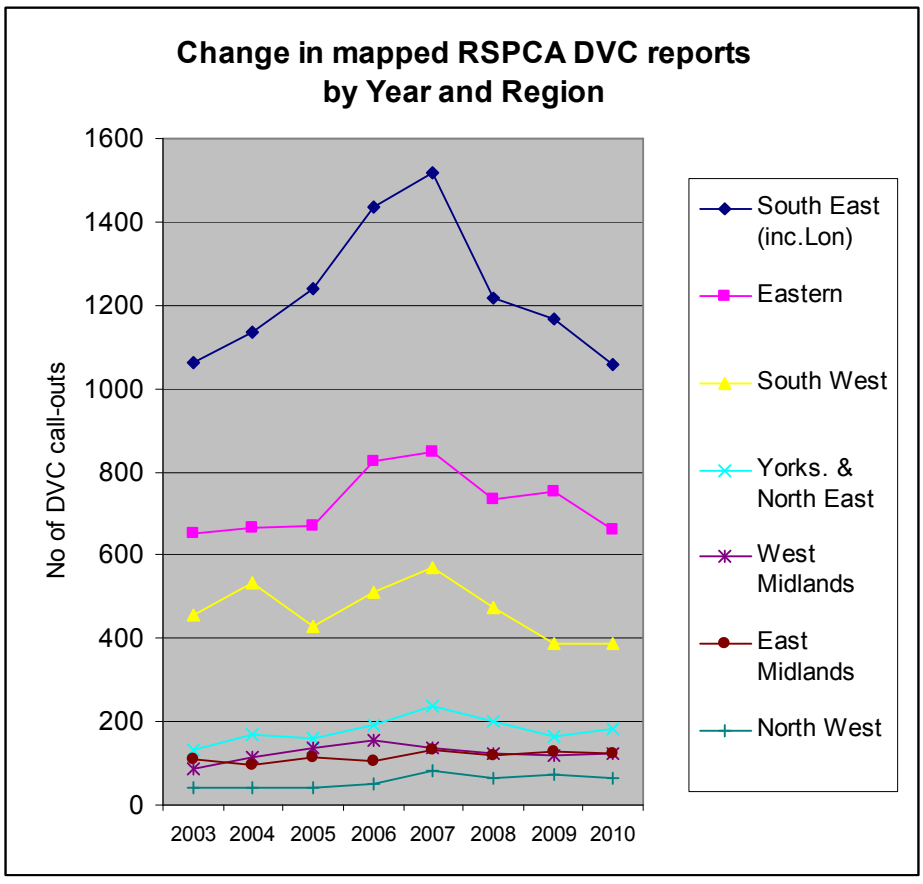



**Figure C-6** : Change in RSPCA DVC records by region and year




[3] Figures relating to the nine main regions of England for purpose of this reports have been combined into seven regions (including Greater London with figures for Southeast; and Yorkshire & The Humber with the North East)

4.3.4 Changes by region for the most recent three years (2008 – 2010), when some overall decline in total numbers of RSPCA DVC reports was recorded, are shown in further detail in **Table-7**, and compared to the annual average for 2003-2007. In the first instance this highlights again that the proportion of records from different regions have remained broadly similar. However, this regional breakdown also shows that such declines in records as have occurred overall since 2007 have largely been confined to those three regions where highest annual tolls of DVCs have been recorded throughout (SE, SW and East); whereas in case of the remaining regions figures have remained either very close to the pre-2008 average (W & E Midlands and York&NE) or in case of North West England actually indicate an increase (see also Figures C-5, M-5 and M-6).

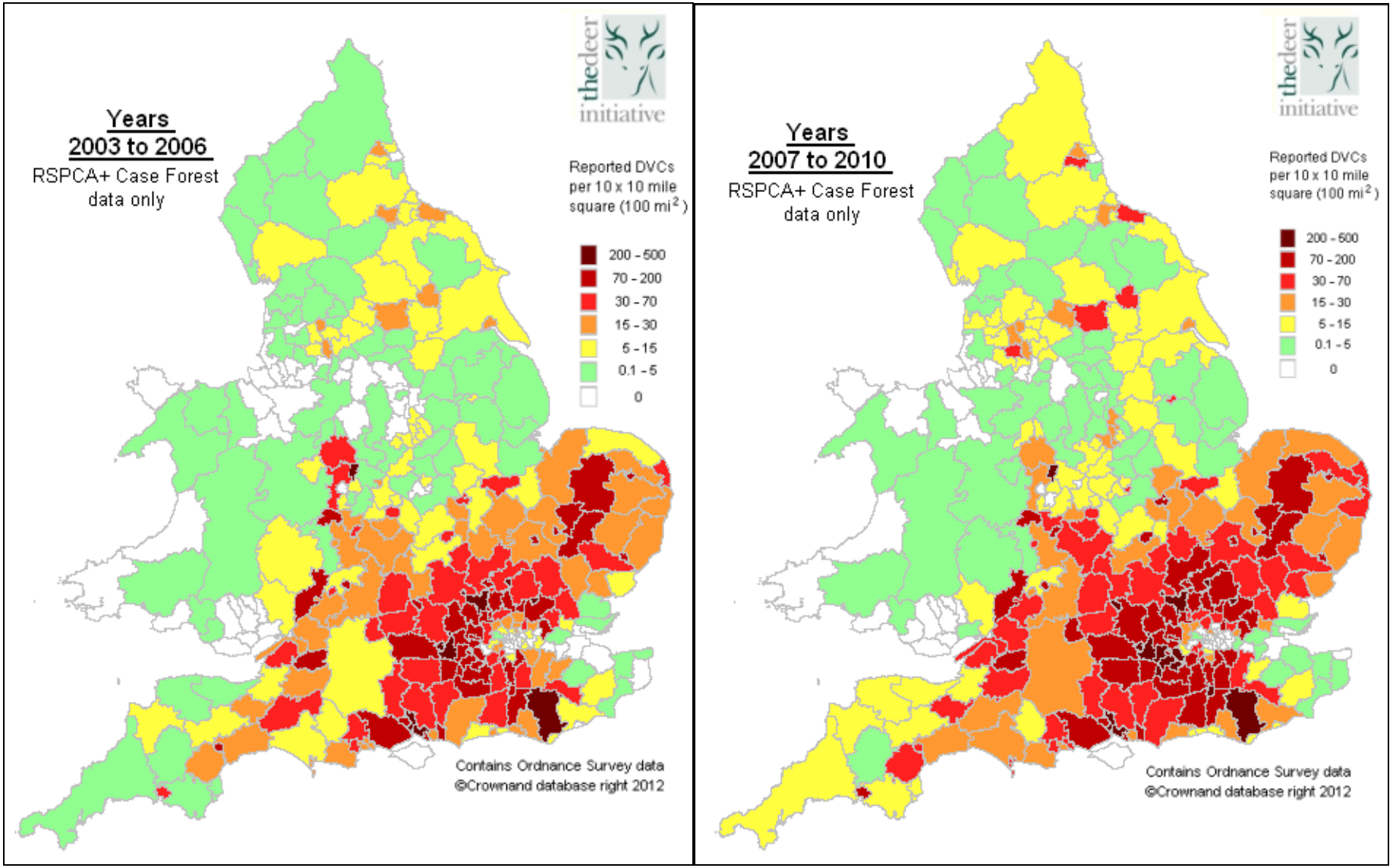
**Table-7 :** Number and percentage of RSPCA DVC reports and traffic by region

| Region | Average 2003-2007 | 2008 | 2009 | 2010 | | Traffic Volume 2010 | *Rate /traffic 2010 |
|---|---|---|---|---|---|---|---|
| **South East (inc.Lon.)** | 1277.8 | 1219 | 1169 | 1057 | | 72.3 | 14.62 |
| *(% of England Total)* | *42.9%* | *41.6%* | *41.9%* | *40.6%* | | 27.4% | |
| **Eastern** | 732 | 734 | 751 | 660 | | 34.0 | 19.41 |
| *(% of England Total)* | *24.6%* | *25.1%* | *26.9%* | *25.4%* | | 12.9% | |
| **South West** | 500.2 | 472 | 389 | 387 | | 29.7 | 13.03 |
| *(% of England Total)* | *16.9%* | *16.1%* | *13.9%* | *14.9%* | | 11.2% | |
| **Yorks. & North East** | 177.4 | 201 | 165 | 183 | | 38.0 | 4.82 |
| *(% of England Total)* | *5.9%* | *6.9%* | *5.9%* | *7.0%* | | 14.4% | |
| **West Midlands** | 126.4 | 121 | 117 | 124 | | 30.3 | 4.09 |
| *(% of England Total)* | *4.2%* | *4.1%* | *4.2%* | *4.8%* | | 11.5% | |
| **East Midlands** | 112 | 117 | 127 | 125 | | 25.1 | 4.98 |
| *(% of England Total)* | *3.8%* | *4.0%* | *4.6%* | *4.8%* | | 9.5% | |
| **North West** | 50.6 | 65 | 73 | 66 | | 34.8 | 1.90 |
| *(% of England Total)* | *1.7%* | *2.2%* | *2.6%* | *2.5%* | | 13.2% | |
| **England** | **2976.4** | **2929** | **2791** | **2602** | | **264.3** | **9.84** |
| *(% of England Total)* | *100.0%* | *100.0%* | *100.0%* | *100.0%* | | 100.0% | |

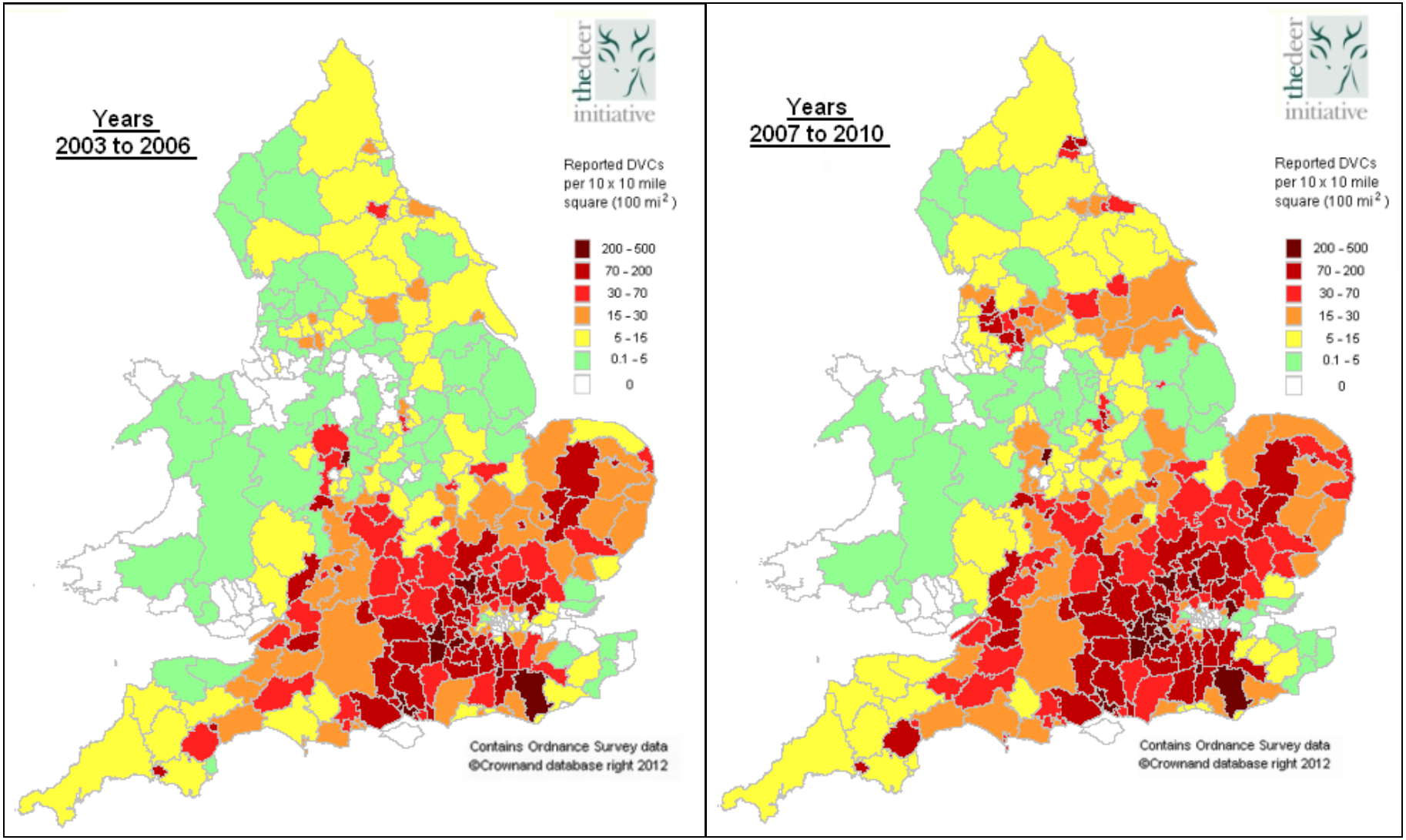
[Ann.Traffic measured in billion vehicle miles; *Rate= RSPCA DVC logs per $10^9$ vehicle miles]

4.3.5 **Table-7** also shows the total annual volume of traffic for each region during the most recent study year (2010), and rates of RSPCA call-outs to deer injured in DVCs per driven vehicle mile. Even after taking into account differences in traffic between regions, the highest rates by far remain those recorded in Eastern, Southeast and Southwest England. For East of England region in particular, Table-7 shows that while it carries around 12.9% of all traffic volume, close to a quarter of all (RSPCA) DVCs are recorded here, with a rate in relation to traffic twice the countrywide average. This is closely in line with separate rates restricted to trunk road DVCs (discussed in Section 3 ; and see Table-4) based predominantly on independent data provided by trunk road agents, where highest rates were also recorded in East of England followed by SW and SE England. This illustrates that while high DVC tolls are inevitably linked to areas with also high levels of traffic, the relative rates of DVCs recorded across the East and Southwest and Southeast England well exceed what might be expected based on regional differences in traffic volumes alone. The higher rates are likely therefore to reflect also real underlying differences in deer abundance.

**Figures M-5a & M-5b :** Relative distribution of DVCs by District council or Unitary authority area boundaries (restricted to data provided by RSPCA throughout England and Wales, plus wildlife rangers from Case Study Forests only).



**Figures M-6a & M-6b :** Relative rates of *reported* DVC occurrence (per unit area) shown by District, Borough or Unitary councils (as Fig._M-5, but here in addition to records provided by RSPCA and forest wildlife rangers, data from Trunk road maintenance teams are also incorporated).



*Incidence and changes over time in DVCs assessed at the level of local authority districts*

4.3.6 Results discussed above show that very clear differences in relative frequency of reported DVCs are apparent even when considered at the level of the seven main regional subdivisions of England. However, within each region, or even within the next lower administrative tier of counties or unitary local authorities, DVCs are mostly far from evenly distributed, with sometimes extremely high levels in some parts of a county but quite few in others. For purpose of mapping and illustrating the relative distribution of reported DVCs across England and Wales in smaller but still readily identified, meaningful areas, records have therefore been assessed and presented at the level of the 201 constituent Local authority district councils (for those county councils are sub-divided in that way), plus the 78 Unitary Councils, 33 London Boroughs and 36 Metropolitan districts. The numbers of DVC reports accrued and mapped for each of these areas as obtained through RSPCA, Case Study Forest rangers, and trunk maintenance teams are provided in **Table-6** (Appendix I).

4.3.7 To take account of the variable size of differing administrative districts before mapping, the frequency of recorded DVCs falling within each local authority district were then divided by their land area, to derive a figure for the numbers of DVCs reported per 100 square miles in each case. Map **Figures M-5a** and **M-5b** show the relative frequency of DVCs across England (& Wales) when including only data from RSPCA + CF rangers (see 4.3.2 above), providing the most consistent samples available across all districts. The two maps, shown here side by side, enable also comparisons of relative DVC frequencies during the first four years after commencement of the initial project in 2003 with those for the four most recent study years (2007 to 2010). Some of main points arising from these maps include:

i. The averaged rate of DVC (per 10 mile by 10 mile square) ranges from as low as 0 to 5 in some districts right up to 200 to 500 recorded in each 4 year period in others.

ii. Highest average DVC rates have consistently been recorded within Southeast England, especially districts in the M25-sphere around London. In addition a number of other districts also in the highest frequency but outside the SE region encompass some of our case study forests with historically high levels of DVCs (incl. e.g. Forest of Dean, Ashdown [esp. Wealden district], New Forest, Thetford, Cannock and Wyre Forest districts; as well as at Ashridge (esp. Dacorum district) and Epping Forest district in the Southeast).

iii. The lowest average DVC rates in the early as well as later phase of the project have been recorded mostly across much of Wales, The Midlands and parts of Northern England. [RSPCA animal rescue logs for Wales are available in same manner as in England (as evident e.g. from inspections of call-out logs to injured badgers and foxes which confirm wide RSPCA coverage throughout Wales].

iv. Within Southern England, the only areas where we have recorded zero or else fewer than 5 incidents per 100 square miles are some districts in central London, Rochford, Thurrock, Southend-on Sea and some eastern districts of Kent.

v. Comparisons between the two study periods demonstrate clearest increases since 2006 in particular a) in several districts within northern England and the Midlands where very few DVCs were reported during 2003 to 2006 but have increased since to rates of >15 or >30 per 100 sq miles, and b) all but one district in SW England previously shown in lowest rate-band (green), increasing to at least the next highest band (yellow or orange).

vi. In Southeast and East of England where relatively high rates were already recorded for most districts during 2003-2006, rates in the great majority of districts assessed over the subsequent four year period have remained broadly similar to before or else increased to the next highest rate band. Rates based on totals for the last four years only show a decrease in a very small number of districts at this stage, although overall numbers of RSPCA plus ranger records in SE and E of England dare known to have fallen by 10 to 20 % in the last two years compared to 2007.

4.3.8 For map figures **M-5a** and **M-5b** only data 'RSPCA + CF' data were included to provide for fairest possible direct comparisons across all local authority districts. Trunk road agent data on dead deer uplifts were deliberately excluded to avoid potential overemphasis of those districts that are traversed by a relatively high proportion of the trunk network. However, while in our overall database trunk road records make up only around 15% of all available records, for close to a third of all district council areas trunk road records contribute over 30% and in case of 1/6$^{th}$ over 50% of all recorded DVCs available. In Figures **M-6a** and **M-6b** the additional records provided by trunk agents have been included in calculation of overall combined DVC rates by district.

4.3.9 Comparison of Figures **M-6a** and **M-6b** illustrate that while some increase in DVCs over recent years for parts of northern England was also already indicated on the basis of RSPCA data alone (Fig.M-5b), these increase are shown up much more clearly on inclusion also of trunk road records that have become available here for recent years. The districts where greatest increases have been recorded here are in particular Preston, South Ribble, Chorley, Bolton and Bury. In addition an increase is notable more generally along the M6, M65, M61 and M62 corridors right through from South Lancashire and the Wirral in the west to the East Riding of Yorkshire and North Lincolnshire in the East. Improved abstraction by HA agents of trunk records in this region may have contributed to some extent here, although similar trend in RSPCA data suggests a real increase in DVC occurrence here, as well as the value of the records now more consistently obtained via trunk maintenance operators.

4.3.10 For other regions aside from northern England, inclusion of the trunk road data in DVC rate calculations does not appear to affect the overall relative patterns arising notably, but adds significantly to the base data available in each area. Not least as in some parts of the country DVC records for trunk roads make up a very high proportion of all available / obtainable records, collection of data on deer casualties logged by trunk road operators and maintenance teams should ideally continue to form part of any future DVC monitoring scheme.

# 5 ROAD TRAFFIC COLLISIONS INVOLVING DEER LEADING TO HUMAN CASULATIES

## 5.1 Introduction

5.1.1 Personal Injury Accidents (PIA) arising through road traffic collisions with or swerving to avoid deer have formed an important element of the previous as well as continued monitoring during present study, not merely because of the serious nature and economic cost of these incidents, but also because such data when available are mostly of good quality, with fairly precise details on location, date/time, severity of casualties, and road conditions. Furthermore, human injury accidents are the main and often sole criteria used for prioritising funding for local road safety projects in the UK. Therefore, although equal concern about the issue of DVCs relates to the toll of tens of thousands of annual deer road casualties and high level of associated animal suffering, information on the 'human costs' form a vital part in the decision making processes wherever expenditure from public funds is required for preventative measures.

5.1.2 Fortunately deer related PIAs tend to constitute only a quite modest percentage of all DVC, estimated in our own previous study at 1.1% to 1.5% for England (Langbein, 2007). Recent figures available for Germany also suggest a human injury rate of just over 1% of all DVCs (DJV, 2010) based on an overall reported toll of 206,700 deer road casualties there in 2009. Nevertheless, where deer related PIA are consistently recorded and identifiable from county or national road accidents statistics, such human injury records have much potential to provide a valuable, well stratified sample of DVC information; which unlike many other sources of DVC data should not have any inherent reporting biases towards particular areas, road types, or time of day.

5.1.3 Although a great amount of detail is recorded and collated on every road traffic accident involving human injury for national statistics collated by The Department of Transport (DfT), it is not at present possible from their database to distinguish between incidents involving differing animal types, other than dogs and ridden horses. Thus, the main ST19 return forms completed by police for any human injury road accidents (and details from these retained by DfT for compiling national statistics) will, in cases where an animal was implicated in some way, only systematically record the animal type for 'dogs' and 'ridden horses'. Whilst deer-specific incidents could therefore not be extracted for us from DfT road accident data, the original incident report forms completed by police do often contain further detail on each incident; including often a short free-form text description of the accident circumstances as summarised by the attending police officer. Contact was made during the project with most of the 40 or so autonomous police forces, or alternatively in many cases with Road Safety teams at county councils (who in some areas collate ST19 police records in extra detail), to request keyword searches of their local human injury road accident databases for any mention of 'deer' within the free text accident descriptions. For police forces where this was possible, similar further requests were then repeated at one or two year intervals to update these data.

5.1.4 A number of polices forces or county road safety teams approached informed us that they were unable to search for and identify 'deer' incidents separately from other animal related PIAs, as their text descriptions of incidents are not retained within their computerised road accident databases. However, a high proportion of police or council road safety teams approached agreed to undertake data searches and provide details on any PIAs where incident descriptions specifically mentioned deer for further analysis.

**Table-8** : Human injury road accidents linked to deer by year (for sample of 38 local authority areas with comparable data)

| Loca Authority | Personal injury road traffic accidents (PIA) linked to collision with or presence of deer on roads | | | | | | | | | | | | | | | | All PIAs reported 2010 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | **Grand Total** | Avg 99_02 | Avg 03_06 | Avg 07_10 | |
| HAMPSHIRE | 27 | 13 | 20 | 16 | 18 | 17 | 13 | 15 | 26 | 21 | 16 | 18 | **220** | 19.0 | 15.8 | 20.3 | 4,409 |
| SUFFOLK | 8 | 9 | 14 | 16 | 14 | 16 | 15 | 20 | 19 | 17 | 11 | | **159** | 11.8 | 16.3 | 15.7 | 1812 |
| ESSEX | 10 | 13 | 3 | 15 | 13 | 10 | 8 | 8 | 9 | 12 | 13 | 11 | **125** | 10.3 | 9.8 | 11.3 | 4,007 |
| OXFORDSHIRE | 9 | 9 | 6 | 10 | 10 | 11 | 13 | 11 | 11 | 5 | 10 | 7 | **112** | 8.5 | 11.3 | 8.3 | 1652 |
| SURREY | 2 | 3 | 4 | 10 | 7 | 10 | 6 | 15 | 6 | 10 | 6 | 16 | **95** | 4.8 | 9.5 | 9.5 | 3803 |
| NORFOLK | | | | 6 | 8 | 8 | 12 | 11 | 6 | 13 | 9 | 9 | **82** | i.d. | 9.8 | 9.3 | 1,796 |
| BUCKINGHAMSHIRE | 6 | 3 | 4 | 3 | 6 | 11 | 9 | 6 | 3 | 4 | 2 | 4 | **61** | 4.0 | 8.0 | 3.3 | 1,909 |
| HERTFORDSHIRE | 4 | 6 | 7 | 6 | 5 | 10 | 6 | 5 | 4 | 7 | | | **60** | 5.8 | 6.5 | 5.5 | 2,702 |
| DORSET | 4 | 2 | 5 | 1 | 7 | 7 | 2 | 5 | 6 | 9 | 6 | 5 | **59** | 3.0 | 5.3 | 6.5 | 1,950 |
| DEVON | 3 | 8 | 5 | 6 | 6 | 10 | 3 | 5 | 7 | 1 | | | **54** | 5.5 | 6.0 | 4.0 | 2,867 |
| EAST_SUSSEX | 2 | 1 | 2 | 3 | 8 | 1 | 7 | 5 | 6 | 5 | 4 | 8 | **52** | 2.0 | 5.3 | 5.8 | 2,225 |
| GLOUCESTERSHIRE | 1 | 3 | 3 | 10 | 7 | 4 | 3 | 4 | 5 | 4 | 2 | 3 | **49** | 4.3 | 4.5 | 3.5 | 1,146 |
| WEST_SUSSEX | | | 1 | 3 | 2 | 9 | 2 | 10 | 5 | 2 | 6 | 8 | **48** | 2.0 | 5.8 | 5.3 | 1818 |
| WEST_BERKSHIRE | 8 | 5 | 4 | 2 | 5 | 3 | 6 | 3 | 7 | 1 | 1 | 3 | **48** | 4.8 | 4.3 | 3.0 | 323 |
| CAMBRIDGESHIRE | | | 6 | 4 | 3 | 3 | 1 | 6 | 9 | 5 | 5 | 5 | **47** | 5.0 | 3.3 | 6.0 | 2,551 |
| SOMERSET | 4 | 0 | 5 | 4 | 5 | 6 | 2 | 5 | 4 | 5 | 2 | 1 | **43** | 3.3 | 4.5 | 3.0 | 1272 |
| LINCOLNSHIRE | 2 | 2 | 3 | 4 | 4 | 5 | 1 | 5 | 5 | 2 | 4 | 6 | **43** | 2.8 | 3.8 | 4.3 | 2434 |
| WILTSHIRE | | | | 1 | 6 | 5 | 3 | 3 | 4 | 2 | 4 | 4 | **32** | i.d. | 4.3 | 3.5 | 1279 |
| C.BEDFORDSHIRE | 2 | 3 | 4 | 4 | 3 | 2 | 1 | 3 | 1 | 2 | | | **25** | 3.3 | 2.3 | 1.5 | 686 |
| KENT | 1 | 2 | 2 | 3 | 0 | 1 | 2 | 2 | 5 | 2 | 1 | 4 | **25** | 2.0 | 1.3 | 3.0 | 4,837 |
| NORTH_YORKSHIRE | | | | | 0 | 0 | 3 | 3 | 4 | 6 | 4 | 2 | **22** | i.d. | 1.5 | 4.0 | 2105 |
| WARWICKSHIRE | 3 | 3 | 4 | 2 | 5 | 2 | 2 | | | | | | **21** | 3.0 | 3.0 | i.d. | 1506 |
| NORTHAMPTONSHIRE | | | | 6 | 3 | 5 | | | | | | | **14** | i.d. | 4.0 | i.d. | 1329 |
| WOKINGHAM (U) | 0 | 1 | 1 | 0 | 0 | 2 | 2 | 1 | 1 | 1 | 3 | 2 | **14** | 0.5 | 1.3 | 1.8 | 302 |
| WIND.&MAID'HEAD (U) | 4 | 1 | 1 | 0 | 1 | 1 | 2 | 2 | 1 | 0 | 0 | 0 | **13** | 1.5 | 1.5 | 0.3 | 345 |
| CUMBRIA | 2 | 1 | 1 | 0 | 1 | 1 | 3 | 2 | | | | | **11** | 1.0 | 1.8 | i.d. | 1,284 |
| BRACKNELL_FOR. (U) | 1 | 1 | 0 | 0 | 2 | 0 | 2 | 0 | 0 | 1 | 1 | 2 | **10** | 0.5 | 1.0 | 1.0 | 230 |
| HEREFORDSHIRE | | | 0 | 2 | 2 | 3 | 2 | 1 | | | | | **10** | 1.0 | 2.0 | i.d. | 475 |
| NOTTINGHAMSHIRE | 1 | 2 | 1 | 0 | 2 | 1 | 1 | 2 | | | | | **10** | 1.0 | 1.5 | i.d. | 3004 |
| S.GLOUCESTERSHIRE | 1 | 0 | 0 | 1 | 1 | 0 | 2 | 1 | 1 | 0 | 0 | 0 | **7** | 0.5 | 1.0 | 0.3 | 621 |
| ***Sub-total (top 30)*** | ***105*** | ***91*** | ***106*** | ***138*** | ***154*** | ***164*** | ***134*** | ***159*** | ***155*** | ***137*** | ***110*** | ***118*** | ***1571*** | ***110.0*** | ***152.8*** | ***130.0*** | ***56,679*** |
| | | | | | | | | | | | | | | *(n=24)* | *(n=30)* | *(n=25)* | |

contin ….

Table-8 continued (part 2 ) :

| Loca Authority | Personal injury road traffic accidents (PIA) linked to collision with or presence of deer on roads | | | | | | | | | | | | | | | All PIAs reported 2010 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | **Grand Total** | Avg 99_02 | Avg 03_06 | Avg 07_10 | |
| continued… | | | | | | | | | | | | | | | | | |
| MILTON_KEYNES (U) | 1 | 2 | 0 | 0 | 2 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | **6** | 0.8 | 0.8 | 0.0 | 648 |
| BEDFORD (U) | | | 0 | 0 | 0 | 1 | 0 | 1 | 2 | 1 | | | **5** | 0.0 | 0.5 | 1.5 | 408 |
| PETERBOROUGH (U) | | | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 2 | 1 | 0 | **5** | 0.0 | 0.3 | 1.0 | 708 |
| SHROPSHIRE | | | | 1 | 1 | 1 | 1 | 1 | | | | | **5** | i.d. | 1.0 | i.d. | 580 |
| CORNWALL | | 1 | 0 | 0 | 1 | 2 | 0 | 0 | | | 1 | | **5** | 0.3 | 0.8 | i.d. | 1,414 |
| WORCESTERSHIRE | | | 1 | 0 | 0 | 0 | 1 | 2 | | | | | **4** | 0.5 | 0.8 | i.d. | 1274 |
| SWINDON_(U) | | | | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | **3** | i.d. | 0.3 | 0.5 | 386 |
| LUTON_(U) | | | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | | **1** | 0.5 | 0.0 | 0.0 | 516 |
| Sun-total (bottom 8) | 1 | 3 | 2 | 1 | 4 | 5 | 2 | 6 | 4 | 3 | 2 | 1 | 34 | 1.8 | 4.3 | 2.5 | 5,934 |
| Sub-total (top 30) | 105 | 91 | 106 | 138 | 154 | 164 | 134 | 159 | 155 | 137 | 110 | 118 | 1571 | 110.0 | 152.8 | 130.0 | 56,679 |
| Grand Total | **106** | **94** | **108** | **139** | **158** | **169** | **136** | **165** | **159** | **140** | **112** | **119** | **1605** | **111.8** | **157.0** | **132.5** | **62,613** |
| | | | | | | | | | | | | | | n=32 | n=38 | n=30 | |
| | | | | | | | | | | **Annual Average per authority:** | | | | 3.5 | 4.1 | 4.4 | |

Notes:

i) figures show numbers of separate accidents reported with at least one or more human casualties. On average for all PIAs in England the total number of reported casualties generally lies approximately 35% higher than the number of accidents.

ii) grey boxes indicate any years for which searches of police data covering that authority were unavailable for all or part of year.

iii) the sample of 38 local authorities for which searches of official ST19 data spanning at least 3 to 12 years were obtained, between them in 2010 accounted for 45.6% of PIAs of all types recorded in England (62,613 of 185,369).

[i.d. = fewer than minimum of two years of data available for calculation of average for period]

## 5.2 Results

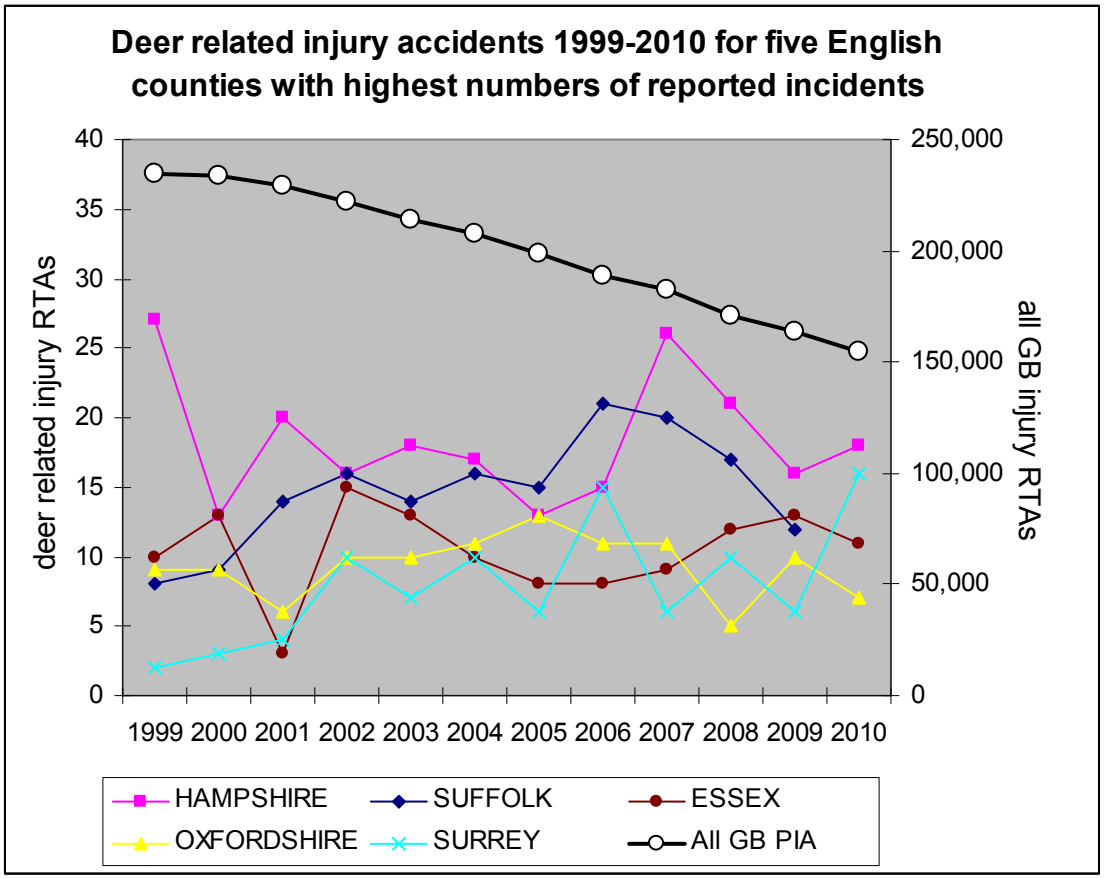
5.2.1 During the initial 2003 to 2005 project information on deer related PIAs was obtained for a sample of 31 different county or unitary local authorities, giving details of close to 1000 separate human injury DVCs occurring in England between 1998 to 2005 across all road types. For 17 of the local authorities available data spanned all eight years, while for another 14 records covered at least three or more full years. Since that time the sample of local authority areas covered by keyword searches for 'deer' related PIAs has been possible to expand to 38 (information available now spanning 10 to 12 years for about half, with data for at least six full years for most of the remaining authorities); and increasing the available overall sample of human injury DVCs in the DI DVC database to 1876. This *sample* of PIAs in which deer were implicated in some way included 35 (1.8%) fatal, 304 (16.2%) serious, and 1537 (82%) slight injuries accidents (based on highest severity level per accident with more than one casualty).

5.2.2 The breakdown of the above PIAs among those local authority areas for which these data could be obtained is shown in **Table-8**, showing the numbers of incidents for each full year for which RTA database searches for that area are available between 1999 to 2010. Also given are average annual figures comparing the three consecutive four year periods 1999-2002, 2003-2006, and 2007-2010 for each authority [with averages given only where data are available for at two years out of each four year period].

5.2.3 **Table-8** shows that highest annual levels of deer PIAs have consistently been recorded throughout the past decade in Hampshire, Suffolk and Essex, each regularly recording over 10 to 20 injury accidents involving deer per year, with an average over 20 in Hampshire over the past 4 years. Other individual local authorities where average numbers of recorded deer related PIAs in recent years have mostly exceeded 5 to 9 per year include Oxfordshire, Norfolk, Surrey, Hertfordshire, Dorset, Devon, Cambridgeshire, Buckinghamshire, East Sussex and West Sussex; a further 20 local authorities where equivalent data are available recorded 1 to 4 deer PIAs a year.

5.2.4 **Figure C-7** summarises changes from 1999 to 2010 for those five counties where the highest total numbers of deer PIA have been recorded. Number can be seen to fluctuate quite widely from year to year, but neither a very clear upward nor downward trend is apparent overall. Particularly noteworthy in this context is that the lack of a clear downward trend in recorded deer-related PIAs runs counter to a very significant decline in numbers of personal injury road accidents of all types over the past decade (DfT, 2011), which have fallen by as much as 25 to 35% in most parts of Britain since 1999. Considered across all those areas for which we have comparable data, the average number of deer related PIAs reported during 2007-2010 was higher in approximately as many local authorities as it was lower when compared to either the averages for 2003-2006 or 1999-2002 (see Table-8). The average number of deer PIAs per local authority (adjusted for sample size) in fact shows some evidence of an increase from 3.5 in 1999-2002 to 4.0 for 2003-2006, and 4.4 in 2007-2010. The fact that reported deer PIAs do not appear to have fallen significantly over recent years, or at least not by as much as might be expected in line with trends in road traffic PIAs overall, suggest firstly i) that DVCs are still likely to be increasing overall, and secondly ii) that the percentage of PIA among all PIA is also rising.

**Figure C-7**: Change in reported deer related personal injury road accidents in counties of Hampshire, Suffolk, Essex, Oxfordshire and Surrey 1999 to 2010.




***Estimating actual numbers of deer related PIAs per year***

5.2.5 Figures presented above show that among our sample of 38 local authorities for which comparable data were obtained (which between them account for approximately 46% of PIAs of all types in England) the number in which deer were specifically mentioned in accident descriptions averaged 132.5 per year during 2007 to 2010. Although this figure provides a good starting basis for tentative extrapolation of the actual number of deer related PIAs, a number of other factors aside from sample size need to be considered for such estimation:

5.2.5.1 The sample of local authorities in England covered by comparable searches for deer related PIA records during 2010 between them accounted for 45.6% of the total number of road traffic PIAs reported in England during 2010. On the assumption that the average proportion of deer related incidents will be broadly similar also for those authorities for which comparable searches to identify deer related ones are currently unavailable, suggests the total number of potentially retrievable records countrywide would lie in the region of 290 per annum (i.e. 132.5/0.456).

5.2.5.2 A previous assessment undertaken by us (see Langbein, 2007) based on detailed inspection of accident text descriptions for a sample of 1900 road traffic related PIAs involving animals of any kind (excluding dogs recorded separately), showed that among those where the type of animal was stated, deer were the most frequent (23.5%), followed by horses & ponies (19.6%), rabbits & hares (11.5%) and foxes (9.7%); with others such as cats, badgers, sheep, cows, and pheasants contributing lower amounts from 2 to 7%. In addition, 20.5% of incidents records stated collision with or swerving to avoid 'an animal' without the animal type being mentioned. It is likely that deer will be represented also among these 'non-specific' animal incidents in similar proportion to

above. By adjusting the previous figure of 290 (from i. above) by a factor of x1.2 to account for those incidents where no animal type is stated, an estimate of the average likely number of deer related incidents among all those PIAs reported in ST19 records in England may be derived as 348 (i.e. 290 x 1.2). Evaluating the above estimate of 348 deer PIAs annually against the most recent 2010 total of all PIAs reported in England (137,277), suggests that deer are likely to be implicated in some way in around 0.25% of all reported injury road accidents.

5.2.5.3 At least a further 65 to 70 deer PIAs are estimated to occur annually in Scotland, based on most recent figures arising from our parallel DVC monitoring work for Scottish Natural Heritage (Langbein, 2011). No equivalent estimates are at present available for Wales. However, based on findings from the present study that fewer than 1% of all RSPCA call-outs for England and Wales occur in the latter, it seems unlikely that many additional deer PIAs occur there annually at present. From the above we may derive a conservative estimate of near 415 deer related human injury accidents per year in Britain.

5.2.5.4 From review of a large sample of the short accident descriptions commonly recorded by police for injury accidents, it is possible to ascertain that among all incidents mentioning deer an actual collision with the animal occurred in around 35% of incidents, swerving to take evasive action leading to collision with another vehicle or object was mentioned in 55%, with whether the deer was hit or not being unclear for the remainder.

5.2.5.5 Even the above figure of 348 deer related PIA per year in England or 415 for Britain as a whole, derived through assessment of ST19 data, must be seen as only a very conservative estimate of actual numbers of human injury accidents and casualties in which deer are implicated. In 2010 there were a total of 208,648 casualties of all severities among 154,414 injury accidents reported (via ST19) to police in Britain (DfT, 2011). However, estimates from the National Travel Survey suggest ST19 figures are likely to represent less than one third of all injury road accidents and casualties. Thus, according to DfT:

> *"STATS19 remains the most detailed, complete and reliable single source of information on road casualties covering the whole of Great Britain. However, it has long been known that police data does not provide a complete record of all injury accidents and resulting casualties. Our best current estimate derived from the NTS data is that the total number of road casualties in Great Britain annually, including those not reported to the police, is within the range 660 thousand to 800 thousand with a central estimate of 730 thousand. This is based on data for the seven year period 2004 to 2010." (Dft, 2011)*

On the basis of the range of these higher NTS estimates, it is not unlikely likely that the true annual number of deer related accidents leading to human injuries may be as high as from 1100 to 1350 in England, and from 1295 to 1595 for Britain as a whole. These are significantly higher estimates than those put forward in our previous study reports (Langbein, 2007; Deer Initiative, 2007) when NTS figures were not yet available. Nevertheless these estimates do not seem entirely unrealistic in the context of published figures for Germany (ADAC, 2009) where even the number of injury accidents reported to police with the causation factor "wild game animal on the road" have consistently exceeded 2700 over the last five years, of which close to 80% (c.2200) annually are believed to result from collisions with roe, red and fallow deer (DJV, 2010;2011).

5.2.5.6 **In summary,** from assessments of ST19 data on reported personal injury road accidents for 2007 to 2010 we may estimate that in England deer will on average be implicated in around 348 accidents. However as National Travel Survey data indicate that only 26% to 32% of all injury accidents are reported to police, the actual number of human injury collisions involving deer in England may well be as high as 1100 to 1350 per year. Among these close to 10% of injury DVCs tend to occur on trunk roads (see Table 10).

***Economic impact of deer related personal injury road accidents in England***

5.2.6 Valuations of the average economic burden, or conversely the value to the economy of the prevention of road accidents of different severity levels are regular published and updated by the Department for Transport (DfT, 2011b). These estimates are derived primarily for use in the appraisal of cost-effectiveness of road schemes. The valuations are build up from costing differing elements including lost economic output, cost of pain, grief and suffering; medical and healthcare costs; material damage; police costs; insurance administration and legal and court costs. The values for prevention of accidents and casualties, adjusted to reflect 2009 prices, by severity of casualty are summarised in Table-9 below:

**Table-9:** Average value of prevention per reported casualty and per reported road accident: (*based on DfT statistical Publication RAS60001 Table 1*)[4]

| Accident/casualty type | Cost per casualty **£ June 2009** | Cost per accident **£ June 2009** |
|---|---|---|
| Fatal | 1,585,510 | 1,790,200 |
| Serious | 178,160 | 205,060 |
| Slight | 13,740 | 21,370 |
| **Average for all severities** | **47,740** | **68,320** |
| Damage only | - | 1,880 |

5.2.7 Applying the average value £68,320 per accident for all severities to our earlier estimate that on average deer will contribute to 415 PIAs reported to police nationwide per year, the economic 'value of prevention' of that level of human injury accidents may be calculated as c. 28.4 million GBP for Britain as a whole, or 26.2 million arising through 384 such accidents in England (excluding costs for damage only accidents). As estimates from the National Travel Survey (5.2.5.5 above) indicate, however, that only approximately 30% of injury accidents are actually thought to be reported to police, numbers of deer related PIAs in England may in reality exceed 1300 per year. The total economic cost associated with that higher number may be expected to be substantially greater than the 26.2 million GBP suggested above. Simple application of the same average value for all severities (£69,320) to the additional 900 or so incidents would be likely to overestimate the additional total costs, as fewer KSI (killed or seriously injured) accidents than slight accidents are likely to go unreported. However, even on the assumption that all of the additional 900 would be only in the slight injury category, this would increase the estimated value of prevention of all deer PIAs in England to 46.3M GBP per annum. Around 12% of annual costs relating to deer PIAs (i.e.up to 5.6 M) would be expected to be incurred on trunk roads (see Table 10).

***Relative occurrence of deer related PIA by road class***

5.2.8 Although accidents leading to human injury make up only a low percentage of the total number of DVC, they do also constitute one of the sources of DVC information with least potential reporting bias towards any particular road class (motorways / A-trunk / principal A-roads or minor roads). **Table-10** shows the breakdown of our available sample of deer related PIAs reported in England between 2003 to 2010 for which details of the road type are available. Also shown for comparison are the distribution of total traffic and total numbers of all human injury road accidents reported in England during 2010 by road class.

[4] Further guidance on the valuation and application of road accident costs is available at the Department of Transport web-site on-line in document 3.4.1: The Accidents Sub-Objective .

5.2.9 The percentage distribution of deer PIAs among different road classes was very consistent across our samples of records for the two consecutive four year periods. For 2003 to 2010 combined, **Table-10** shows that accidents on motorways made up less than 3% of all deer related injury incidents, even though motorways carry more than 20% of all road traffic. That motorways generally have lower human injury accident rates in relation to traffic carried is well known, contributing also less than 5% of injury road accidents overall. In case of deer related incidents many motorways also present a much more substantial barrier to movement, and wider DVC data indicate deer movement across motorways and major trunk roads is likely to be more seasonally restricted than for other roads (see also 6.2). Incidents for all trunk roads (motorways + A-class trunk) contributed 12.2% of deer related PIAs, compared to 8.4% of any human injury road accidents in England occurring on trunk roads. A-class trunk roads were represented somewhat more frequently (9.3%) among deer PIAs than might be predicted purely from the overall proportion of human injury accidents on that road type (4.1%), but in view of the relatively small total numbers of incidents involved no statistical significance can be attached to these differences. However, as A-class trunk roads will less often be fitted with deer or other wildlife fencing, they are also generally more readily accessed by deer.

**Table-10** : Distribution of available sample of deer related PIA by road class

| | Period | Motorway | A-Trunk | A-Principal | Minor | All roads |
|---|---|---|---|---|---|---|
| Available sample of deer related PIA | 2003 - 2006 | 19 | 64 | 282 | 338 | 703 |
| | *%* | *2.7%* | *9.1%* | *40.1%* | *48.1%* | *100.0%* |
| | 2007 - 2010 | 17 | 52 | 206 | 265 | 540 |
| | *%* | *3.1%* | *9.6%* | *38.1%* | *49.1%* | *100.0%* |
| | Tot 2003-10 | 36 | 116 | 488 | 603 | 1243 |
| | *%* | ***2.9%*** | ***9.3%*** | ***39.3%*** | ***48.5%*** | ***100.0%*** |
| Traffic 2010 | $10^9$ veh.miles | 55.0 | 28.7 | 85.3 | 95.3 | 264.3 |
| | *%* | ***20.8%*** | ***10.9%*** | ***32.3%*** | ***36.1%*** | ***100.0%*** |
| *All reported PIA England 2010 | n | 5,940 | 5,578 | 57,194 | 68,551 | 137,263 |
| | *%* | ***4.3%*** | ***4.1%*** | ***41.7%*** | ***49.9%*** | ***100.0%*** |

[*Overall numbers of reported personal injury road accidents and traffic based on DfT, 2011]

5.2.10 Table-10 shows that the relative distribution of deer related injury accidents among non-trunk A-roads (39.3%) and Minor roads (48.5%) is seen to be almost directly in line with the distribution of total numbers of human injury accidents among these road types (41.7% and 49.9% respectively). This suggests that, even though minor roads carry only 36% of all road traffic in England, risk of injury DVC, as indeed for reported PIAs overall, is marginally greater on minor roads than major roads.

5.2.11 Review of our wider database of all DVC records for which the road type is known indicates that the proportion of all recorded DVCs that occur on non-trunk A-class roads may well be rather higher (55%) but lower on Minor roads (35%) than suggested in Table-10 based on human injury accident records alone. This higher estimate for DVCs on non-trunk A-roads is derived from an overall sample of 10,248 records for 2003-2010 in the wider DVC database (including RSPCA and forest ranger data but excluding records provided by trunk maintenance agents to avoid introducing bias towards major roads). The proportion of incidents on A-class trunk roads and motorways within this wider sample is 8.3% and 2.7% respectively, which for those road types does approximate to figures from the PIA data. However, figures based on the overall sample of DVCs may be influenced to some extent by a somewhat greater likelihood of DVCs being reported on major roads than minor roads, and PIA data are likely to provide the most reliable basis for estimating the relative overall incidence of DVCs on differing road classes.

# 6 Other data, road class, seasonal and species aspects

## 6.1 Introduction

6.1.1 Following the first three years of study from 2003 when data had been actively requested from a very diverse range of organisations (including amongst others district council roads departments, police control rooms, individual stalkers, and general public), data collection was reduced initially from 2006 onward to focus mainly on five broad data categories that had provided best detail and countrywide sampling coverage between them in the past (i.e. RSPCA [r], trunk road agents [ut], ST19 human injury accidents [st], Fortis Insurance records [ic] and countryside rangers from eight main DVC 'case study' forests [d-c]). In view of a substantial reduction in resources (by >40%) available to allocate to the database project from April 2009 onwards, data collection and analysis for the last two study years was pared down further to retain officially only three core data types (r, ut, st) to be actively gathered as part of the commissioned work. Nevertheless, extra data of good quality volunteered by other past sources and provided in near ready format for inclusion in the database has also continued to be collated and incorporated as far as possible since. However, as records from many of the former sources are now less consistently available across all study years or geographical coverage, they are in general less suitable for inclusion in overall assessments of trends in DVC occurrence over the past decade, or for monitoring changes and comparisons between regions or local authorities etc..

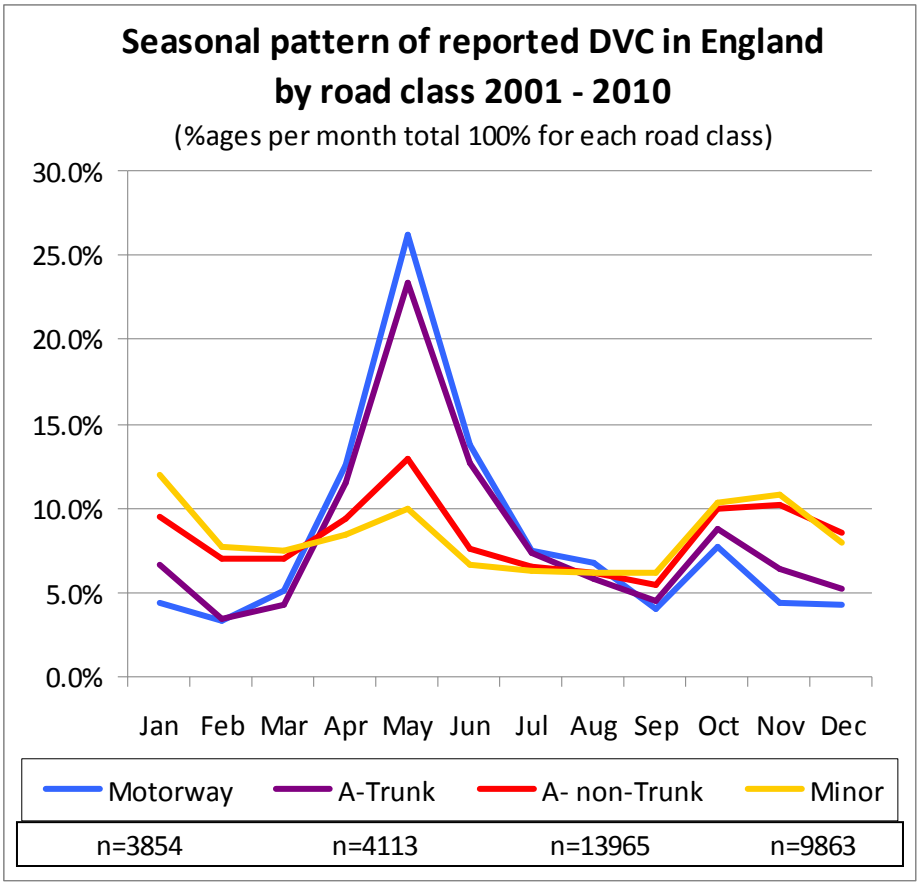
6.1.2 Analysis and discussion of data types obtained from various other sources that were not included systematically for continued monitoring in later years of the project was presented in some detail in a previous project report (Langbein, 2007), and new data obtained from those former sources since will not be presented individually here. The information that has continued to be received from among other sources has nevertheless continued to add usefully to the overall volume of records available for particular areas and for assessments when requests for information on specific road sections or other areas are received. Records which have continued to be obtained for our major 'case study forests' through to end 2010 were discussed in earlier sections of this report (Section 4; and see Table-6), and are planned to form the basis of a number of separate site-specific DI case-study reports. Other details available, both from these case study forests as well as from a number of individual deer managers and or others with a special interest in deer who have continued to send in DVC records from other parts of the country, remain very useful to the project, to add in first instance simply to the overall data available for any particular location. In addition, such records from individuals with good knowledge of deer tend to, unlike most reports received from our core data sources, provide information on the deer species; helping to increase the amount of data available to investigate species-specific and seasonal aspects of DVC as presented in the following sections.

## 6.2 Comparative seasonal patterns of DVCs by road class and species

6.2.1 From previous studies on DVCs (Staines et al. 2001; Langbein, 1985, Langbein & Putman, 2006; Langbein et. al. 2011) it is well known that although deer accidents take place in significant numbers throughout the year, a prominent peak in accidents commonly occurs around May followed in some areas by a secondary peak during late autumn. Key factors contributing to the spring peak are believed to be dispersal of young deer born the previous year from their natal ranges at this time (in particular in case of roe deer; Langbein et al. 2011), as well as females with young at heel being more prone to being hit by vehicles. Several variable factors are likely to influence the size and occurrence of a second accident peak in late autumn, which tends to be much more prominent in areas where larger deer species (such as fallow,

sika or red deer) are present. That peak may in part be attributed to the fact that the larger deer species all rut and as a consequence tend to be much more mobile at that time of year. Shorter day length as well as change from British Summer time back to GMT at end of October (which abruptly brings dawn and dusk, when deer also tend to be at their most active, in line with peak 'rush hour' traffic times) may also contribute.

**Figure C-8**: Seasonal pattern of DVCs in England on trunk roads (motorways plus strategic A-roads) and non-trunk roads (other A-class roads and Minor roads).




6.2.2 A number of recent road safety initiatives to increase driver awareness of the risk of DVCs have already targeted activities on these spring or autumn DVC peaks, to forewarn drivers of the heightened risk of collisions with deer at these times. (This has included the *DeerAware* campaign in England set up in autumn 2009 by the Highways Agency (2009) working with the Deer Initiative and its partners; and seasonal short term use of Variable Message Signs (VMS) now used regularly by Transport for Scotland during spring in many parts of the Scottish trunk road network). The much more extensive information on DVCs accumulated and mapped during the present study now provides much larger samples of records not merely overall, but also for different road types. It therefore seems appropriate here to review the seasonal patterns emerging in greater detail.

*Comparative seasonal patterns for all DVCs (involving any type of deer) by road class*

6.2.3 The percentage distribution of DVC records for differing months in England is shown in **Figure-C8**, based on 31,615 records available for which details of the road class as well as date is known. The graph is broken down to enable comparative examination of the seasonal pattern for Trunk roads (divided into Motorways and A-class trunk roads) and Non-trunk roads (split into 'principal' A-class; and Minor roads { B-roads and smaller).

6.2.4 In the first instance, the overall graph reconfirms a prominent **peak during May on all road classes**, with elevated levels beginning in April and lasting into June. However - it demonstrates particularly clearly that **in England this peak is most prominent by far for Motorways and A-class trunk roads.** Over 52% of all DVCs on motorways (total n > 4000) , and 48% on A-class Trunk roads were recorded in the three month from April to June. A regular late spring peak is also seen on non-trunk A-class roads and Minor roads, but here is not much higher than secondary peaks in October and November and January. The importance of this finding, from view of minimising risk of deer incidents on the *HA trunk road network*, is that it re-affirms that a high proportion of deer collisions may potentially be addressed through seasonally targeted mitigation; such as e.g. VMS signage focussed mostly on mid-April to mid-June. On the other hand, similar seasonally restricted mitigation for non-trunk roads in general is less likely to be as (cost) effective.

*Differences between deer species in effect of road class on seasonal DVC pattern*

6.2.5 As discussed in introduction above (6.1) seasonal patterns of DVCs in general are well known to differ also between deer species. In previous reports however we have not considered in any detail whether the differences in seasonal patterns between trunk and non-trunk road classes (as illustrated by Figure C-8) remain similarly apparent for all or just some of our deer species if considered separately.

6.2.6 Only a comparatively low proportion (<30%) of all the DVC reports received by the project include information on the deer species, as major sources such as trunk or local authority road agents and police records will generally only state 'deer' as the animal type. However, at least in the case of roe, fallow, and muntjac deer large samples of DVC records (>3000 per species) are available to us for which the road class is also known; these species-specific records having been obtained mainly from among either i) deer stalkers / managers and naturalist in our 'Deer-wise' data source category and ii) RSPCA records. The comparative seasonal patterns for different road classes for each of these three species-specific data sets are shown in **Figure-9(a-d).**

6.2.7 For roe deer DVC reports, Figure-9a shows a pattern very closely in line with that shown in Figure-8 (based on all our DVC records combined irrespective of whether species detail is known), with a high peak roe deer incidents on all road classes though being most prominent for trunk roads. A secondary peak is apparent in autumn for non-trunk roads, but on neither A-class or Minor roads is this as high as the spring peak. In case of roe deer autumn does not coincide with their (mid-summer) mating season (cf. below for fallow); the most likely reason that a limited peak occurs for this species is likely to be linked to the shorter day length and greater coincidence with peak traffic flows around dawn and dusk when deer are most active.

6.2.8 For fallow deer DVCs by contrast, the most prominent peaks, on trunk and non-trunk roads, are observed during October and November. A significant rise in recorded incidents with fallow in spring is only noticeable in case of motorways, thereafter falling back during summer before rising to a much clearer peak in autumn for noted on road types. This same pattern is also indicated for red deer (Figure-9d) although here only rather limited samples specifically identifying this species are available for our trunk road data in England. The particularly prominent autumn peak in DVCs involving these larger species coincides with the time of their late autumn rut; a time when these deer will be particularly active, as mature males begin first to move from their often separate summer ranges to female ranges, fight for dominance with other males and in pursue females in attempt to mate or chivvy them onto rutting territories (Langbein, et. al 2008). The co-incidence of this period of high activity, at same time

as day length shortens and traffic increased around dawn and dusk are likely to combine to make this peak particularly prominent for this species.

**Figure C-9**: Comparative seasonal DVC patterns by road class for Roe, Fallow, Muntjac, and Red deer in England. (%ages across months sum to 100 for each road class)

Fig.9-a : Roe deer

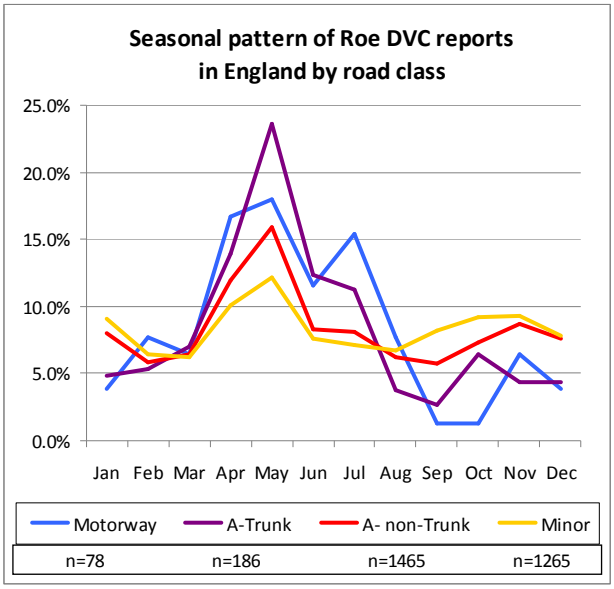



Fig.9-b : Fallow deer

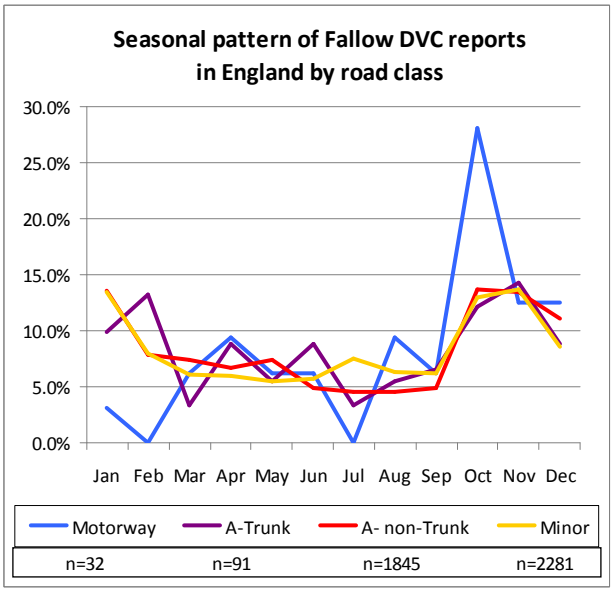



Fig.9-c : Muntjac deer

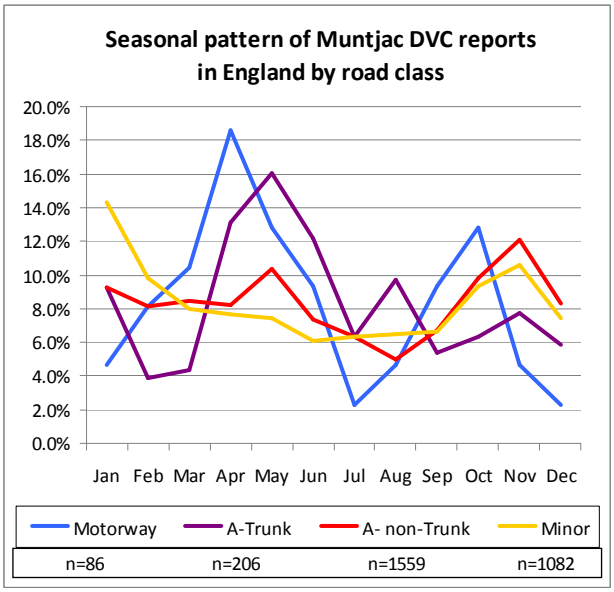
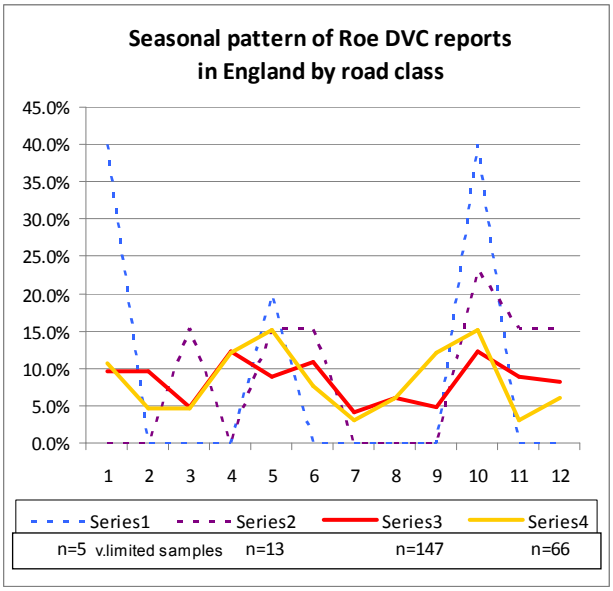



Fig.9-d : Red deer




6.2.9 For muntjac deer DVC reports patterns observed are intermediate between those for fallow and roe. The most prominent peaks in case of this species are observed on trunk road during spring, but for muntjac this increase appears to commence rather earlier from late March. An increase in May is also apparent on non-trunk roads, but not on minor roads for muntjac DVC. In case of A-class non-trunk roads highest numbers tend to be recorded during November and in case of Minor roads in January. This intermediate pattern makes good sense in what is known about the behavioural ecology of this species in Britain. Muntjac are a non-native species introduced to England from the Far East and breed throughout the year without any fixed mating season (Chapman, 2008); they also reside in relatively small home ranges covering just a few hectares for much of the year while feed is abundant, but

during winter will need to move further in search of food on a daily basis. As in the case of DVCs with all deer species effects of shortening day-length are likely to contribute to rising numbers of muntjac collisions from late October.

## 6.3 Proportion and distribution of DVCs involving differing deer species

6.3.1 Asdiscussed earlier, the species of deer involved is only known for around 30% of all records currently held in the DI DVC database. That proportion has gradually declined further in the last three years as result of the more limited project resources allocated primarily to focus on just three core source types, with much reduced collection of data from individual deer stalkers and wildlife rangers who have in the past been able to provide the most reliable information on deer species involved. Nevertheless, for England alone the database now contains well over 10,000 species-specific DVC records from 2001 to 2010.

6.3.2 Among all the records with reported species detail in England, overall approximately 40% involve fallow, 29% roe, 28% muntjac deer, 2.2% red deer, and a little under 1% each concern sika and Chinese Water deer. Although the majority thus relate to fallow, this species is likely to be relatively overrepresented to some extent; as fallow are not only the most common species in seven of the eight major 'case study forests', but species specific recording has also long been much better there than in most other areas. If – on the other hand, assessment is restricted entirely to use of RSPCA records only, within that sub-set the most commonly mentioned species is muntjac (58%) followed by roe deer (30%), whilst fallow make up just 8%, and red, sika, and CWD around 0.5 to 1% each. However, we already previously established that RSPCA are called to a much lesser degree than local deer rangers for incidents in the major case study forest where highest concentrations of fallow DVCs occur. Also, muntjac are a quite distinctive species which most contributors may be able to identify correctly more readily than distinguishing between e.g. a fallow doe, roe doe or sika hind. Therefore, a roughly equal split of the bulk of all DVCs in England among fallow, roe and muntjac seems at present likely to be the best approximation possible from the information currently available, with the remaining three species contributing only around 5% of the total.

6.3.3 Various other findings relating to DVCs involving the differing deer species (including their distribution across England, differential accident risks posed for human injury and material damage, as well as likelihood that they will survive initial collision impact and require treatment or humane dispatch at the road side) were discussed in some detail in an earlier report on this project (Langbein, 2007); these will not be re-presented here but can be accessed on-line (see references). However, to enable appraisal of the most likely species to be involved in DVCs in different parts of England, updated maps showing which species have been reported as being involved in DVCs in differing district or unitary authorities are presented in Figures M-7 and M-8.

6.3.4 For the three deer species most commonly involved in DVCs in England, **Figure M-7** shows the proportion of any species-specific records accounted for by fallow, roe, and muntjac in each district. Overall this map is based on in excess of 9000 records, but the pie charts for each district indicate simply the relative contribution of each species in that area. A number of points arise from the map, including that :

- The predominant species involved in incidents across much of northern England can be seen to be roe deer, with fallow and muntjac DVC reports in only a much more limited number of districts.
- In the West Midlands by contrast the predominant species involved are fallow, whereas in the East Midlands and East of England muntjac are the most commonly reported deer road casualties; with some but a much lower proportion of roe incidents in most districts throughout the Midlands.

- In Southwest England roe deer DVCs again predominate in most districts, except in and around Forest of Dean district in Gloucestershire and in West Devon to the southwest of Exeter.
- The pattern is most mixed in Southeast England, with significant proportions of all three species in most areas, but roe contributing highest proportion across most districts within Hampshire, Surrey and West Sussex; fallow dominating DVC reports in East Sussex and Kent, whilst west and north of London muntjac have he highest proportion in some districts and fallow in others.

6.3.5 Only quite low numbers of DVC records are available in which red deer (<300), sika (<150) or Chinese Water Deer (< 100) are clearly identified in the reports. The distribution of these is shown in **Figure M-8**, but it should be noted that this provides an indication only to the occurrence of at least some, but in many cases only a quite few reports with that species.

- Sika deer are seen to be most widely represented in districts within Dorset, where the main population of this species within England is known to occur, as well the New Forest, as well as some reports in the Ribble Valley in northern Lancashire and one or two reports in Ryedale district, North Yorkshire.
- Chinese Water deer, in line with what is knows of their distribution, are reported in DVCs most commonly in Bedfordshire and Huntingdonshire, Norfolk, and some more isolated reports the Cotswolds and Forest of Dean.
- After fallow, roe and muntjac, red deer DVC reports are by far the most widely other type reported, be it in small numbers. Highest numbers relate to Somerset and Devon and East Anglia where largest English populations of red deer are known to occur, and others coinciding with known location of substantial red deer herds including New Forest, Cannock, and Cumbria, However, some DVCs involving red deer are reported also for many other districts across southern and eastern England, as well as part of northern England. While in many places these will amount to only low numbers of incidents, it highlights the fact that the presence and consequently potential for DVCs with also our largest species exists in most parts of the country.

**Figure M-7:** Proportion of DVCs with species detail, reported as Fallow deer, Roe deer or Muntjac by region local authority.

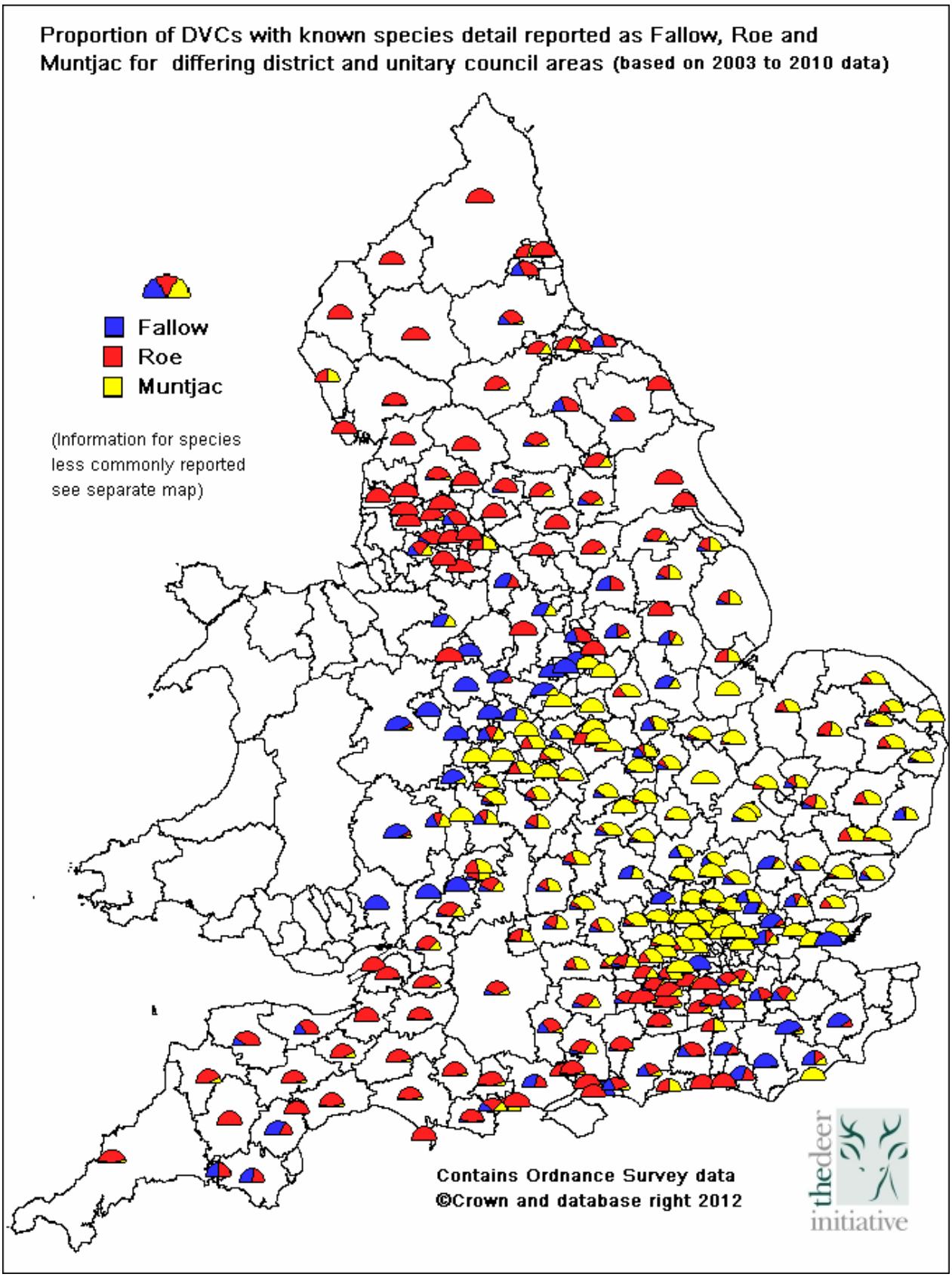
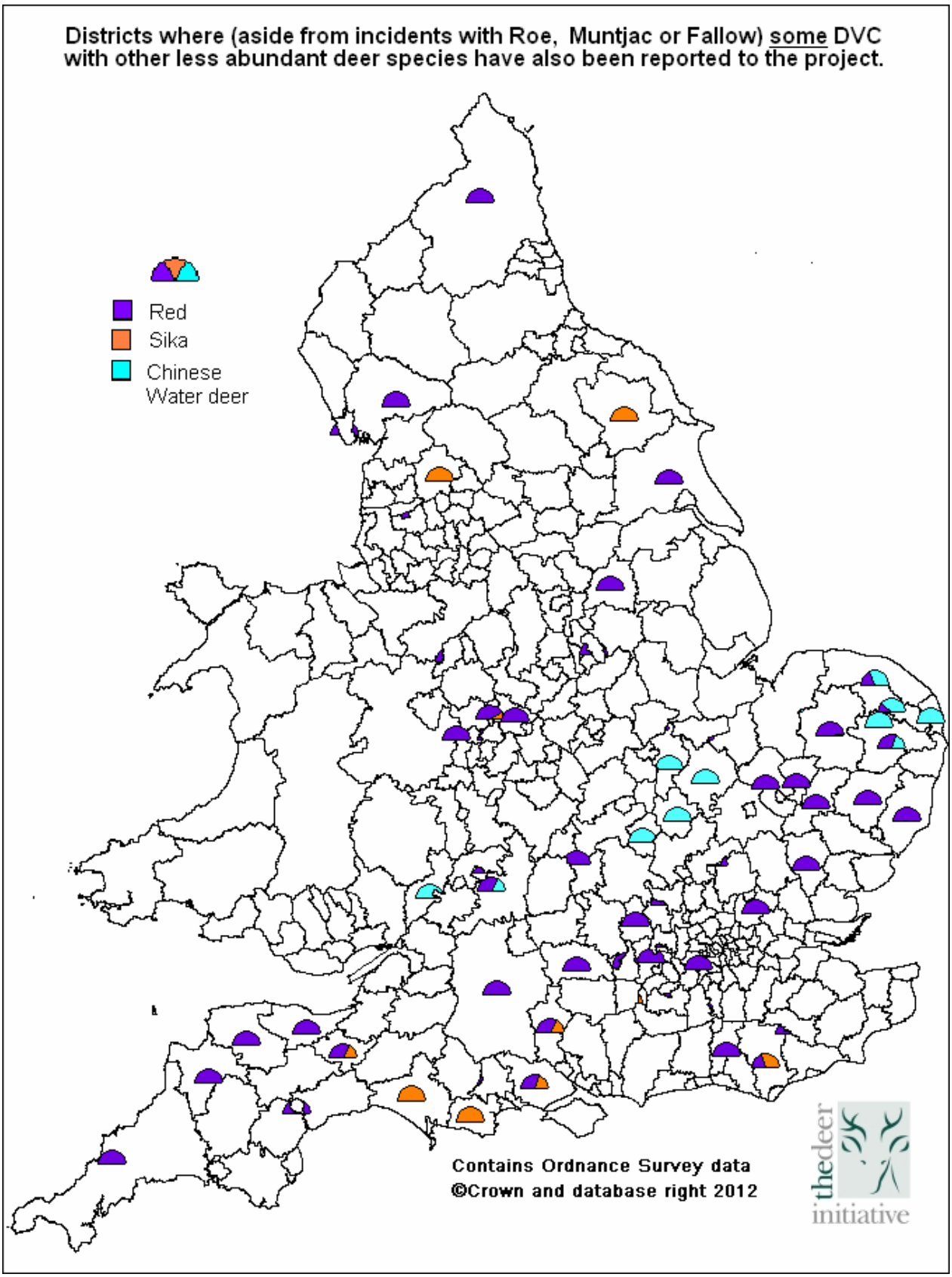


**Figure M-8:** Districts where in addition to incidents with Roe, Muntjac or Fallow, some DVCs with other nationally less abundant species have also been reported to the project.



# 7 Discussion and Conclusions

## 7.1 Scale of the problem and past research

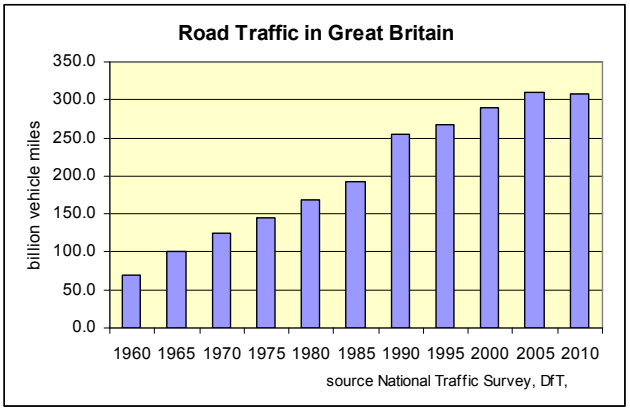
7.1.1 The second half of the 20th century has been a time of extensive proliferation of road networks, rising traffic volumes and speeds throughout Europe. Over the same time densities of deer have also increased in most European countries (Gill, 1990; Apollonio et al., 2010), as has the frequency of road traffic accidents involving deer and other wildlife. **Table-11** shows available published estimates of the annual toll of deer road casualties in differing European countries, comparing figures collated by Groot-Bruindrink and Hazebroek (1996) with more recent estimates collated by Appolonio et al. (2010). This illustrates that on average DVCs are believed to have increased by around 50% over a period of just ten years in most of those countries for which comparable estimates during the two periods are available, with a lowered estimate reported in just one (Denmark). The figures in Table-11 also show our own estimate of 34,000 to 60,000 in England derived from the initial years of the present project in a wider European context, where this can be seen to be of not dissimilar magnitude to estimates for Austria and Sweden; both countries with higher estimated population sizes of deer (c. 1 to 1.25 million in each) but considerably lower total traffic volumes than in England.

**Table-11:** Comparison of available estimates of annual toll of deer road casualties in European countries during early 1990's and/or 2001-2006.

| Country | Annual DVC estimate by Period | | Orig. source of latter estimate |
|---|---|---|---|
| | 1991 - 1996[1] | 2001 -2006[2] | |
| Germany | 125000 | 227000 | *Kerzel 2005 ; DJV 2006* |
| Sweden | 55000 | 61000 | *Seiler 2004* |
| Austria | 35400 | 40500 | *Austrian national statistics* |
| England[3] | >20,000 | >34000 | *Langbein 2007* |
| France | - | 23500 | *Maillard et al. 2010* |
| Scotland[3] | >4000 | >8500 | *Langbein & Putman 2006* |
| Switzerland | - | 8000 - 10000 | *Imesch-Bebie et al. 2010* |
| Norway | 5500 | 8870 | *Andersen et al. 2010* |
| Denmark | 10100 | 6000 | *Andersen & Madsen 2007* |
| Slovenia | - | 6000 | *Slovene Hunters Association* |
| Netherlands | 2500 | 5400 | *van Wieren and G-Bruinderink 2010* |
| Finland | - | 5000 | *Ruusila and Kojola 2010* |
| Spain | - | >4000 | *Carranza 2010* |
| Hungary | - | 3700 | *Official Hungarian Hunting statistics* |
| Croatia | - | 1000 | *Official Croatian Statistics* |

[1] based on Groot-Bruinderink & Hazebroek, 1996
[2] based Langbein, et al. 2011; orig. data sources and refs. see Appolonia et.al 2010
[3] to 1996 based on SGS, 1998; later estimate from present project

**Figure C-9** : Increase in total road traffic in Britain 1960 to 2010



7.1.2 The scale and escalation of wildlife collisions in Europe are mirrored by figures from the United States, where during the early 1990s annual tolls of DVCs were estimated at around 550,000 to 750,000 (Romin & Bisonette, 1996; Convover et al. 1995), but by 2004 assessments by State Farm Insurance and the Insurance Institute for Highways Safety found that this had risen to over 1.5 million deer road kills or related collisions (IIHS, 2004, 2008). The high level of DVCs poses considerable impacts both on deer populations and in terms of economic and human costs. In many European countries collisions with vehicles are by far the most frequent cause of mortality among deer populations aside from intentional culling, and for example in Germany it is estimated "*that every fifth roe deer is not culled by a hunter but dies as result of a road accident*" (DJV, 2010). In addition to recorded road casualties many deer hit by vehicles are not necessarily killed outright but run off and die later of their injuries; and - depending on the deer species involved - from 20 to 30 % tend to survive the initial impact but are left incapacitated at the roadside (Langbein, 2007) until such time that humane dispatch or treatment by a suitably qualified person can be arranged, posing further welfare and safety issues.

7.1.3 In addition to the impact on the deer populations themselves, animal collisions with vehicles pose a significant risk-factor to road safety, causing significant material damage in many cases (estimated previously by us at around 25%, based on samples of DVCs leading to insurance claims - Langbein,2007), and more minor damage in many others. The percentage of DVCs leading to human injuries has been estimated at from 1% to 5% by most published research (Allen and McCulloch, 1976; Hartwig, 1991, 1993; Romin and Bisonette, 1996; Langbein, 2007; Bisonette et al., 2008), influenced to some extent by whether figures are derived purely as percentages of all DVC incidents actually reported to police or include also other animal road kill reports. The numbers of human fatalities caused in DVCs are fortunately much lower, estimated variably at around 1 in every 1500 to 2500 incidents (Hartwig, 1991; IIHS, 2008).

7.1.4 Although deer road casualties had been a significant longstanding problem in some parts of Britain, very little information on the national scale of this issue became available until the late 1990s. In late 1996 the Highways Agency commissioned SGS Environment to undertake a first national study to draw together any available national records of known DVCs that had occurred during 1995 and 1996 (ed. Smith & Langbein, SGS Environment, 1998). That study obtained information on just under 2,000 DVC records across Great Britain for each of those two years, but concluded that if many of the various source organisations approached had been given prior warning to retain such records (rather than merely searching them out retrospectively), then two to three fold that number might have been possible to collate per year. One of the main recommendations arising was that a national scheme for recording animal RTAs should be established and further research is undertaken into effectiveness of roadside deterrents, driver behaviour and national cost implications of DVCs. A later short-term study focussed on Scotland alone still based on purely retrospective collection of available past records (Staines, Langbein, and Putman, 2001) came to similar conclusions, and led the authors of both the above studies to put forward joint proposals later in 2001 to develop and maintain a GB wide DVC database to collate incidents as they happen; so as to enable advance warning to potential stakeholders and contributors of requests for information on DVCs throughout the project period. From that basis the 'National Deer-Vehicle Collisions Project' was launched in England early in January 2003 by The Deer Initiative, with lead funding provided by The Highways Agency and additional finance and in-kind support via other DI Partners. The project was extended to include full coverage of Scotland from June 2003, with funding to DI for this made available by the Scottish Executive.

7.1.5 In the initial phase of the DI National DVC database project records on over 30,500 DVCs occurring in Britain between 1/1/2000 – 31/12/2005 were gathered (of which 24,500 in England and 6,060 in Scotland) from across a very wide range of differing sources; for the three study years of most comprehensive data collection (from January 2003 to December 2005) samples accrued extended to 14,897 records in England and 4,902 in Scotland. The detailed findings of these studies describing the different types, quality, and national spread of DVC data obtained, occurrence by road types, seasonal and diurnal timing, and the animal welfare, human and economic costs associated with DVCs were presented in the separate reports for Scotland (Langbein and Putman, 2006) and England (Langbein, 2007), and formed the foundation for further monitoring of DVC undertaken since.

7.1.6 In England continued financial support by the Highways Agency enabled DVC data collection to be maintained without break to end December 2010, although partly in view of lesser resources available has been based on a progressively reduced set of those data source categories that between then would still enable national and regional trends to be monitored, as well as local areas of relatively high DVC occurrence to be identified. Data collection for the DI DVC project for Scotland ceased in early 2006, but was restarted in June 2008 at the request of Scottish Natural Heritage (SNH), and has since also focussed on collection of information from a more limited set of data sources (Langbein, 2011) and remains on-going.

7.1.7 Despite focus of data collection on a more restricted set of the most reliable and best stratified data categories (mainly RSPCA, trunk road agents, human injury road accidents, and a number of case study forests) over 36,000 further DVC records for England have been added to the data base since 2006. The full DVC database for 2001 to 2010 now contains >60,500 records for England and >12,500 from parallel studies in Scotland, over 83% of which have been mapped for GIS analysis.

## 7.2 Overall Trends in recorded deer-vehicle collision 2001 to 2010.

7.2.1 In the original 2003 to 2005 study a significant weakness was inconsistent availability of data of comparable quality for different areas, and lack of well stratified data sets of substantial size that could provide even, countrywide coverage. As a consequence it was difficult to separate out actual differences in abundance of DVCs between areas from the effects of DVCs being recorded more commonly or in a more readily retrievable manner in some areas than others. For continuation of monitoring since 2006 increased emphasis has therefore been placed on improving collection and quality of DVC records from those sources that on their own, or in combination with others, can provide the best stratified samples of DVCs countrywide with minimal avoidable recording bias; rather than on collection of all possible DVC records obtainable.

7.2.2 Despite focussing data collection on a more restricted set of sources, a further 36,000 DVC records for England have been added to the data base since 2006, in addition to the 24,500 DVC records that had been accrued by end 2005. The overall database now contains over 73,000 records for the years 2001 to 2010, of which over 60,500 relate to incidents in England and over 12,500 from parallel studies in Scotland. For over 83% of these grid references have been possible to ascribe for mapping and GIS analysis (Table-2).

7.2.3 The DVC database now clearly provides an extremely substantive and valuable resource for investigating the nature and trends in deer collisions over the past decade. Interpretation of the data must however be undertaken sensitively, with due regard to the fact that **a)** records are at best a limited sample of all the deer road casualties and related traffic accidents that have occurred in each year, **b)** in most

cases records have not been made and kept specifically for our project, but identified and retrieved from among records being maintained by organisations for their own purposes (e.g. police accident statistics, insurance claims, animal and other debris uplift requests) in which the mention of 'deer' could be identified, **c)** different source categories and individual contributors vary widely in detail and accuracy of information provided (for example, locations are rarely reported more accurately than to within plus or minus 0.1 miles and details given maybe at times suffice to give only approximate locations along a road to the nearest one or even three miles of where a deer was hit. For purpose of assessments of differing aspects of the DVC issue, analyses of trends or comparative frequency between areas have therefore mostly been restricted to specific sub-sets of data that can provide most even sampling across years or given regions if not available countrywide.

7.2.4 Overall the combined size of the sample of records obtained by us from among our three core data categories (UT, R, ST; Table-2) for which widespread data are available for all years from 2001 through to 2010, indicates an increasing pattern ever since start of the study (Figure C-1). Numbers of records obtained from trunk road operators in particular have increased throughout that time, whereas samples of DVC call-outs logged by RSPCA and reported human injury records appear to level off or else show a slight decline after 2007. Trends in data received from each of these core sources are discussed further in turn below.

*Trunk roads*

*7.2.5* Motorways plus A-class trunk road between them contribute just 2.4% of total road length but carry one third of all road traffic in England. In view of the strategic importance of these routes particular emphasis has been placed throughout all project years on obtaining DVC information available for the trunk road network. Numbers of non-duplicate records obtained via trunk road maintenance agents or HA National Command & Control Centres have risen from around 550 – 750 per year from 2003 to 2007 to between 1100 to 1300 per year for 2008 to 2010 (Table 2). A significant part of the overall increase in DVCs on trunk roads is likely to be associated with improved coverage of data achieved for some HA Areas and DBFOs where little or no animal uplift data had been possible to obtain previously. However, comparison of 2008-2010 data with 2003-2005 showed average increases by 64% also among those nine HA management Areas for which data of comparable quality and coverage have been available ever since 2003 or before (Table-3 and Figure C-2). While here too some further improvements in record keeping may possibly have contributed, inspection of data by Area suggest a general underlying increase in DVCs across much of the network since 2005, with greatest increases in northern England.

*RSPCA*

7.2.6 Logs of incidents for which RSPCA received requests from the public, police or others to attend or arrange rescue or collection of live injured deer that have been involved in road traffic incidents have formed the single largest data source throughout this project, contributing 2500 to 3500 records every year. In addition several hundred 'advice' calls relating to dead deer casualties at roadsides (not normally attended by RSPCA) or ones where deer were no longer present or suffering have also been provided in most years. The total numbers of records received from RSPCA rose steadily from 2001 reaching a peak level of over 3800 in 2007 (Table 2), but has fallen back gradually ever since. The possibility that some change in recording or abstraction of data may have contributed to the observed decline was reviewed in some detail by us with assistance also of RSPCA Wildlife Department (4.2.3 – 4.2.4) to extract any additional records that had previously been missed. However, an overall decline in DVC incidents handled by RSPCA since 2007

also remained apparent after inclusion of any additional records found for each data year.

7.2.7 The above decline noted post 2007 among RSPCA DVC incidents logs coincides directly with the timing of the first significant recorded decline in total annual road traffic in England for over fifty years (cf. Fig.C-3 & C-4). Annual traffic assessments by the Department for Transport (DfT, 2011) show that road traffic volumes (generally assessed as total vehicle miles travelled) increased steadily up to and including 2007, and have fallen by around 1% year on year since. The very close overlap of the two trends may be partly fortuitous, as clearly other factors (including not least deer abundance, but for which no good estimates of the actual extent of change over that period are available) will also be likely to influence the overall incidence of DVC. Nevertheless, the close co-incidence with change in traffic does provide one possible explanation, as well as indication that considered at national levels DVCs may be falling, even though quite possibly deer numbers are still thought to be increasing in many areas.

*ST19 Human injury records*

7.2.8 A much greater and earlier decline, than that discussed above in relation to falls in traffic since 2007, has occurred over the past decade in the numbers of any road accidents leading to human injuries. In most parts of Britain reported human injury road accidents assessed across all road types have fallen on average by over 25% since 2001. However, within our wide sample of local authorities for which information on deer-related human injury accidents was obtained (see 7.4 below for further detail) there was no clear evidence of such a general decline. In fact, while numbers were quite variable between years within individual authorities, average numbers per authority increased slightly from 4.1 to 4.4 injury DVCs per annum. In relation to the total number of all types of injury road accidents the proportion in which deer are believed to be implicated thus actually appears to have increased over recent years (Figure C-7).

## 7.3 Variation between regions and DVC hotspots

7.3.1 Distribution of DVCs among different regions of England is very uneven, with South East and East of England region together accounting for over 65% of DVCs per year overall as well as over 50% of those recorded on trunk roads (Fig. M-6). This is only in part attributable to the fact that these regions also have greatest share of road traffic (40%). DVC rates calculated *per driven vehicle mile* to account for differences in traffic are highest overall in East of England followed by Southeast and Southwest Region (Table 7) and likely to reflect also higher average densities of deer in these regions rather than merely differences in traffic.

7.3.2 Comparison between regions by year show that any such reductions as have been noted in overall samples since 2007 (see vi. above) are largely confined to SE, SW, and East of England, where highest overall tolls of DVCs continue to be recorded. In North West England by contrast both RSPCA and trunk road agent reports show an increase over recent years (Fig. M-6), with most notable increases around Preston, Bolton and Bury including along the M6, M65, M61 as well as the M62 corridor from South Lancashire in the west to East Riding of Yorkshire and North Lincolnshire in the east. Local districts where some of the clearest DVC reductions have occurred include a number of our case study forests where increased landscape level deer management and awareness campaigns have been undertaken (in particular Dinmore Hill in Herefordshire; Ashridge Forest in the Chilterns).

7.3.3 Within the trunk road network overall highest tolls of DVCs recorded since 2007 per mile include several sections of the M3 and M27 in Hampshire, A12_M25 links, M40 east of Oxford, and M11 and A12_M25 in Essex (see overview Fig. M-3b). However, in view of wide differences between network areas in road type and levels of traffic, consideration

of priority locations for potential mitigation or further investigation is more appropriately confined to within separate HA Management Areas, where the manner of recording animal road kills will also be most directly comparable. To this end separate maps showing the relative distribution of DVCs within each of the 12 HA Areas and 13 DBFO and PFI schemes for 2003-6 and/or 2007-2010 are provided in Appendix 2 (on the CD included with this report).

## 7.4 Human injury DVC

7.4.1 Although differing types of wild animals involved in reported personal injury road accidents (PIAs) are not distinguished in national statistics, annual samples of 110 to 150 PIAs per year arising on trunk and non trunk roads in which deer were implicated were obtained; having been derived through means of keyword searches undertaken for us by separate police forces or local authority road safety teams covering in all 38 different local authority areas for periods of six to twelve years each (which between them account for approximately 46% of all PIAs in England). Estimates based on these samples (see 5.2.5) indicate that around 350 deer related PIA are likely to be reported per year to police for the whole of England, and a further 65 to 70 in Scotland. However as National Travel Survey data (DfT, 2011) indicate that only 26% to 32% of all injury accidents are reported to police, the actual number of human injury collisions involving deer in England alone may well be as high as 1100 to 1350 per year. These figures are significantly higher than the upper bounds of estimates proposed in our 2007 report, but are not unrealistic in context of estimates of 2200 human injury accidents involving deer reported annually in Germany (DJV, 2010).

## 7.5 Road class and interaction with seasonal effects

7.5.1 Based on our sample of around 1,800 human injury records, which of all our DVC source types are likely to have least if any inherent reporting bias towards particular road types, 11.2% occurred on trunk roads, 39.3% on non-trunk A-roads and 48.5% on Minor roads (48.5%). These figures are almost directly in line with the relative proportion of any reported human casualty accidents in England (Table-10). Among our wider DVC samples from RSPCA and other sources (but excluding trunk agents to avoid sample biases) again close to 10% occurred on trunk roads, but a rather higher proportion (55%) on non-trunk A-class roads, and fewer (35%) on minor roads. However, as the likelihood of any deer road casualty being reported may well be rather greater on major roads than on more minor roads, the earlier figures based on PIA data alone seem more likely to reflect also the actual spread of all DVCs by road class.

7.5.2 The incidence of recorded DVCs overall shows notable peaks in May and/or October in all areas. The seasonal patterns are however most apparent by far when considered separately by road class. In England over 52% of all DVCs on motorways and 48% of those on A-class Trunk roads were recorded in the three month from April to June (Fig. C-8), falling to less than 30% in case of non-trunk A-road and minor roads. Additional seasonal variation occurs between species, with autumn peaks most pronounced where fallow, red or sika deer predominate. The very pronounced patterns found emphasise that a high proportion of the risk of DVCs on English trunk roads could potentially be addressed through short-term mitigation action during mid-April to mid-June alone (e.g. using seasonal VMS signage or other methods), whereas mitigation restricted to the same period on non-trunk roads is less likely to be (cost) effective.

## 7.6 National toll and economic impacts

7.6.1 Estimation of total numbers of DVCs in England was not a formal project objective and remains difficult based on the data available, as it is not known what proportion of all

DVCs that occur are captured by any of our different sources. Estimates proposed on the basis of the 2003-2005 study lay between 34,000 to 60,000 DVCs per year for England. National trends discussed above (7.2), indicate that DVC numbers are likely to have peaked in 2007 but have since returned to similar levels to those in 2003-2005, and overall DVC numbers are thus likely to remain within the same range as suggested previously. To assess minimum proportion of incidents missed by our core data sources on trunk and non-trunk roads proposals for a '*Special recorder scheme*' were put forward in 2009 (based on selected volunteers recording but leaving in situ any road casualties observed by them and assessing proportion of these reported also by our core data source organisation) but in view of cuts in project resources could not be pursued as intended.

7.6.2 The human costs of DVC vary widely between a low percentage that lead to human injuries and fatalities (est. <1.5% and 0.05% respectively), and the great majority of others that cause at least some minor damage or in a quarter to a third of cases more significant material damage leading to insurance claims. The economic 'value of prevention' even for our low-end estimate of 350 human injury DVCs occurring on trunk and non trunk roads in England per year is calculated at £24 million (using government figures for assessing economic impact of road accidents, DfT 2011); but will be near twice that level if accounting for the finding that fewer than 70% of non-fatal injury accidents tend to be reported in national road accident statistics (DfT, 2011).

7.6.3 Based on annual sample figures of insurance claims mentioning deer provided by AGEAS (formerly Fortis Group), we estimate that >11,000 vehicles in England (>14,000 in UK) will incur significant damage (i.e. above common insurance claim excess of £250) as a result of DVCs arising on trunk and non trunk roads, imposing further costs in England near £16M over and above the £24M to £50M incurred through human injury DVC accidents alone. Further substantial economic consequences of DVCs not included in the above estimates arise through traffic delays, dealing with injured and removal of dead from the roadside as well as the extensive impact in terms of animal welfare.

## 7.7 Future monitoring and other further work

7.7.1 Complete or even near-complete recording of the majority of all DVCs occurring annually in England is unlikely ever to be achievable or maintain year on year countrywide. On the other hand, results from this study show that despite having focussed data collection on improved recording from a smaller number of main data source categories than in the previous 2003-2005 study, the total number of records obtained has been possible to maintain as high or higher in most years. More importantly the geographical coverage of records obtained now provides much more even sampling, less skewed by superior recording in some areas than others.

7.7.2 To monitoring future changes, the two core data sets which in combination would be likely to continue to provide at least an index and best stratified information at a countrywide and regional basis, but require only comparatively limited resources are:

- deer road casualty reports and carcass uplifts requests on the trunk network reported to HA National Command and Control centres and/or trunk road managing agents.
- Request received by RSPCA to arrange dispatch or treatment of live deer injured in traffic collisions.

Ideally however the latter should be supplemented a) by records from wildlife rangers in the eight or so major community (case study) forests where by contrast to the wider countryside RSPCA receive only a minority of known requests to deer injured in DVC; b) records from several recently developed countywide police led DVC deer dispatch call-out schemes which may become relatively under-sampled by RSPCA data alone.

7.7.3 The recommended focus of national monitoring on the above sources should not be taken to imply that other potential sources, such as for example local authority animal debris uplift records, police force call room logs, or insurance company records cannot also be valuable; with collections of data from such other sources having been discontinued during later years of this project primarily as comparable data could not be obtained across local authority or police force areas throughout England. It is recommended therefore, that where and when results of the countrywide monitoring based on our principal data sources highlight a significant increase in DVCs for a given local authority district or specific road sections within, this should be the time to trigger collation of additional local data. In the first instance such additional information gathering could draw on closer review of any such past archived records already available in the DI DVC England database, followed by request if required for additional records to local authority roads departments, police control room logs, local rangers and Wildlife Trusts. Whilst obtaining records from such local sources consistently year-on year for our national level monitoring has not been feasible, greater support from local stakeholders would seem probable for one-off requests for data searches where a particular local DVC issue has been identified, and further information is required to help develop and target local mitigation measures most appropriately.

7.7.4 The main objective of the present project has been to monitor changes in DVCs at national and regional level and identify areas of relatively high risk. The substantial database of over 75,000 DVCs for the UK accrued now provides a valuable resource for further investigation into local DVC issues. This has already aided in dealing with requests for DVC information received in particular from HA managing agents in many different parts of the trunk network, as well as from several local authority road safety teams, and should continue to be useful in this manner not least if it becomes possible to update the existing database in future years.

7.7.5 In addition to any future monitoring of DVCs, it would seem valuable to undertake some further detailed research into the 50 or so hotspots on the trunk road network where highest DVC frequencies have been highlighted by the present study. Initially this might involve desk-top study of any available habitat and aerial photography material for each hotspot in order to determine any common features. The findings could then be used to select an appropriate smaller sub-set of areas for field survey. This might include ground truthing available DVC records, characteristics of road side habitats, driver sight lines, condition and type of boundary fencing and other features that may contribute to high DVC frequency. In addition any existing structures present in the vicinity of hotspots leading under or over the trunk road should be assessed for their potential to act as safer passages if greater use by deer and other wildlife can be encouraged through appropriate lead-in fencing or other adaptations.

7.7.6 Despite extensive publicity and numerous reports in the national press, television and other media over the past eight years regarding the DVC project, a high proportion of the general public still appear to remain unaware of the very widespread and frequent occurrence of DVCs throughout Britain. Regular *DeerAware* campaigns in autumn and spring launched by the Highways Agency in association with the Deer Initiative and its Partners have helped to raise the profile of the issue and provide advice to drivers on how to minimise risk of collisions, and should continue in future years. Our estimates of 42,000 - 74,000 DVCs annually in Britain (or 34,000 to 60,000 in England) indicate that approximately ***"every 10 minutes a deer is killed on Britain's roads"*** - a message that may be worth incorporating in future driver awareness campaigns.

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## Appendix 1 : Supplementary Tables and Illustrations not shown within narrative

**Table-6 (part A)** : Number of DVC reports by core source and study period by local authority

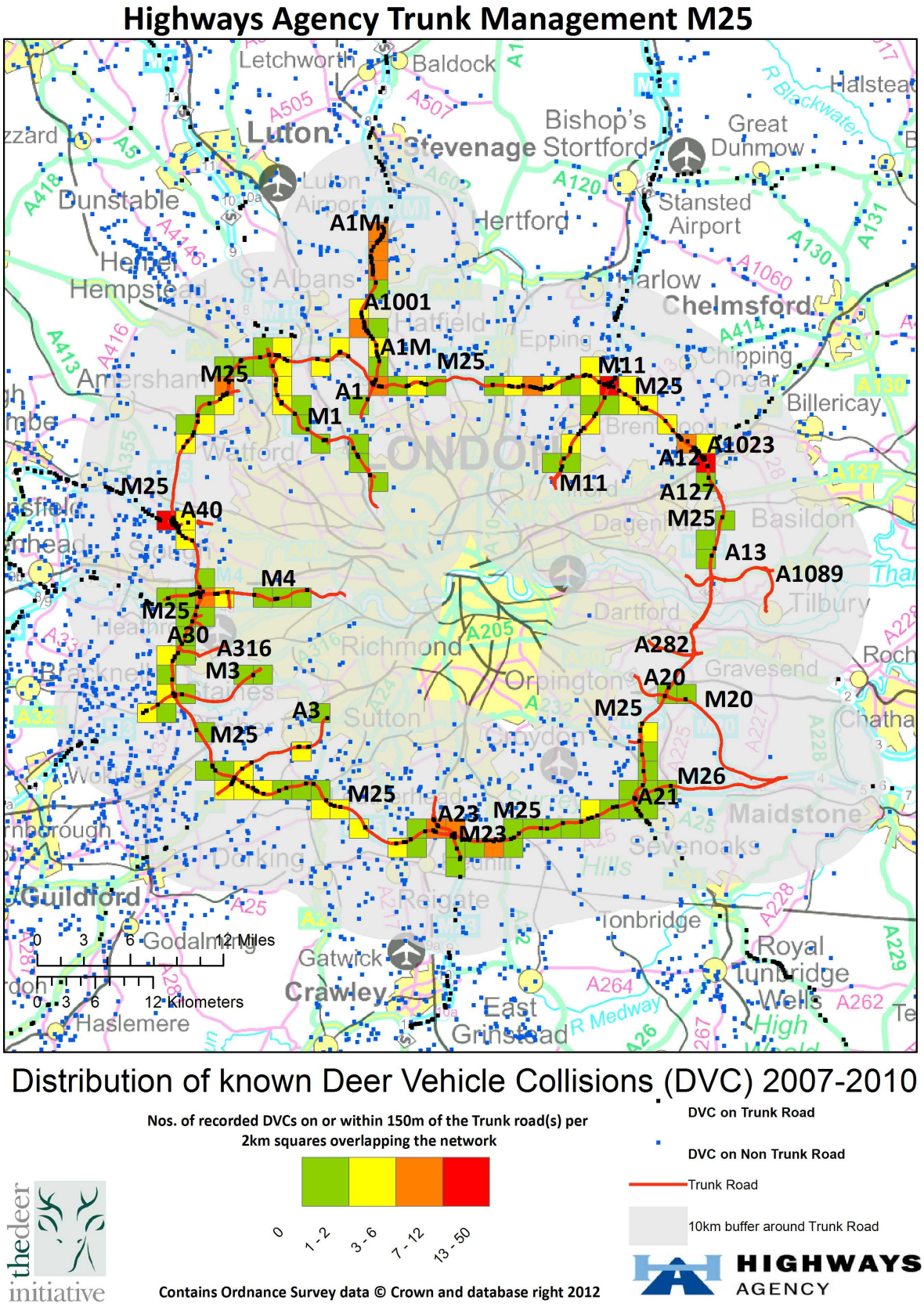
| County or Unitary Authority | Trunk UT 2003-06 | Trunk UT 2007-10 | RSPCA 2003-06 | RSPA 2007-10 | Case For. 2003-06 | Case For. 2007-10 | Total |
|---|---|---|---|---|---|---|---|
| BARNSLEY_DISTRICT_(B) | 0 | 6 | 2 | 5 | 0 | 0 | 13 |
| BATH_AND_NORTH_EAST_SOMERSET | 5 | 1 | 106 | 122 | 0 | 0 | 234 |
| BEDFORD_(B) | 4 | 2 | 42 | 77 | 0 | 0 | 125 |
| BIRMINGHAM_DISTRICT_(B) | 0 | 6 | 5 | 6 | 0 | 0 | 17 |
| BLACKBURN_WITH_DARWEN_(B) | 1 | 6 | 6 | 15 | 0 | 0 | 28 |
| BLACKPOOL_(B) | 0 | 0 | 0 | 2 | 0 | 0 | 2 |
| BOLTON_DISTRICT_(B) | 3 | 19 | 7 | 33 | 0 | 0 | 62 |
| BOURNEMOUTH_(B) | 0 | 0 | 4 | 5 | 0 | 0 | 9 |
| BRACKNELL_FOREST_(B) | 0 | 4 | 71 | 95 | 0 | 0 | 170 |
| BRADFORD_DISTRICT_(B) | 0 | 0 | 14 | 29 | 0 | 0 | 43 |
| BUCKINGHAMSHIRE_COUNTY | 21 | 144 | 349 | 428 | 104 | 44 | 1090 |
| BURY_DISTRICT_(B) | 0 | 22 | 6 | 6 | 0 | 0 | 34 |
| CALDERDALE_DISTRICT_(B) | 0 | 10 | 10 | 13 | 0 | 0 | 33 |
| CAMBRIDGESHIRE_COUNTY | 11 | 95 | 211 | 336 | 0 | 0 | 653 |
| CENTRAL_BEDFORDSHIRE | 5 | 33 | 145 | 190 | 29 | 35 | 437 |
| CHESHIRE_EAST_(B) | 1 | 5 | 2 | 2 | 0 | 0 | 10 |
| CHESHIRE_WEST_AND_CHESTER_(B) | 0 | 0 | 0 | 2 | 0 | 0 | 2 |
| CITY_OF_BRISTOL_(B) | 1 | 9 | 25 | 30 | 0 | 0 | 65 |
| CITY_OF_DERBY_(B) | 0 | 0 | 3 | 2 | 0 | 0 | 5 |
| CITY_OF_KINGSTON_UPON_HULL_(B) | 0 | 4 | 8 | 6 | 0 | 0 | 18 |
| CITY_OF_LEICESTER_(B) | 0 | 0 | 3 | 4 | 0 | 0 | 7 |
| CITY_OF_NOTTINGHAM_(B) | 0 | 3 | 3 | 3 | 0 | 0 | 9 |
| CITY_OF_PETERBOROUGH_(B) | 0 | 3 | 61 | 62 | 0 | 0 | 126 |
| CITY_OF_PLYMOUTH_(B) | 4 | 5 | 20 | 36 | 0 | 0 | 65 |
| CITY_OF_PORTSMOUTH_(B) | 1 | 5 | 7 | 5 | 0 | 0 | 18 |
| CITY_OF_SOUTHAMPTON_(B) | 3 | 3 | 34 | 31 | 0 | 0 | 71 |
| CITY_OF_STOKE-ON-TRENT_(B) | 0 | 0 | 1 | 2 | 0 | 0 | 3 |
| CORNWALL | 43 | 81 | 50 | 99 | 0 | 0 | 273 |
| COUNTY_DURHAM | 15 | 29 | 52 | 50 | 0 | 0 | 146 |
| COUNTY_OF_HEREFORDSHIRE | 17 | 13 | 29 | 31 | 46 | 5 | 141 |
| COVENTRY_DISTRICT_(B) | 0 | 0 | 14 | 13 | 0 | 0 | 27 |
| CUMBRIA_COUNTY | 0 | 84 | 58 | 105 | 0 | 0 | 247 |
| DARLINGTON_(B) | 12 | 5 | 17 | 9 | 0 | 0 | 43 |
| DERBYSHIRE_COUNTY | 1 | 21 | 16 | 23 | 0 | 0 | 61 |
| DEVON_COUNTY | 105 | 163 | 235 | 258 | 24 | 21 | 806 |
| DONCASTER_DISTRICT_(B) | 1 | 30 | 16 | 26 | 0 | 0 | 73 |
| DORSET_COUNTY | 1 | 30 | 191 | 253 | 0 | 0 | 475 |
| DUDLEY_DISTRICT_(B) | 0 | 3 | 2 | 5 | 0 | 0 | 10 |
| EAST_RIDING_OF_YORKSHIRE | 0 | 73 | 58 | 128 | 0 | 0 | 259 |
| EAST_SUSSEX_COUNTY | 0 | 5 | 205 | 202 | 796 | 850 | 2058 |
| ESSEX_COUNTY | 45 | 214 | 428 | 625 | 172 | 265 | 1749 |
| GATESHEAD_DISTRICT_(B) | 0 | 8 | 6 | 20 | 0 | 0 | 34 |
| GLOUCESTERSHIRE_COUNTY | 8 | 72 | 196 | 223 | 311 | 230 | 1040 |
| GREATER_LONDON_AUTHORITY | 22 | 73 | 143 | 218 | 0 | 0 | 456 |
| HAMPSHIRE_COUNTY | 349 | 526 | 924 | 1027 | 237 | 268 | 3331 |
| HARTLEPOOL_(B) | 0 | 0 | 2 | 2 | 0 | 0 | 4 |
| HERTFORDSHIRE_COUNTY | 90 | 148 | 441 | 551 | 262 | 125 | 1617 |
| KENT_COUNTY | 28 | 103 | 137 | 172 | 0 | 0 | 440 |
| KIRKLEES_DISTRICT_(B) | 0 | 15 | 3 | 7 | 0 | 0 | 25 |
| KNOWSLEY_DISTRICT_(B) | 2 | 2 | 0 | 0 | 0 | 0 | 4 |
| LANCASHIRE_COUNTY | 5 | 190 | 42 | 88 | 0 | 0 | 325 |
| LEEDS_DISTRICT_(B) | 0 | 53 | 42 | 70 | 0 | 0 | 165 |
| LEICESTERSHIRE_COUNTY | 0 | 25 | 25 | 50 | 0 | 0 | 100 |
| LINCOLNSHIRE_COUNTY | 3 | 4 | 76 | 127 | 0 | 0 | 210 |
| LUTON_(B) | 0 | 3 | 21 | 22 | 0 | 0 | 46 |
| MANCHESTER_DISTRICT_(B) | 0 | 1 | 1 | 0 | 0 | 0 | 2 |
| MIDDLESBROUGH_(B) | 0 | 7 | 3 | 3 | 0 | 0 | 13 |
| MILTON_KEYNES_(B) | 0 | 7 | 48 | 51 | 0 | 0 | 106 |
| NEWCASTLE_UPON_TYNE_DISTRICT_(B) | 3 | 18 | 10 | 13 | 0 | 0 | 44 |
| NORFOLK_COUNTY | 19 | 15 | 411 | 651 | 568 | 467 | 2131 |
| NORTH_EAST_LINCOLNSHIRE_(B) | 0 | 2 | 3 | 12 | 0 | 0 | 17 |
| NORTH_LINCOLNSHIRE_(B) | 0 | 52 | 17 | 38 | 0 | 0 | 107 |
| NORTH_SOMERSET | 9 | 27 | 60 | 52 | 0 | 0 | 148 |
| NORTH_TYNESIDE_DISTRICT_(B) | 2 | 23 | 2 | 4 | 0 | 0 | 31 |
| NORTH_YORKSHIRE_COUNTY | 30 | 113 | 159 | 170 | 0 | 0 | 472 |
| NORTHAMPTONSHIRE_COUNTY | 4 | 38 | 145 | 204 | 0 | 0 | 391 |
| NORTHUMBERLAND | 26 | 20 | 38 | 87 | 49 | 21 | 241 |
| NOTTINGHAMSHIRE_COUNTY | 18 | 66 | 30 | 61 | 0 | 0 | 175 |

continued overleaf .....

**Table-6 :** continued (part B) : DVC reports by core source and study period by local authority

| County or Unitary Authority | Trunk UT 2003-06 | Trunk UT 2007-10 | RSPCA 2003-06 | RSPA 2007-10 | Case For. 2003-06 | Case For. 2007-10 | Total |
|---|---|---|---|---|---|---|---|
| OLDHAM_DISTRICT_(B) | 0 | 0 | 1 | 8 | 0 | 0 | 9 |
| OXFORDSHIRE_COUNTY | 35 | 140 | 442 | 642 | 0 | 0 | 1259 |
| POOLE_(B) | 0 | 1 | 10 | 13 | 0 | 0 | 24 |
| READING_(B) | 4 | 8 | 35 | 52 | 0 | 0 | 99 |
| REDCAR_AND_CLEVELAND_(B) | 0 | 1 | 24 | 33 | 0 | 0 | 58 |
| ROCHDALE_DISTRICT_(B) | 1 | 8 | 4 | 7 | 0 | 0 | 20 |
| ROTHERHAM_DISTRICT_(B) | 0 | 11 | 5 | 1 | 0 | 0 | 17 |
| RUTLAND | 2 | 1 | 16 | 27 | 0 | 0 | 46 |
| SALFORD_DISTRICT_(B) | 0 | 12 | 0 | 4 | 0 | 0 | 16 |
| SANDWELL_DISTRICT_(B) | 3 | 0 | 1 | 0 | 0 | 0 | 4 |
| SHEFFIELD_DISTRICT_(B) | 0 | 2 | 0 | 3 | 0 | 0 | 5 |
| SHROPSHIRE | 2 | 2 | 22 | 23 | 23 | 24 | 96 |
| SLOUGH_(B) | 1 | 14 | 15 | 19 | 0 | 0 | 49 |
| SOLIHULL_DISTRICT_(B) | 3 | 5 | 8 | 15 | 0 | 0 | 31 |
| SOMERSET_COUNTY | 23 | 51 | 289 | 329 | 0 | 0 | 692 |
| SOUTH_GLOUCESTERSHIRE | 15 | 59 | 55 | 85 | 0 | 0 | 214 |
| ST_HELENS_DISTRICT_(B) | 0 | 5 | 0 | 0 | 0 | 0 | 5 |
| STAFFORDSHIRE_COUNTY | 0 | 26 | 42 | 52 | 344 | 126 | 590 |
| STOCKPORT_DISTRICT_(B) | 0 | 0 | 0 | 2 | 0 | 0 | 2 |
| STOCKTON-ON-TEES_(B) | 2 | 1 | 5 | 13 | 0 | 0 | 21 |
| SUFFOLK_COUNTY | 49 | 15 | 398 | 478 | 358 | 192 | 1490 |
| SUNDERLAND_DISTRICT_(B) | 0 | 3 | 2 | 1 | 0 | 0 | 6 |
| SURREY_COUNTY | 105 | 134 | 583 | 892 | 0 | 0 | 1714 |
| SWINDON_(B) | 5 | 44 | 55 | 71 | 0 | 0 | 175 |
| TAMESIDE_DISTRICT_(B) | 0 | 0 | 0 | 2 | 0 | 0 | 2 |
| TELFORD_AND_WREKIN_(B) | 0 | 3 | 6 | 5 | 0 | 0 | 14 |
| THE_CITY_OF_BRIGHTON_AND_HOVE_(B) | 1 | 0 | 6 | 4 | 0 | 0 | 11 |
| THURROCK_(B) | 2 | 2 | 2 | 1 | 0 | 0 | 7 |
| TORBAY_(B) | 0 | 0 | 1 | 4 | 0 | 0 | 5 |
| TRAFFORD_DISTRICT_(B) | 0 | 0 | 1 | 0 | 0 | 0 | 1 |
| WAKEFIELD_DISTRICT_(B) | 0 | 19 | 4 | 4 | 0 | 0 | 27 |
| WALSALL_DISTRICT_(B) | 0 | 1 | 3 | 4 | 0 | 0 | 8 |
| WARRINGTON_(B) | 0 | 5 | 0 | 3 | 0 | 0 | 8 |
| WARWICKSHIRE_COUNTY | 16 | 56 | 169 | 226 | 0 | 0 | 467 |
| WEST_BERKSHIRE | 47 | 154 | 227 | 297 | 0 | 0 | 725 |
| WEST_SUSSEX_COUNTY | 21 | 45 | 338 | 546 | 42 | 27 | 1019 |
| WIGAN_DISTRICT_(B) | 1 | 4 | 2 | 6 | 0 | 0 | 13 |
| WILTSHIRE | 15 | 76 | 174 | 242 | 13 | 0 | 520 |
| WINDSOR_AND_MAIDENHEAD_(B) | 28 | 49 | 97 | 116 | 0 | 0 | 290 |
| WOKINGHAM_(B) | 30 | 44 | 147 | 165 | 0 | 0 | 386 |
| WORCESTERSHIRE_COUNTY | 12 | 45 | 103 | 118 | 40 | 56 | 374 |
| YORK_(B) | 0 | 16 | 17 | 37 | 0 | 0 | 70 |
| **England 'core data sources' TOTAL** | **1341** | **3809** | **8810** | **11847** | **3418** | **2756** | **31981** |
| *Other English authorities for which zero DVC reports available from any core sources, include: CITY_OF_WOLVERHAMPTON_DISTRICT_(B); HALTON_(B) , ISLE_OF_WIGHT; ISLES_OF_SCILLY; LIVERPOOL_DISTRICT_(B); MEDWAY_(B); SEFTON_DISTRICT_(B) ;SOUTH_TYNESIDE_DISTRICT_(B); SOUTHEND-ON-SEA_(B); WIRRAL_DISTRICT_(B) .* | | | | | | | |
| **Wales :** | | | | | | | |
| MONMOUTHSHIRE | 0 | 0 | 18 | 22 | 15 | 9 | 64 |
| NEATH_PORT_TALBOT | 0 | 0 | 2 | 9 | 0 | 0 | 11 |
| CARMARTHENSHIRE | 0 | 0 | 2 | 8 | 0 | 0 | 10 |
| POWYS | 0 | 0 | 4 | 2 | 0 | 0 | 6 |
| DENBIGHSHIRE | 0 | 0 | 3 | 3 | 0 | 0 | 6 |
| GWYNEDD | 0 | 0 | 1 | 4 | 0 | 0 | 5 |
| CONWY | 0 | 0 | 4 | 0 | 0 | 0 | 4 |
| NEWPORT | 0 | 0 | 0 | 1 | 0 | 0 | 1 |
| BRIDGEND | 0 | 0 | 1 | 0 | 0 | 0 | 1 |
| **Wales 'core data sources' TOTAL** | **0** | **0** | **35** | **49** | **15** | **9** | **108** |
| Other Welsh authorities for which zero DVC reports available from any core sources not shown. | | | | | | | |

**Figure HA-5b : Example of individual HA Area Maps (for 2007-2010 data)**
**[For full set of 34 maps see Appendix 2 – on report CD ]**




Distribution of known Deer Vehicle Collisions (DVC) 2007-2010