An Examination of Livestock and Wildlife crimes in Agricultural areas of the UK.

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A thesis presented for the degree of Doctor of Philosophy

University College London

Declaration

I, *Dorothea Alice Brabner Delpech*, confirm that the work presented in this thesis is my own. Where information has been derived from other sources, I confirm that this has been indicated in the thesis.

Abstract

Wildlife crime is receiving increasing international media coverage, with much of the focus on the international Wildlife Trade (IWT) and iconic species (e.g. elephants, tigers and pangolins). Limited research exists on the impact of wildlife crime on native species in the UK.

The majority of the UK landscape is categorised as rural and classified as Farmland. To account for the spatial overlap between Livestock and Wildlife, the thesis aimed to assess the incidence of these crime types on farmland in the UK.

The thesis presents a multimethod analysis of livestock and wildlife crimes, beginning with a review of the existing research on the most effective prevention methods for crimes against terrestrial (land based) species (TS), which identified an overall dearth of empirical evidence.

A victimization survey was then conducted of farmers in the UK. The survey received over 800 responses. Amongst the many survey findings, was the low level of reporting, with over 70% of wildlife crime incidents going unreported to the Police. The survey responses also identified an inverse relationship in the seasonal variation of these crime types.

Finally, the thesis assessed Police data for Livestock and Wildlife crimes, between 2010 and 2015 from Dorset constabulary. The Police data was used to assess the seasonal variation in these crime types and identified the need to disaggregate the Police data into crimes involving different species to identify annual trends. Data quality issues associated with the recording of crimes in rural areas were identified and potential solutions for better location recording described.

The thesis provides a comprehensive overview of the current state of Livestock and Wildlife crime in the UK, as well as highlighting the numerous avenues for further research.

Impact Statement

The thesis is the first study specifically focussing on the incidence of Livestock and Wildlife crime across the UK. The findings would be of interest to a number of stakeholders and could be the basis for engaging with not only farmers and Police, but other commercial, academic and political groups nationally and internationally to disseminate the results and discuss potential solutions to issues such as data accuracy.

The contents of the thesis offer the potential for future conversations with stakeholders about:

- *Research* – The systematic review highlights the lack of research that has been conducted to assess the effectiveness of situational prevention techniques. As discussed in *Chapter Three*, the findings may be indicative of poor access to these assessments, or due to the lack of studies evaluating effectiveness. The result is limited evidence for decision makers to use for allocation of resources. The thesis highlights the need for increased research into the effectiveness of prevention strategies, to better advise conservation and crime prevention work internationally of best practices. Government spending on tackling international Wildlife crimes/trade should dedicate funding towards the assessment of existing prevention techniques to identify 'What Works?' and improve the transference of effective methods to other locations seeking solutions for crimes against species.

  In addition to international research into the effectiveness of crime prevention techniques, further research is needed to identify the incidence, impact and nuances of Livestock and Wildlife crime in the UK. The thesis should be used as complementary research to those of a similar nature conducted in other countries, and not seeking to draw attention away from the plight of other species. By illustrating that the UK is failing to effectively monitor the crimes impacting Livestock and native Wildlife, the thesis highlights the need for Political support for units such as the National Wildlife Crime Unit and its expansion, to try and unify the national strategy to the monitoring and tackling of these crime types.

- *Crime Recording Practice* – The thesis identifies simple and cheap ways to amend the recording of Livestock and Wildlife crimes by Police Staff and Officers, to make sure that future extraction and filtering of data relating to these crime types is made easier and quicker. In addition to this, are recommendations for increasing the accuracy of the

recording the location information of these crimes for future spatio-temporal analysis. Improving the details contained in crime records relating to Livestock and Wildlife crimes, will provide data of better quality for analysis in future not only by Police analysts but researchers.

The thesis provides the first comprehensive review of Livestock and Wildlife crime in the UK, with the potential for several publications.

The thesis identifies a variety of avenues for future research to expand on these initial findings, but also to investigate new issues highlighted in Police data and survey responses from Farmers.

This thesis is dedicated to my parents

Clare and Roger.

"They lift you up, your mum and dad,
They really mean to, and they do,
They fill you with great things they had
And add some extra, just for you."

– James Tooley

This Be The Converse

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"…a perfect house whether you liked food or sleep, or storytelling or singing or reading or just sitting and thinking best, or a pleasant mixture of them all. Merely to be there was a cure for weariness, fear and sadness."

– J. R. R. Tolkien, *Lord of the Rings: The Fellowship of the Ring*

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CHAPTER ONE

Introduction

Criminological research has traditionally concentrated on volume crimes (such as burglary and theft) in cities in western countries (Swanson 1981). The urban ethnocentrism of research has treated crime as a homogenous entity across countries irrespective of the socio-demographic, economic, cultural and physical differences in urban and rural environments (Brantingham & Brantingham 1993; Felson 1995; Mears et al 2007b; Weisheit & Wells 1996; Wells & Weisheit, 2004). However, a variety of crimes occur that can be considered unique to rural areas and businesses such as farms (Donnermeyer & Barclay, 2005; Smith et al 2013). The types of crime that occur on agricultural land include fly-tipping and dumping of waste, theft of crops and livestock, theft of tools and machinery, as well as providing a location for criminal sports (e.g. hare coursing). Crimes on agricultural properties, have been shown to have links to organized crime groups, and international illegal trade markets, indicating that the impacts of such crimes are not limited to the setting in which they occur (Barclay 2001).

Despite the majority of the UK being classified as rural and used for agriculture, there is a dearth of literature on the incidence of crime in rural areas, particularly in relation to farm, livestock and wildlife crime, despite there being an overlap between the rural landscape dedicated to crops and livestock and the habitats of wildlife.

One of the main incentives for wildlife crime is that it is an extremely lucrative business, with the potential profits reaching tens to hundreds of thousands of pounds, whilst the penalty fines if caught committing these offences can be as low as a few hundred pounds, and convictions rarely ever result in imprisonment (EAC 2003-2004; Lowther et al 2002; Schneider 2008). The comparative ease of committing wildlife crimes compared to other crimes which carry much more significant penalties has led to the involvement of organized crime groups (Lawson & Vines 2014).

Factors influencing the vulnerability of rural areas to rural crimes must therefore be identified if policies and prevention methods are to be successfully developed and implemented (Mears et al 2007a,b).

Aims & Objectives

The thesis aims to address the gap in the existing criminological literature on rural crime, with a particular focus on Livestock and Wildlife crime on agricultural land in the UK, by providing a comprehensive examination of the occurrence of these crimes, what environmental features may influence victimisation, if these crimes exhibit any seasonal variation, and what methods exists that are effective in preventing these crimes types. To accomplish this, the thesis uses three approaches: a Systematic Review, a Victimisation Survey and the analysis of Police crime data.

To identify what prevention methods can be used to prevent crimes against species, the thesis uses a systematic review of situational crime prevention methods. The systematic review was used to establish what crime prevention techniques have been identified in the existing literature as effective in preventing crimes against terrestrial species. The review aims to answer the following research question: *What situational crime prevention methods are effective in preventing crimes against terrestrial animal species?*

An online victimisation survey of farmers in the UK is used to collect primary data to answer several research questions including: *What is the incidence of Livestock and Wildlife crime in the UK? What influence do physical features such as Roads, Rights of Way, and having a Permanent residence on the farm, have on the likelihood of victimisation of farmland? Does farmer pluriactivity influence the likelihood of victimisation? Do Livestock and Wildlife crimes show seasonal variation?* and *What proportion of Livestock and Wildlife crimes are reported to the Police?*

The thesis uses secondary data provided by a Police force in the UK for a six year period (2010-2015) to identify the number of Livestock and Wildlife crimes recorded over this period (2010-2015), and to identify whether the recorded crimes show seasonal variation, to answer the following research question: *Does seasonal/annual variation exist in Livestock and Wildlife crimes recorded by Police between 2010-2015?*

Outline of Thesis

Chapter Two provides a detailed review of the evolution of crime mapping and environmental crime theories of relevance to this thesis. The chapter continues to then provide an overview

of Rural crime and the issues associated with accurately classifying crimes in rural areas. It concludes by presenting the existing literature on Farm, Livestock and Wildlife crime.

Due to the variety of different methods used to assess Livestock and Wildlife crime in the thesis, subsequent chapters provide their own independent reviews of relevant literature.

Chapter Three presents the results of a systematic review of situational crime prevention methods for preventing crimes against terrestrial species. Systematic reviews are used in many fields to provide overviews of the available information on a given topic, the results of which are often used by policymakers and other stakeholders to try and optimise the allocation of resources or determine future strategies. The work in this chapter drew on literature from a variety of sources internationally, including grey literature, that have assessed the effectiveness of prevention strategies. The returned literature provided a variety of information, including pilot studies of prevention strategies, and discussions of potential methods for preventing crime. However, the results of the systematic review highlight the small number of empirical assessments as to the effectiveness of prevention methods.

The results of a Victimisation Survey of Farmers in the UK are presented in *Chapter Four*. The victimisation survey was sent to over 10,000 farmers via email and received over 800 responses. The findings from the survey relate to information on the incidence of these crimes, reporting of these crimes to the Police, features of the farms that may contribute to the likelihood of victimisation, and seasonality of Livestock and Wildlife crimes. The findings indicated that there were very clear and inverse seasonal patterns in Livestock and Wildlife crimes. The reporting of these crime types was low, but particularly so for wildlife crime, where over 70% of those that experienced Wildlife crime failed to report it to the Police, highlighting the significance of the 'dark figure' of these crimes, and the underestimation of these crimes when using data sources such as Police data on its own. Environmental features were not found to significantly influence the likelihood of farms being victims of Livestock and Wildlife crimes. The results provide a comprehensive overview of victimisation specifically tailored to addressing Livestock and Wildlife crime in the UK.

Chapter Five presents the results of a Thematic Analysis of the answers to the final question in the Victimisation Survey sent to Farmers. The final question of the survey was a free text question offering respondents the opportunity to inform the researcher any other information

relating to crime on their farmland. The thematic analysis provided direct quotes from farmers about their experience of crime, as well as their opinion of criminals, prevention strategies and Policing of farm crime in their area.

Chapter Six presents a seasonal analysis of Police crime data from Dorset constabulary on Livestock and Wildlife crimes for the period 2010-2015. *Chapter Six* aimed to address the absence of evidence on the seasonal patterns of Livestock and Wildlife crimes, and to identify the association between the seasonal patterns for these crime types. The results of the seasonal/annual variation, highlight the need for these crimes to be recorded more accurately for future research, and for crimes to be disaggregated into respective species to identify the true seasonal patterns in crimes (e.g. chickens and other birds show inverse seasonal trends). The chapter goes on to address the data quality issues identified in relation to the accuracy of the terminology used and the crime location information. An FOI sent to all Police forces in the UK aimed to assess the variation in data recording practices, the results of which highlight the need for more accurate recording of crimes in rural areas. It is important that Police forces in rural areas target their limited resources in the most efficient way possible. Having a better understanding of how the criminal activities vary seasonally, would help rural Police forces target their limited resources.

Chapter Seven and *Chapter Eight* present a synthesis of the aims of the thesis and a discussion of the results from the preceding chapters and how the thesis contributes to the existing research on Rural, Livestock and Wildlife crime. The final chapter also presents recommendations from the findings of the thesis and areas for future research.

CHAPTER TWO

Literature Review

Environmental Criminology

Historically criminologists have focused on identifying the dispositional features that differentiate criminals from law-abiding citizens. By identifying the features that make people inherently 'bad' and attracted to crime, it was believed that these individuals could possibly be cured through treatment of their criminally disposed natures (Wortley & Mazerolle, 2013).

During the twentieth century, academic research progressively shifted from person to place, with increasing awareness that illegal acts require more than an arbitrary inclination on the part of potential criminals to commit crime, but also the convergence of individuals and opportunities. The body of research and theories that aimed to explore crime as a person-place interaction are grouped together in a field called 'Environmental Criminology'. Environmental Criminology has moved beyond the dispositional view and instead looks at the influence of spatial, temporal and socio-demographic factors to explain the occurrence of crime (Cohen & Felson 1979).

Theories of environmental criminology build upon the knowledge that criminal events do not occur randomly in space and time (Sherman et al 1989). Jane Jacobs (1961a,b) was one of the first researchers to suggest a relationship existed between crime and the urban environment, indicating that by manipulating the physical environment, it may be able to reduce crime. The work of Jeffery (1977) & Newman (1972) continued on from Jacobs (1961a,b), by evaluating how the manipulation of the environment could have an effect on the incidence of crime. The majority of their work looked at urban city planning, architecture and street networks.

Crime Prevention through Environmental Design (CPTED) conceptualized by Jeffrey focused on the influence of the design of the physical environment on the fear of crime and its occurrence. By changing the existing environment, it was proposed that it would be possible to change the behavior of offenders (Jeffery, 1977). Jeffrey hypothesized that the ability for individuals to move around their environment unimpeded made it easier for criminals to find opportunities to commit crimes. Jeffrey advised that features of the environment that promote security such

as increased natural surveillance, and restricting movement to reduce the accessibility of areas, could help reduce crime.

Following the publication of CPTED, Newman (1972) published his work on 'Defensible Space'. The work by Newman contained similarities in that they both reflected on how the built environment has a direct impact on how areas are used. Newman's work was different from Jeffrey's in that Newman focused on how the anonymity achieved through the development of large-scale, high-rise housing may increase criminal opportunities. The work by Newman hypothesized that the influence of housing style on crime was due to inhabitants feeling an absence of ownership and responsibility to their surrounding environment, which in turn meant they did not feel responsibility to protect it. Moffat (1983) built upon the CPTED and Defensible Space theories to identify six main characteristics of the built environment that can be manipulated in order to deter criminal activity: Territoriality, Surveillance, Access Control, Activity Support, Image Maintenance and Target Hardening.

The work of Jeffrey, Newman and Moffat aims to create security through reinforcing legitimate interactions between people and places. To promote and support legitimate use, it is important to understand how people interact with their environment, and how this may prevent, generate or attract crime in different areas. Theories associated to the person-place interaction and how criminal opportunities occur include Rational Choice, Routine Activities and Crime Pattern Theories, which will be discussed in more detail next.

Rational Choice Theory

The Rational Choice (RCT) perspective focuses on decision-making processes. Individuals make choices every day (e.g. which route to take to work, road A or B? where to get lunch? whether to invest in company A or company B?) and these choices require decisions to be made. The manner in which people make decisions has been the focus of research in variety of fields such as economics, biology and psychology (Outhwaite & Turner, 2007). Microeconomics provided a significant amount of research into RCT. However, the models used to explain choices in economic fields where the sole aim is financial profit, do not accurately translate to real world scenarios such as crime events. The decision-making processes involved in criminal events vary due to social, physical and situational factors (Clarke 1997; Copes & Vieraitis 2009). These factors include:

- The variety of reasons people commit crimes (e.g. money, excitement, revenge etc.)
- The types of crimes different individuals with be attracted to and the different levels of knowledge, preparation, experience, etc. required to commit different crimes (e.g. shoplifting vs. bank robbery).
- The opportunistic nature of many crimes (i.e. many crimes are not premeditated or planned by the offender, but rather are the result of a motivated individual exploiting an opportunity they encounter going about their daily routines (see Routine Activity Theory section).

The influence of choice processes is illustrated by the fact that not all those with criminal records choose to engage in any and all crimes they find opportunities to commit, and conversely, individuals who are generally law abiding may occasionally violate the law.

RCT as it relates to crime, expands beyond the individuals total net benefits, and incorporates the environment they find themselves in, where they are able to use possible alternative choices and environmental cues to weigh up the relative risks/advantages. For individuals to achieve their personal aims efficiently, they must make the best possible i.e. rational decision.

The information available may be copious or there may be nothing at all to base their decision on. The variation in available information is termed 'bounded rationality' where factors such as time, ability and information available limit the individuals' ability to make a perfectly rational choice, therefore they must instead make a 'good enough' choice. The available cues and alternatives in reality are not exhaustive, and the individual will utilize whatever is to hand in making their choice/s. The variability of available information means that any final decision can never be optimal, as the individual is not able to consider all possible information/alternatives within their decision-making process (Kahneman 2002; Tversky & Kahneman, 1989). Clarke & Cornish (1985) discuss psychological studies that indicate that even expert decision-making processes are not perfectly rational, and in particular 'risky' decision studies, the choices people made were found to be influenced by a variety of factors including beliefs, experience, irrational fears and prejudices.

RCT provides a structural explanation for how decisions are made and why people might choose alternatives based on their experience, environment and knowledge. An example event diagram shown in *Figure 2.1,* illustrates how information may be utilised by an offender in

choosing suitable target/s. Decision making processes can be modeled in an optimal manner, taking into consideration a variety of factors such as security, distance from home location, value of goods, knowledge of area etc. Despite optimal models existing in theory, the practical process means offenders will commit crimes using the imperfect nature of decision making.

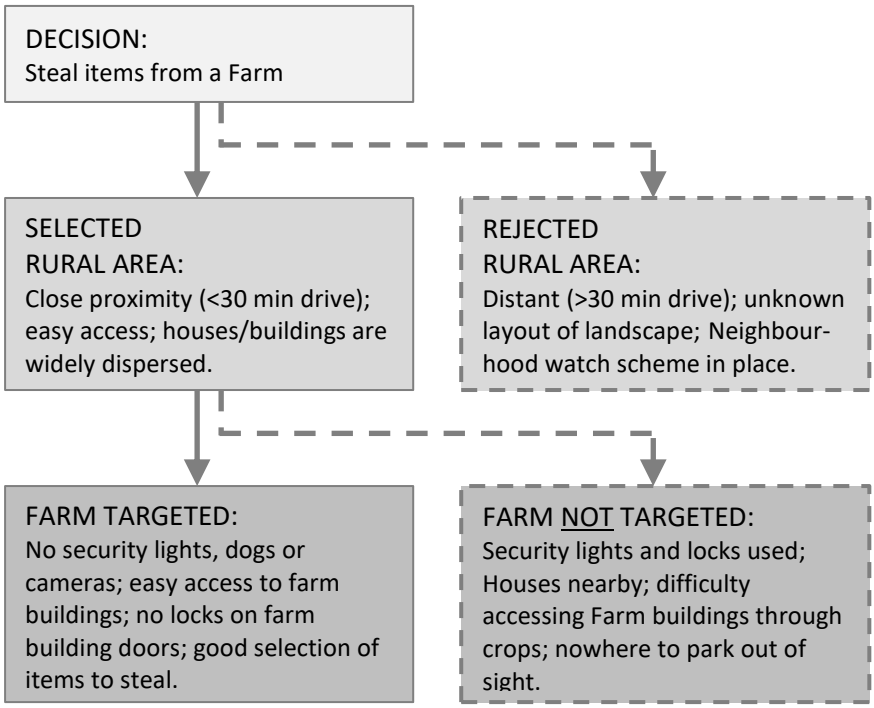

Figure 2.1: Event diagram showing an example of the reasoning that may be involved in choosing between areas and targets once an individual has decided to commit a crime.

Crime specific rational choice models were adopted in recognition that each crime has its own individual and highly specific decisions involved in their commission and/or in the process of deciding to commit the crime (Cornish & Clarke, 2014). The decision process involved in criminal activity is crime/target/location specific, where the offender must assess the immediate environment to identify if the rewards outweigh the risks in that specific situation.

Offenders make a variety of decisions at every stage of the preparation and committal of offences. The use of crime scripts (see example in *Figure 2.2*) to identify the stages involved in committing crimes also identify the most significant decisions that are made by criminals in the planning and committing of crimes (Cornish, 1994; Cornish & Clarke 2002).

Establishing the key decisions made in the commission of crime can help identify where crime prevention techniques may be most effective in influencing behavior, or interrupting the sequence of events that form the most basic conditions ('pinch point') necessary for criminal activity to persist (Read & Tilley 2000). Directing research and analysis to 'pinch points' should result in solutions that will have the longest endurance and widest impact.

Identifying where to target interventions must go beyond the individuals' decision-making process and extend to the spatial orientation and movements of victims and offenders. The decisions made by offenders are the result of the opportunities around them. How daily activities influence who/what offenders come into contact with forms the basis of Routine Activity Theory.

Figure 2.2: The possible sequential steps involved in committing a specific crime – sheep theft – creating the basic crime script.

The crime script includes stages such as reconnaissance, acquisition of objects needed to commit offence, the offence itself and exiting the scene of crime. Additional steps can include the disposal of goods related to crime. Each stage involves decisions to be made by the offender, which can be explored through event diagrams such as that shown in *Figure 2.2*.

Routine Activity Theory

Criminal events require the presence of both a suitable target (be it an object or person) and a motivated offender, in a location where there is an absence of an appropriate guardian. Cohen & Felson (1979) identified that the everyday legitimate activities of individuals (e.g. work, school, home etc.) influences the convergence in time and space of targets, criminals and a lack of supervision, which forms the basic constituents needed for a criminal event to occur.

Criminal events had previously been explained by ecological theories of crime using socioeconomic factors (e.g. poverty, education etc.). However, in the 1950s and 1960s there was a significant improvement in socioeconomic conditions, which was not reflected in the crime rate which was found to increase. Cohen & Felson (1979) looked at alternative explanations for the increase in crime rates and focused on changes in the patterns of daily activities. The research of Cohen and Felson identified that activities were no longer focused around homes, with women going to work, students leaving home for higher education and the increasing uptake of foreign holidays, the increasing movement of people away from their homes meant homes were left empty for longer periods of time and there were more opportunities to cross paths with possible offenders (Felson, 2008).

Legitimate activities form the basis for how illegitimate activities may be created. The environmental focus of routine activity theory on the movement of individuals provided an explanation for how factors outside of the crime and criminal could impact the likelihood of a crime occurring (Felson & Clarke 1998). The basic elements necessary for a criminal event to occur were illustrated using the crime triangle developed by Eck (1994). The crime triangle highlights how interventions can be developed to prevent the necessary elements that make crime possible converging (see *Figure 2.3*).

Figure 2.3: Crime triangle with the three necessary elements required for a crime event to occur.

The knowledge that crimes tend to occur within the boundaries of individuals routine activities has been used to identify the probable locations for crimes to occur and the frequency with which crimes may occur. The inclusion of routine activities as contextual variables can improve the predictive power of crime maps and analyses.

Crime Pattern Theory

Crime Pattern Theory (CPT) combines Rational Choice Theory, Routine Activities Theory and other environmental factors to explain where crime occurs. Building upon the work of Cohen & Felson (1979), Brantingham & Brantingham (1981) suggested that that crime occurs as a result of the intersection of criminals and victims/targets (Felson & Poulsen 2003; Weisburd et al 2004). An individual's awareness space is created through their routine activities, for example the location of an individual's workplace, home and recreational activities are their main nodes of activity (see *Figure 2.4*).

Figure 2.4: The intersection of an individual's activity space (routines activities and pathways between them—e.g. work, home and recreation) and target areas (opportunities) can result in crime.

The routes they travel between these nodes are called 'pathways' and it is the combination of the nodes and pathways that construct the individual's activity and awareness spaces. An individual will know these routes very well and most likely know the nearby local vicinity surrounding the nodes and pathways. Different individuals' activity spaces can vary in size and complexity, depending on how far they have to travel for their different daily activities.

It is when the activity space of a victim and offender intersect that crimes can occur, therefore understanding the factors that influence movement of people within an environment can

highlight areas where there is a higher rate of population interaction, and therefore where opportunities to commit crime are likely to be higher.

Crime Mapping Tools

Historically maps have been used to communicate information such as street networks, weather patterns, outbreaks of disease, species habitats, boundaries of cities and a variety of other elements (Weisburd & McEwen 2015). Over the last century, pins have been pushed into maps to represent locations of events of interest, such as the locations of crimes (Geanuracos et al 2007).

As described earlier in this chapter crime does not occur randomly in space and time, with a significant proportion of crime being spatially auto-correlated (concentrated or dispersed) in a way that would not be expected by chance (Levine 2006). Visualization of crime events on maps have been used to identify spatial patterns in relation to a variety of ecological (e.g. poverty and unemployment) and physical features (e.g. road networks, stations etc). The majority of criminal activities can be analysed spatially, as most crimes have an associated spatial dimension (i.e. A burglary happens at a specific address) (Ratcliffe 2004b).

Technological advancements over the last few decades have led to the development of computer software for mapping information previously done using paper maps and pins. The development of Geographical Information Systems (GISs) (e.g. hardware, software, storage etc.) and Geographical Information Science (GISc) (e.g. analytical techniques) have allowed crime analysts to combine a variety of data sets (e.g. crime data with census information) and identify spatial relationships (Canter 1998; Ratcliffe 2004a).

As UK Police budgets are perpetually constrained and the number of police officers between 2010 and the present have declined, the requirement for targeted policing has become necessary, where officers and resources are deployed to the areas where they are most likely to be effective (Allen & Dempsey, 2016; Bell, 2015). Analysis of crime patterns has been used to successfully conduct intelligence led policing (Maguire, 2000). GIS is a vital tool in intelligence led policing and crime prevention (Ratcliffe 2004b; Weisburd & McEwen 2015). The visualization of a variety of spatial relationships using GIS is now applied in a variety of sectors and countries at different spatial and organisational levels (Levine 2006; Ratcliffe 2004a).

Theories of environmental criminology focus on the person-place interaction, and in combination with software such as GIS, provide an invaluable tool with which to develop a greater understanding of the physical and social factors that create crime opportunities (Weisburd & McEwen 2015). GIS provide researchers and intelligence groups with the tools to analyse crime patterns from a variety of perspectives, and test possible hypotheses for why crime occurs in some areas and not others, potentially providing clues as to the most beneficial locations and methods of crime prevention.

Situational Crime Prevention

Informed by routine activity and the rational choice perspective, situational crime prevention is a body of work that exploits the person-place interaction (Clarke, 1995). By controlling the elements that may influence the choice and manner in which individuals commit crimes, the aim of SCP is to prevent or disrupt criminal activity. The instrumental objective of Situational Crime Prevention is to remove the perceived opportunities for a specific crime in a given area. Clarke original proposed 16 techniques for reducing criminal opportunities, which were overtime expanded to 35 techniques as empirical research identified additional factors that could influence the occurrence of crime.

The 25 situational crime prevention techniques fall within five broad prevention groups aimed at influencing the offenders' perception of the risks and rewards associated to a given criminal opportunity. Techniques include increasing the effort and risks, reducing the rewards and provocations and removing the excuses associated to the situational dynamics of a crime (see *Table 2.1*) (Cornish & Clarke 2003; POP 2015; Wortley, 2001).

In many cases it is not possible to remove targets, therefore it is more effective to manipulate the environment surrounding the target, thereby reducing the possible opportunities (Clarke 1980).

Mapping of crime events using software such as GIS can help identify the locations of concentrations of crime or repeat victimization, for police and other enforcement agencies (Sherman et al, 1989). These concentrations can in-turn be used to identify what possible features of that environment generate or attract criminal events (Farrell & Pease 1993). By identifying the features that may contribute to the likelihood of a particular place or item being

targeted, it is then possible to propose methods specific to that target and that environment that may reduce or remove the likelihood of crime occurring. Crime patterns can therefore be used to inform analysts where best to focus situational crime prevention techniques.

Table 2.1: The twenty-five situational crime prevention techniques (Cornish & Clarke, 2003).

Increase the Effort	Increase the Risks	Reduce the Rewards	Reduce Provocations	Remove Excuses
Harden Targets	Extend Guardianship	Conceal targets	Reduce frustrations and stress	Set Rules
Control access to facilities	Assist Natural Surveillance	Remove targets	Avoid disputes	Post instructions
Screen exits	Reduce Anonymity	Identify property	Reduce emotional arousal	Alert conscience
Deflect Offenders	Utilize place managers	Disrupt markets	Neutralize peer pressure	Assist compliance
Control tools/weapons	Strengthen formal surveillance	Deny benefits	Discourage imitation	Control drugs and Alcohol

Urban Bias of Existing Research

The theories associated to environmental criminology continue to be the focus of criminological research internationally for a variety of crimes. Environmental Criminology theories are utilised by crime analysts' to better understand patterns of criminal incidents in space and time, with the analysis performed by police, researchers and intelligence agencies internationally being used to tackle criminal events ranging from local petty crimes (e.g. shoplifting) to terrorism and smuggling networks (Wartell & Gallagher, 2012). However, it can be argued that the manner in which these theories originated and the subsequent work carried out to establish their efficacy are biased. Criminological research has been predominantly

conducted on volume crimes such as burglary and theft, in urban cities in western, developed countries (Swanson 1981).

Issues with Urban Bias

The urban bias of criminological research can be explained by the fact that significantly more data exists in relation to burglary and theft compared to other crimes, with crimes in developed countries recorded more consistently. However, the urban ethnocentrism of research and crime theory development has treated crime as a homogenous entity across countries irrespective of the socio demographic, economic, cultural and physical differences in urban and rural environments (Brantingham & Brantingham 1993; Felson & Clarke, 1998; Mears et al 2007a,b; Weisheit & Wells 1996; Wells & Weisheit, 2004).

Theories developed for urban environments, obfuscate alternative factors that may be more relevant for the analysis of rural environments. Previous research on rural crime mention the need for rural-specific crimes to be independently assessed, to address any differences in crime patterns in rural areas.

The criminological literature requires a more nuanced approach to the application of theories from urban to rural areas. Future research must begin by establishing whether existing theories apply ubiquitously across urban and rural areas. The lack of research in areas other than developed metropolis means that the current theories have not been validated as being universally applicable, they are instead the best fit for urban areas, and the only available model for areas that do not conform to the urban model.

The urban bias of research has been compared to convenience sampling, where important sources of variation may have been excluded through the absence of research on rural areas and crimes. The study of rural areas may be complex to conduct, due to factors such as difficulty in retrieving data (as will be discussed later in Chapter Six); however, this does not support focusing criminological research on solely urban environments (Weisheit & Donnermeyer 2000; Weisheit & Wells 1996; Wells & Weisheit, 2004). It cannot be assumed that research focusing on burglary or theft in an urban area is going to be representative in areas where cattle theft or criminal damage are of more concern to the community and local Police.

Specific crimes have differing opportunity factors that may explain their occurrence. The factors influencing the occurrence of crimes in rural areas must therefore be identified if policies and prevention methods are to be successfully developed and implemented (Mears et al 2007a,b).

This thesis aims to address the absence of clear evidence as to what physical features may attract or deter would-be criminals in rural areas. By identifying factors that are associated with increased vulnerability of specific rural areas, which could allow for the appropriate allocation of resources in rural environments.

Rural Crime

The urban bias of existing research as described in the previous section, highlights the need for research on crime in rural areas. To identify associations between environmental features and crimes in rural areas it is necessary to define the rural environment itself. The following section defines 'rural' as a concept and describes the existing research in the UK.

Definition of Rural Crime

The term 'Rural Crime' does not have a nationally agreed upon definition. Police forces often provide their own definitions, specifying a variety of crimes of particular interest to their most prevalent issues (Smith 2010). The National Rural Crime Network (NRCN) is a network of 28 Police and Crime Commissioners of predominantly rural constituencies who came together to tackle the issue of rural crime in the UK. The NRCN recognizes that individual forces use different definitions for rural crime, but does not endorse a single definition itself; recognizing that a variety of crimes – including crimes against people, property, species and statutory offences – can occur in rural areas, and as such, policing should incorporate all crimes in rural areas of the UK (Cebulak 2004; Jobes et al 2004; Jones 2010; NRCN, 2015, Smith & McElwee 2015).

The thesis will not be examining the 'ubiquitous' crimes (e.g. burglary, vehicle theft and robbery etc.) experienced in rural areas by residents/business owners but will instead focus on the occurrence of crimes impacting Livestock (e.g. livestock theft and worrying) and Wildlife (e.g. hare coursing and poaching).

There exists limited research on the occurrence of crime in rural areas, with even less information on the occurrence of crimes impacting farmed and wild species, particularly in the UK. The author acknowledges that wildlife crimes can occur in urban and peri-urban areas, however, in this thesis wildlife crimes will be examined within the context of the agricultural industry in the UK, as there is a significant overlap between the landscape used for agricultural businesses and the natural habitat of native wildlife species.

The terminology used by stakeholders and researchers in relation to rural crime, can vary greatly, with significant overlap between groupings, for example rural crime can contain

wildlife crime, but not all wildlife crime is limited to rural areas. The terminology used to describe crimes in this thesis are explained below:

- Rural Crime – Any crime affecting individuals or businesses in rural areas.
- Species Crime – Crimes involving both farmed and wild species.
- Farm/Agricultural Crime – Any crime occurring on farmland or impacting farms.
- Livestock Crime – Any crime that directly impacts livestock on a farm (e.g. theft, worrying etc.)
- Wildlife Crime – Any crime that directly impacts wildlife (e.g. hare coursing, poaching) (NB. that for the purposes of this thesis wildlife crime is assessed as a crime that occurs within the boundaries of farmland in the UK).

The remainder of this chapter will present the definition of 'rural', the spatial classification of rural areas, rural policing and the existing research that has been conducted on rural crime. The chapter will then present an overview of the existing literature and legislation relating to Farm, Livestock and Wildlife crime.

What does the term 'Rural' mean?

The terminology 'Rural' and 'Urban' can be counter-productive in research, as these words imply a homogeneity within, and mutual exclusivity between, these two groups, which may not be the case (Hoggart 1990; Merritt & Dingwall 2010). A universal definition for the term 'Rural' that meets the diverse needs of policy makers and researchers does not exist. International organisations such as the United Nations (UN) acknowledge that the significant variation in what constitutes rural and urban areas internationally means a global definition would be impossible to develop and implement (Djikstra & Poelman 2014). The term 'Rural' can be used to describe a variety of areas (e.g. national parks, farmland and commuter towns), at a variety of spatial scales, varying in size from local regions, counties/states to countries (Weisheit & Donnermeyer 2000).

Rural vs. Rurality – There exists a distinction between the dimensions of 'rural' that constitutes a geographical location and 'rurality' that describes a behavior associated with such areas (Hoggart 1990). 'Rurality' can be described using economic, social and cultural dimensions that contribute to the stereotypical view of the 'rural idyll' as a whole. The dimensions are described below along with some of the issues caused by the association of such stereotypes to rural communities.

Cultural – The cultural representation of rural areas is based upon beliefs, traditions and values relating to living in the rural landscape. The term 'Rural' commonly evokes bucolic and idyllic images of picturesque landscapes, traditional values and tight knit communities (Weisheit & Wells 1996). Literature tends to stereotype rural communities as being intolerant of individuals who do not conform, reporting that 'illegitimate members' (e.g. single mothers, homosexuals, travelers/Romany and non-white individuals) of rural communities are ostracized, as they do not fit into the rural idyll (Scott & Hogg 2015).

Social – Rural areas are often perceived as possessing uniquely strong community cohesiveness not found in urban areas. Local traditions of rural areas can be intrinsic to the community's social identity, and reinforce the tight knit communities, which benefit from a more cohesive social network (Yarwood, 2001). This perception, however, does not account for variation in the density of acquaintanceship within and between rural communities (Scott & Hogg 2015).

Economic – Rural areas are associated with traditional extractive industries such as mining, farming, logging, and so on (Weisheit & Donnermeyer 2000). Rural communities are assumed to make their income through traditional agricultural jobs, living off the land and performing traditional farming roles. The reality is that rural areas and industries have significantly changed over the last century (Mawby 2014). The mechanisation of farming that developed since the world wars has transformed the rural landscape and decreased the opportunities for those wishing to work the land in traditional ways (Newby 1980). There is increasing need for pluriactivity of those remaining in rural areas, to maintain such a lifestyle. Accordingly, the income of rural residents and workforces increasingly comes from a diverse range of sources, not just agriculture (Jervell 1999).

Whilst economic, social and cultural dimensions all contribute to the overall construct of rurality, they cannot be used to accurately and consistently differentiate between urban and rural areas. The economic, social and cultural dimensions contribute to the general perception that close-knit traditional communities involved in bucolic roles such as farming are synonymous with rural areas and fail to represent the variety of actual communities that live and work in rural areas. Many researchers refer to rural areas as if they share uniform and undifferentiated characteristics, that they are one in the same and can be compared universally (Hoggart 1990). This ecological fallacy can lead to misleading analysis and conclusions being made, by assuming that there is homogeneity across all rural areas, when they can in fact vary

from (for example) isolated farm holdings in Snowdonia National Park to a market town within easy commute of London (DCLG 2006; Marshall & Johnson 2005; Somerville et al, 2015).

International Rural & Urban Classification

The UK presents a unique environment for research as compared to other countries such as Canada and Australia (where the majority of previous research on crime in rural areas has been carried out) where the physical differences and distance between rural and urban areas are considered to be far less extreme (Mawby 2014). The scale of countries, the population density and the size of settlements all can influence the differentiation of rural and urban areas. The significant variation between different countries classification systems mean that comparing studies from different countries can be difficult but not impossible as long as the contextual information of the areas being compared are taken into account (Hedayati, 2008).

'Rural' as a geographical location is predominantly classified internationally using demographic information of population density. However, the population values attributed to urban areas in one location may be considered well within the boundaries of rural for another area or country. Therefore, the rural/urban classification systems that do exist tend to be country specific to account for variations in population size and the size of the country (Jobes et al 2004).

Rural & Urban Classification System in the UK

The UK classification system for urban and rural areas uses population density and in some countries the distance to urban centres from census', to differentiate between urban and rural areas. The classification of rural areas in the UK varies from populations of less than three thousand in Scotland to populations of ten thousand in Wales and England as shown in *Table 2.2*.

Census information is used to attribute population densities and to classify the UK land cover into Urban and Rural areas. The population density for census output areas (lowest geographical level for which census data is provided) in England, Northern Ireland, Wales and Scotland vary depending on country size and total population.
The "Urban" classification can be misleading as there are locations in the UK that possess large

areas of open countryside beyond a central settlement that are classified as "Urban the percentage of the total land cover classified as "Rural" is likely to be underestimated in the official figures given. The percentage of land classified as Rural for the countries that make up the UK ranges from 79% to 98% as shown in *Table 2.2.*

The rural landscape is a mosaic of different land uses, with significant overlap between areas such as National Parks and agricultural industries. There are fifteen national parks across the UK, with ten in England, three in Wales and two in Scotland, which attract millions of visitors every year (National Parks, 2015). The National Parks incorporate conservation areas and scheduled ancient monuments, as well as agricultural land (see *Figure 2.5*). *Table 2.3* shows the number of farm holdings in the National Parks of England.

Table 2.2: Classification boundaries for rural and urban areas in the UK – Variation in Government Classification of Rural Areas

UK Area	Land Use	Classification (Definition by Population Density)		% Land Area	% Rural
England[3]	Urban	> 10,000		21	79
	Rural	< 10,000		79	
Wales[3]	Urban	> 10,000		13	87
	Rural	< 10,000		87	
Scotland[1]	Urban	*> 3,000*	*(± 30 –> 60 min drive time to nearest urban settlement)*	2.06	98
	Rural	*< 3,000*	*(± 30 –> 60 min drive time to nearest urban settlement >10,000)*	97.64	
Northern Ireland[2]	Urban	*> 5,000*	*(± 20 –> 30 min drive time to nearest urban settlement)*	6.2	94
	Rural	*< 5,000*	*(± 20 –> 30 min drive time to nearest urban settlement >5,000)*	93.8	

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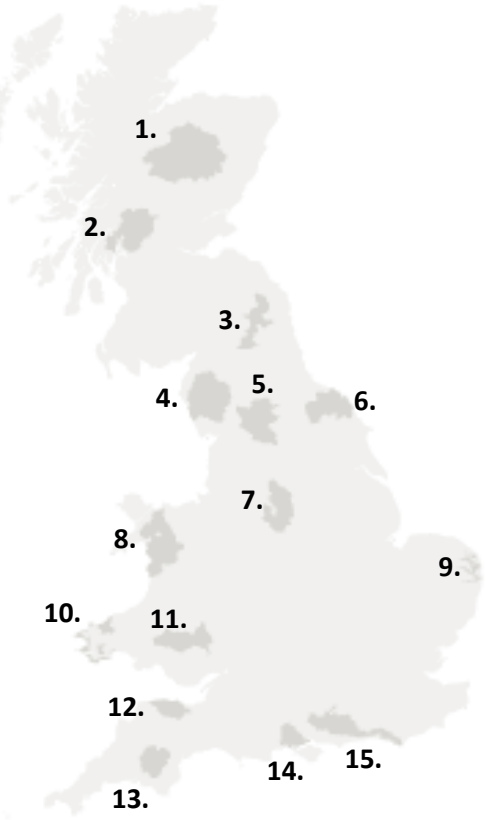
1. SCOTLAND (2014) Scottish Government Urban/Rural Classification 2013 – 2014.
2. IRELAND (2015) Northern Ireland Statistics and Research Agency
3. ENGLAND & WALES (2013) Urban and Rural Area Definitions for Policy Purposes in England and Wales: Methodology (v1.0).



1. Cairngorms
2. Loch Lomond and the Trossachs
3. Northumberland
4. Lake District
5. Yorkshire Dales
6. North York Moors
7. Peak District
8. Snowdonia
9. Broads
10. Pembrokeshire Coast
11. Brecon Beacons
12. Exmoor
13. Dartmoor
14. New Forest
15. South Downs

Figure 2.5: National Parks in the UK. Note: Northern Ireland currently does not have any National Parks (National Parks, 2015).

Table 2.3: The number of Agricultural Holdings in National Park areas of the UK as of 2013 (? = Where official figures were unavailable) (GOV, December 2015).

	National Parks	Area (km^2)	No. of Farm Holdings	% of Area utilised as Farm Holdings
ENGLAND	The Broads	303	170	?
	Northumberland	1,048	181	?
	New Forest	570	346	25
	Exmoor	694	510	?
	Dartmoor	953	751	90
	Yorkshire Dales	1,769	839	?
	South Downs	1,624	892	85
	North Yorkshire Moors	1,434	978	?
	Lake District	2,292	1,083	?
	Peak District	1,437	1,327	82
SCOTLAND	Cairngorms	4,528	?	?
	Loch Lomond & the Trossachs	1,865	?	55
WALES	Snowdonia	2,176	?	80
	Pembrokeshire Coast	621	?	?
	Brecon Beacons	1,344	?	80

The predominant use of the UK rural landscape is for the agricultural industry with 71% of the UK land area classified as agricultural between 2011-2015 (DEFRA 2014; Farming Statistics 2015; World Bank, 2019).

Farm holdings are not homogenously distributed in size of location across the UK rural landscape. Instead different farm types tend to concentrate in specific regions. The livestock distribution maps shown in Figure 2.6, illustrates the varying concentrations of farms with livestock, based on livestock type, with Sheep, Cattle and Pig holdings being largely concentrated on the western side of England and Wales.

The proportion of total land area that is used for agriculture, and distribution of farm types within the landscape, highlight the complex overlap between rural landscapes dedicated to crops and livestock, areas used for recreational purposes (e.g. national parks and attractions) and the habitats of the UKs wildlife.

As Table 2.2 shows, the vast majority of the UK is classified as Rural, yet there is an absence of literature and research that exists on the incidence of crime in rural areas, and in particular, with relation to agricultural, livestock and wildlife crime in the UK. Without understanding the incidence and patterns of such crimes, it is impossible to estimate the impact of them on the economy, environment and rural communities.

It is also difficult without such research to accurately establish what methods of prevention would be best suited to rural areas and agricultural properties, and how these could be implemented. Dedicated research into the variety of crimes that can impact rural areas, would fill the gaps in the urban geography of crime (Yarwood 2001).

The following section will briefly describe rural policing in the UK, and the existing research relating to rural crime and more specifically farm crime.

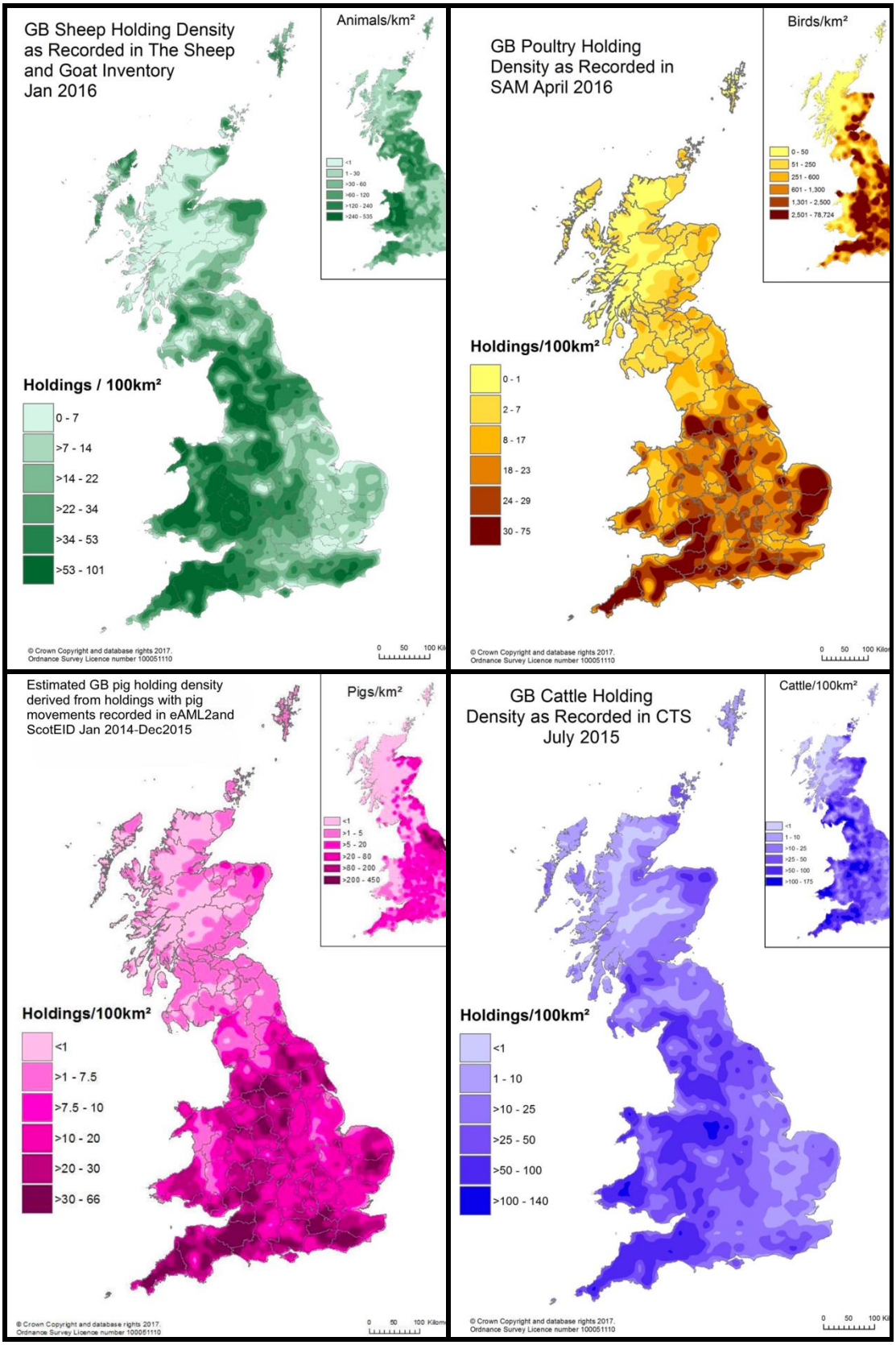


Figure 2.6: Density of Sheep, Poultry and Gamebird, Pig and Cattle holdings in Great Britain (Produced by the Animal & Plant Health Agency) (DEFRA, 2019a).

Rural Policing in the UK

The National Intelligence Model (NIM) was adopted by UK Police in 2000 to manage their day-to-day work and focus Police efforts on issues agreed to be the most pressing nationally, such as organized crime (NIM n.d.). The NIM can be used as a decision-making tool at the local, Force/Regional and National level, to identify key issues and allocate resources intelligently. Despite the NIM model aiming to represent national priorities, it is considered to be urban biased, with competing interests between national and local priorities (John & Maguire, 2004; Smith et al 2013). The use of such a model to determine national priorities can fail to account for the variation in crime priorities between areas irrespective of their rural or urban classification (Smith et al 2013).

Police forces have been declining in number and in recent years there has been a significant reduction in the number of rural officers and rural police stations in the UK. Between 2000 and 2012 over one thousand police stations have been closed with even more on reduced opening hours (Smith et al, 2013). This has directly impacted on the level of police surveillance and increased areas the already limited officer numbers patrol (Barclay 2003).

The current core training of police officers omits information on the policing of areas and types of crimes more typically associated to urban centres. The absence of such specialist training may be a contributing factor to the high turnover of officers in rural areas (Smith et al, 2013).

Sources of data for Rural Crime Research

The data sources on crime in the UK include crimes recorded by Police as well as the Crime Survey of England and Wales, formerly known as the British Crime Survey (BCS). The Crime Survey has been conducted in England and Wales since 1982 to survey the public regarding their experience of crime, providing a wealth of data to support police crime data and identify trends in crimes. The original aim of the BCS was to uncover the 'dark figure' of crime i.e. the rate of crimes that have occurred but have not been reported to the Police. The CSEW has highlighted for many crime types that the crime rates identified from the survey responses are higher than that seen in crimes records held by the Police (Jansson, 2007).

Police data and survey information cannot be considered to be completely representative of the actual levels of crime, but the UK has one of the most comprehensive databases of crimes compared to other countries such as Australia, Canada, New Zealand, United States, Finland, Netherlands and France (NAO 2012), and in combination with the records from the CSEW and other victimization surveys, these data sources can provide a substantial amount of information with which to conduct research into crimes in both rural and urban environments.

Research on Rural Crime in the UK

Two main pieces of research have been conducted to quantitatively assess the actual levels of ubiquitous rural crime in the UK. Marshall & Johnson (2005) used the two main sources of official crime data in the UK, Police recorded data and the results of the British Crime Survey to assess the occurrence of volume crime categories (burglary, vehicle crime, criminal damage and violent crimes) between rural and urban areas in the UK.

The overall results indicated that rural areas experience lower levels of volume crimes than urban areas. It is commonly stated in research that criminal activity occurs more frequently in urban areas compared to rural areas, and whilst this statement is statistically true, it oversimplifies the qualitative and quantitative differences between rural and urban areas, and the impact rural crime has on the community and environment (Jones 2012; Marshall & Johnson 2005; Yarwood 2001).

Marshall and Johnson (2005) assessed the number of volume crimes and identified that the ratio of crimes in rural and urban areas varied depending on crime type, therefore differences in levels of victimization were crime specific. The influence of different crimes in rural and urban areas may mean comparing volume crimes and assuming this represents the impact of all crime in these areas is misleading, as rural areas are qualitatively and quantitatively different to urban areas.

Since the work of Marshall & Johnson (2005) there has been little quantitative research conducted to assess rural crime in the UK. The most significant development in this field came from the NRCN, who developed and conducted the first large-scale (22,087 respondents) survey into the occurrence and impact of rural crime in the UK in 2014/15.

The survey conducted by the NRCN was targeted at people who self identify as living in rural areas. As previously mentioned 'rurality' is not easily defined and personal perceptions of 'rurality' can be dramatically different between individuals; to account for this the survey used the postcodes of those taking part and the Office of National Statistics rural definition to identify and filter those classified as living in rural areas (22,087 initial respondents filtered down to 13,193 included in final analysis who were classified as living in a rural output area within the UK).

The survey was self-completed online unlike the CSEW, which involves interviewing those taking part. Whilst the use of online surveys is convenient and more affordable way of reaching a larger population of people, it can also exclude those who are unable to access the Internet or who have difficulty with computers.

The NRCN recognize in their published report that the methods of recruiting people to take the survey was convenience sampling and as such is likely to have introduced bias, where people with strong feelings on a particular matter or those more recently victimized were more likely to take part. Due to this the results are not as representative of the larger population, as they may have been had the sample population been randomly chosen (like the CSEW). Despite this, the results provide an insight into the perception of the police, fear of crime and socio-economic factors such as feelings of community cohesiveness and annual household income. The NRCN survey offered the opportunity for participants to include their feelings about crimes such as poaching, livestock theft, farm machinery theft and other rural crimes that fall outside of the remit of victimisation surveys such as the CSEW; as well as the traditional volume crimes such as burglary and vehicle theft.

The results were published in 2015 with the main findings highlighting that crime is a significant source of fear and concern for rural residents and businesses, a statement that goes in direct contradiction to the results from the British Crime Survey that implied rural communities have lower levels of fear and concern of crime than urban residents. The NRCN survey also identified that the use of claim data such as that by NFU Mutual, seems to have severely underestimated the cost of rural crime, as out of the survey respondents, only 26% of individuals and 32% of businesses actually made insurance claims as a result of criminal activity. Due to the significant amount of underreporting, a problem acknowledged in crime nationally, and failure to claim from insurance companies, the cost of rural crime was re-estimated by the NRCN to be closer

to £800 million (NRCN, 2015), a significantly larger figure than the £37.8 million estimated by NFU Mutual in 2014.

Whilst the CSEW has provided a significant amount of information regarding crime in the UK, the volume crime focus means that crimes which may be considered more prevalent in rural communities can be masked by the limited scope of the survey questions. Whilst the NRCN survey may not be a reliable representation of the rural UK as a whole, the overall information gleaned from it indicates a general concern about rural crimes among the thousands of individuals who took part, which is a significant outcome of the survey.

The lack of empirical research that exists relating to rural crime, is an indicator of its perceived triviality compared to urban crime. Marshall & Johnson (2005) and the NRCN have highlighted the need for more research into rural crime, to better understand the levels of crime that occur, the impact of these crimes, and the utility of different crime prevention methods in rural environments.

Farm Crime

The rural landscape in the UK is predominantly used for agriculture, and as such there is an overlap between the location of wildlife crime and farm crime. Many illegal activities such as hare coursing and badger baiting are discovered because farmers identify trespassers on their land. The following sections will present the information on the types of crimes impacting Farms and Wildlife, the Policing of these crimes and the data available to assess the incidence and spatial patterns of Livestock and Wildlife crime in the UK.

In both developed and developing countries, agriculture is a major contributor to local and national economic security through natural assets and exports (Donnermeyer & Barclay, 2005; Swanson 1981). The net worth of the agricultural industry in the UK in 2014 was £271 Billion (GOV, November 2015).

Agricultural holdings vary in size and production types (Jones 2010). The three types of agricultural land uses include *Arable* (growing crops), *Pastoral* (raising animals) and *Mixed* (both crops and animals).

A variety of possible opportunities exist in rural areas, especially on agricultural land (Donnermeyer & Barclay, 2005; Smith et al 2013). The targets and uses of agricultural land that criminals can exploit, includes:

- *Land* - Fly-tipping and dumping of waste, growing or manufacturing drugs), the
- *Produce* – Theft of crops, fruit, plants and nuts.
- *Machinery & Equipment* – Tools and machinery used for working and moving around rural landscapes (e.g. tractors and quad bikes).
- *Base of Operations* – Isolation of farmland provides privacy from illicit activity such as drug production sites.
- *Recreation* – Activities such as criminal sports (e.g. dog fighting)
- *Livestock Rustling* – Theft of livestock (sheep, cattle and pigs predominantly in the UK.

Farm crime has developed increasing links to organized crime groups and international illegal trade markets (Barclay 2001). Organised crime groups are exploiting the Industry expertise of

'rogue farmers' in the commission of a variety of crimes that require specialist knowledge. Increasingly rogue farmers are thought to be complicit in the planning and commission of farm crimes (Smith & McElwee 2015).

The impacts of agricultural crime can be widespread and complex in nature, due to the number of people a single criminal event can impact upon from farmer to consumer. Examples of the impacts of Livestock/Crop crimes are described in *Table 2.4.* The majority of crimes that occur in relation to farms ultimately impact the consumer, either through absence of produce or increased prices (Swanson 1981; Swanson & Territo, 1980).

Table 2.4: The Economic, Environmental, Health and Security impacts of Livestock/Crop Crime.

Impacts of Livestock/Crop Crime	
Health	Livestock and crops are susceptible to a variety of diseases such as Foot and Mouth Disease, Blue Tongue, Avian Influenza and African Swine Fever. Failure to comply with procedures/regulations or the illegal movement of livestock (e.g. theft) can result in the transmission of infectious diseases (Naylor et al, 2018). Illegitimate stock entering the food chain (e.g. Horse Meat scandal) can be associated with improper slaughter processes and waste disposal, increasing the risk of disease in legitimate stock (FSA, 2015; Jones & Phipps, 2012). Those working in agriculture are at a higher risk of committing suicide compared to other occupations. Financial stress, which could include the impact of livestock/crop crimes, was found to contribute to the anxiety and depression experienced by farmers (Booth & Lloyd, 2000; Fraser et al, 2005; Gregoire, 2002; Meltzer et al, 2008; Pollock et al, 2002; Parry et al, 2005; Simkin et al, 1998; Watkins & Jacoby, 2007).
Security	Agro-Terrorism is a significant threat to the agricultural system in Western countries, as agricultural land is vulnerable to attacks from transnational / domestic terrorists, economic opportunists, militant animal rights and environmental activists (Moats, 2007; Olson, 2012). Organised Crime groups from Italy, Poland & Turkey are implicated in the commission and trade of goods acquired through farm crime and the diversification of farms into drug production (Barclay & Donnermeyer 2011; Sergi & Lavorgna 2012; Smith & McElwee 2015). Organised crime syndicates are involved in the theft and resale of agricultural machinery. UK farming equipment has been found in countries as far away as Africa, Australia and Eastern Europe (PANIU, 2015a & 2015b; Smith et al, 2013).
Environmental	Animal worrying in the process of trespassing, rustling or removing animals from farmland can have devastating effects on the animal's health, including heart attacks, injuries and in the cases of pregnant farm animals, stress can result in miscarriage. The theft of farm animals can result in breeding stocks being decimated or reduced to dangerously low levels. This can result in the loss of years of work as well as the value of time-spent breeding and building up bloodlines, which once lost, cannot be replaced (Jones & Phipps, 2012). As well as the animal welfare issues associated to the theft and illegal slaughter of species (Jones & Phipps, 2012). Transmission of disease and pests from one area to another through human/animal movements and the knock-on effects can be widespread and detrimental to other ecosystems and associated livelihoods (World Bank, 2014).
Economic	Loss of produce (both crops and livestock) as well as machinery and tools, can have a significant financial impact on farmers, damaging the farms productivity, and the highly sensitive timeframe for completing farm work. Claims on part of landowners to insurers leads to an increase in insurance premiums (Barclay et al 2004; Hedayati, 2008). The financial impact on trade and exportation when incidents of disease or animals with false papers entering food chain occurs, can result in loss of jobs, reduced productivity and consumers (Barclay 2003). Reduction in tourism due to crime impacts the economic benefits to the local area (George, 2010).

Policing of Farm Crime in the UK

Analysis of agricultural crime in Northern Ireland by Armstrong (2005) found that factors such as the reduction in security patrols and closure of rural police stations were related to an increase in farm crime. Neighbourhood Police tactics used in urban areas such as door-to-door visits and street presence of officers are unachievable in rural areas (Merritt & Dingwall 2010). A large proportion of interventions deployed to increase security, ranging from technology to Police roles (e.g. Police Community Support Officers (PCSO's)), were developed in urban areas to deal with urban crime patterns. Despite the urban origins, many of these methods have been applied ubiquitously across the country in a variety of locations ranging from urban to rural with little research or evidence to suggest such methods or roles would work in rural contexts (Anderson & McCall 2005; Merritt & Dingwall 2010).

Rural policing is a specialized role with specific training, however the skills required and previously taught for rural policing are no longer employed by the training authorities involved in national police training (Smith et al, 2013). Specialist training can relate to a variety of relevant areas such as Wildlife crime investigation (Smith et al, 2013). The training of Police officers nationally and internationally has been found to omit information and advice about dealing with agricultural crime (Barclay & Bartel, 2015). Officers with specialist training often achieve this despite minimal support and financial resources for training due to a propensity for more concern to be paid to volume crimes, which tend to be deemed more 'important'. Whilst volume crimes (e.g. burglary, violence) may be the priority in certain areas, in others the impact of wildlife and farm crime may have a much more substantial impact and be the most beneficial focus of police time and resources (Smith et al, 2013). Many rural and agricultural areas establish schemes with the Police such as Neighbourhood watches, however these require significant community involvement to be implemented effectively (Weisheit & Donnermeyer 2000; Yarwood 2015). Those unwilling or unable to be involved in such schemes are also those who tend not benefit in the community (Yarwood 2015).

EU Legislation relating to Livestock

EU legislation relating to farming and farm animals does exist, it is not directly linked to the crimes of interest to this thesis such as theft and worrying. The main issues tackled by EU legislation is related to Animal Welfare include farm animal welfare standards, the movement and export of live farm animals, and animal sentience.

Legislation of Farm Crime in the UK

Judges and juries involved in punishing those involved in agricultural crime tend to have a minimal understanding of the impact of these crimes, which can be attributed to a nationwide lack of specialist courts and judges with experience in dealing with these crime types (Donnermeyer & Barclay, 2005). The repercussions and punishments received by individuals convicted of committing crimes related to agricultural properties (e.g. illegal selling of farm equipment, tools, animals) is significantly less than for other crimes such as drug offences. There have been international calls for punishments for such crimes to be increased (Barclay 2001; Jones 2010).

The majority of legislation related to agriculture in UK is in place to prevent the spread of pests and disease management, and not specifically for preventing farm crimes (Barclay 2001).

Farm Crime Data

Data on farm crime in the UK is complicated by the significant underreporting in rural areas (Anderson & McCall 2005; Barclay 2001; Barclay 2003; Barclay et al 2004; Donnermeyer & Barclay 2005; Swanson 1981; Weisheit & Donnermeyer 2000; Weisheit & Wells 1996). The rationalizations victims use to not report crimes include:

- Ostracism – concern that reporting will have a negative effect on their community ties.
- Cultural – belief that certain crimes are inevitable or tolerable and therefore reporting would be an overreaction.
- Lack of proof
- Uncertainty – farms are often large areas and lack of surveillance for a period of time can lead to uncertainty if a crime has occurred in the interim.
- Too much time had passed.
- Disbelief that Police would not be able to catch offender
- Lack of Police understanding of Farm crime
- Do not want hassle of legal process
- Concerned about media attention
- Deal with the issue themselves (informal social control)

Farmers often hold multiple jobs (pluriactivity) and thus cannot be present on farms the entire time. This absence from the farm area has been found to be another reason why farmers feel less capable of complaining about crimes that have occurred (Barclay 2003).

Non-reporting of crimes by victims was also found to be linked to police discretion in rural areas, as highlighted in the work by Wooff (2015) in relation to the handling of ASB in rural Scotland. Police discretion is believed to play a much bigger role in rural locations compared to urban, due to the limited community size, meaning the police are likely to know both victims and criminals and therefore seek to find a solution that limits harm to community stability (Barclay 2003; Barclay et al 2004; Donnermeyer & Barclay, 2005; Wooff, 2015). Informal social control is considered a significant method of managing crime in rural areas, as isolated local areas cannot rely on the presence of law enforcement, and so turn to each other to act as surveillance for potential criminal activity (Groff, 2015; Mears et al 2007a,b).

An alternative explanation for the lack of reporting of crimes on farmland, include farmer complicity in criminal activity. Smith & McElwee (2016) discussed how Organised Rural Crime Groups (ORGPs) exploited farms in the UK and worked with 'rogue' farmers who were diversifying their farm work with illicit activities such as the production of smokies (improperly slaughtered and prepared sheep carcasses for sale with the Halal meat trade) to supplement their legitimate farming income. The decision not to report crimes on farmland may be a reflection of farmers wanting to prevent Police from attending the farmland and detecting illicit activities, or due to fear of retribution from the organised crime groups.

The scale of underreporting has been assessed via surveys of the UK farmers and rural residents. A survey conducted in 1998 of Scottish farmers found that 50% had failed to report a crime in the previous year (SFCS, 1999). A survey by the National Rural Crime Network found that underreporting was a significant issue in rural areas, with one in four incidents not being reported (NRCN 2015).

Data issues exist even with those crimes that are reported, as most farm crimes are recorded in a way that poorly illustrates the type of crime that has occurred (e.g. farm vehicles that are stolen can be multipurpose, therefore the theft of multipurpose farm equipment may be recorded as a generic vehicle theft) (Hedayati, 2008). Police forces in Australia and the UK do not have a uniform way to record farm crimes, with many incidents tagged under 'Other Crime'

(Discussed further in Chapter Six). Due to the lack of a formal system for identifying crimes relevant to farms and rural areas from the variety of other crimes that fall under this code, extraction of relevant data is complex and in some systems may be impossible (Barclay 2001; Jones & Phipps, 2012).

Wildlife Crime

The international illicit trade of flora and fauna is estimated to be worth $7–23 billion annually (Nellemann et al, 2014). This value does not extend to the impact of the crimes that occur to supply the illicit trade network, but only looks at the financial gain of the illegal trade. Estimating the economic impacts of wildlife crime beyond the cost of the illicit trade is almost impossible due to the complexity of attributing values to natural capital and associated environmental damage (Wellsmith 2011). The offences that take place to supply the illicit trade of flora and fauna will be here on referred to as 'Wildlife Crime' and will be explained further in this chapter with relation to its occurrence in the UK.

Wildlife crime is typically associated with more bio-diverse countries such as Asia and Africa and their more iconic species (e.g. elephants, tigers and rhinos) (WAP, 2014; WWF, 2017). Native species in the UK may not be as diverse as those of other countries or continents. Nevertheless, a variety of wildlife crimes occur in the UK and are having a detrimental effect on species populations.

Wildlife Crime in the UK

Wildlife crime in the UK is described as any action that contravenes the current legislation protecting animals and plants (NWCU, 2016a). A formal definition of wildlife crime does not exist due to the variety of offences such a definition would need to cover, and the fact that many actions can cause damage to species and habitats but may not be considered unlawful under current legislation (EAC, 2003-2004).

The Wildlife Crimes that occur in the UK include:

- *Poaching* – The illegal killing of animals for food or monetary gain, often involving the use of guns or dogs. Poaching is stereotypically seen as a traditional folk crime and mistakenly perceived as not being a serious offence (Eliason 1999).

- *Coursing* – The coursing of species (typically deer and hares) is a traditional 'sport' that often involves spectators and gambling, where dogs are challenged to chase the species, with many of them being injured or killed by the dogs. Coursing was banned by the Hunting Act 2004.
- *Persecution* – The persecution of species can include any action (e.g. trapping or poisoning) that injures/kills the species, destroys their home, causes distress and/or death
- *Trade* – The illegal trade in protected species or their products. The international trade is regulated by the Convention on International Trade in Endangered Species (CITEs) agreement between international governments.
- *Theft/Disturbance* – The removal of species (including native flowers such as Orchids and Bluebells) that are protected, therefore removing them is an offence. Wildlife crimes relating to theft is most commonly associated with bird eggs in the UK.
- *Cruelty* – The law identifies cruelty to animals as being any action taken to mutilate, kick, beat, impale, stab, burn, stone, crush, drown, drag, and asphyxiate any wild mammal with intent to cause suffering.
- *Hunting* – The Hunting Act 2004 indicates the types of hunting that are illegal in the UK. However wild mammals being hunted by dogs are generally banned in the UK as of 2005.

The current UK priorities include persecution (specifically that of badgers, bats and raptors), illegal trade, poaching (specifically deer, hare and fish) and the protection of freshwater pearl mussels (NWCU, 2016b).

Eliason (1999) identified the main motivations for committing wildlife crimes can be attributed four incentives: Necessity (Food), Exhilaration (Sport), Money and Tradition (Cultural). These motivations will vary depending on the type of crime committed (e.g. badger baiting is unlikely to be done in the pursuit of food). The commission of a particular type of wildlife crime does not indicate specialization (e.g. hare coursers have been shown to diversify to badger baiting) (WAP, 2014). Criminals involved in wildlife crime are also likely to have committed other offences such as drug production/dealing, burglary, assault, criminal damage and firearm offences (Zimmerman, 2003). The impacts of wildlife crime are wide reaching, ranging from economic, environmental, health and security related, examples of which are given in *Table 2.5.*

One of the main incentives for wildlife crime is that it is an extremely lucrative business, with the potential profits reaching tens to hundreds of thousands of pounds, whilst the penalty fines

if caught committing these offences can be as low as a few hundred pounds and rarely ever results in imprisonment (EAC, 2003-2004; Lowther et al 2002; Schneider 2008).
In the UK the maximum penalties for committing a wildlife crime is a fine of £5,000 and a 6 month custodial sentence, with the actual penalties awarded by UK courts tending to be significantly smaller (EAC, 2012-2013; WCPRG 2015). Between 2004 and 2014 the Criminal Justice System successfully prosecuted 2,065 individuals for Night & Day Poaching. Those found guilty were sentenced to a variety of punishments including community service. Of those found guilty 1,864 were fined, the average fine over the ten-year period was £227. The majority of those fined paid between £25 and £250 when found guilty of poaching, with only 7 individuals paying more than £1,000 (CJS 2014). Over this ten-year period the total amount of money from fining those successfully prosecuted for Night & Day Poaching amounts to £422,908. The minimal fines imposed to those who are successfully prosecuted are not considered a deterrent to a crime that can earn poachers significantly more money. The majority of fines paid by convicted poachers were equivalent of one or two speeding tickets based on the current £100 fine in the UK.

The comparative ease of committing wildlife crimes compared to others which carry much more significant penalties, has led to an increasing involvement of organized crime groups particularly those involved in drug production (Lawson & Vines 2014)

Wildlife crime is a complex collection of a variety of crimes, and the legislation and enforcement of associated offences are recognized as having been inconsistent (Nurse 2011). For crime analysis to be effective and provide insight, accurate and detailed data must be available with which to analyse crime patterns. The current status of Police Recording and Legislation will be presented, to explain the issues associated with the acquisition of data for the purposes of research on Wildlife Crime.

Table 2.5: The Economic, Environmental, Health and Security impacts of Wildlife Crime.

Impacts of Wildlife Crime	
Health	Diseases and infections can be passed between humans and animals indirectly through food and drink, or direct human-animal interactions in the form of bacteria, parasites, fungi and/or viruses (DEFRA, 2013; WHO, 2014). Unregulated and illicit trade of goods such as the bush meat trade has been implicated in the transmission of diseases such as anthrax, monkey pox, SARS, foot & mouth disease and Ebola. This is of particular relevance with the resurgence of Ebola in 2014. Scientists have suggested that the bush meat trade is one of the primary factors in the emergence of new diseases (Karesh et al, 2005).
Security	International governments have highlighted the use of the illegal trade in wildlife by non-state armed militia for funding terrorist activities, as a serious threat to global security (Nellemann et al, 2014). Sudanese Janjaweed, Lords Resistance Army (LRA), Mozambican National Resistance (RENAMO), Al Qaeda, Haqqani Network (affiliated with Taliban) and Al Shabaab have all been associated to the poaching, transportation and selling of wildlife and their by-products (e.g. ivory) (Warchol, 2004). In the last decade over a thousand rangers have died in the line of duty with 80% being killed by poachers (IUCN, 2014).
Environmental	A decline in species populations can result in insufficient numbers remaining for successful breeding. The removal of keystone species can result in a dramatic shift in the local ecology, including the removal of species involved in seed dispersal and predation. The change to the ecological fingerprint and food chain and lead to subsequent local extinctions (Garibaldi & Turner, 2004; Mills et al, 1993). The effects of the changes are unpredictable until they occur (Wright et al 2000). Poaching has been shown to have a direct effect on the sex ratio of species: • Animals suffering higher levels of stress can produce more female offspring. • Bias toward males in selective hunting (e.g. Stags hunted for their antlers, bull elephants hunted for their tusks). Skewed sex ratios may not be indicative of extinction, but the limited number of males could lead to future breeding problems (Kimanzi & Wanyingi, 2014; Marealle et al, 2010).
Economic	For communities who rely on subsistence for their livelihoods and food resources in these developing regions, the over exploitation of natural resources must be controlled (Fa, 2007; Pearce, 1998; Rosen & Smith 2010). The illicit trade in wildlife and wildlife products is the fourth most lucrative illicit trade globally and accounts for £4.5 to £6 billion (Pounds Sterling) (Haken, 2011; Pietschmann & Walker, 2011) and this illicit global trade removes millions in resources from the developing regions whose land is being exploited.

Policing of Wildlife Crime in the UK

A memorandum of understanding exists between Natural England, Natural Resources Body for Wales, the Crown Prosecution Service and the National Police Chiefs Council; for the prevention, investigation and enforcement of wildlife crime (MoU, 2015). Wildlife crime investigations in the UK are carried out by a variety of organisations in addition to the police, including NGOs and charities (Nurse 2013a,b; Hughes & Lawson, 2011). Some of these organisations may be species specific (e.g. Badger Trust) or general animal welfare such as the Royal Society for the Protection of Birds (RSPB), Badger Trust and Royal Society for the Prevention of Cruelty to Animals (RSPCA).

It is recognized that there is a general lack of specialist understanding of wildlife crime throughout the criminal justice system (including police, prosecutors, judges and magistrates). Police forces nationally have at least one designated Wildlife Crime Officer; however, this is not a stand-alone role and the associated tasks of investigating wildlife crime are usually performed secondary to the Wildlife Crime officer's main duties (Wellsmith, 2011). The general perception of Wildlife Crime Officers is that they are non-core roles, and training for such roles is likely to be one of the earliest casualties of reduced Police budgets. The National Wildlife Crime Unit (NWCU) is a specialist police unit launched in 2006 to coordinate the enforcement activity of police nationally and centralise intelligence on wildlife crime in the UK. In addition to assisting forces in deterring and preventing wildlife crime, the unit also collects intelligence relating to wildlife crime nationally (NWCU 2016c). Despite the NWCU being the only dedicated unit to deal with Wildlife Crime nationally, the units funding is repeatedly brought under question, the unit nearly lost funding in early 2016 until a last-minute reprieve from the government confirmed it would retain funding until 2020.

The NWCU works with other agencies that are brought together within the Partnership for Action Against Wildlife Crime (PAW) network. The unit also produces a strategic report based on intelligence of wildlife crime in the UK with information collated from Police, NGOs and other agencies. The latest findings from the Tactical Assessment for 2017, highlights the significance crimes such as poaching (see Table 2.6).

The NWCU investigations can range from individual criminals to organized crime gangs. Organised crime is typically investigated by statutory organisations such as the National Crime

Agency (NCA), which was operationalized in 2013 to handle serious and organized crime impacting the UK. Whilst wildlife crime has links to organized crime groups, the NCA does not yet deal with wildlife crimes beyond those associated to border force and CITES violations, which are more stereotypically associated to international organised crime. The Home Office Minister Lord Henley was asked why wildlife crime was not included in the NCA's scope, in response Lord Henley indicated wildlife crime would be something possibly handled by the NCA in the future, but in the immediate future the NCA would need to 'settle down' (HoC EAC, 2012). The absence of specialist knowledge relating to wildlife and rural crime in law enforcement agencies such as the NCA perpetuates general disinclination of official bodies to handle offences of this type. There remains a void between charities and NGOs involved in conservation and preventing wildlife crime, and law enforcement, which is bridged only by the National Wildlife Crime Unit and specialist officers, which are in short supply.

Table 2.6: Number of Wildlife Crime Incidents recorded by Police, NGOs and other Agencies in the UK between 01/04/2017 - 30/09/17.

Wildlife Crime	No of Incidents Reported to NWCU by National Police Forces and Other Agencies
Poaching (Fish, Deer, Hare)	459
Other (animal cruelty, shooting etc.)	212
CITEs - all (e.g. Ivory, raptors)	153
Badger Persecution	113
Bat Persecution	93
Raptor Persecution	90
Freshwater Pearl Mussels	0

Wildlife crime is technically 'victimless' as in England animals cannot be considered victims of crime (Wellsmith 2011), reporting therefore relies on witnesses or those who discover evidence of such crimes reporting this to Police. The lack of accuracy in recorded Police data is increased further by the variety of organisations that intelligence can be reported to (e.g. vets, RSPCA, RSPB and many other smaller and local charities) as well as Police.

EU Legislation relating to Nature/Wildlife

The UK (at the time of writing this thesis) is due to leave the European Union, however the existing EU legislation relating to the protection and trade of wild flora and fauna will still be applicable during the transition period, as stated within the Withdrawal Agreement Bill.

The following section provides an overview of the EU legislation relating to wild flora and fauna that overarches all member states. (Note: The Annexes of the legislation are amended every time a new country joins the European Union to account for new environments and species).

The EU as part of its Nature and Biodiversity strategy is aiming to help stop biodiversity loss and improve the conservation efforts internationally not just within the EU member states (EUROPA: Biodiversity, 2019). The EU is currently involved in numerous studies to assess a variety of issues effecting the natural environments (e.g. invasive alien species, illegal wildlife trade as well as sustainable agriculture and fisheries). Whilst evaluation and conservation research is ongoing within the EU, there exist several laws to protect wild flora and fauna that apply to all member states within the EU (EUROPA – Legislation, 2019):

- Birds Directive 1979 – (amended in 2009) aims to protect all wild Bird species that naturally occur within the European Union (EUROPA – Birds Directive, 2019). The legislation aims to protect wild bird species across borders, by:
  - Creating areas for threatened species to thrive by supporting the creation of Special Protection Area's (SPA's).
  - Providing guidance on hunting practices including methods used, species targeted, and limiting the hunting period to allow for seasonal activities such as migration and reproduction.
  - Apart from a select few species, the legislation bans the killing, capture, trade or destruction of nests. The legislation also bans non-selective or large scale killing of birds.

- Habitats Directive 1992 – aims to protect a variety of wild flora and fauna species and natural habitats (EUROPA – Habitats Directive, 2019).
  - Designating core areas of habitat as Sites of Community Importance (SCI) which are managed to support the needs of the species.
  - Applying strict protection regimes within the EU (within and outside of Natura 2000 sites – Natura 2000 is the largest coordinated network of protected areas internationally, providing a haven for vulnerable species and habitats) (EUROPA – Natura 2000, 2019).
  - The monitoring and management of the exploitation and taking of wild species to support conservation efforts.

- Zoos Directive 1999 – The majority of the legislation for natural habitats and biodiversity focus on supporting the wild flora and fauna in their natural habitats, however, there is an acknowledgement of the important part that captive protection of wild animal species outside of their natural habitat. The Zoos Directive provides a guide for best practice to member states, for the licensing and inspection of zoos to make sure the facilities provide appropriate accommodation for species, as well as adhering to the conservation and protection of the species (EUROPA – Zoos Directive, 2019).

- Invasive Alien Species 2015 – Animals and plants that are introduced deliberately or accidentally to an environment where they would not be found normally, can have negative influences on the new environment. The EU legislation includes a list of 'Species of Union Concern'. The legislation goes on to provide prevention, early detection, eradication and management measures that EU Member States can use in the control of invasive alien species (EUROPA – Invasive Alien Species, 2019).

- Legislation on Wildlife Trade – There are several pieces of legislation that apply to the trade in wild flora and fauna (EUROPA – Wildlife, 2019).
  - Cites Convention – The monitoring and control of the international trade in specimens of wild animals and plants to prevent trade negatively impacting their survival. EU Member States are required to comply with the EU Wildlife Trade Regulations (see below for more information) to account for the absence of systematic border controls within the EU Single Market.
  - Trade in Seal Products 2009 – Prevents the trade in products derived from seals within the European market.
  - Humane Trapping Standards 1991 - (commonly known as the Leghold Trap Regulation) The legislation prohibits the use of leghold traps within the EU and the importing of goods that have been produced using animal species from countries that use leghold traps or other methods that do not meet the international trapping standards which encourages hunting and trapping methods that are as humane as possible.

  EU Wildlife Trade Regulations – CITEs is implemented in EU Member States through the EU Wildlife Trade Regulations (EUROPA – CITES, 2019). The EU legislation is then incorporated into National legislation of the Member States so that they can actively enforce and punish infractions.

Whilst the EU legislation provides protection to wildlife across all EU member states, the legislation is predominantly focused on the protection of habitats from exploitation, to provide wild species with safe havens. The UK's national legislation provides more detailed information on the specific wildlife crimes prohibited in the UK.

Legislation of Wildlife Crime in the UK

Wildlife crime has been historically considered low priority by the security forces and government bodies that regulate which crimes are prioritised nationally. This can be illustrated by the absence of a Home Office Counting code for wildlife crime until April 2014 when it was eventually given a separate code (Code 96) after animal welfare charities highlighted the need for wildlife crimes to be accurately recorded (OCI, 2014). Before the adoption of the new code in 2014 wildlife crime had been grouped under Code 99 'Other Notifiable Crimes', which contained a variety of miscellaneous offences (Baker, 2014).

Legislation relating to wildlife crime is complex due to the number of species and number of crimes the legislation covers. There are currently over 300 individual statutes that relate to wildlife crime. These statutes range from those written in the 1800's to those relating to recent changes in hunting laws in the early 21st century. The sheer volume and variety of legislation that exists is confusing and provides a variety of inconsistencies and loopholes through which criminals can exploit wildlife in the UK (Nurse 2013b).

Issues relating to legislation were addressed by the House of Commons: Environmental Audit Committee, who identified that whilst the existing legislation covers the relevant issues associated to wildlife crime, these are scattered across a variety of statutes and regulations from species specific (e.g. Protection of Badgers Act 1992, Conservation of Seals Act 1970) to more generic in coverage (e.g. Night Poaching Act 1828, Game Act 1831). The Committee referred the issue of legislation to the Law Commission with a recommendation that consolidation is required to enhance enforcement and make the legislation more easily accessible by the public, police forces and judges/magistrates (St John et al, 2012). The Law Commissions final report on the legislation for Wildlife Crime in the UK was published in 2015 (Law Commission, 2015). The review concluded that a new single statute would be developed that incorporated details from the below existing pieces of legislation:

Hares Preservation Act	1892
Destructive Imported Animals Act	1932
Prevention of Damage by Rabbits Act	1939
Agriculture Act	1947
Pests Act	1954
Weeds Act	1959
Conservation of Seals Act	1970
Import of Live Fish (England and Wales) Act	1980
Wildlife and Countryside Act	1981
Deer Act	1991
Protection of Badgers Act	1992
Conservation of Habitats and Species Regulations	2010

The recent changes to Police and Home Office recording rules and the recognition that wildlife crime requires clear legislation for effective enforcement indicates that crimes against wildlife are being taken more seriously by those in the criminal justice system and government.

The continuing improvement in the systems in place to enforce, record and penalize wildlife crime, should assist in building a better understanding of wildlife crime in the UK and provide the information needed for research into the individuals committing these crimes and what crimes patterns exist.

Existing International Research into Farm Crime

Despite agricultural crime being a contributor to rural crime, it is a severely neglected area of criminological research internationally (Jones & Phipps, 2012; Smith, Laing & McElwee, 2013). The majority of international research into farm crime has been conducted in the USA and Australia where agriculture forms a significant part of the countries economy and exports (Barclay et al, 2001; Jones 2010; Smith & McElwee 2015). The research that has been conducted on farm crime, analyses the association between spatial, temporal and ecological factors on victimization.

Spatial – Existing research on farm crime found the type of crime varied based on the proximity of farmland to urban centres and main roads. Proximity was also used to assess the distance between targets (e.g. livestock, machinery, farm buildings) and residential farmhouses (Anderson & McCall 2005; Donnermeyer & Barclay, 2005). Barclay & Donnermeyer (2011) found the spatial relationship between crime type and farmland could be separated into four groups:

- *Theft of fuel, tools, machinery and burglary*:

  The likelihood of tools, equipment and external storage facilities being targeted increased the further storage units were from the main farmhouse and the less visible they were. Holdings of equipment and machinery that are isolated from main farmhouse were more likely to be victimized (Barclay & Donnermeyer 2011; Jones & Phipps, 2012).

  Highly accessible farms close to urban centres and main roads typically experienced higher levels of machinery and tool theft. Fly tipping was also found to be associated with close proximity to urban centres and main roads (Anderson & McCall 2005; Barclay & Donnermeyer 2011; SFCS 1999).

- *Malicious damage, illegal trespassers and poachers*:

  Farmland in close proximity to roads and urban centres were more likely to be victimized. Malicious damage, illegal trespass and shooters occur distant from urban centre but near highways (Barclay 2001; Barclay & Donnermeyer 2011; Jones & Phipps, 2012). The influence of proximity to urban centres was inconsistent between studies with both increased and decreased proximity seemingly indicative of a higher likelihood of victimization.

- *Stock theft*:

  Isolated farmland with dense vegetation and rough terrain suffered higher likelihood of victimization (Anderson & McCall, 2005; Barclay, 2001; Barclay & Donnermeyer, 2011).

Other levels of analysis that have shown to be of relevance to farm crime, includes temporal and ecological factors:

Temporal – Seasonal Variation in livestock theft was found to impact farms in Australia, with victimization occurring predominantly just before calving, lambing or shearing season (early spring) when the stock was at its premium value (Barclay, 2001).

Ecological – The *v*ariations in terrain have been shown to affect the likelihood of victimization and influence the choice of target. Farms with difficult terrain were most likely to be victim of trespass, poaching and livestock theft whereas farms with flat terrain over large areas experience more small equipment theft, vandalism and burglary (Jones & Phipps, 2012). Mears

et al (2007a,b) compared the occurrence of crime in California on arable and pastoral farms with dense cover and found that fruit and nut farms with dense cover suffered higher rates of victimisation than livestock or grain farms with dense cover.

The existing farm crime research has identified features of farms that may increase the likelihood of victimization, however many of the authors indicated that the occurrence of farm crime is highly situational and likely to vary between regions and countries (Mears et al 2007b). It is therefore important to identify what patterns exist in relation to farm crime in the UK.
In addition to the research conducted in Australia and the USA a recent piece of research on farm crime by Walsh & Walsh (2017a,b,c) was conducted in the Republic of Ireland. The Republic of Ireland is closest in proximity to the UK compared to the other studies available internationally, however, the relevant legislation for crimes related to Livestock and Wildlife differ to those in the UK, therefore the Republic of Ireland was not included within the studies within this thesis. However, the results of the study by Walsh & Walsh (2017a,b,c) provided some interesting results in relation to the incidence of farm crimes, and the financial impact.

Of the total number of respondents 66% had experienced agricultural crime in the study period (2014-2016) (Walsh & Walsh, 2017a). The respondents (N = 861) were the victims of 1,512 incidents in total, divided across four crime categories: (i) vandalism/criminal damage/trespass (VCDT); (ii) theft; (iii) criminal assault; and (iv) fraud. The survey identified that less than half (45%) of all incidents (1,166 - where information on reporting was provided) were reported to the Gardai. Separated by crime type, 63% of thefts were reported, and 47% of VCDT were reported (Walsh & Walsh, 2017c).

Financial Impact – The survey asked respondents to detail three sources of financial costs associated to crime on their farmland: 1) direct financial loss from agricultural crime/s; 2) cost resulting from the time spent attending to the aftermath of agricultural crime/s; and 3) Money spent on minimising the farms exposure to financial loss (i.e. cost of insurance and crime prevention measures) (Walsh & Walsh, 2017b). The average cost of agricultural crime for farmers that experienced it was €4,328 (Walsh & Walsh, 2017b). The authors theorised that the farmers who did not provide a cost or indicated zero cost did so due to the difficulty in quantifying the associated costs, as they may be indirect, or arise at a different time to when the crime was committed (Walsh & Walsh, 2017b).

The survey also identified the average number of hours spent dealing with agricultural crime (based on 274 responses from farmers who had experienced crime). Farmers were found to spend an average of 14.1 hours dealing with the aftermath of crime. Using farmers average income in Ireland, the time spent dealing with crimes was calculated as costing the farmer approximately €248 (Walsh & Walsh, 2017b).

The research presented in this section provides an overview of the international experiences of farm crime, including the cost of these crimes as well as what environmental features may contribute to vulnerability of farms. To better understand the relevance of the international findings in it is necessary to identify what research exists into the experience of farm crime in the UK.

Farm Crime in the UK

Farm crimes in the UK equating to tens of thousands of pounds receive little to no media attention, whilst a crime of similar value committed in an urban area receives significant coverage (Donnermeyer & Barclay, 2005).

The National Farmers Union (NFU) Mutual is the UK's leading rural insurer. The NFU Mutual Rural Crime Report is produced annually, using the insurance claim information gained in the previous year to evaluate the costs and year-on-year variation of crime in rural areas (NFU Mutual, 2018).

The Rural Crime Report by the NFU is the only annual report specifically focusing on crimes affecting rural businesses, such as farm crime. The report provides a useful insight into the value of rural crime nationally, as well as the specific cost of crimes such as Livestock, Quad Bike and Tractor theft. The limited resources with which to understand the rates of farm crime in the UK, means the NFU Mutual report and the information it provides is pivotal to the national understanding of the impact of rural crimes, particularly on the farming community.

The most recent Rural Crime Report 2018 estimates that Farm Crime cost the UK £44.5M in 2017, an increase of 13.7% on 2016 (as shown in Table 2.7). The total cost of Farm Crime is rising at its fastest rate since 2010. The cost of Livestock Theft alone in 2017 was GBP£2.4 M, an increase since 2016.

The Rural Crime Report by NFU Mutual has become a milestone publication for the public and Police to understand the state of Farm Crime in the UK. However, much like the use of Police data, insurance data is limited in its representativeness.

Table 2.7: The cost of Rural Crime and Livestock Theft in the UK based on insurance claims to NFU Mutual (NFU Mutual, 2015, 2016, 2017, 2018, 2019).

Rural Crime Report (NFU)		
Year	Total Farm Crime (Cost of Claims)	Livestock Theft (Cost of Claims)
2010	£49.7M	-
2011	£52.7M	-
2012	£42.3M	-
2013	£44.5M	-
2014	£37.8M	£6.6M
2015	£41.0M	£2.9M
2016	£39.2M	£2.2M
2017	£44.5M	£2.4M
2018	£49.9M	£2.5M

Source: Insurance Claim Data

Due to the nature in which insurance data is collected, the NFU Mutual data is unlikely to be representative of all the crimes that may have occurred on farmland in the UK for a number of reasons. As discussed in the NRCN Rural Crime survey in 2018, approximately 28% of 'Specific Rural Business Owners' who were financially impacted made official claims on their insurance, highlighting one of the limitations of using insurance data. Farmers are more likely to claim when they have been significantly financially impacted by crime and therefore data may exclude crimes with a smaller financial impact. The NFU Mutual claim data also cannot provide information about farmers who are insured through other organizations, which is likely to vary between regions.

In addition to the variation in the types of crimes claimed through insurance, another limitation is that some farmers do not have comprehensive insurance or are uninsured. Crimes such as Sheep Worrying may require policy extensions that farmers are unaware they need to opt into, and can increase the overall costs of insurance premiums deterring farmers from adequately insuring the livestock and farm against these types of crimes. The variability in the uptake of

insurance on farms in the UK directly impacts the accuracy of the subsequent claim data (Case, 2018 & 2019; Farming UK, 2019).

Whilst the information in the NFU Mutual reports provide an indication of the impact of farm crime in the UK, more information and details are needed on the types of crimes farmers experience to understand the scale of the problem.

The victimisation surveys in the following section provide a more representative picture of the variety and incidence rates of crimes on farms in the UK.

Victimisation Surveys in the UK

The limited amount of information that exists in relation to the occurrence of Livestock and Wildlife related crimes in the UK, has been identified using insurance data (NFU Mutual), or through victimisation surveys. The following section will present an overview of the main victimization surveys conducted in the UK, before identifying surveys which provide more specific information relating to Livestock and Wildlife crime.

Victimisation Surveys: Personal

To better understand the incidence and impacts of crime on individuals and businesses, victimisation surveys were established internationally to provide a clearer insight into crime rates. Surveys conducted in the UK that aim to elicit information from individuals about their experiences of crime including those not reported to the Police. The survey results are utilised by the government to make decisions about crime and justice and relevant policies (ONS Crime & Justice, 2017). The surveys conducted in the UK include: 1) Crime Survey of England & Wales (CSEW), 2) Crime & Justice Survey: Scotland (C&J), 3) Northern Ireland Crime Survey (NICS).

The *Crime Survey for England & Wales* (CSEW) – previously the British Crime Survey has been conducted since 1981 with members of the public being asked about their experiences of crime over the previous 12 months (CSEW ONS, 2015).

The *Scottish Crime & Justice Survey* (SCJS) is due to be produced annually from 2017 onwards. Earlier surveys did not cover the highlands and Islands of Scotland, and prior to 2008, surveys were conducted intermittently, in paper form and sent to approximately 5,000 participants (SCJS(a,b), n.d.).

The *Northern Ireland Crime Survey* (NICS) surveys private households in Northern Ireland. The survey was previously conducted on an ad-hoc basis but has been conducted annually since 2005 (NICS, n.d.).

The surveys relating to personal experiences of crime have some of the largest sample sizes of victimisation surveys in the UK. Table 2.9 details the sample sizes for the separate surveys, and what proportion of the respondents were categorised as living in urban and rural areas. Between a quarter to a third of respondents were categorised as living in a rural area for all the crime surveys conducted, reflecting the urban bias of people living in the UK (see Table 2.8).

Table 2.8: Percentage of population living in Rural and Urban areas of the UK (ONS, 2013; GOV SCOT, 2018a; DAERA, 2018a; DEFRA, 2019b).

Country	Urban Population (%)	Rural Population (%)
England	83%	17%
Wales	67%	33%
Scotland	83%	17%
Northern Ireland	63%	37%

The crime surveys ask respondents to reflect on their experience of a variety of crimes detailed in Table 2.10. The sample surveyed and the offences reviewed intentionally avoid crimes against businesses and focus solely on crimes experienced by an individual/household. For this reason, these surveys only provide an overview of the experience of personal crime in rural areas, not the type of crimes involving livestock and wildlife that impact farmland and farmers.

Table 2.9: UK Crime Surveys conducted over the last ten years and the number of rural and urban participants involved (Bolling et al, 2008, 2009; Campbell, 2015, 2016, 2017; Campbell & Cadogan, 2013; Campbell & Rice, 2018a, 2018b; CSEW, 2012a, 2012b, 2014, 2015, 2016, 2017; Davidson et al, 2014; Flatley et al, 2010; Fitzpatrick & Grant, 2011; Grant et al, 2016, 2018, 2019; Page et al, 2010a, 2010b; Page & Twist, 2011; Toner & Freel, 2010, 2011, 2013; SCJS Data Tables, 2019).

Survey Period	No. Respondents	Participants	
		Urban	Rural
Crime Survey for England & Wales			
Apr 2007 – Mar 2008	30,985	-	-
Apr 2008 – Mar 2009	45,519	-	-
Apr 2009 – Mar 2010	45,189	≅ 33,000	≅ 12,000
Apr 2010 – Mar 2011	46,380	≅ 35,000	≅ 12,000
Apr 2011 – Mar 2012	45,930	≅ 35,000	≅ 11,000
Apr 2012 – Mar 2013	35,169	≅ 27,000	≅ 8,000
Apr 2013 – Mar 2014	34,902	≅ 27,000	≅ 8,000
Apr 2014 – Mar 2015	33,588	≅ 26,000	≅ 8,000
Apr 2015 – Mar 2016	35,146	≅ 27,000	≅ 8,102
Apr 2016 – Mar 2017	35,420	≅ 28,000	≅ 8,000
Scottish Crime & Justice Survey			
Apr 2008 – Mar 2009	16,003	12,419	3,584
Apr 2009 – Mar 2010	16,036	11,641	4,395
Apr 2010 – Mar 2011	13,010	9,995	3,015
Apr 2012 – Mar 2013	12,045	9,582	2,463
Apr 2014 – Mar 2015	11,472	9,237	2,235
Apr 2016 – Mar 2017	5,567	4,500	1,067
Apr 2017 – Mar 2018	5,475	4412	1063
Northern Ireland Crime Survey			
Apr 2009 – Mar 2010	4,102	2,391	1,711
Apr 2010 – Mar 2011	4,081	2,329	1,752
Apr 2011 – Mar 2012	4,064	2,344	1,720
Apr 2012 – Mar 2013	4,055	2,709	1,346
Apr 2013 – Mar 2014	3,598	2,396	1,196
Apr 2014 – Mar 2015	2,074	1,314	757
Apr 2015 – Mar 2016	1,975	1,260	712
Apr 2016 – Mar 2017	1,877	1,227	650
Apr 2017 – Mar 2018	1,582	1,025	557

Survey Method: Interview

Table 2.10: Topics covered in the Crime Surveys of England, Wales Scotland, Northern Ireland (Campbell & Rice, 2018b; CSEW ONS, 2015; Grant et al, 2019).

Crime Types	CSEW	SJCS	NICS
Household			
Burglary (including attempts) Burglary with Entry Attempted Burglary Other Household Theft Property outside of the home stolen or damaged Damage to Property	✓	✓	✓
Vehicle related-Theft (including attempts) Theft from a vehicle Theft of a vehicle Attempted theft of/from a vehicle	✓	✓	✓
Criminal Damage / Vandalism Vehicle Vandalism	✓	✓	✓
Bicycle Theft	✓	✓	✓
Security of Premises	-	-	-
Personal			
Personal Property Personal property stolen/attempted to be stolen Personal property was damaged	✓	✓	✓
Violence: Assault with minor injury Assault with no injury Wounding Threats	✓	✓	✓
Perceptions: Crime & Safety Crime Reporting Criminal Justice System Police / Gardaí	✓	✓	✓
Additional Information			
Stalking	✓	✓	-
Sexual Victimisation	✓	✓	-
Mental, Physical or Sexual abuse during childhood.	✓	-	-
Domestic violence.	✓	-	-
Drugs and Alcohol.	✓	-	-
Anti-Social Behaviour	✓	-	-
Gangs and Personal Security	✓	-	-
Financial Loss and Fraud	✓	-	-
Harassment and Partner Abuse (Psychological & Physical)	-	✓	-
Illicit Drugs	-	✓	-
Workplace Abuse	-	✓	-
Smuggled and Fake Goods	-	✓	-
Risk Factors	-	✓	-

The following section reviews the small number of Surveys and Reports focusing on crimes experienced specifically by farms in the UK.

Agricultural Surveys & Reports in the UK

Agriculture is a devolved matter in the United Kingdom, and therefore it is the responsibility of the Scottish and Welsh Governments, and the Northern Ireland Assembly to manage their own agricultural policy and data production (EUROSTAT, 2018). There are several surveys of farms conducted by government departments to monitor trends in output, such as the Farm Business Survey (FBS).

Farm Business Survey

The *Farm Business Survey* (FBS) is an annual survey of farmers in the UK, and is a source of information on the financial, physical and environmental performance of farm businesses (Farm Business Survey, n.d.). The Farm Business Survey was first conducted in England in 1936 with other countries in the UK producing their own versions of the Farm Business Survey annually (GOV FBS, 2018a,b). The information collected by the FBS is intended to be a resource for governments, other stakeholders and researchers. The institutions involved in collecting survey data and compiling it into resources for governments and researchers are detailed below:

England – The FBS is conducted on behalf of DEFRA by the Rural Business Research (RBR) group, an academic consortium of six university research centres (AFIT, n.d.; RBR, 2018).

Wales – The FBS is conducted by the Institute of Biological, Environmental and Rural Sciences (IBERS) at Aberystwyth University on behalf of the Welsh Government (FBS Wales, n.d.). The information from the separate surveys in England and Wales are then combined and the Farm Business Benchmarking publication is produced by the Rural Business Unit (RBU) at the University of Cambridge (Rural Business Unit, n.d.).

Scotland – Scotland's Rural College (SRUC) collects survey data on behalf of the Scottish Government (SRUC, 2018; FBS Scotland, n.d.).

Northern Ireland – The Department of Agriculture, Environment and Rural Affairs (DAERA) conducts and publishes the results of the FBS in Northern Ireland (GOV DAERA, 2017; DAERA, 2017,2018b).

The FBS/NFS surveys provide detailed information on farm structures, business incomes, harvest summaries and livestock inventories etc. But whilst these surveys account for farm

crimes indirectly within the net income/losses associated to farms, the surveys do not explicitly address the incidence, costs or impact of livestock and wildlife crimes on farmland in isolation. Therefore, more crime focused surveys are required to adequately address these issues.

The Victimisation Surveys and Farm Business Survey provide a wealth of information on the crimes individuals have experienced, as well as general information on the structure of the farm business, but neither provide specific information about crimes experienced on the farmland in relation to livestock or wildlife.

Of the limited available information on farm crime and in particular crimes affecting Livestock and Wildlife, five surveys were identified. Table 2.11 presents a comparison of the locations, duration, number of respondents and the topics covered by the included surveys and reports, and the following sections present the background and main findings from each of these surveys.

Table 2.11: Comparison table of the Rural and Farm Crime focused surveys in the UK (CVS, 2014, 2015, 2016, 2018; CVS Technical Report, 2018; NRCN, 2015, 2018; NFU Mutual, 2018; Smith, 2018; SFCS, 1999).

Survey/Report	Location	Year	Duration	No. Respondents	Target Group	General Topics Addressed in Survey/Report
Commercial Victimisation Survey	England & Wales	2013	Previous 12 months	1,085	Agriculture, Forestry and Fishing Business Premises	• Types of Crime • Incidence and Prevalence of Crime • Items Stolen or Damaged • Costs of Crime (including Financial Loss) • Action Taken & Reporting Patterns (Police etc) • Experience of Intimidation following Crime • Cyber Crime, ASB and Crime Prevention Measures
		2014	Previous 12 months	1,019		
		2015	Previous 12 months	1,098		
		2017	Previous 12 months	1,019		
Rural Crime Survey (NRCN)	UK	2015	Previous 12 months	13,193	• Rural Visitors • Rural Residents • Rural Business Owners	• Crime Types and Rates in Rural Areas • Impact of Crime on Victims / Wider Community • Reporting of Crime • Perceptions of Criminals / Crime • Perceptions of Police in Rural Areas / Satisfaction • Security Measures
		2018	Previous 12 months	16,191		
Rural Crime Report (NFU Mutual)	UK	Annual	Previous 12 months	Based on Insurance Claims	Rural Farms & Businesses	• Cost of Rural Crime (Large Agricultural Focus) • Trends and Perspectives of Stakeholders
Farm Crime in England and Wales (PhD Research)	England & Wales	2017	Previous 12 months	126	Farmers	• Farm Crime • Crime Prevention • Police • Predictors of Farm Victimisation
The Scottish Farm Crime Survey	Scotland	1998	Previous 15 months & Previous 5 years	1,022	Farmers (owners, tenants and managers)	• Crimes committed against farms • Vulnerabilities of farms to crime • Initiatives to combat farm crime • Police and Farm Crime • Impact of Farm Crime

Victimisation Surveys: Commercial/Business

To compliment the data collected on crime in the UK affecting Households and Individuals as outlined in the previous section, the ***Commercial Victimisation Survey*** (CVS) was developed. The Commercial Victimisation *Survey* (also known as the *Crimes Against Businesses Survey),* is a series commissioned by the Home Office to measure crime against businesses in England & Wales. A version of the Commercial Victimisation Survey was first conducted in 1994, followed by another survey in 2002 and has subsequently been conducted annually since 2012. The aim of the CVS survey was to gain a better understanding of the crimes effecting businesses that may not be clear via traditional sources of data (e.g. police or insurance records) (CVS, 2013).

The CVS Survey gathers information on a variety of crimes that can impact businesses, as well as information on prevention methods utilised by respondents. All respondents were asked the same core questions to provide information on their experiences of crime and to allow comparison between business areas. The topics covered include: Burglary / Attempted Burglary, Vandalism or Deliberate Damage, Theft of Vehicles / from Vehicles, Robbery, Assaults or Threats, Theft by Customers / Employees / Others / Persons Unknown, Fraud by Employees / Others / Persons Unknown, Cyber Crime, Experience of Anti-Social Behaviour, and Crime Prevention.

The CVS survey initially focused on businesses in the retail and manufacturing industries. The survey then expanded to include other commercial areas (as shown in Table 2.12) and since 2013 has incorporated the area of 'Agriculture, Forestry and Fishing' (CVS 2018). The Commercial Victimisation Surveys conducted in 2013, 2014, 2015 and 2017 included respondents from the 'Agriculture, Forestry and Fishing' sector.

In the most recent survey in 2017, a total of 1,019 premises were included in the 'Agriculture, Forestry & Fishing' sector, with 87% described farming as the main activity at their premises. The results relating to crimes experienced by the 'Agriculture, Forestry and Fishing' sector identified that:

- 27% of premises had experienced crime in 2017.
- 113,000 crimes were experienced in 2017, which equated to 1,335 crime per 1,000 premises, this was the lowest rate of crime across all sectors since 2013.

- The most commonly experienced crime for this sector was Vandalism which was experienced by 33% of premises, and equated to 37,000 incidents, this was followed by Theft which was experienced by 25% of premises.

Table 2.12: Number of respondents to the Commercial Victimisation Survey each year for the nine separate commercial sectors (CVS, 2014, 2015, 2016, 2018).

Year	Manufacturing	Wholesale & Retail	Transportation & Storage	Accommodation & Food	Arts, Entertainment and Recreation	Agriculture, Forestry and Fishing	Construction	Information & Communication	Administrative & Support Services
1994	-	3,027	-	-	-	-	-	-	-
2002	2,561	3,955	-	-	-	-	-	-	-
2012	962	1,021	879	1,155	-	-	-	-	-
2013	-	1,956	-	2,288	888	1,085	-	-	-
2014	-	2,111	-	1,052	-	1,019	-	-	-
2015	-	973	-	-	-	1,098	958	177	-
2016	-	1,128	904	-	-	-	-	-	931
2017	991	1,053	-	-	964	1,019	-	-	-
					Total	***4,221***			

Survey Method: Telephone Interviews.

Based on the data collected via the CVS survey of the 'Agriculture, Forestry and Fishing' sector between 2013 and 2017 (excluding 2016 which was not surveyed for this sector) there was shown to be no statistically significant change in the number of crimes over this period.

In addition to the more general questions about crimes that were asked of all sectors, more specific questions relevant to this thesis were asked of the respondents from the 'Agriculture, Forestry and Fishing' sectors. The questions of relevance to this thesis included information on whether livestock had been stolen, the number of livestock stolen and the financial impact of these thefts. The results identified that only 2% of respondents had experienced livestock theft in 2017 a decline from 4% in 2013. These results are challenged by the results of other surveys and reports that will be discussed in the following section.

In addition to livestock theft, respondents were also presented with examples of Anti-Social Behaviour (ASB), and asked to indicate if these 'Other ASB' crimes had occurred on their premises:

- Trespassing or unauthorised access of land or buildings
- Poaching, hare coursing, illegal hunting
- 'Lamping', quad biking or other vehicles on your land without permission.
- Unauthorised occupancy of land / buildings
- 'Fly Grazing' – Use of land for grazing animals with permission.
- Chasing or Worrying of livestock (with people or dogs)

The results identified the most frequently experienced crimes in 2017 from the 'Other' ASB examples, were: 1) Trespassing/Unauthorised access of land or buildings (26% - 35%), 2) 'Lamping', quad biking or use of other vehicles on land (15% - 23%), and 3) Poaching, Hare Coursing or Illegal Hunting (15% - 26%) as shown in Figure 2.7. The prevalence rates of all the 'Other' ASB types were found to have increased since 2013, although not to a statistically significant level.

Reporting Crime to Police – In addition to the information about experiences of crime by respondents, the survey also recorded the reporting rate of crimes to police by premises in this sector. The results indicated that in the 'Agriculture, Forestry and Fishing' sector between 15% and 20% of premises contacted Police in relation to crimes and crime prevention affecting businesses.

Satisfaction with Police – Participants in the survey were then asked to indicate their satisfaction level in the way the Police have handled crimes in their local area. The results were separated to show the difference between the satisfaction levels of victims and non-victims as shown in Figure 2.8.

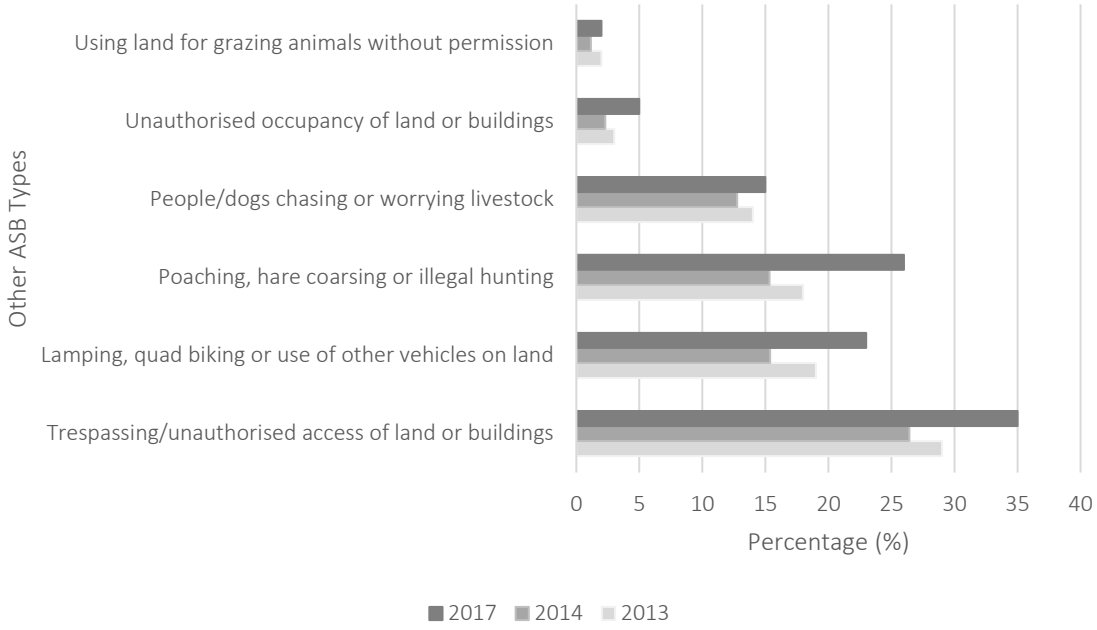


Figure 2.7: The percentage of AFF premises that experienced 'Other' Anti-Social Behaviour (ASB) types of crime in 2013, 2014 and 2017 (CVS Tables, 2014, 2015, 2018).

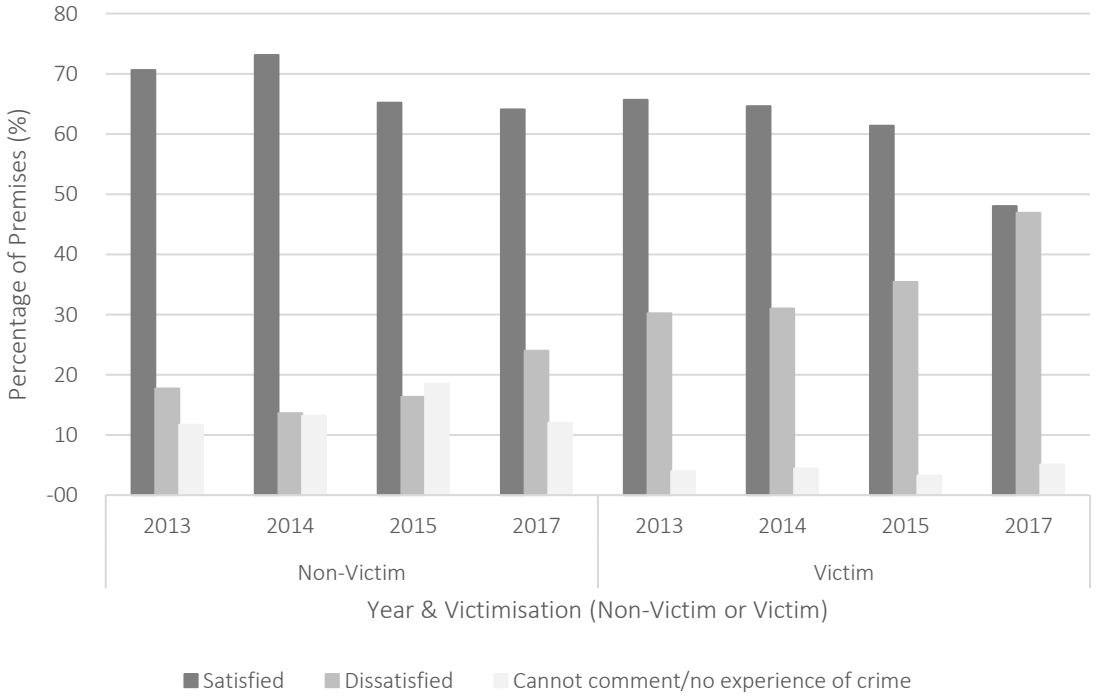


Figure 2.8: The satisfaction of premises with how the Police have handled crime in their area, for those who have/have-not been victims of crime (CVS Tables, 2014, 2015, 2016, 2018).

The results showed that the satisfaction levels of non-victims were fairly high between 60-75%, however a slight increase in dissatisfaction was seen between 2013 and 2017. The change in satisfaction levels amongst victims of crime were more distinct. Between 2013 and 2017, the level of satisfaction dropped by nearly 20% and dissatisfaction rose by 15-20%.

Respondents were asked to indicate reasons why they were dissatisfied with the Police response to crime in their local area, the most commonly selected choices were 1) That there were not enough Police / Police undermanned / Not enough resources, 2) Takes too long to react to incidents, 3) Not interested in reported crimes.

The results of the CVS survey give an overview of the general crimes experienced by premises in the 'Agriculture, Forestry and Fishing' sector. In addition to the more general questions the survey provided a small insight into the other types of crimes that can impact premises, including livestock theft and ASB such as Poaching and Hare Coursing, all of which are relevant to this thesis. However, questions relating to crimes impacting livestock and wildlife on farms were an addition to the main-focus of the survey, and therefore the information provided was limited. As discussed in the following section these results do not necessarily represent the true incidence rates of these crimes. To address this issue, the following surveys/reports have a more defined rural focus to provide more relevant information about livestock and wildlife crimes and their impacts.

Victimisation Surveys: Rural

Rural Crime Survey (NRCN)

The National Rural Crime Network (NRCN) was established in 2014, by Police and other organisations involved in rural affairs. The network is now supported by 30 Police & Crime Commissioners and Police Forces across England and Wales. The network developed a new survey, to complement the existing surveys on crime in the UK (NRCN, 2018). The NRCN Rural Crime survey aims to better understand the experiences of crime impacting rural residents and business owners. The NRCN Rural Crime Survey has been conducted twice since 2015 and included with over 10,000 responses from the UK. This survey varies from those discussed previously because it includes crimes impacting individuals as well as businesses. In addition to this, unlike the Crime Survey of England and Wales, or the Commercial Victimisation Survey, the NRCN survey addresses crime types experienced ubiquitously in urban and rural areas alongside crimes more typically associated with rural areas, with equal emphasis.

Experience of Crime – Respondents were asked to indicate what crimes they had experienced over the previous 12 months. The results (presented in Table 2.14) show the percentage of respondents that experienced each crime type.

The results for 2015 and 2018 are tricky to compare with the information available, due to the 2015 survey results being presented as a proportion of all respondents that had been victims, this included those who lived, worked and visited rural areas. In the 2018 survey the results were presented separately for each of these groups. As the thesis is attempting to focus on the crime experiences of farmers, data relating to respondents who identified as working in rural businesses were extracted from the 2018 survey results and presented in Table 2.14 and all subsequent tables relating to this survey. Therefore, whilst the 2015 and 2018 survey results are presented in the same table, the results are not directly comparable.

The results from the 2018 survey showed the main crimes experienced by 'Specific Rural Business Owners' included: 1) Fly Tipping (18%), 2) Wildlife Crimes/Hare Coursing (14%), and 3) Theft of agricultural machinery (11%). The presence of 'Wildlife Crimes/Hare Coursing' as the second most experienced crime by respondents highlights the impact of such crimes and supports the aim of this PhD to provide more detailed research into this crime type in the UK.

Cost of Crime – Of the total number of victims of crime in the group classified as running businesses in rural areas, 86% suffered some kind of financial loss in 2015.

The 2018 survey identified 57% were financially impacted by crime. The average financial loss due to crime was found to be £4,800 in 2018, a 13% increase on the value of £4,100 in 2015. Of those financially impacted, approximately 28% proceeded to make an insurance claim, and of those that did make a claim, they received on average 52% reimbursement of the original claim value.

Crimes Perceived to go Unreported – Respondents were asked to indicate which crimes they perceived as going largely unreported to the Police. The results presented in Table 2.13 have been extracted from the full list of crimes to highlight crimes of particular relevance to this thesis. Over a thousand respondents to the survey perceived wildlife crime (14.6%) and poaching (10.7) to be largely unreported to Police and were amongst the top five of all crime types perceived to go frequently unreported.

Table 2.13: Proportion of respondents that perceived crimes to go unreported to the Police (NRCN, 2015).

Crimes Perceived to go Unreported to Police	% in 2015 (N = 13,193)
Fly Tipping	61.1
Wildlife Crime (including hunting and hare coursing)	14.6
Poaching	10.7
Trespass	1.9
Animal cruelty/sheep worrying	1.1
Damaging Crops	0.3

Non-reporting by crime type – Respondents were asked to provide the non-reporting rates for crimes impacting individuals and businesses in rural areas. Non-reporting rates were 38% in 2018, increasing by two thirds for 'Rural Businesses' since 2015. Table 2.15 presents the non-reporting rates for crime types directly or indirectly linked to livestock, wildlife or farms.

Table 2.14: Proportion of respondents that experienced crime types in the 2015 and 2018 Rural Crime surveys. Crimes specific to Farms or of interest to PhD are highlighted (NRCN, 2015, 2018).

Type of Crime	% of Respondents who Experienced Crime Type	
	2015* (N = 4179)	2018** (N= 1,121)
Fly Tipping	1.6	18
Wildlife crimes/hare coursing	0.8	14
Theft of agricultural machinery	5.2	11
Arson/Vandalism/Criminal Damage	16.6	8
Theft from outhouse/garden theft	6.3	7
Burglary	17.5	6
Trespass	0.9	6
Dog Attacks / Sheep Worrying	0.8	5
Theft of Fuel	3.9	4
Harassment	10.4	3
Other Theft	3.6	2
Theft of agricultural materials (e.g. fertilizers)	1.9	2
Attempted burglary/theft	1.2	2
Other crimes	1.1	2
Theft from car	5.5	1
Violent Crime	3.0	1
Theft of bike	1.9	1
Theft of horse tack/equipment	1.4	1
Being deceived out of money or property	1.4	1
Being deceived out of money or property online or by email	1.2	1
Theft of Livestock	1.1	1
Online Harassment	0.8	1
Theft of possessions from your person	-	1
Attempted fraud / scams	-	1
Shoplifting	0.5	0
Robbery	0.4	0
Theft of personal possessions	-	0
Domestic abuse	-	0
Crime of a sexual nature	-	0
Theft of your vehicle (inc. trailers/caravans/quad bikes)	2.4	-
Theft of equipment of tools	2.1	-
Public order/ASB	1.7	-
Roads related/Dangerous driving	1.6	-
Poaching	1.3	-
Theft of Materials	1.0	-
Theft of metal	0.8	-
Theft of plants or produce	0.7	-

*2015 – answers are from all respondents to survey who were victims of rural crime.
**2018 – answers are specific to 'Specific Rural Business Owners' respondents to survey.

Table 2.15: The percentage of crimes not reported to Police, that are associated to livestock, wildlife and farms (NRCN, 2015, 2018).

Crime Type	2015 (N = 1,147)	2018 (N = 4,462)
Fly Tipping	56%	72%
Trespass	41%	55%
Theft of fuel	32%	42%
Arson/Vandalism/Criminal Damage	35%	39%
Theft of Livestock	25%	35%
Wildlife crimes/Hare Coursing	18%	33%
Theft of horse tack/equipment	11%	24%
Theft of agricultural materials (e.g. fertilizer)	49%	23%
Dog attacks/Sheep Worrying	19%	20%
Theft of agricultural machinery/equipment	21%	17%
Theft of your vehicle (inc. trailers/caravans/quad bikes)	5%	0%
Theft of plants or produce	50%	-
Theft of equipment or tools	44%	-
Poaching	29%	-

The results highlight that approximately a third of 'Theft of Livestock' and 'Wildlife Crime / Hare Coursing' crimes were not reported to Police by respondents.

Reasons for Not Reporting Crimes to the Police – The perception of respondents was that there is a general disinterest of Police to tackle rural crimes, particularly where it is hard to prove or say what happened, or to tackle crimes involving the travelling community. The reasons for not reporting are shown in Table 2.16. The main reasons for not reporting that accounted for 64% of responses were 1) Waste of time/would be no point, 2) Police couldn't have done anything and 3) Too trivial/not worth reporting. These responses indicate a general distrust in the effectiveness of the Police in crime resolution for rural residents and businesses.

Table 2.16: The proportions of survey respondent's reasons for not reporting crimes to Police (NRCN, 2015, 2018).

Reasons for not reporting	% in 2015 (N= 1,147)	% in 2018 (N= 1,678)
Waste of time/would be no point	44	31
Police couldn't have done anything	43	21
Too trivial/not worth reporting	27	12
Reported to another authority (e.g. council)	-	7
Dealt with matter myself/ourselves	12	6
Previous bad experience with Police/Criminal Justice System	7	5
Fear of Reprisals	6	3
Only an attempted crime and no damage was done	-	2
Felt intimidated	-	1
Was threatened / intimidated	-	1
General dislike/fear of Police	1	0
Other (Please Specify…)	12	10

The authors highlight that certain crimes such as 'Fly Tipping' were likely to have been reported to other agencies such as local authorities or the Environment Agency. Therefore, the absence of informing the Police does not mean the incidents were not reported at all.

Perception of Rural Policing – The overall proportion of survey respondents that felt the local police did a good job was 11% percentage points lower in 2018 than in 2015. Of the respondents in the 'Specific Rural Business Owners' category (1,054) asked about their perception of local policing, 25% categorised local policing as 'Good / Excellent' and 30% as 'Poor / Very Poor'.

Respondents who experienced crimes related to Livestock and Wildlife were asked to indicate how they felt the local Police dealt with these issues. The results (shown in Table 2.17) indicate that for Poaching, Livestock Worrying and Hare Coursing, around 50% of respondents felt these crimes were poorly dealt with by Police.

The NRCN survey identified that those who were aware of local initiatives to tackle rural crime were more likely to perceive the local Policing as good or excellent.

Table 2.17: Proportion of respondents that rated how Police dealt with issues in their area as 'Poor' or 'Very Poor' (NRCN, 2018).

Issues dealt with by Police	% Poor or Very Poor
Fly Tipping	74
Criminal Damage / Vandalism / Arson	68
Trespass	68
Poaching	56
Livestock Worrying	54
Hare Coursing	45

These findings support the idea that communication and engagement between the Police and the local community will result in better Policing and increase the sense of security amongst rural residents and businesses. Variation between regions and perceptions of Police indicate that rural issues are being proactively tackled by some Police forces and should be used as examples for areas where Policing is perceived as being poor.

Security Measures – In 2018 answers from 3,585 rural business owners indicated that the most commonly used and (perceived to be) effective deterrents were security lighting, locks and locking items away. Other methods used by the approximately 50% respondents included keeping gates secure, installing and/or maintaining fences and hedges, and burglar or other alarms, and were thought to be fairly effective. The methods perceived to be least effective by respondents were marking systems including smart water, DNA markers on livestock and other marking equipment, followed by upgrading security measures, perimeter alarms and using signage about neighbourhood/farm/horse watch. The survey authors theorised that the likely reason for a lack of faith in the effectiveness of marking property is that these methods may be useful for reuniting property with the owner, but ineffective in preventing the original crime.

In summary the NRCN RC survey is the largest crime survey of rural residents, visitors and businesses in England and Wales. The results of the survey covered several pertinent topics to this thesis relating to Livestock and Wildlife crimes. However, the RC survey does not solely focus on Farms, despite the inclusion of the 'Specific Rural Business Owners' respondent category. In addition to the diversity of respondents, the survey aimed to gather information on the respondents general experiences of crime, therefore the survey dealt with crimes experienced in both urban and rural areas (e.g. robbery, violent crime etc.), limiting the focus

on crimes impacting rural areas, including agricultural businesses, such as hare coursing, poaching, and livestock worrying.

The following section will present surveys that have focused on the experiences of crime on agricultural properties that provide more detailed information on the experience of crimes relevant to this thesis.

Victimisation Surveys: Farm Crime

The existing Surveys focusing on Farm Crime in England and Scotland include:

- Farm crime in England and Wales: a preliminary scoping study examining farmer attitudes.
- Crime and the Farming Community: The Scottish Farm Crime Survey.

Farm crime in England & Wales: A Preliminary Scoping Study Examining Farmer Attitudes

The most recent research on farm crime in the UK, was a PhD thesis published in 2018 titled: 'Behavioural Science and Farm Crime Prevention Decision Making: understanding the behavioural culture of farmers in England and Wales' which looked at the attitudes of farmers to crime, crime prevention, the police and insurers (Smith, 2018). The thesis' overall aim was to explore the decision-making processes of farmers in the UK in relation to crime prevention on farmland in the context of prior victimisation, and the physical features that may influence the likelihood of victimisation (Smith & Byrne, 2017).

Smith (2018) recognised the limited amount of information that exists on rural crime and farm crime, particularly in the UK. Their survey provided insight into victimisation on farms in the UK, and what physical features may influence the likelihood of victimisation.

The initial stages of the research consisted of an online survey of farmers, that received 126 responses. In addition to the survey the researcher completed one-to-one interviews with six farmers and completed four focus groups (4-7 farmers per group) across four counties. Interviews and Focus Groups were conducted to complement the survey and provide additional information relating to the perspectives of Farmers on the issues of rural crime and the effectiveness of rural policing.

Of the 126 respondents to the survey 62.8% had been victims of crime in the previous 12 months, with 53.5% of those who had experience crime being repeat victims. The environmental factors that were assessed in relation to victimisation included proximity to roads, proximity to urban centres and proximity to neighbouring farms. The results indicated that none of these factors had a statistically significant effect on the likelihood of victimisation. However, repeat victimisation was found to be higher for more isolated farms, with isolation being based on proximity of the farm to neighbouring farms. The size of farms was also found to be a predictive factor for victimisation. Farms of 250 hectares or less were significantly more likely to be victimised, with the analysis showing a negative correlation between farm size and victimisation.

In addition to identifying how environmental factors influence the likelihood of victimisation, the survey asked respondents to provide their perception of the policing of farm crime. The findings identified that farms closer to main roads were more satisfied with the response by Police, highlighting the need for Police to engage more with isolated and larger farms whose satisfaction levels may be impacting the reporting of crimes.

Smith' (2018) survey contributes to the limited literature relating to farm crime in the UK. However, whilst the survey focused on farm crime, the results did not differentiate between the different types of crimes experienced by respondents and instead addressed victimisation in general. Therefore, the results did not provide specific information on the types of crimes of interest to this thesis. The following section presents survey results that look more in detail at the types of crimes experienced.

Crime and the Farming Community: The Scottish Farm Crime Survey.

After the publication of 'A Study of Crime in Rural Scotland' looking at crime in rural areas, the Scottish Office recognised the need for more research looking into the nature and extent of crimes committed specifically against farms in Scotland (Anderson, 1997; Laird, 1999). In addition to understanding the scale of the problem, the research also aimed to understand what factors influenced the vulnerability of farms, what prevention techniques and initiatives were being used, and the reporting of crimes to Police. Additional questions dealt with factors such as farm turnover and perceptions for causes of farm crime, but the results of these questions will not be reviewed in this section (SFCS, 1999).

The survey was carried out in March of 1998 and involved telephone interviews with 1,022 farmers (including owners, tenants and managers), which was considered a representative sample of the major farms in Scotland. Respondents were asked to provide information from the previous 15 months, asking for details on the five most recent crimes experienced on the farm. The respondents were then asked to provide details on a maximum of 15 incidents, including details on incident types and timings for the four years prior to 1997. Combined the information collected provided an overview of respondents' crime experiences in the previous five years.

In the 5 years covered by the survey, 32% of the farmers interviewed experienced crime. Crimes when averaged over the previous five years equated to 1.24 incidents per farm. However, the actual incidents of crime were concentrated and when the figures were adjusted for repeat victimisation in the last five years, the average number of incidents rose to 3.85 per farm. The most prevalent crimes (commercial and domestic) In the previous five years, were Theft (of any type) 58%, and Vandalism 21%. When crimes were separated by type, commercial incidents were found to account for 83% of all crimes experienced in the previous five years. Table 2.18 presents the proportion of crime types in the previous 15 months and 5 years.

In the 5 years prior to 1993, a total of 305 farms were impacted by commercial crime. Of these farms 55 (5% of all farms in survey) experienced 'Theft of Livestock / Horses'. This represented the second largest type of commercial Theft after the 'Theft of Large Tools', 'Injury to Livestock' and 'Livestock Worrying' impacted 1% of all farms in the survey.

Factors Influencing Farm Vulnerability – Factors that influenced the likelihood of farms being victimised over previous 5 years included increasing farm size and increasing number of units. Accessibility (good road links and proximity to centres of population) and Remoteness were found to be important factors for predicting the vulnerability of farms to crime. Results showed that of farms 'Near a small town' or 'Near a large town/city', 55% had been victims of crime in the previous 5 years, with an average of 5.83 crimes per farm. In comparison, 32% of farms in more isolated locations (168 respondents total) were victims in the previous 5 years, with average of 1.27 crimes. Indicating repeat victimisation of farms that were easier to access and closer to urban centre

Table 2.18: Proportion of crimes types in the previous 15 months and 5 years (SFCS, 1999).

Commercial Crime Type	% Since Jan 1997 (381)	% Since Jan 1993 (969)
Vandalism	20	18
Theft of Livestock/Horses	12	14
Theft of Gates/Fencing	9	7
Theft of Small Tools	9	10
Fly Tipping	6	4
Theft of Large Tools	5	3
Theft of Chainsaw/Powersaw	5	4
Theft of Fuel	4	3
Theft of Machinery	4	3
Theft by Housebreaking	3	2
Other Commercial Theft	3	5
Fireraising	3	3
Injury to Livestock	2	2
Theft of Quad Bikes/ATVs	2	1
Theft of Other Vehicles	2	2
Damage to Crops	2	2
Livestock Worrying	2	1
Theft of Horticulture Produce	1	1
Theft of Office Equipment	1	1
Theft of Feeding Stuff	1	1
Attempted Theft and Housebreaking	1	1
Theft of Lawnmower	1	1
Theft of Tractor Radio	1	1
Theft of Tractor Battery	1	1
Theft of Farm Crops	*	1
Theft of Electric Fencing	*	1
Theft of Cash/Wages	*	1
Robbery	*	1
Total Commercial Crime	86	83

*Less than 1% but not zero.

Time of Crime Occurrence – Of 381 respondents that provided information on victimisation in the previous 15 months, 32% could not specify a time when the crimes had occurred. Once the 'Don't Know' category was removed, 53% of respondents believed crimes occurred between 11pm – 6am. Crimes occurring in fields and farmyards were more likely to occur in the evening or at night based on respondents' answers.

Of all crimes in the previous 15 months, 47% took place in an open area of the farm and 38% in fields around the farm. Dairy, Cattle and Sheep farmers were identified as more susceptible to incidents that involved field access, whilst cereal and general cropping farmers were more likely to have their sheds accessed.

Trend analysis looking at the month of year and victimisation was impacted by the survey asking respondents to only provide information about the five most recent crimes in the last 15 months, and up to 15 crimes in the previous 4 years.

Reporting of Crimes to Police – In the 15 months prior to the survey, 49% of all incidents were reported to Police. A large difference in the reporting practices of respondents was acknowledged between domestic and commercial crimes, with 75% of domestic incidents reported, compared to 47% of commercial incidents. Reporting of crimes was found to vary depending on crime type (as shown in Table 2.19) and was lower for respondents that had been repeat victims.

Table 2.19: Proportion of crimes reported to Police by those that have experienced crime since January 1997 (SFCS, 1999).

	Crime Reported to Police?	
Crimes	Yes (%)	No (%)
Any Commercial Crime (326)	47	53
Theft of Livestock / Horses (41)	44	56
Theft / Damage to Crops (13)	45	55
Livestock Injury (15)	26	74

Respondents highlighted that of the crimes not reported to Police, 4% were reported to other authorities.

Police responded immediately to 45% of reported crimes, with a visit being made to the farm the same day of the crime being reported for 75% of the reported incidents. Remoteness of the farm influenced the level of Police response, with the more isolated farms being less likely to receive an immediate visit or response on the same day from Police.

Of those that did not report incidents to the Police, the most common reasoning for not reporting was that 'Police could not (46%) or would not (12%) have done anything about it' or that is was 'Too Trivial' (28%). The inconvenience of reporting accounted for 10% of the farmers that did not report incidents.

Cost of Crime – Majority of crime reported was considered 'petty' and the cost of these crimes were relatively low, with 71% of the incidents costing between GBP£0 and GBP£500. However, when looking at specific crimes, as shown in Table 2.20, the average cost of crimes like 'Livestock Injury' and 'Theft of Livestock' cost between GBP£838 and GBP£2,038. Highlighting how the costs of these crimes can be disguised when taking all farm crime costs into account.

Table 2.20: The average cost of crimes based on crime type (SFCS, 1999).

Crime Type	Average Cost (£)
Theft of Livestock	2038
Any Theft	1662
Robbery	1320
Livestock Injury	838
Theft of Farm Equipment	823
Theft of Fencing	558
Vandalism	494
Crop Damage	94

Perceptions of Crime – Respondents were asked to provide their perception of crime over the previous decade. The results indicate that 71% perceived farm crime as 'Not really a problem at all' or a 'Not very serious problem'. Of the total number of respondents 27% perceived crime to be 'quite' or 'very serious'.

Respondents were then asked to indicate how crime had changed in the previous decade, with 50% indicating that they felt farm crime had 'stayed about the same', and 35% felt farm crime had 'increased a little'.

The perception of crime varied based on farm type, size of farm (larger farms perceived farm crime to be a bigger problem), proximity to urban centres (farms closer to urban centres perceived farm crime to be a bigger problem).

Initiatives to Combat Farm Crime – There were low levels of knowledge of measures and schemes with 66% of respondents unable to identify any schemes. Support for schemes such as Farm Watch varied between Police force areas. Variation of awareness was likely due to the general understanding of the aim of the scheme and the effectiveness of the promotion of the scheme by Police.

Police Response Satisfaction – Respondents were asked to indicate their satisfaction in the Polices response to crimes experienced on farm. The results indicated that 62% were 'very' or 'quite' satisfied, with 30% 'not satisfied' (14% 'not very satisfied' and 16% 'not at all satisfied'). Overall the opinions of farmers on the handling of crime by Police was favourable, with no strong views against the Police's commitment to trying to tackle/solve farm crime. However, when asked about the outcomes of previous incidents, respondents identified that 10% resulted in arrest or a warning, 5% in prosecution, and in 8% of incidents the property was recovered. In general, commercial crimes were less likely to be solved than domestic crimes.

The Scottish Farm Crime survey provided a detailed overview of how both Domestic and Commercial crimes impacted farms in Scotland in the 1990's. By separating the crimes into domestic and commercial, it was possible to further subdivide the crime types for a more detailed analysis.

The survey addressed a variety of crime types including those directly impacting Livestock including injury and theft. However, it did not collect information on Wildlife crimes that may have impacted farms such as poaching. The questions relating to the perceptions of crime and police response were generalised for all crimes and could not be used to identify the information relating to individual crime types.

Summary

The insufficiency of Police and Insurance data to accurately estimate the incidence of crimes has been recognised for some time as a source of error, with non-reporting of crime - also known as the 'Dark Figure' of crime - negatively influencing the representativeness of the data and subsequent analysis. The impact of under-reporting of crimes is an underestimation of the incidence rates, which inturn can lead to a lack of prioritisation by enforcement authorities.

To address the issue surveys are needed to understand the experience of crime by rural communities and businesses such as farms. Domestic crimes have been the focus of surveys for decades both nationally and internationally. In the UK surveys such as the 'Crime Survey of England and Wales' provide an invaluable resource by which to estimate the true incidence of crime in England and Wales. In addition to the Domestic crime focused surveys, the 'Commercial Victimisation Survey' aims to provide an insight into the crime experiences of businesses. Whilst both the Domestic and Commercial surveys help to establish the true incidence of a selection of crimes experienced ubiquitously (e.g. Burglary, Robbery, Theft, Fraud etc), these surveys do not provide specific information on crimes relating to Livestock and Wildlife.

Difficulty in combining and comparing results from the various surveys relating to rural crime and farm crime, is due to the diversity of terminology used, inconsistent combination of crime types, and asking participants questions on various details about their experiences and the impacts of these crimes. In some cases, overly generalised crime type categories made it impossible to extract those that experience crimes specifically related to livestock and wildlife. Table 2.21 illustrates both the limited information available and the complexity of trying to compare existing data to present a unified national picture of Livestock and Wildlife crime.

Large scale surveys funded by governments cannot account for all crimes that may impact individuals and business premises, but the impact of such crimes on species and land owners requires attention, particularly as Livestock and Wildlife crimes are being increasingly linked to the intimidation of rural residents and organised crime activities.

The dislocation between the frequency and standardisation of these surveys highlights the need for more detailed, formal and nationally supported research into the real incidence rates of these crimes and the impacts to farmers, farms, wildlife/livestock as well as the impacts further down the line relating to the food chain and food security.

Table 2.21: Comparison table of the main information on Livestock and Wildlife crime from the literature available on these crimes in the UK (CVS, 2014,2015,2016,2018; CVS Technical Report, 2018; NFU Mutual, 2018; NRCN, 2015,2018; SFCS, 1999; Smith, 2018).

Survey/Report	Year	No. Respondents	Proportion of Respondents that Experienced Livestock Crimes (%)		Proportion of Respondents that Experienced Wildlife Crimes (%)	% of All Crime Reported to Police	% of Respondents Satisfied with Police
			People/Dogs Chasing/Worrying Livestock	Livestock Theft	Poaching, Hare Coursing or Illegal hunting		
Commercial Victimisation Survey	2013	1,085	14.0	4.0	18.0	19.0	66.0
	2014	1,019	13.0	2.0	15.0	15.0	65.0
	2015	1,098	-	2.0	-	19.0	61.0
	2017	1,019	15.0	2.0	26.0	18.0	48.0
Rural Crime Survey (NRCN)	2015	13,193	0.8	1.1	Poaching 1.3 Wildlife crime/Hare coursing 0.8	23.0	36.0
	2018	16,191	5.0	1.0	Wildlife crime/ Hare coursing 14.0	38.0	26.0
Rural Crime Report (NFU Mutual)	Annual	n/a	-	-	-	-	-
Farm Crime in England & Wales (Smith, 2018)	2017	126	-	-	-	68.0	>80.0
The Scottish Farm Crime Survey	1993 - 1998	1,022	1.0	14	-	Commercial Incidents in previous 15 months 47.0	62.0

CHAPTER THREE

Systematic Review of Situational Prevention Methods for Crime against Species

Introduction

Illegal activities concerning terrestrial species (TS) are responsible for a variety of health, environmental, economic and security issues. The majority of academic research associated with species relates to conservation, with few publications specifically investigating the scale of crimes impacting species or how they can be prevented. This Chapter systematically reviews the available evidence about what works to prevent crime against terrestrial species. Of over 29,000 documents that were returned in the first stage of the review, these were filtered to just over 100. The remaining documents were partially or fully read to identify the most relevant documents to include in the final qualitative synthesis.

The review results show there is a significant lack of primary research in this area, as only five articles were found that met the study inclusion criteria. The identified articles focus on the effects of two types of situational crime prevention interventions: community outreach and ranger patrol frequency. Community outreach was shown to have a significant impact on local poaching levels, while for patrolling the evidence suggests a positive impact on the discovery of poachers, animal carcasses and poaching paraphernalia, however, the quality of these studies varied greatly.

To prevent the further decline of species numbers internationally, more effort should be invested in publicising existing research into the effectiveness of prevention strategies that have not reached the wider scientific audience, as well as the funding and promotion of research into alternate methods of crime prevention.

Literature Review

Crimes against species have significant consequences internationally. As discussed in the Literature review (Chapter Two), the illicit exploitation of flora and fauna has a variety of

negative impacts including threats to *health security* (e.g. disease spreading, improper preparation of meat), *national security* (e.g. terrorism financing through illicit trade in species), *environmental security* (e.g. animal population decline and possible extinctions) and *the economy* (e.g., costs associated to the damage and removal of natural capital). In 2014, the illicit trade in wild flora and fauna was estimated to be worth US$7–23 billion internationally, in combination with other forms of environmental crime (Nellemann et al, 2014). However, the 'dark figure' of wildlife crime (i.e, unreported/undetected offenses), along with the difficulty in attributing a 'value' to natural capital, makes accurately estimating the total global costs of such crimes challenging.

Contrary to popular belief, the targets of crime are not limited to exotic and iconic species, such as elephants and tigers, but also include farmed produce including livestock and crops (e.g., livestock theft/rustling, sheep worrying and coursing). Crimes involving farmed produce in particular is an increasing problem for developing and developed countries alike, where agriculture forms one of the main contributors to both local and national economy through natural assets and exports (Donnermeyer & Barclay, 2005; Swanson 1981). The fundamental role of agriculture globally means the impacts of crime involving farmed produce are widespread and affect stakeholders from 'field to fork'. The National Farmers Union (NFU) Mutual, one of the leading insurers of farms in the UK, estimates the cost of rural crime in the UK at GBP£49.9M in 2018, with Livestock crime (LC) alone costing GBP£2.5M (Sidebottom, 2013; NFU 2019; 24th PANIU 2015a,b). Various stakeholders, from individuals to governments, are involved in tackling the issue of wildlife crime and spend significant sums of money on programs aiming to protect species. For example, the Global Wildlife Program launched in 2015 and led by the World Bank, is a partnership of organisations focused on reducing the impact of wildlife crime globally, with a particular focus on Africa and Asia. The World Bank conducted a review of international donor funding, and identified that since 2010, funds of around US$1.3 Billion were pledged to tackling these crimes internationally. Of this funding US$1.1 Billion (86% of total funding) was provided by the Global Environment Facility (GEF), United States, European Commission (EC), Germany and the World Bank Group (WBG) (World Bank 2016a,b,c).

In 2013, the UK and US governments committed GBP£10M and US$10M respectively to tackle wildlife crime internationally. The UK pledged this money to support specific projects such as the Elephant Protection Initiative, but also to establish a fund to invest and support projects

that are aiming to tackle wildlife crime internationally. The International Wildlife Trade Challenge Fund has been run annually since 2014 and has so far invested GBP£18.5million in 61 projects aimed at tackling wildlife crime (TRAFFIC, 2013; UK Government, 2013; Lawson & Vines 2014; IWT DEFRA, 2015, IWT, 2018). Beyond these international conglomerates donations, collaborations such as the Wildlife Crime Initiative (WCI) between WWF and TRAFFIC, aim to tackle wildlife crime from source to supplier by engaging with local, national governments, charities and NGOs in order to deter the continued exploitation and extinction of species (UNODC, 2017; WWF, 2017; UN News, 2016). For all of these stakeholders there exist pragmatic questions about what problems to focus on, and what approaches and interventions to invest in. To ensure that the programs implemented are cost effective and produce no or limited negative consequences, decision-makers must also be aware of the likely impacts of different crime prevention techniques. However, the range of crime prevention techniques is large, varying from the use of a padlock on a barn door, to international legislation regulating trade in specific products. The variety of techniques employed, and the fidelity of implementation achieved, hinder the ability to estimate the effectiveness of programs on a macro-scale. This is illustrated by the example of the use of policy in order to prevent the trafficking of illegitimate goods. Establishing the impact of legislation and policy on an international scale, whilst accounting for the influence of local projects and schemes, would be major task.

The aim of this review is to assess what is currently known about the impact of interventions on crimes against species. To effectively review existing prevention techniques, specific intervention types were chosen from those defined within the Problem Orientated Policing (POP) intervention framework (Goldstein, 1990). POP aims to develop strategies to combat problematic activities, to reduce their impact. It does this by looking at a localized level and using contextual information, to tailor the measures used to tackle the problematic behavior/activity. POP is not limited to but may involve a variety of opportunity-removing techniques to prevent potential criminal opportunities being exploited; a group of strategies used at a local level are collectively referred to as Situational Crime Prevention (SCP) techniques. The contextual information of a given location is used to select or design suitable interventions that may increase the risks and effort required by the criminal, reduce the rewards and provocation and/or remove excuses, as perceived by offenders (see Table 3.1). Whilst all of the SCP techniques are potentially effective in preventing crime, they are not all

suited to every given situation. For this reason, it is important to establish 'What Works' in relation to given types of crime, in this case crimes against species.

Kurland et al (2017) recently conducted a literature review of prevention methods used in conservation and wildlife crime prevention. The review provided a useful overview of relevant prevention techniques. However, this systematic review aims to address two limitations of Kurland et al.'s study. The first limitation is that Kurland et al (2017) combined literature from the fields of conservation and crime prevention. Whilst both research areas relate to species protection; conservation techniques are not used solely to address illicit activities against species. A combined review of prevention techniques used to alter legal and illegal activities, requires a clear distinction between the different methods and/or mechanisms by which the techniques work (e.g. increased penalties for illegal activity vs. education of the impact of legal but destructive activity) and the impact of these interventions.

The second limitation was identified by Kurland et al (2017) themselves. Whilst the authors provided a description of their search methods for the selection and filtering of articles, information relating to inclusion and exclusion criteria or an extraction framework were absent. In concluding their review, Kurland et al (2017) commented on the benefits of completing a more systematic review that could provide a comprehensive understanding of the mechanisms, contexts and outcomes of assessed prevention methods (Campbell Collaboration, 2017; Petticrew, 2001). The purpose of this systematic review is to assess the effectiveness of existing SCP techniques for the prevention of crime against species. It aims to complement and expand on Kurland et al.'s work, and to address the lack of research into what works in the prevention of species crime.

Our work focuses on the measures implemented for the situational prevention of crimes against 'Terrestrial Species' (TS). Species is the term used as a principal taxonomic unit that denotes a 'group of organisms of similar individuals which are able to interbreed' (Larkcom & Delpech, 2013). Species fall into one of five Kingdoms: Plantae, Animalia, Fungi, Bacteria, and Protoctists. During the scoping phase of this review, we decided not to include marine and other aquatic species, as movement on and around areas of water and shorelines introduced additional variables (e.g., theoretical offshore boundaries vs. physical on land boundaries; freedom of movement on and around these areas, modes of transport) (Larkcom & Delpech, 2013). Microscopic species (e.g. protozoa, algae) were also excluded from the scope. The

terrestrial species in the remaining Kingdoms of Animalia (other than Humans), Plantae and Fungi were included, and hereafter will be collectively referred to as 'Terrestrial Species'.

TS can be divided into two main groups (Driscoll et al 2009):

- *Wild species:* native fauna and flora of a region e.g. elephants, tigers, bluebells, orchids.
- *Farmed (domesticated) species:* kept & bred/raised and used as assets e.g. cows, chickens, wheat, ginseng.

Table 3.1: Lemieux (2014) adapted the Situation Crime Prevention table in (Cornish and Clarke, 2003) for wildlife crime prevention.

Increase the Effort	Increase the Risks	Reduce the Rewards	Reduce Provocations	Remove Excuses
Harden Targets *e.g. GPS collars on vulnerable animals*	Extend Guardianship *e.g. Gunshot detectors*	Conceal targets *e.g. Translocate animals away from villages*	Reduce frustrations and stress *e.g. Community outreach*	Set Rules *e.g. Memorandums of understanding for wildlife use*
Control access to facilities *e.g. Fence National Park*	Assist Natural Surveillance *e.g. Rewarding informants*	Remove targets *e.g. Rhino dehorning*	Avoid disputes *e.g. Elephant trenches*	Post instructions *e.g. No Trespassing signs*
Screen exits *e.g. Sniffer dogs at airports*	Reduce Anonymity *e.g. Automatic number plate readers on park roads*	Identify property *e.g. Require RFID chips for legal wildlife exports*	Reduce emotional arousal *e.g. Provide alternative sources of income/protein*	Alert conscience *e.g. Clearly mark game reserve borders*
Deflect Offenders *e.g. Checkpoints along protected area roads*	Utilize place managers *e.g. Encourage lodge owners to report suspicious activity*	Disrupt markets *e.g. Ban international trade*	Neutralize peer pressure *e.g. Conservation education*	Assist compliance *e.g. Allow regulated hunting*
Control tools/weapons *e.g. Limit public sale of spears/traps/nets*	Strengthen formal surveillance *e.g. More ranger foot patrols*	Deny benefits *e.g. Add dye to Rhino horn*	Discourage imitation *e.g. Forbid profit sharing with communities producing poachers*	Control drugs and Alcohol *e.g. Substance abuse programs for communities*

The decision to combine information on prevention methods relating to wild and farmed species was made because many TS are categorized as both wild and farmed, depending on the given habitat (e.g. ginseng can be found in the wild but is also farmed in many countries) (Daerr, 2001). In addition to a categorical overlap, there also exists a geographic overlap, where the environments wild species inhabit are increasingly being used for agricultural purposes. Beyond the categorical and geographic similarities between TS, there exists a shared etiology in the crimes that affect them. TS are targeted for financial gain, subsistence and/or sport, which could mean that prevention techniques used for wild species may be transferable to farmed species and vice versa.

The following section details the systematic review method employed, including a description of inclusion and exclusion criteria. The Results section includes a workflow of the filtering stages undertaken, before providing a qualitative synthesis, using the EMMIE framework, of the studies included in this review.

Method

Inclusion and Exclusion Criteria

The following inclusion and exclusion criteria were employed:

- Date of Research Publication – There were no exclusion criteria relating to the 'date of publication'.
- Published and Unpublished Research – To mitigate the effect of publication bias, whereby the likelihood of publication in peer-reviewed journals is associated with positive outcomes, a comprehensive search of the available literature was performed, including unpublished 'grey' literature (Mlinaric et al, 2017).
- International Literature – There was no restriction on the countries from which publications originated, but they must have been written in, or be available, in English.
- Intervention Type – Interventions included were those that were based on situational crime prevention (SCP) techniques; i.e., those aiming to influence the perceived effort, rewards and risks of committing crimes, as well as removing the provocations and excuses associated with criminal behaviour (Cornish & Clarke, 2003).
- The interventions examined in the reviewed studies were included if they were implemented to directly reduce crime against species, rather than for other indirect

purposes, such as general conservation. The exclusion of more generic conservation literature was due to many of these studies attributing declines in species numbers to a variety of factors that go beyond crime, including land use changes, sustainable development and legal hunting.

This review does not include exploratory or 'proof of concept' studies, exploring potential methods of crime prevention against species that did not implement and evaluate the effectiveness of the techniques.

For this reason, literature relating to international or national policies such as those published by NGOs and governments are not included in the review. This literature relating to policy has insufficient data or assessment to establish the effectiveness on species crime prevention (Pires et al, 2011).

- *Location: Rural Areas* – Different countries use a variety of classification methods to differentiate between rural and urban areas. Studies explicitly described as occurring in an urban setting were excluded. The terms used in primary research to describe rural areas vary greatly, and included *forest, farmland, agricultural land, national park, area of outstanding natural beauty, area of scientific interest,* and *village*. Due to this variety of terms, and to avoid the exclusion of relevant articles, articles that did not specify a particular location, and those using generic rural terminology were automatically progressed to the next screening stage, if they met the other inclusion criteria.

Search strategy

The following search engines were used:

General Databases: International Bibliography of the Social Sciences (IBSS); ProQuest; PsychINFO; Scopus; Web of Knowledge; Zetoc.

- *Agricultural / Environmental:* AgEcon Search – which covers research in Agricultural and Applied Economics – It is a free, open access repository of full-text scholarly literature on agricultural and applied economics; RSPCA – Wildlife Centre Research
- *Criminological Databases:* Australian Government – Institute of Criminology; COPAC – UK Library Catalogue Database; National Criminal Justice Reference Service (NCJRS).
- *Grey Literature Databases:* British Library EThOS; System for Information on Grey Literature in Europe (SIGLE).

In addition, the following journals were hand-searched for relevant studies: American Society of Agricultural and Biological Engineers (ASABE); Crime Prevention & Community Safety;

International Journal of Agricultural Management; Journal of Applied Ecology; Journal of research in crime and delinquency; Journal of Rural Affairs**;** Proceedings of the Royal Society of London: Biological Sciences; Rural Sociological Society**;** Southern Rural Sociology**;** Understanding and managing threats to the environment in South Eastern Europe. As were the following books: Crime & Conflict in the Countryside; Situational Prevention of Poaching; Crimes Against Nature: Environmental criminology and ecological justice.

Keywords for Boolean Searches – The search terms chosen were based on keywords used in articles on species crime (as shown below). Due to the broad variety of possible terms that could be associated with species crime from animal type to prevention methods, the terms used were intentionally general in an attempt to recover a comprehensive selection of relevant studies through database searching.

Search Terms were separated into three categories:

1st : Livestock, Animal, Wildlife, Species, Plants, Crops AND

2nd : Crime AND

3rd : Intervention, Prevention, Reduction

Filtering Stages

Initial article filtering was achieved by reading article titles and abstracts for relevance (as denoted by the inclusion/exclusion criteria described earlier). EPPI Reviewer software was used to manage the inclusion/exclusion process and the collation of relevant studies. A hierarchy of exclusion is shown in Table 3.2 and includes: Theme, Geography, Intervention and Species.

Table 3.2: Hierarchy of exclusion for filtering the results of the database searches.

THEME	The title/abstract of the paper must clearly identify its relevance to the prevention of crime against species (e.g., poaching, theft, illegal trade).
GEOGRAPHY	The title/abstract must not indicate a location that is exclusively urban (e.g., urban area, town, cities). If the title/abstract did not specifically indicate a location it was progressed to the next stage.
INTERVENTION	The title/abstract must have referred to specific interventions for the situational prevention of crime against species.
SPECIES	Aquatic (e.g., coral, fish) or microscopic species (e.g., protozoa, algae) were excluded. Humans did not qualify as targets of crime in this review.

Articles that were considered ambiguous based on their abstract and title were progressed to the second filtering stage. Articles that were advanced to the second filtering stage, were read in full to prevent the loss of relevant studies in the filtering process.

Quality Assessment and Data Extraction

The EMMIE framework was used to organize the synthesis of information extracted from the final included studies (Johnson et al., 2015). Rather than focusing exclusively on the effect size of interventions, the framework was developed to emphasise the need to explicitly synthesise (and assess the quality of research concerned with) what is known about other important dimensions of interventions that are of relevance to policy-makers and other stakeholders. The five dimensions of EMMIE are: Effect, which considers the size of the impact of an intervention; The Mechanisms through which an intervention is believed to bring about its intended effects; the contextual Moderators that may influence the likelihood that an intervention has its intended effects; the key aspects of Implementation that are required for the delivery of the intervention; and, the Economic costs and benefits associated with the intervention. As well as synthesising what is known, the aim of the framework is to help explicitly identify gaps in knowledge.

Results

Figure 3.1 illustrates the stages of document screening and shows that of the 29,252 articles initially identified, only five remained after the application of the study criteria.

Research on species crime often combines unknown volumes of criminal activity and unknown populations of species, creating a complex field of research, where the methods adopted are the best fit for the data available, rather than those with the greatest internal validity.

Of the five studies that met the inclusion criteria, one examined the impact of community outreach, while the remaining four examined the impact of anti-poaching patrols. In what follows, given the limitations in the data available, the two interventions identified, and the analytic methods used in the primary studies, the overall findings for each type of intervention are presented in the form of a narrative synthesis, following the basic structure of the EMMIE framework.

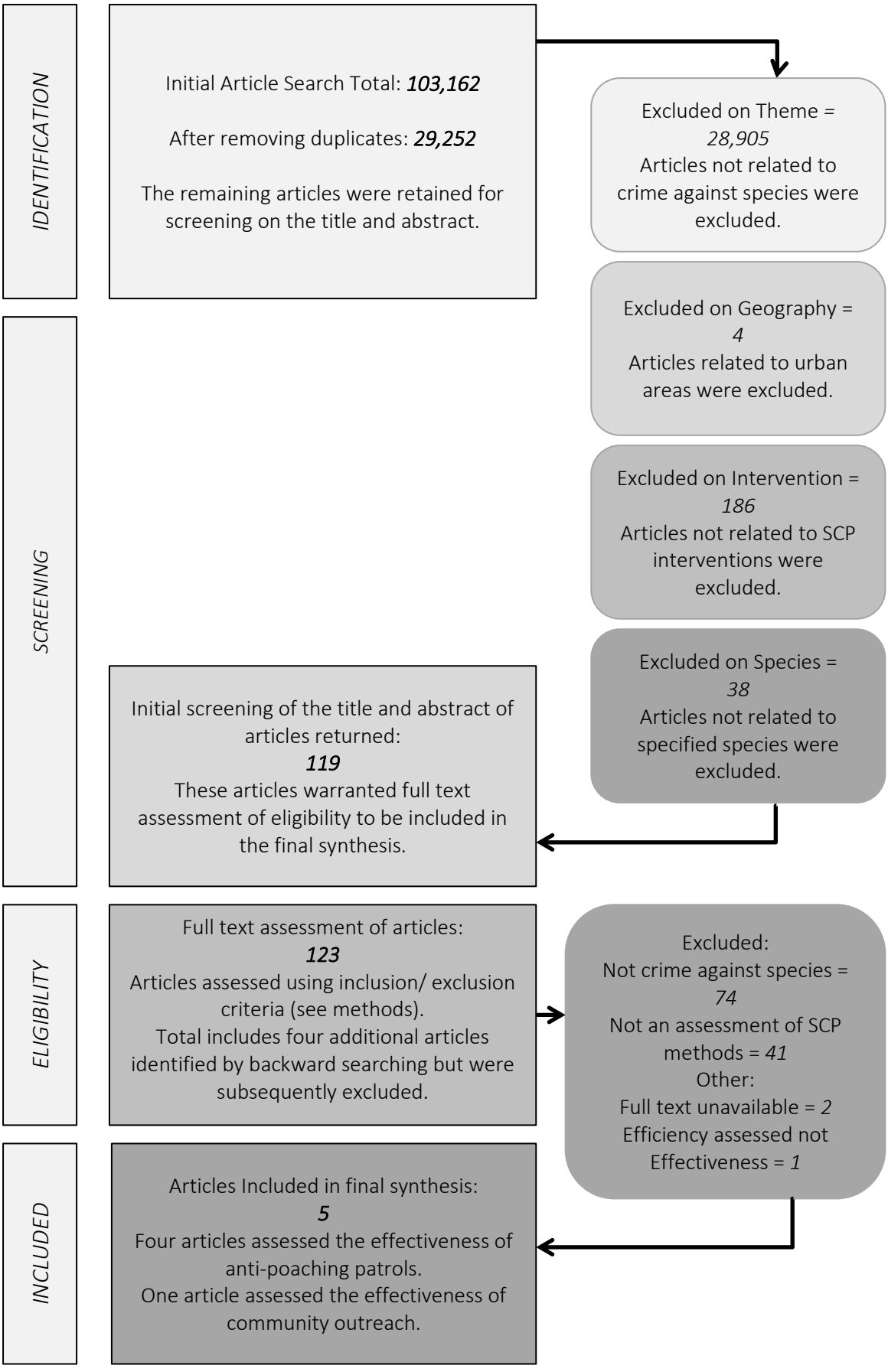


Figure 3.1: The process used to filter and assess articles.

Community Outreach

A study by Steinmetz et al (2014) assessed the effectiveness of a community outreach intervention. This was implemented between 2008 and 2011 in Kui Buri National Park, Thailand. Over the four-year period 116 outreach events were ran which reached approximately 7,500 people across 24 villages. The outreach work was estimated to have covered 83% of villages within 5 km of the park, with some visited more than once. The outreach programme aimed to build trust, raise awareness, motivate, offer opportunities for action, increase perceived behavioural control of villagers and generate social pressure against poaching. The results of the study suggest that species crime has reduced as a result of the outreach programme.

Wildlife Abundance Over Study Period

The wildlife populations of four species, at three sites (4 species x 3 sites = 12 measurements) were monitored using observation surveys conducted annually from 2006 – 2011 (in the dry season: November to June) at three sites (each being 30 km^2 to 50 km^2). The surveys revealed that three of the monitored species increased significantly: Pig occupancy almost doubled at Klong Kui ($p = 0.034$), Muntjac roughly trebled ($p = 0.018$) and Pig increased by roughly half at Hup Inthanin ($p = 0.045$), other species such as Gaur in Klong Kui were nearly extinct from the area but began repopulating. Whilst the increase in Gaur occupancy was not statistically significant ($p = 0.17$), it was biologically important for the local area with the repopulation of the species. The only species to see a decline was Sambar, which was stable at Hup Inthanin but declined in the two other monitoring sites; however, this decline was not found to be statistically significant ($p > 0.07$).

Camera trapping was incorporated to the study to complement the occupancy surveys. Cameras were placed in 25-28 locations in 2007, 2009 and 2011, in a 130 m^2 that encompassed two of the occupancy survey areas. The image results corroborated the survey findings, with estimated increases in species numbers identified over the study period for Pig ($p = 0.007$), Porcupine ($p = 0.037$) and Gaur ($p = 0.002$), for which the numbers nearly doubled. For the Muntjac ($p > 0.28$) and Sambar ($p = 0.086$) the numbers were found to be stable.

Poaching Pressure Over Study Period

Poaching pressure was calculated using the encounter rate of poaching signs (shotgun shells, tree stands, snares, carcasses, hunting camps) per 100 km. Poaching pressure declined

significantly by 4-fold (p = 0.059) between 2009 and 2011, reducing from 10.1 hunting signs per 100 km in 2009, to 6.8 in 2010, and finally 2.4 in 2011.

The authors conducted two analyses to assess the influence of existing patrols on the observed decrease in poaching pressure and increase in wildlife abundance: 1) Deterrence effect of patrolling on poaching pressure – whether any changes in poaching pressure were the result of the established anti-poaching patrols in the study area the previous month, 2) Effect of patrolling on wildlife trends – patrol effort was used in and around the three wildlife monitoring sites; patrol effort was used as the predictor variable, and the wildlife occupancy trends as the dependent variable.

Two additional analyses were carried out to verify that the observed decrease in poaching pressure and increase in wildlife abundance were due to the outreach campaign: 3) Effect of intensive outreach on poaching – from June to November 2010, outreach events were held in close succession next to eight patrol zones allowing the authors to examine the effects of intensive outreach by looking at patrol effort and poaching data between two periods before and after outreach work took place, and 4) Effect of outreach on poaching, as perceived by locals – multiple choice questionnaires were used to elicit the opinion of locals as to levels of poaching before and after the outreach work took place. The results of these analyses are presented below:

- *Patrolling Effects on Poaching Pressure & Wildlife Abundance*

To account for existing patrolling the authors assessed the influence of patrolling on the reduction in poaching over the same period of time the outreach work was conducted. No correlation was found between patrol effort and poaching pressure (p = 0.43). There was also no relationship between annual patrol effort and the mean occupancy trends of the monitored species in the same year (p = 0.532) or subsequent years (p = 0.792). Note: there was no significant difference (p = 0.10) in the mean monthly patrol effort per zone in 2009 (1.7 days), 2010 (0.94 days) and 2011 (1.2 days). Patrol effort was not found to differ significantly before and after the intense outreach campaign ($median_{before}$ = 1.0 , $median_{after}$ = 1.7, p = 0.161) either.

- *Outreach Effects: Deterrence effect of Intensive Outreach on Poaching*

To examine the short-term spatial effects of intensive outreach, the authors used patrol effort (mean number of days patrolled per month) and poaching index data (number of poaching signs per 100 km) and tested whether differences existed in the months prior (7 – 19 months) and post (2 – 8 months) the outreach campaign. As explained above, patrol effort was not found to differ significantly before and after the intense outreach campaign. However, poaching was found to decline after the outreach campaign ($p = 0.017$) with a median number of poaching signs per 100 km falling from 4.7 to 0.

- *Outreach Effects: Perceptions and Attitudes Questionnaire*

Of the 7,500 members of the community estimated to have been involved across the 12 areas where community outreach had been conducted around the park, 311 adults completed a survey to assess their perceptions of poaching related behaviours (consumption of wildlife, sale of wildlife within village, sale to outsiders, hunting by villagers, hunting by outsiders, hiring of villagers to hunt by outsiders), the overall poaching trend over the last 5 years (covering the time of the outreach work), and nine potential causes for change in poaching trends (park patrolling, park outreach, wildlife abundance, market demand, number of hunters, time available for hunting, income, conservation awareness, interest in consuming wildlife). Finally, respondents were asked about their attitude towards wildlife recovery (support, oppose, indifferent).

Most respondents indicated that they had perceived a decline in the six types of poaching behaviours, with 88% believing that there had been a decline in poaching overall. The survey respondents were asked what they felt contributed to this perceived decline: 'Increased park outreach' was the main answer (67% of the locals), followed by 'increased patrolling' and 'conservation awareness' (61%).

In summary, the results suggest that a decline in poaching behavior occurred, with the locals believing the outreach work was the main reason for this decline. In addition to the outreach work, locals also believed increased patrolling (despite data indicating no significant change in patrol effort before and after the outreach work) and increased conservation awareness (indirect benefit of building stronger relationships between park staff and the local community through the outreach work) had also been influential on the decline in poaching.

Mechanisms

The authors presented outreach participants with three ways in which they could positively impact the occurrence of poaching locally: 1) educate other community members on the issues facing local wildlife, 2) kurb their own hunting and consumption of wildlife, and 3) ostracizing/inconveniencing those involved in poaching.

The central mechanism to explain how community outreach activities would prevent specific crimes against species, involves tackling neutralisation and removing excuses. Neutralisation is a psychological approach to distance oneself from acting contrary to social norms and personal values. Neutralisation techniques include denial of injury, denial of victim, and condemnation of condemners (Sykes & Matza, 1957). The most common neutralisation technique associated with criminal behaviour is the denial of responsibility. An individual will define a situation in a way to relinquish personal responsibility for their behaviour or actions. By using community outreach to educate individuals about the impact of poaching, including the direct and indirect effects of their actions, the intention of the intervention was to make it harder for some individuals to utilise neutralisation techniques to appease their conscience, in relation to species crime.

By removing some of the excuses associated with species crime, such as ignorance of the impact, or belief that no other opportunities exist, the individuals involved come under increasing pressure both from their local community and their own morality to desist in taking part (Maruna & Copes, 2005).

Moderators

The following moderators were identified as factors that could influence the outcome of community outreach schemes designed to protect species:

- *Access to other alternative livelihood opportunities*

Recognition of the location specific context is important when considering the likely impact of any intervention. The villages concerned had an agricultural base which many poachers could turn to for work and food. However, the authors admit that not all individuals associated with poaching will have alternative means of income available and, therefore, outreach work would have a variable impact (Cooney et al. 2017). The identification of alternative livelihood opportunities is thus important to consider when implementing such interventions.

- *Target Audience*

The authors reflected on historical outreach work from other fields and focused significant amounts of educational outreach at schools and towards children, hypothesising that the children would then relate this information to their parents and thus use social pressure to encourage positive behaviours.

The authors did not measure the perception of the social-psychological processes utilised and therefore could not attribute the behaviour changes observed to any one aspect. However, social pressure seems to have played a large role in the change in poaching over the study period. By targeting audiences with greater outreach potential such as local leaders, park staff and children, the authors attempted to maximize the impact of the work being undertaken.

- *Number of poachers*

In this study the authors refer to other research on poaching in South-East Asia, where typically only a minority of the local population were involved in poaching. This meant that there was a significant social pressure from the community who were not involved with poaching. It is possible that where there is greater fraction of the community involved in poaching, the outcomes of outreach activities will be more limited. It will be for future research to establish whether this is the case.

Implementation

The community outreach work required researchers to work in conjunction with the local government agencies and NGOs to connect with and obtain the permission of local chiefs to reach a large number of community members. Steinmetz et al (2014) targeted six social or psychological conditions to create behavioural change: Trust, Justification, Motivation, Ethical, Feasible Actions and Confidence.

The first four issues were dealt with through face-to-face interactions with locals, providing them with education and evidence of the importance of preventing species crime and explaining the benefits and responsibility of locals in maintaining healthy environments and species numbers.

The outreach work was conducted by 6-10 park staff, as well as the authors, who held events including those at: village meetings, schools, temple fairs, youth camps, and government meetings; which lasted for 2-3 hours. The outreach sessions were interactive and included 10-

20 minute presentations, a quiz with prizes, a Q&A session, and musical performances by the park ranger band. Between 2008 and 2011 the researchers and park staff completed 116 outreach events. School based events also included additional games and getting students to create 'wildlife recovery plans' which detailed actions students could take to help wildlife. The education of locals was supplemented by suggesting feasible actions to change the incidence of poaching in their local area, and by providing locals with the confidence to control their environment.

Economics

The associated costs of the Community Outreach Scheme were not described in this study.

Summary

Community outreach is increasingly used to tackle security problems internationally, with schemes such as Neighbourhood Watch, Farm Watch and others, being actively used to encourage the community to take responsibility and preventative action against crimes in their local area (What Works, 2015). Community outreach in relation to crime is not limited to developing countries or rural areas: many schemes simply aim to increase the awareness of illegal activity amongst local people, and to build community bonds which encourage intervention by locals when crimes are witnessed, or the provision of information on illicit activity to the authorities. The intervention tried to promote responsibility and awareness of the impacts of species crime. The findings suggest that, with sufficient intensive outreach work, involving gaining the trust of influential members of society (e.g. local leaders), educating the local people about the negative impact of illicit activities, and advising locals of alternative livelihoods to illicit activities, can contribute to the reduction in species crime. However, with data was only available for one study (which did not have an untreated control site), further evaluation research is clearly necessary to determine whether the impacts reported are replicable and, if so, whether they are context specific.

Anti-Poaching Patrols

The four remaining articles examined the effectiveness of anti-poaching and protected-area patrolling. Patrols for the prevention of species crimes such as poaching, typically involve rangers/soldiers moving through protected areas usually on foot, searching for poachers or poaching paraphernalia (Moreto et al, 2014a). The studies reviewed used quasi-experimental

methods, where a control group may not exist, or if it does, it may not receive the same experimental treatment as the treatment group. Several of the studies combined the results with qualitative information collected through interviews or surveys of stakeholders. The variability between areas (e.g. accessibility, terrain, target species, socio-political factors), and patrols (e.g. methods, resources, rangers) make it difficult to plan and execute 'gold standard' experiments such as randomised control trials. Moreover, most of the studies conducted have relied on historical data, which makes randomization impossible.

The targets of such crimes were some of the most iconic species associated with poaching across Africa and Asia, including elephants, rhinos, buffalo and tigers. All of the included studies (shown in Table 3.3 & 3.4) concluded that anti-poaching patrols in their various forms were effective to varying degrees, in altering the prevalence of species crime.

Study 1

Hilborn et al. (2006) estimated the effectiveness of patrolling in the Serengeti National Park, Tanzania, using three datasets recorded over several decades (see Table 3.3). In 1977 Tanzania's economy declined and cuts to the park budget meant that poaching was anecdotally believed to have increased. In the 1980s the park budgets increased, and the increased investment allowed park staff to resume patrolling activities. Hilborn et al. (2006) reviewed historical datasets which suggested that poaching declined, and species populations improved or recovered when anti-poaching funds were made available, and patrolling was actively implemented in the National Park.

The census of Buffalo abundance was used as an indicator of the level of poaching intensity. A simple dynamics model illustrated that between 1955 and 2005, the variations in buffalo numbers could be accounted for by changes in poaching behaviour, which in turn could be accounted for by the changes in patrolling effort.

Whilst this study covered the longest time period, it provided minimal details relating to the patrols (as shown in Table 3.3) and did not account for confounding variables that may have contributed to the variation in poaching and patrolling levels. Overall this study provided the lowest quality assessment of the effectiveness of patrolling as a preventative technique, but it relied on historical data, which perhaps explains this.

Study 2

Leader-Williams et al.'s (1990) findings corroborate those of Hilborn et al (2006), also suggesting that the presence of patrols were associated with a deterrent effect on poaching. Leader-Williams et al. (1990) conducted research in Luangwa Valley in Zambia on the anti-poaching patrols aimed at combating the poaching of elephant and rhinos. Data was derived from 781 foot patrols conducted between 1979 and 1985, using evidence of elephant and rhino sightings as well as the detection of skulls/trophies witnessed by rangers. Patrols were made up of three to five scouts, and varied in duration between a few days to several weeks, but averaged 5-9 days per patrol.

This study looked at various indicators of illegal activity (carcasses, camps and poachers apprehended) as well as a number of other covariates (shown in Table 3.4), with the analysis overall being one of the most robust assessments of effectiveness of the identified studies.

The study identified that the observations of elephant abundance and subsequent changes in this value, were a composite measure of loss due to illegal activity and local immigration/emigration, which could not be quantified separately. Due to this, the authors could not definitively conclude that the number were representative of the relationship between patrolling and elephant abundance but could conclude that the patrolling provided the elephants with a safe haven that other elephants moved into.

In contrast to elephants, rhinos were not found to move location to areas of increased safety, and therefore their abundance values were considered to be representative of the species and any losses.

The authors identified that between 1979 and 1985 there was a decline in elephant and rhino numbers in the Luangwa Valley. However, this decline in numbers was identified as not being the result of a lack of motivation by patrols, but instead was more likely the result of insufficient numbers of patrol officers to cover the size of the National Parks in Luangwa Valley.

Patrols were found to be effective where they were implemented with sufficient manpower. Foot patrols and vehicle patrols were found to catch large numbers of offenders over the study period. In these locations, patrol effort was found to have a reductive effect on the distribution of illegal activity and inturn increase the abundance of elephants and rhinos, with findings

Table 3.3: The details of the patrol methods used in the returned articles relating to Patrol effectiveness in preventing wildlife crime.

Publication	Patrol Location	Patrol Area (km^2)	Study Period	Patrol Methods	No. of Patrol Unit/s	No. of Patrol Areas	No. of Rangers (Patrol Team Size)	Patrol Duration (days)	No of Patrols	Distance Covered by Patrols
Hilborn et al 2006	Serengeti National Park Tanzania	-	1957 – 2005	▪ Foot ▪ Vehicle	-	-	-	-	-	-
Leader-Williams et al 1990	Luangwa Valley Zambia	63,000	1979 – 1985	▪ Foot ▪ Vehicle	1979: 2 1984: 4	6	3 – 5	5 – 9	781	-
Jachmann & Billiouw 1997	Central Luangwa Valley Zambia	14,000	1988 – 1995	▪ Foot ▪ Intelligence/ Investigative	14	6	6 – 10	10	-	-
Linkie et al. 2015	Kerinci Seblat National Park Indonesia	13,800	2000 – 2010	▪ Foot ▪ Vehicle ▪ Intelligence/ Investigative Recording methods used meant it was not possible to separate foot and informant patrol records.	2000: 2 2005: 6 2006: 5	2000: 2 2010: 8	4	-	642	8,885 km

Table 3.4: The data sources, variables and outcomes of the returned articles relating to Patrol effectiveness in preventing wildlife crime (1/4).

Publication	Data Source/s	Dependent Variable/s	Independent Variable	Confounding Variable/s	Statistical Analysis	Results: Effectiveness of Patrols
Hilborn et al. 2006	**Arrest Records** Recorded since 1957. **Antipoaching Activity Records** Only available for some years. **Species Abundance** Buffalo, Elephant and Rhino numbers.	**Abundance of Species** African Buffalo, Elephant, Black Rhino.	**Relative Poaching Effort** Ratio of Poaching Intensity (arrests per patrol) to Antipoaching effort (patrols per day).	Influence of community engagement mentioned, however the authors claim the decline in poaching effort occurred before the community programs were initiated, therefore the authors attribute the reduction in poaching to patrols.	**Population Dynamics Model** Plotting the time series data on Abundance of Species and Relative Poaching Effort.	The trends observed indicated that declines in species abundance correlated with periods when patrolling was limited due to park funding. As patrolling increased, species abundance was found to improve.
Leader-Williams et al. 1990	**Field Records** Provided information on: • **Illegal Activity** – Total Poachers Encountered – Camps – indication of illegal activity. – Fresh Carcasses (flesh covered rhino/elephant carcasses with trophies axed off) – indication of successful poaching activity. • **Patrol Data** Number of Patrol days.	**Illegal Activity** (poachers, camps, carcasses) **Abundance of Species** Historical sightings of Rhino and Elephant by foot patrols used as a measure of population trends.	**Patrol Effort** Encounter rates per effective patrol day.	• Month / Season • Patrol Length • Number of Scouts • Area • Year (fitted as categorical) • Anti-Poaching Unit (APU).	**Simple Regression** Rates of change in species abundance and patrol effort (in all areas in all years), to assess if animal abundance declined faster in areas where there was least effort. **Multiple Regression** Illegal activity, patrol effort and species abundance to establish if illegal activity was distributed in areas with least patrol effort and most quarry.	Negative relationship between camps, carcasses and effort. Increased patrol effort was associated with a reduction in finds of fresh carcasses and camps. Overall, the results suggested that patrol effort reduced the number of finds of fresh carcasses and illegal activity.

Table 3.4 Continued: The data sources, variables and outcomes of the returned articles relating to Patrol effectiveness in preventing wildlife crime (2/4).

Publication	Data Source/s	Dependent Variable/s	Independent Variable	Confounding Variable/s	Statistical Analysis	Results: Effectiveness of Patrols
Jachmann & Billiouw 1997	**Patrol Reports** Detailing routes and observations.	**Number of elephants killed Illegally** (per annum)	**Financial and Patrol variables:** • Total law enforcement budget per km^2 (US$) • Personal emoluments per scout per month (US$) • Transport expenditure per km^2 (US$) • km^2 per scout • Km^2 per carrier • Effective patrol days per km^2 • Effective investigation days • Number of bonuses paid Average bonus rates (US$).	-	**Poisson Regression Model**	Deterrence effects of both foot and investigative patrols were found to be equally important. The predictor variables below were found to be significantly negatively associated with the number of elephants killed illegally: • Bonuses Paid • Number of Scouts • Law enforcement budget • Personal emoluments per scout per month.

Table 3.4 Continued: The data sources, variables and outcomes of the returned articles relating to Patrol effectiveness in preventing wildlife crime (3/4).

Publication	Data Source/s	Dependent Variable/s	Independent Variable	Confounding Variable/s	Statistical Analysis	Results: Effectiveness of Patrols
Linkie et al. 2015	Field data from ranger patrol logbooks. • **Snare Trap Occurrence** • **Patrol Frequency** • **Patrol Effort** Biological data on tiger prey base collected using camera trap images from 2004-2006 and 2009-2011. • **Tiger Occupancy/ Abundance**	**Snare Trap Occurrence** **Tiger Prey Occupancy /Abundance**	**Patrol Frequency** (number of times visited over previous 1 and 2 year periods). **Patrol Effort** (number of kilometres patrolled in previous 1 and 2 year periods).	Spatial covariates related to accessibility: • Elevation • Slope • Proximity to nearest road • Proximity to forest edge • Proximity to nearest village & protected area status. Additional covariate assessed between 2009-2010: • Tip Off – influence of intelligence-based patrolling.	**Markov Model** Modelling the deterrence of poachers by patrols, due to the removal of snares leading to reduction in the success of poaching.	Snare trap occurrence between 2000 and 2010 declined by 24%, but the result was not statistically significant. The authors identified that the analysis did not control for potential spatial effects created by the establishment of new teams in previously unpatrolled areas. These new teams would likely contribute to the overall number of snares detected in the study area. Highlighting the importance for local-level, individual patrol measurements.

Table 3.4 Continued: The data sources, variables and outcomes of the returned articles relating to Patrol effectiveness in preventing wildlife crime (4/4).

Publication	Data Source/s	Dependent Variable/s	Independent Variable	Confounding Variable/s	Statistical Analysis	Results: Effectiveness of Patrols
Linkie et al. 2015 …Continued	-	-	-	-	-	Patrol Frequency was found to have the most influence over the detection of snare traps, followed by Patrol Effort (number of kilometers walked). Both variables were found to have an increased influence on the detection of snares if performed routinely over more time (e.g. 2 years compared to 1 year). Accessibility was found to be an important factor in relation to patrol team performance. More snare traps were recovered from sites considered more accessible due to lower elevation, and flatter terrain.

showing a negative relationship between patrol effort and the discovery of poaching camps or fresh carcasses (Elephants p = 0.05; Rhinos p = 0.01).

The authors of this study reiterate that the decline in species numbers in the Luangwa Valley is not reflective of the effectiveness of the patrols, as the existing patrols were found to be effective where deployed. The decline is species abundance is an indicator of the need for more patrols to cover the entirety of the Valley effectively.

Study 3

Linkie et al. (2015) researched the performance of anti-poaching patrols in Kerinci Seblat National Park in Sumatra that aimed to protect tigers and their ungulate prey. The research looked at foot patrols conducted between 2000 and 2010. The study was one of the most comprehensive studies (see Table 3.3) of patrolling effectiveness, measuring patrol frequency and patrol effort, snare trap occurrence, and species (tiger and prey) abundance (using patrol data and camera trap data).

Over the study period, the researchers reviewed 642 forest patrols (see Table 3.4) covering 8,885 km during which time they removed 122 snares set specifically for tigers and 4,311 traps set for the ungulate prey. Detection histories for each patrol year were used to calculate the snare detection probability between 2000 and 2010.

Detection Probability is used in situations when total abundance cannot be accurately identified (e.g. counting animals in the wild or poaching paraphernalia). Detection probabilities allow researchers to account for unavoidable variability, by taking into account the number of targets detected, the number of visits to sites as well as allowing researchers to account for confounding factors that may make the target population change temporally or spatially.

The study showed a (statistically insignificant) decline in snare trap occurrence of 24%, between 2000 and 2010. However, the authors were unable to control for the influence the introduction of new patrols would have had on the overall number of snares detected in the study area.

The authors suggest that the reduction (albeit non-significant) in snare trap occurrence, combined with no significant changes in the occupancy of tiger prey species over this period,

is indicative of the park's anti-poaching strategies contributing to a stable tiger and prey population. The frequency of patrols was found to have a greater impact on snare detection compared to increasing the distance covered by the foot patrols.

Patrols appeared to gain experience in detecting snares, shown in the detection probability increasing annually between 2000 – 2006 before plateauing.

The study incorporated several covariates relating to accessibility of the landscape to both poachers and patrols. Accessibility was found to be a key factor in snare detection. The more accessible areas require less effort to reach them and are therefore more practical target locations for both poachers and patrols.

Intelligence–based patrols were assessed for the period 2009 to 2010 in addition to the traditional foot patrols. Intelligence patrols used informant tip-offs, which significantly increased patrol effectiveness, when compared to ordinary foot patrols. The detection probabilities of intelligence-based patrols were 48% higher than foot patrols in 2009 and 41% higher in 2010.

Study 4

Jachmann and Billiouw (1997) conducted research in Central Luangwa Valley in Zambia, into resource allocation and elephant poaching between 1988 and 1995. During the study period, 149 elephant carcases were discovered, with all but two having been killed for ivory. The results of Jachmann and Billiouw (1997) suggest that patrolling had a positive impact, preventing illegal activity relating to elephants. They also identified specific variables that appear to have influenced the efficiency and effectiveness of patrolling.

The authors looked at nine variables associated with resource allocation (see Table 3.3). The results of the study indicated that five of these had a significant effect on the number of elephant carcasses discovered. With respect to the discovery of elephants found killed illegally, effective investigation days ($p = 0.04$), and scout density ($p = 0.04$) were found to be significant predictors. So too were the number of bonus claims paid ($p = 0.003$), personal salary per scout month ($p = 0.04$), and Law enforcement expenditure per km^2 ($p = 0.05$). Based on these findings, Jachmann and Billiouw (1997) recommend that stakeholders involved in species

protection focus resources towards increasing the number of scouts/rangers and supporting the collection and rewarding of intelligence and informants.

Mechanisms

The two main mechanisms by which patrols are believed to affect poaching activity are increasing the perceived risks of being caught and the perceived cost of carrying out illegal activity.

- *Increased risks*

One of the core principles of the SCP framework involves increasing the (actual or perceived) risks of offending. Increasing the number, distance and size of patrols, therefore has the potential to act as a deterrent to those considering poaching. The rangers also used informal surveillance in the form of community informants, who reported poachers and poaching activity in their particular areas.

- *Increased costs*

The removal, confiscation and destruction of poaching paraphernalia (such as snares, weapons, vehicles, etc.) has a financial impact on those committing such crimes, which in turn can discourage their activity. If snares are removed by anti-poaching patrols repeatedly, the costs associated with replacing the snares may deter an individual from being involved in such crimes in future. Several studies mentioned that increased patrolling or patrolling in new areas could lead to displacement of poaching activity, where the poacher changes their spatial movements in an effort to avoid the patrols. However, displacement and its potential impacts was not investigated by any of the studies.

Moderators

Factors that influence the detection rates for patrols varied greatly between different patrol teams and over time. Moderating factors identified in the literature that could influence the outcome of anti-poaching patrols:

- *Accessibility*

Accessibility is an important factor in the spatio-temporal analysis of TS crimes, with locations being influenced in variety of ways by natural features including terrain and vegetation, man-made features such as road networks, and potentially the political/safety considerations of the

areas being patrolled (Linkie et al, 2015). Linkie et al. (2015) incorporated accessibility factors into their analysis of poaching and patrol effectiveness, and found it significantly influenced the likelihood of poaching and patrolling activity.

- *Ranger Experience and Ranger Numbers*

The experience and number of rangers are considered influential factors in the efficiency of the patrols. The increase in number of rangers had an impact on number of patrols and coverage, both of which influence the likelihood of detection thereby having a positive impact on the effectiveness of patrols for the purposes of preventing crime against species. Linkie et al (2015) noted that over time the patrols increasing experience lead to an increase in the detection of snares.

- *Time spent patrolling*

Patrol variables such as time and distance, are related to the type of species being targeted. Jachmann and Billiouw (1997) noted that the number of effective patrol days was not a significant factor in the number of elephants killed. These findings contrast with those of Linkie et al. (2015) who found that the duration spent patrolling was the most significant factor for effective patrolling, compared to other factors such as distance patrolled. The detection of snares for tigers, as assessed in the work of Linkie et al. (2015), suggested that increased frequency of patrolling over long periods of time (two years) had a strong influence on snare detection rates in the areas being patrolled. The variation in target (e.g. elephant carcasses, tiger snares, species of interest, poachers) is therefore likely to significantly influence the relevance of predictor variables.

- *Intelligence-led operations vs. Foot Patrols*

Jachmann and Billiouw (1997) assessed the detection rate of intelligence-led operations (based on informant information), as opposed to routine uninformed foot patrols. There results suggest that intelligence-led operations were more efficient than conventional foot patrols. In relation to arrests, one man-day of intelligence-led operations equated to 23 man-days of foot patrols. However, the costs (discussed later) of intelligence-led operations were 6 times higher than those for foot patrols. Therefore, intelligence-led operations were a factor of four better than routine foot patrols, in terms of the costs associated with arrests.

- *Target Type*

Leader-Williams et al (1990) discussed the difference in movement between elephants and rhino, with elephants immigrating/emigrating between areas. The variation in target type (e.g., elephant carcasses, tiger snares, species of interest, poachers) would impact patrol variables (e.g. time and distance) and subsequently the effectiveness of patrolling.

- *Bonuses and Incentives*

Jachmann and Billiouw's (1997) study was the only one to examine the influence of bonuses and incentives on the effectiveness of patrolling. Bonuses were found to have a significant effect on the number of elephants found killed. The use of financial incentives to encourage others to cooperate with patrols is controversial but was shown to be effective in this study.

Implementation

The search for evidence of criminal behaviour involves a variety of implementation stages and procedures. The studies identified in this review all retrospectively assessed the effectiveness of anti-poaching patrols. Information pertaining to patrolling such as number of rangers, distances travelled, equipment used was limited or absent across the articles reviewed, which reflects the inconsistency and difficulties faced when using historical data (Hilborn et al., 2006).

- *Changes in data recording procedures*

What rangers observe during patrols was typically recorded on paper using maps to record the location of the incident they had intercepted. While technology for recording patrolling information has advanced (e.g., Global Positioning System (GPS) equipment can now be used to accurately log patrol routes), it is important to acknowledge that access to such equipment is not widespread, and therefore significant differences exist in the recording method for different areas. The rangers' awareness and ability to navigate new recording systems can impact the accuracy of recorded data. Variability in data recording can also have a significant impact on subsequent data analysis (Linkie et al., 2015).

Changes in the behaviour of rangers are unlikely to be quick, and this needs to be taken into account when analysing data, and estimating the relative 'success' of an intervention that may still be in the process of being fully integrated ten years after its first introduction.

- *Technological limitations*

GPS coverage can vary and may be limited in places covered by dense canopies or thick vegetation. Failure of equipment to automatically record ranger locations accurately will impact on the accuracy of the information recorded and any subsequent analysis (Martin, 2013).

Economics

As previously stated, the specific financial costs of interventions are not commonly documented in primary research, and again there existed limited information to include in this section from the articles identified. Jachmann and Billiouw (1997) described some of the financial costs associated with patrolling, where cash rewards were offered for information on poaching and poachers, with arrests or recovered firearms/trophies receiving additional cash awards to compliment patrolling. The article describes the estimated costs associated with patrolling (including salaries and bonuses) and proposes that efficient patrolling could be achieved with a total enforcement budget (based on the given circumstances of the region) of US$50 per km^2.

Leader-Williams et al (1990) conducted research in the same area as Jachmann and Billouw and provided estimates of cost-effectiveness. According to their estimates, between 1979 and 1985 spending on patrols equated to about US$1.1M. Over the same period, 1,483 offenders caught by four anti-poaching units. Taken together, they estimate that the cost per offender caught was US$730, and they suggest that this was comparatively cheap when compared to other forms of law enforcement. Of course, the reviewed papers were published in the 1990's and the financial costs will have increased in the last 20 years, but the estimates provide a basis for estimating likely current costs.

Data Quality Issues: Retrospective Data and Species Population Measures

All of the articles identified had similar issues associated with the quality of the data available, and the methods employed given that the authors were limited to analysing largely retrospective secondary data. The issues encountered were as follows:

- Animal population – Estimating the population of a target species is fraught with difficulty, and due to this, it is impossible to accurately quantify the proportion of animals illegally killed; instead, researchers must assume that the detection of animals and poached

carcasses provides a proxy measure of the poaching pressure or variation in animal abundance.

- Movement of Animals – Calculations are complicated further by having to account for the emigration and immigration of animals into and out of the areas of interest.
- Poaching Pressure – It is assumed that what is detected by patrols (camps, carcasses, poaching paraphernalia) is directly proportional to the poaching pressure in a given area. However, these figures only reflect the areas actually patrolled and hence provide only a partial picture.
- Patrol Coverage - In relation to the patrolling of protected areas, most areas have little to no patrol coverage, and ranger patrols are not uniformly distributed. As such, accurate levels of crime prevention are difficult to estimate (Moreto et al., 2014).

Such issues need to be considered when reviewing articles on this topic and in future work.

Discussion

Empirical evaluations are a valuable resource to inform resource allocation. However, 'green criminology' – which is a subfield of criminology focusing on the causes of, and responses to, 'ecological', 'environmental' and 'green' crimes, harms and hazards – suffers from a lack of empirical quantitative studies (Lynch et al., 2017; White, R. 2013). This systematic review confirms the severely limited amount of evaluations on the effectiveness of techniques for preventing terrestrial species crime. The five articles identified in this review reported on the effectiveness of two methods of situational crime prevention. A single study suggested that Community Outreach was found to be effective in reducing poaching. The other studies provide evidence to suggest that Patrols can be effective, although the quality of the studies varied greatly. This review provides a starting point for decision makers, but based on the very limited research available, it is impossible to be certain if these two types of intervention are the most effective in terms of preventing crime against the target species.

In the process of conducting this review, several limitations were identified relating to the studies included in this survey, as well as the limitations of studies relating to this topic in general. These will now be discussed with a view to informing future primary evaluations.

Limitations of Studies

Accuracy of Data – An ever-present issue with species crime relates to the 'dark figure' of illegal activities. That is, a large proportion of crimes are likely to go undiscovered (Biderman and Reiss, 1967; Lemieux, 2014). This presents a significant problem for primary studies of intervention, and subsequent systematic reviews. It makes the collection of accurate primary data a complex but important task for future research to better assess and understand the impact of illegal activities involving species.

Changes in Practices – Across studies, the methodology employed, and the accuracy of the data varied significantly. The studies included in this review were published between 1990 and 2016, with the data originating from the 1970's onwards. As increasing funding and technology has been channelled to anti-poaching patrols, the systematic nature of record keeping has steadily improved. Researchers must take this into account when comparing data from one period, where rangers were using paper maps and notebooks, to another, where GPS equipment, drones and other technology were used. Any observed differences concerning, for example, the detection rates between such periods may reflect better detection, or more accurate data-recording. In addition, differences between areas may be due to variable access to such technology, which is unlikely to be ubiquitous across places.

Variation in Terminology – The terminology used in different fields of research has led to a situation where some keywords have become used generically to describe a multitude of scenarios from disparate fields of research. Several conservation studies discussed activities such as 'poaching' and 'by-catch' as being one of many elements impacting the local ecology. However, the focus of their research, whilst aiming to benefit the local ecology in general, did not focus specifically on preventing wildlife crimes. Studies relating to conservation may have dealt with issues that were detrimental to the environment but were not technically illegal. As the focus of this review was to establish what interventions exist to prevent terrestrial wildlife crime and how effective these methods are, the conservation studies initially identified did not ultimately meet the inclusion criteria.

Variation in Legal/Illegal Activities – Actions that impact upon species may be deemed illegal in one country but not in another. Due to differences in law between countries, the authors of this review selected articles where prevention methods were being used to tackle illicit

activities against species. Kurland et al (2017) incorporated both conservation and crime prevention methods, in a literature review. This systematic review could be supplemented with information from other systematic reviews of methods of prevention/intervention techniques focused solely on wildlife conservation. By encouraging the production and updating of reviews focused on TS crime, researchers and decision makers will have a larger quantitative and qualitative data set on the effectiveness of methods for protecting terrestrial species.

Diversity of Prevention Methods – In their analysis of a decade of projects funded by The Tiger Funds, Gratwicke et al. (2007) argued that the variety of intervention types and methodologies used were too diverse for them to effectively conduct a meta-analysis. The same can be said here. The validity of future work depends on standardising as far as possible the data (e.g. including recording practices) and analytic approaches taken in primary studies to make it possible for future systematic reviews to include a quantitative and qualitative synthesis.

Funding – Limited funding for projects relating to wildlife crime is a continuing issue internationally. Investments have been made in recent years to tackle the problem of international wildlife crime, but continued financial support is not guaranteed. Moreover, the majority of the research undertaken to date has concerned conservation. Whilst conservation studies are a useful source of information relating to the topic of interest, conservation studies tend to indirectly examine the impact of interventions on crime associated with the international wildlife trade. Clearly, future work that seeks to also examine the latter will be necessary if we are to learn what works to reduce this form of offending.

The expediency of solutions is one of the major issues with transposing ideas for tackling crime. Whilst technological solutions may theoretically provide some deterrence and detection benefits, it is only when there is sufficient funding for training, deployment, operation and maintenance, that such prevention methods are truly feasible. And, without evidence to show that particular approaches work, limited resources may be squandered on good ideas that fail to reduce crime or costs effectively.

Publication Bias – Publication bias is a complex issue in relation to conservation research internationally. The most prominent countries in relation to biodiversity and conservation, are also those with developing economies. A study carried out by Fazey et al. (2005) examined the main barriers that prevent conservation research conducted in developing countries from

reaching international audiences. These included language barriers, as well as access to technology and funding to be used to conduct and publish the results of the research. Unless these issues are addressed valuable research and potential solutions to crimes involving TS would continue to be overlooked.

Displacement of Illegal Activity – The displacement of illegal activity was not discussed directly in any of the studies reviewed but alluded to as an important avenue for future research. Identifying the impact of interventions in areas beyond the focus of the intervention would indicate whether poaching activity is being actively reduced by patrolling or is being spatially displaced to nearby locations (Linkie et al., 2015). In addition to spatial displacement, target displacement where criminals may choose to target other species should also be considered in future research. In the case of urban crime, it has been shown that police patrols do not appear to displace crime (see Bowers et al, 2011;), but context matters and this may not be the case for poaching (Johnson et al., 2014).

Conclusion

The articles identified in this review provide a basic insight into the difficulties faced by stakeholders and researchers in identifying the most applicable methods by which to prevent crime against species. It should be clear from the number of articles that were included in this review that there is very little research on what works to prevent species crime. The minimal amount of research assessing what works best in protecting species, could be addressed in two ways: Firstly, through retrospective publication of assessment research not readily available. Secondly, through the conduct of new research designed to assess the effectiveness of existing and proposed prevention measures. The impacts of crimes against species, such as dwindling numbers and impending extinctions that were described in the included research (written over three decades ago) remains a significant issue that needs to be addressed. Many organisations are devoted to trying to prevent the extinction of iconic species internationally, often involving significant financial investment, yet research informing or evaluating their impact is lacking. Without more empirical evidence to present to such conservation organisations about the effectiveness of prevention methods, it will be a continuing challenge to justify the need for funding and supporting prevention efforts, such as community outreach and patrolling. With increasing financial pressure, the limited evidence to support current prevention techniques and developing new methods, the challenge to prevent the extinction of species is likely to continue.

CHAPTER FOUR

Victimisation Survey of Farmers in the UK

Introduction

As evidence is increasingly suggesting that urban criminals are moving into rural areas of the UK, a limited amount of research has been conducted to examine the criminal activity that takes place in rural locations such as farms (NRCN: Our View, 2019).

Sources of data typically used when assessing the impact of crimes include Police and Insurance data. However, these sources of data present a number of issues relating to their representativeness. The 'dark figure' of crime has long been acknowledged as a flaw within official data sources, where not all crimes are going to be reported, or held by authorities such as Police and Insurance companies, therefore the available data may only provide a partial picture of the actual incidence of these crimes types (Biderman et al, 1967; Skogan, 1977).

In addition to the absence of data, the recording and recovery of data relating to Livestock and Wildlife crimes is complicated by the existing recording systems used by Police having various abilities to tag these crime types and locations (farm). In addition, many forces tend to record farm crimes such as Livestock and Wildlife crimes as incidents rather than crimes, which do not get included amongst the official crime statistics.

To overcome the lack of reliable police data, victimisation surveys have been conducted internationally for several decades to better understand the true incidence and impact of crime as discussed in the Literature Review (Chapter Two).

Surveys on crime impacting rural areas and farms are limited internationally, and to an even greater extent when specifically looking at the UK. The limited number of publications providing information about the incidence of farm crime, often combine the variety of different crime types experienced on farmland, potentially masking the significance or patterns of specific crime types. Information on Livestock and Wildlife crimes is largely omitted, or present as a peripheral topic in victimisation surveys of individuals and businesses.

The aim of this study was to address the absence of information on the impact of Livestock and Wildlife crimes by conducting a victimisation survey of farmers in the UK. The results of the survey provide an overview of the rate of livestock or wildlife crimes experienced by respondents who work and/or live on farmland in that region, and assess the accuracy of information from previous studies, surveys and police data. Ultimately, it should contribute to the body of knowledge used to identify police priorities and set policies to prevent crimes impacting farms, livestock and/or wildlife nationally.

Literature Review

To better understand the incidence and impacts of crime on individuals, victimisation surveys were established internationally to provide a clearer insight into crime rates. The following section reviews the relevance of the existing crime surveys, and why there is a need for a more detailed assessment of the incidence of Livestock and Wildlife crimes in the UK.

Victimisation Surveys in the UK

There exist three main victimisation surveys conducted in the UK: 1) Crime Survey of England & Wales (CSEW), 2) Crime & Justice Survey: Scotland (C&J), 3) Northern Ireland Crime Survey (NICS) (CSEW ONS, 2015; NICS, n.d.; SCJS (a,b), n.d.).

Used by policymakers to address issues with crime, Policing and the Criminal Justice System, they are used to elicit information from individuals about their experiences of crime including those not reported to the Police (ONS Crime & Justice, 2017). Victimisation surveys ask respondents to reflect on their experiences of crime but intentionally avoid crimes against businesses and focus solely on crimes experienced by an individual or household. For this reason, these surveys only provide an overview of the experience of personal crime in rural areas, not the type of crimes involving livestock and wildlife that impact farmland and farmers, which would be considered business related.

Victimisation Survey: Commercial/Business

To complement the information collected in personal victimisation surveys, the Commercial Victimisation Survey (CVS) was developed to collect data on crime affecting various business sectors. The Commercial Victimisation Survey (also known as the Crimes Against Businesses

Survey), is a series of surveys commissioned by the Home Office to examine the extent of crimes against businesses in England & Wales. A version of the Commercial Victimisation Survey was first conducted in 1994, followed by another survey in 2002 and has subsequently been conducted annually since 2012 (CVS, 2013). The survey initially focused on businesses in the retail and manufacturing industries, but since 2013 has incorporated the area of 'Agriculture, Forestry and Fishing' (excluding 2016) (CVS 2018).

In addition to the more general questions about crimes experienced at premises in the 'Agriculture, Forestry and Fishing' sector, the survey includes questions about livestock theft and 'Other' types of ASB including Poaching and Hare Coursing, all of which are relevant to this thesis. However, questions relating to crimes impacting livestock and wildlife on farms were an addition to the main focus of the survey, and therefore the utility of the resulting data is limited. Indeed, studying these crime types independently would allow for comparison of occurrence rates and patterns, to other crimes that occur on farmland and in rural areas.

Farm Crime Surveys in the UK

Surveys such as the Australian Farm Crime survey, have been conducted in various countries to establish how crimes impact farms and rural communities (Anderson & McCall, 2005). However, no national surveys have been conducted that focus specifically on the incidence of crimes relating to livestock and wildlife in the UK.

To date, the Rural Crime Survey conducted by the National Rural Crime Network (2015; 2018) and the Scottish Farm Crime Survey (1998) provide the most relevant resources of information relating to crimes impacting farmers in the UK (NRCN, 2015, 2018; SFCS, 1999). A study by Smith & Byrne (2017) on 'Farm Crime in England and Wales' also provided some insight into the current issues associated to crime on farmland. These surveys provide information on a variety of crimes occurring in rural areas and on farms (as shown in Table 4.1), but are not aiming to assess Livestock and Wildlife crime specifically, therefore do not provide detailed information about species crime (see Chapter Two for a review of existing victimisation survey data).

Issues associated to the existing surveys include that incidents where animals, livestock or wildlife have been victims can easily be omitted either intentionally or unintentionally. Social and cultural factors may make it easier for individuals to recall crimes that have directly

Table 4 1: Rural and Farm Crime focused surveys in the UK (CVS, 2014, 2015, 2016, 2018; CVS Technical Report, 2018; NFU Mutual, 2018; NRCN, 2015, 2018; SFCS, 1999; Smith, 2018).

Survey/Report	Location	Year	Duration	No. Respondents	Target Group	General Topics Addressed in Survey/Report
Commercial Victimisation Survey	England & Wales	2013	Previous 12 months	1,085	Agriculture, Forestry and Fishing Business Premises	• Types of Crime • Incidence and Prevalence of Crime • Items Stolen or Damaged • Costs of Crime (including Financial Loss) • Action Taken & Reporting Patterns (Police etc) • Experience of Intimidation following Crime • Cyber Crime, ASB and Crime Prevention Measures
		2014	Previous 12 months	1,019		
		2015	Previous 12 months	1,098		
		2017	Previous 12 months	1,019		
Rural Crime Survey (NRCN)	UK	2015	Previous 12 months	13,193	• Rural Visitors • Rural Residents • Rural Business Owners	• Crime Types and Rates in Rural Areas • Impact of Crime on Victims / Wider Community • Reporting of Crime • Perceptions of Criminals / Crime • Perceptions of Police in Rural Areas / Satisfaction • Security Measures
		2018	Previous 12 months	16,191		
Rural Crime Report (NFU Mutual)	UK	Annual	Previous 12 months	Based on Insurance Claims	Rural Farms & Businesses	• Cost of Rural Crime (Large Agricultural Focus) • Trends and Perspectives of Stakeholders
Farm Crime in England and Wales (PhD Research)	England & Wales	2017	Previous 12 months	126	Farmers	• Farm Crime • Crime Prevention • Police • Predictors of Farm Victimisation
The Scottish Farm Crime Survey	Scotland	1998	Previous 15 months & Previous 5 years	1,022	Farmers (owners, tenants and managers)	• Crimes committed against farms • Vulnerabilities of farms to crime • Initiatives to combat farm crime • Police and Farm Crime • Impact of Farm Crime

impacted them and fail to recall other types of crimes that have occurred where animals/livestock/wildlife have been the victim. The absence of these crimes from survey results may not be a reflection of the absence of these crime types, but instead caused by omission on the part of the respondent/s, or the survey not providing the opportunity to discuss these specific crime types. By focusing on these crime types specifically, this survey aims to gather a more focused and accurate picture of the occurrence of these crimes on farmland.

Where information was collected in relation to Livestock and Wildlife crime, the inconsistency in the terminology and crime groupings used made it difficult to extract for comparison purposes. In addition to these issues, the Scottish Farm Crime Survey was conducted nearly 20 years ago and only focuses on Scotland, therefore brings into question the representativeness of the results to the current state of farm crime in the UK.

This chapter aims to rectify the absence of information on Livestock & Wildlife crime by conducting the first survey of farmers in the UK on this specific topic area. The following section of the Literature Review will provide supporting evidence for the hypotheses the survey aimed to assess, relating to the seasonality of Livestock and Wildlife crime on farms and the features that may influence the vulnerability of farms to such crime.

Seasonality of Victimisation

Temporal and seasonal variation in crimes has been known of for over a century. A large amount of research has been conducted to try and identify whether different crime types (e.g. murder, assault, robbery, burglary, vehicle theft, theft of personal property, sex crimes and domestic violence) follow predictable cycles, and to try and understand the underlying mechanisms (e.g. meteorological and climatic conditions such as temperature, humidity, sunlight, precipitation, wind, barometric pressure) that could explain the oscillations in crime occurrence, but the specific link between time/season and crime is still debated (Baumer & Wright, 1996; Dong et al, 2017; Hird & Ruparel 2007; McDowall et al, 2012).

A better understanding of the seasonal patterns of crimes (and the factors that influence them) would improve the stakeholders' ability to explain, predict and control for specific crime types (Cohn, 1990; Hipp et al, 2004). In rural environments, it would enable Police forces that are particularly strained due to having large areas to patrol and limited officer numbers to forecast

crime and concentrate already limited crime prevention resources. It would also allow the accurate evaluation of the effectiveness of prevention strategies and avoid mistaking natural seasonal variation in crime rates as being the result of a given prevention strategy (Dong et al, 2017; Farrell & Pease, 1994; McDowall et al, 2012).

Barclay (2001) identified seasonal pattern in Livestock theft in Australia, with theft occurring at times when Livestock were higher in value. Whilst anecdotal evidence exists to suggest seasonal fluctuations in Livestock and Wildlife crimes in the UK, with wildlife crimes (e.g. Hare Coursing) known to increase after harvest, no studies in the UK have directly addressed this issue in relation to farm crimes, therefore the survey will aim to assess the seasonal variation in these crime types.

If seasonal patterns are identified in livestock and wildlife crimes, it would then be important to identify the ecological and physiological processes that may be creating these temporal/seasonal patterns (Anderson, 1989; McDowall et al, 2012). Farms follow a strict agricultural calendar with the timings and movement of people and livestock being dependent on the size of farm, produce type and farming method (e.g. intensive vs. extensive). In addition to the farming calendar, it is important to take into consideration the seasonal patterns associated with wildlife (e.g. migration, hibernation etc.). Seasonal patterns associated with farmed and wild species as well as routine activities associated to the farmland itself (e.g. harvest making fields more accessible, increasing the potential for exploitation of the farmland) would be important to compare to any seasonal patterns identified in the incidence of crimes involving Livestock and Wildlife.

H1: Farms experience a variation in the number of a) Livestock crimes and b) Wildlife crimes depending on the month of the year (January to December).

In addition to looking at the seasonal patterns in the incidence of Livestock and Wildlife crimes, it was important to look at variations in the number of staff on the farm too. Seasonal farm labour creates increased movement of people within the rural environment and specifically on the farmland itself. From the routine Activity Theory perspective, the change in the ecological conditions, with variation in the number and movement of people on the farmland throughout the year, could be conducive to variation in crime risk. The presence of additional people on the farm could be perceived as either increasing the level of surveillance or conversely an

increase in the vulnerability. To examine this issue, the survey included questions about the seasonal patterns of workers on the farmland.

H2: Farms experience more a) Livestock crimes and b) Wildlife crimes during the months identified as typical for Seasonal Staff to be present on the farmland.

Guardianship on Farmland (Habitation, Supervision, Pluriactivity)

Cohen and Felson (1979) introduced the fundamentals of routine activity theory, where the convergence in time and space of a motivated offender and suitable target, in the absence of a capable guardian are required for a crime to occur (Hollis et al, 2013). The work of Eck (1994) & Felson (1995) expanded upon the Routine Activity Theory posited by Cohen and Felson (1979) to show the influence of controllers on the three elements required for a crime to occur (Hollis-Peel et al, 2011). Three main subtypes of guardianship were identified: guardians, handlers, and managers (Hollis-Peel et al, 2011). The adaptation to the Problem Analysis Triangle highlighted the links between these guardianship types, with a handler involved with an offender, managers involved with criminogenic places and guardians involved with specific targets (Hollis et al, 2013).

These different forms of guardianship (handler, manager, guardians) are connected to the occurrence and prevention of crime. Guardianship does not only include formal social control (e.g. police, security guards) or target hardening (e.g. use of crime prevention methods such as locks, alarms, etc.), guardianship also relates to the simple presence of an individual, whose presence results in the prevention of crime, as the potential offender is, or feels as if they are being watched (Hollis-Peel et al, 2011).

Farmers living on the farmland can be perceived as being both the Target Guardian and the Place Manager. These dual roles highlight the need to better understand the influence of Guardianship on crime in rural and farming environments. Factors that may result in fluctuations in the presence of farmers on the land (e.g. permanent residence on the farm, or employment away from the farm), are likely to directly influence the amount and quality of guardianship on the farmland. The survey asked several questions to better establish the influence of general guardianship on Livestock and Wildlife victimisation.

The presence of a permanent residence on the farm is hypothesised to act as a deterrent to opportunistic criminals, who may interpret the presence of a permanent residence as increasing the risk of being seen and caught committing a crime. To test this fourth hypothesis, the survey respondents were asked to identify if anyone lived permanently on the farmland, to establish how the presence of a permanent residence on the farmland influenced the likelihood of victimisation.

H3: Farms experience more a) Livestock crimes and b) Wildlife crimes when no one lives on the farm permanently.

An extension to the examination of guardianship on the incidence of Livestock and Wildlife crime on farmland, examined the impact of pluriactivity (i.e., additional employment away from the farmland) which many farmers must have for financial security. For the fifth hypothesis, respondents were asked whether they have additional employment away from the farm.

H4: Farms experience more a) Livestock and b) Wildlife crimes when the farmer is involved in pluriactivity away from the farm.

Whilst the presence of a permanent residence on the farmland may act as a deterrent to criminals, the presence of a residence does not necessarily translate to occupancy and effective guardianship (Reynald, 2011). Active monitoring has been an under researched aspect of Guardianship, but forms a fundamental part of guardianship for it to be effective in reducing opportunities for crime. The work of Lynch & Cantor (1992) suggests that occupancy significantly effects crime opportunities but the influence of occupancy differs by crime type. To examine this issue, the survey also asked respondents to indicate the average amount of time (daily) that the farmland is left unsupervised. This question is intended to provide an indication of general guardianship on the farmland.

H5: Farms experience more a) Livestock and b) Wildlife crimes as the number of hours the farmland is unsupervised increases.

Permeability of Farmland (Rights of Way, Roads, Village)

The structure and design of buildings, towns and cities have been the focus of increasing research, to assess what features may make a location more or less vulnerable to crime. The authors Jeffery (1977), Newman (1972) and Jacobs (1961a,b) published work discussing (permeability, situational determinism and defensible space/territoriality respectively) how aspects of urban design (such as house construction and road layouts) influence the occurrence of crime.

The work of Jane Jacobs discussed the influence of permeability and hypothesized that increasing accessibility created by using a grid street network would in turn lead to increased social interaction – "eyes on the street" – and a stronger sense of community (Cozens, 2008; Jacobs, 1961a,b). Despite Jacob's hypothesis that increased permeability decreases the potential opportunities for victimization, research conducted over several decades has found that increased permeability actually increases the opportunity for crimes, where the increased accessibility for pedestrians and vehicles, provides access to not just all citizens but also potential offenders (Cozens, 2008; Ekblom, 1995; Johnson & Bowers, 2010). Whilst the existing research indicates that increased permeability in street networks leads to an increase in the likelihood of crimes, the majority of the existing research into the influence of permeability has focused on urban and suburban areas and housing estates (Davies & Johnson, 2015; Frith et al, 2017; Johnson & Bowers, 2010).

Research on rural and farm crime nationally and internationally has assessed factors including proximity to roads and villages/towns/cities. These environmental factors have been used to assess the influence that the accessibility/isolation of farmland can have on victimization (Anderson & McCall, 2005; Young et al 2011). Anderson & McCall (2005) found that remote farms were 20% more likely to be victims of crime; however, the type of crimes experienced varied depending on the isolation/remoteness of the farmland.

Research conducted by Ceccato & Uittenboaad (2013) in Sweden assessed wildlife and environmental crime data, and identified that environmental and wildlife crimes occurred predominantly within 2km of roads, with larger rural areas suffering higher levels of victimization. Proximity to roads was also identified as a significant factor in relation to victimization when assessing crime records in National Forests in the USA (Maingi et al 2012; Wing & Tynon 2006; Young et al 2011). Ceccato & Uittenboaad (2013) found the influence

of spatial features varied between different types of crime, indicating any future research should assess offence specific spatial and temporal crime patterns. By identifying patterns of crime in the rural UK, it may be possible to identify spatial features that could explain these patterns.

A survey conducted recently on Farm Crime in England by Smith (2018) found that proximity to roads and urban centres had no influence on the likelihood of farm victimization. The influence of permeability/accessibility in rural areas has yet to be assessed within the UK specifically in relation to Livestock and Wildlife crime. It is important to look at the environmental factors that may influence victimization for different crime types that can occur in rural areas and farmland, as the proximity to roads, neighbours and villages may vary based on the modus operandi of the criminals and whether the crime is opportunistic in nature (poaching) or requires comparatively more planning and equipment (e.g. theft of a large number of sheep). To do this, in the current survey, respondents were asked about the proximity of the farmland to the nearest main road and village to assess the influence of these factors on the victimization of Livestock and Wildlife (Cozens, 2008) to test the following hypotheses:

H6: Farms experience fewer a) Livestock crimes and b) Wildlife crimes with increasing distance from main roads.

H7: Farms experience fewer a) Livestock crimes and b) Wildlife crimes with increasing distance from the nearest village.

In addition to the proximity of roads, the survey aimed to identify the influence of another rural feature that may increase the permeability of the farmland. Found throughout the rural landscape in the UK, Rights of Way (RoW) are pieces of land that the public have the legal right to use for walking or specific leisure activities, and include footpaths, bridleways, restricted byways and byways open to all traffic (see Table 4.2).

Table 4.2: Types of Rights of Way (RoW) in the countryside in the UK (RoW Access, 2019).

Rights of Way	Purpose of Rights of Way
Footpaths	Walking, running, mobility scooters or powered wheelchairs
Bridleways	Walking, horse riding, bicycles, mobility scooters or powered wheelchairs
Restricted byways	Any transport without a motor and mobility scooters or powered wheelchairs
Byways open to all traffic	Any kind of transport, including cars (mainly used by walkers, cyclists and horse riders)

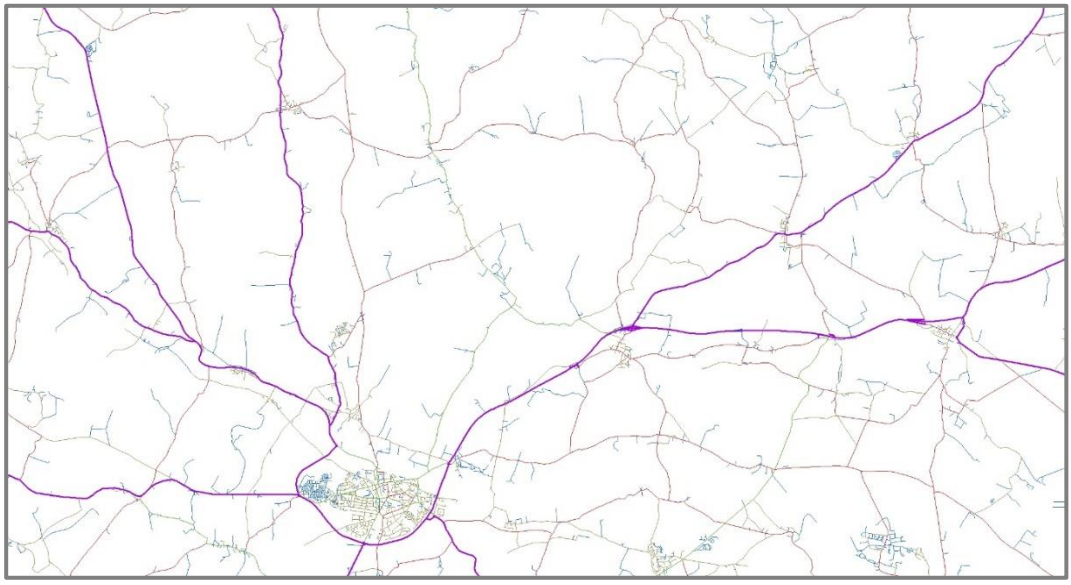
There exists a large network of RoW in the UK, that covers much of the rural landscape, and as a result RoW can be found alongside and/or bisecting fields and farms (Ramblers, 2019). The RoW Act 2000 supports the public's 'right to roam' in upland and uncultivated areas of England and Wales, which increases the permeability of the rural landscape.

The influence of permeability on crime occurrence has been studied in urban and suburban settings, and within surveys on rural and farm crimes. However, the influence of RoW have not been assessed in relation to rural crime in the UK or more specifically on Livestock and Wildlife crimes in the UK. Figure 4.1 illustrates how RoW can increase the permeability of the rural landscape.

To account for the potential variation in farmland permeability the survey asked respondents to indicate whether the farmland contained Rights of Way.

H8: Farms will experience more a) Livestock crime and b) Wildlife crime if they contain Rights of Way.

(a)



(b)

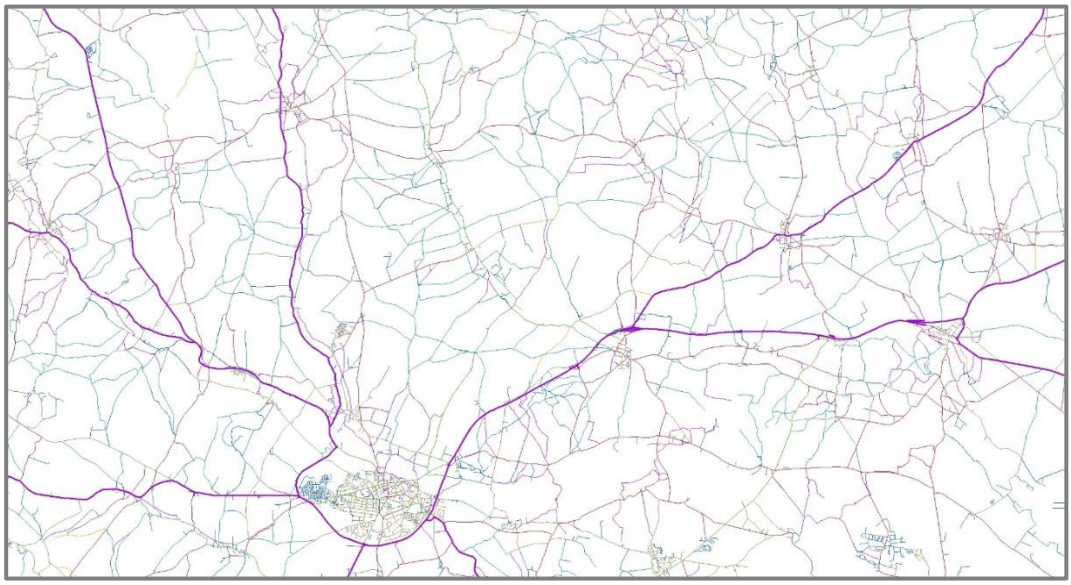


Figure 4.1: Maps showing (a) The road network and (b) the combination of the road network and the RoW, for a section of the Dorset landscape, illustrating the significant increase in the permeability of the landscape when RoW are taken into account.

Crime Reporting

As well as collecting information on the victimisation of farms across the UK, the survey aimed to understand the reporting practices of farmers for Livestock and Wildlife crimes. Under-

reporting is an issue for many crime types, and it is important to understand the reasons why individuals choose not to report crimes when they occur, and try to address these in the future. Disparity between the proportion of Livestock and Wildlife crimes reported to Police could also be considered a function of the differing financial impact of these crime types. In the context of this thesis, the theft, damage or killing of Livestock have a direct financial impact on farmers, whereas damage or killing of wildlife could be considered to have less of an impact on a business in financial terms (when excluding damage to property caused during the criminal activity). The financial implication of Livestock crime would be expected to encourage farmers to report the crime, particularly if the farmer is expecting to recover livestock or make an insurance claim. This leads to the third hypothesis tested in this chapter:

H9: There is a significant difference between the reasons for not reporting crimes for Livestock crimes and Wildlife crimes.

Method

A web-based survey of farmers in the UK was conducted to assess the incidence of Livestock and Wildlife crimes on farmland in the previous two years and historically, and what features may influence the likelihood of victimisation. The survey design was informed by questions asked in international farm crime surveys conducted on similar topic areas, but with the questions being more narrowly focused on wildlife and livestock crimes (SCFS, 1999; Anderson & McCall, 2005). Additional questions were developed based on discussions with Police, other stakeholders and research on Livestock and Wildlife crime types in the UK.

Questions

The survey contained a mixture of 33 qualitative and quantitative questions (see Appendix 1 for the full list of questions). The survey contained five sections relating to the following themes:

- Demographic Information (7 questions) - Age, gender, location.
- Victimisation (13 questions) – Actual incidence rates of Livestock and Wildlife crimes on farms in the UK. E.g. *'Have Livestock crimes occurred on the farm? Which months have livestock crimes occurred on the farm?'*
- Reporting (2 questions) – Reporting rates of Livestock and Wildlife Crimes in the UK and reasons for not reporting. E.g. *'Which of the reasons below best explain why livestock crimes have not been reported to the police in the past?'*
- Surveillance (5 questions) – Factors that may influence the level of supervision on farmland such as pluriactivity and having a permanent residence on the farm. E.g. 'Does anyone live on the farm permanently?'
- Permeability (3 questions) – Exposure of the farmland to potential offenders due to proximity to roads, towns and the presence of rights of way on the farmland. E.g. *'Does the farmland contain public rights of way (e.g. public footpaths, byways or bridleways)?'*

The final question in the survey was the only free-text question providing respondents with an opportunity to give additional information relating to their experiences of crime on their farmland. A thematic analysis of the free text question can be found in Chapter Five.

Survey Mode/Design

The survey was administered online, and created using the UCL software Opinio, so UCL was present in the link sent to participants. Increasingly researchers are using web-based methods, due to the advantages of quicker dissemination and lower associated costs (Ganassali, 2008; Heerwegh & Loosveldt, 2006; Kaplowitz et al, 2012; McPeake et al 2014; Michaelidou & Dibb, 2006; Petrovčič et al, 2016). Despite the benefits associated with conducting a web-based survey, this mode of interaction also presents challenges for the researcher, with the majority of the existing literature finding that web-based surveys tend to have a lower response rate compared to other survey modes (e.g. telephone or paper) (Rübsamen et al, 2017). Researchers have tested a number of manipulations to improve response rates for web-based survey (including survey length, invitations & reminder emails, affiliation – email subject line & survey link, progression indicators and personalization) and these are discussed below (Dillman et al, 1998; Heerwegh, 2005; Joinson & Reips, 2007; Pearson & Levine, 2003; Porter, 2004; Porter et al, 2004; Porter & Whitcomb, 2003,2005; Saleh & Bista, 2017; Trespalacios & Perkins, 2016).

Survey Length

To increase response rates, and reduce the likelihood of break-off, Heerwegh & Loosveldt (2006) recommend lowering the perceived costs to the respondent in terms of the time and effort required to complete the survey. The farmer survey was trialled by 7 postgraduate students who took between 5 and 10 minutes to complete it. This was considered suitable given Fan & Yan (2010)'s findings suggesting that the optimal survey duration was 13 minutes. The invitation email and instructions explicitly told participants the approximate length of time (10 minutes) it would take to complete the survey.

Sample

As detailed in Table 4.3, there are approximately 217,000 farm holdings in the UK. A sample size calculator was used to estimate the required sample size, which identified a minimum sample of 664 at a 99% Confidence Interval with a 5% Margin of Error.

Table 4.3: The number of holdings and average area of holdings/farms (hectares) in the UK (DEFRA England, 2017; NI GOV, 2018; SCOT GOV(a,b) 2017; WELSH GOV, 2018).

Country	Average Area (Hectares)	No. of Holdings	% of total Holdings
England	86.6	105,900	48.0
Wales	48.5	38,470	17.4
Scotland	112.5	51,138	23.2
Northern Ireland	41.1	25,000	11.3
	Total	220,508	100

Due to a poor response rate to an earlier pilot survey using social media to promote the survey, the decision was made to send this survey directly to farmers. It was identified that the UK breeder society websites (see Appendix 2) provided contact information for a large number of farmers and breeders in the UK and could be used for directly inviting relevant individuals to take part in the farm crime survey.

Information on the most common breeds in the UK was used to target specific breed society pages and identify potential sample participants. A form of purposive sampling was used termed Criterion sampling (see Palinkas et al, 2015), where the selection of sample participants was based on three criteria. The selection criteria required participants to be: 1) a farmer/breeder of specific breeds of livestock (cattle, sheep, pigs), 2) registered with one of the included breed societies/livestock databases, 3) provided contact details (specifically email address). Those who met these criteria had their contact information extracted and incorporated into the final survey sample (Palinkas et al, 2015).

The Chrome browser extension Web Scraper was used for data extraction of farmer contact details from the relevant websites such as BASCO, BREEDPLAN and Grassroots (BASCO, n.d.; Breedplan, n.d.; Grassroots, n.d.; Web Scraper, n.d.). Contact information was then collated with data collected by hand from websites that did not allow for automated extraction. A total of 12,755 email addresses were extracted from open source searching of websites as shown in Table 4.4.

Table 4.4: Number of contacts extracted from the relevant websites and databases before and after the removal of duplicates.

TOTAL EMAILS	
CATTLE	7,632
SHEEP	5,849
PIGS	1,073
TOTAL NO. OF EMAILS IDENTIFIED THROUGH OPEN SOURCE SEARCHES	14,554
REMOVAL OF DUPLICATES	1,799
FINAL TOTAL	12,755

Email Invitation and Reminders

The survey was carried out between the 15th June 2018 and the 27th July 2018. This allowed 6 weeks in total for respondents to complete the survey. Two reminders were sent during this time to those who failed to respond, to encourage farmers to open the survey invitation as detailed in Figure 4.2 and Table 4.5.

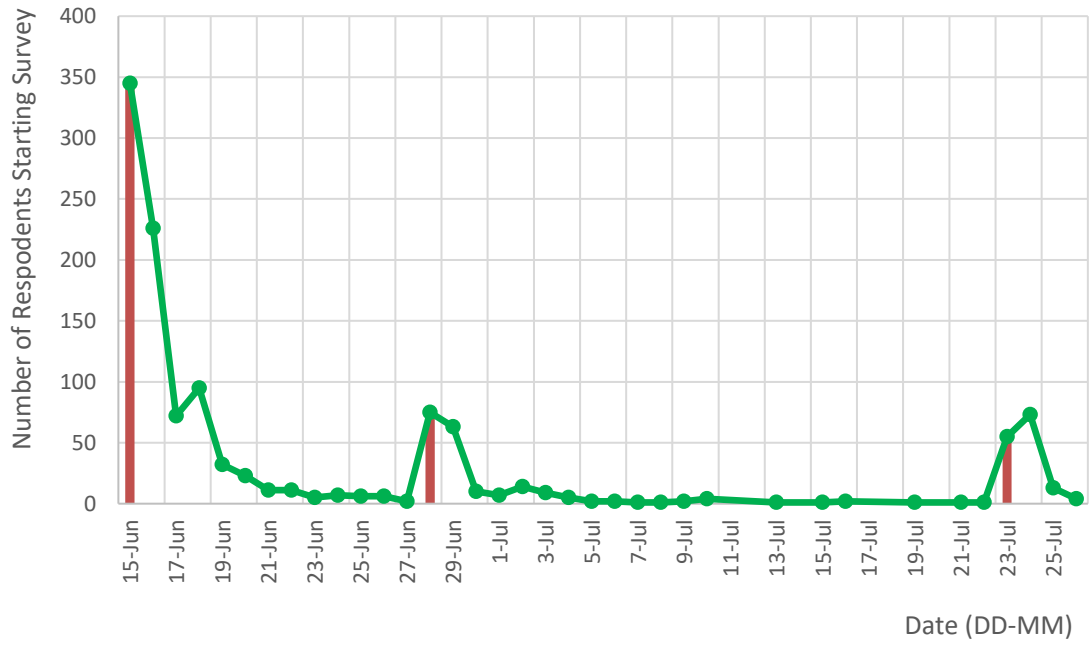


Figure 4.2: The number of surveys started by respondents, with markers indicating when the initial invitation and two reminders were sent. (Note: Red lines show the dates when the initial and reminder emails were sent to farmers).

Table 4.5: Dates and times of the emails sent to survey sample during the survey period.

Timeline of Emails	Date	Time
Survey Link Email	June 15th 2018	5.00 pm (GMT)
Reminder to Unopened Contacts Email 1	June 28th 2018	5.30 pm (GMT)
Reminder to Unopened Contacts Email 2	July 23rd 2018	8.15 pm (GMT)

Reminder emails sent to potential participants that failed to respond to the original request, have been shown in experimental studies to have a mixed influence on response rates (Cook et al, 2000; Edwards et al, 2002; McPeake et al, 2014; Trouteaud, 2004; Sahlqvist et al, 2011). There exists some evidence to indicate that reminders can be interpreted as intrusive and can result in non-compliance and a reduced response rate (Manfreda et al 2008). Research into the use of pre-notification and reminders with paper-based surveys, has been shown to be effective in improving response rates, with the reminders assumed to highlight the importance and legitimacy of the research (Fan & Yan, 2010; Trouteaud, 2004).

Figure 4.2 shows the number of survey invitation recipients that started the survey (irrespective if they continued to complete it or not) alongside the dates when the initial invitation and reminders were emailed to encourage participation. The graph clearly shows a peak on the date of and following the reminder emails being sent to recipients, indicating that survey participation reminders positively influenced the number of surveys completed in this case.

The survey was sent to 12,616 individual email addresses. Of these, 1,183 (9.4%) started the survey. The final sample consists of the 836 farmers (6.6%) who completed at least 20 questions. Table 4.6 presents the demographic information of the respondents to the survey (N = 836).

The 836 respondents were mapped geographically based on the location information given in the survey (Figure 4.3). The majority of responses were returned from England (63.2 %) and Scotland (16.5 %), and the least were from Wales (10.5 %) and the East of England (11.5%).

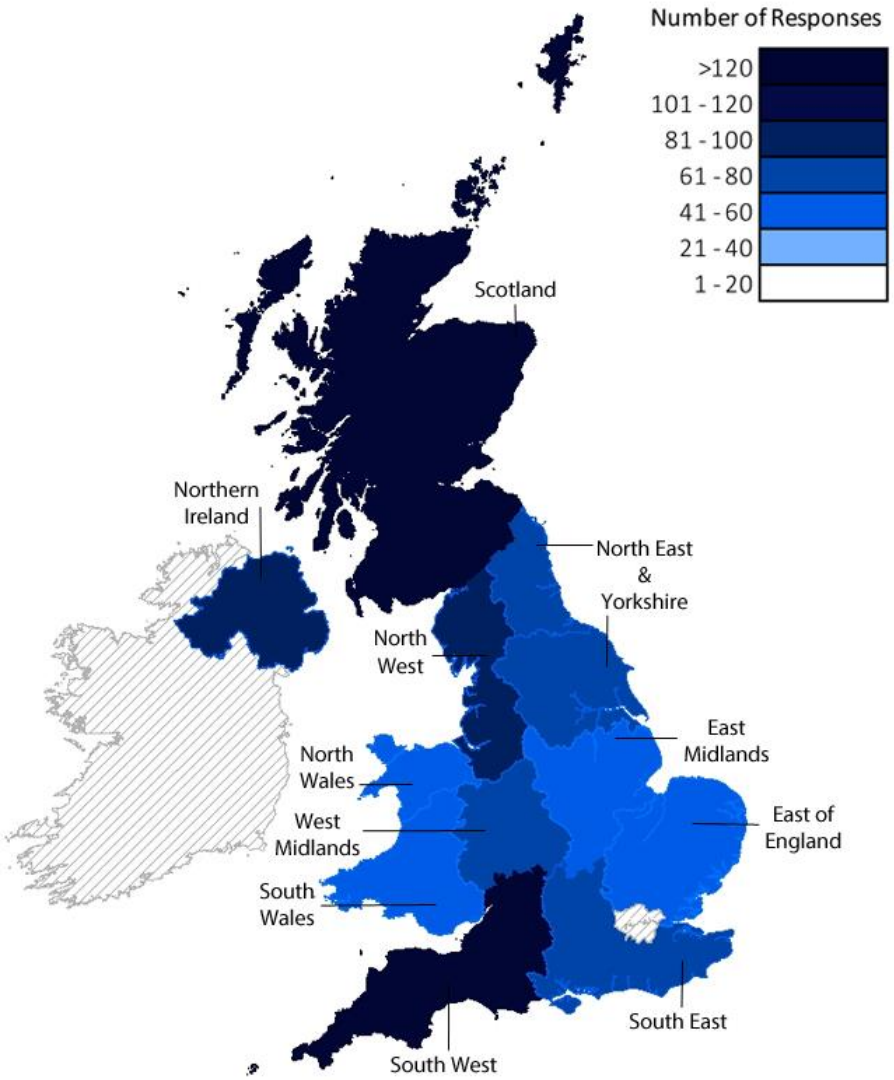


Figure 4.3: The number of respondents from the different regions in the UK.

Table 4.6: Demographic, Geographic and Business information relating to Survey respondents.

	Demographic Information	*Number of Respondents (N = 836)*	*Percentage of Respondents (%)*
Gender (n = 834)	Female	280.0	33.6
	Male	554.0	66.4
Age (n = 836)	18 – 24	42.0	5.0
	25 – 34	53.0	6.3
	35 – 44	102.0	12.2
	45 – 54	196.0	23.4
	55 – 64	250.0	29.9
	Over 65	193.0	23.1
Years on Farm (n = 832)	Under 10 yrs	140.0	16.8
	11 – 20 yrs	169.0	20.3
	21 – 30 yrs	173.0	20.8
	31 – 40 yrs	175.0	21.0
	41 – 50 yrs	113.0	13.6
	51 – 60 yrs	55.0	6.6
	Over 61 yrs	7.0	0.8
Employment Type (n = 835)	Farmer/Director/Spouse (Full Time)	504.0	60.4
	Farmer/Director/Spouse (Part Time)	245.0	29.3
	Farm Manager	30.0	3.6
	Farm Worker (Part Time)	21.0	2.5
	Farm Worker (Full Time)	15.0	1.8
	Other	16.0	1.9
	Casual Worker	4.0	0.5
Farm Size (Hectares) (n = 825)	<5	44.0	5.3
	5 to <20	130.0	15.8
	20 to <50	197.0	23.9
	50 to <100	140.0	17.0
	>100	314.0	38.1
Farm Type (n = 807)	Commercial Sale (Grown to Sell)	732.0	90.7
	Subsistence (Personal Use Only)	75.0	9.3
Farm Type (Produce) (n = 833)	Mixed	339.0	40.7
	Grazing Livestock (Lowland)	266.0	31.9
	Grazing Livestock (Less Favourable Area)	174.0	20.9
	Specialist Pigs	18.0	2.2
	Dairy	17.0	2.0
	Other	14.0	1.7
	General Cropping	3.0	0.4
	Cereals	1.0	0.1
	Horticulture	1.0	0.1
	Unclassified	0.0	0.0
	Specialist Poultry	0.0	0.0

England was overrepresented in the proportion of responses (63%) when compared to the number of holdings in England (48%). The proportion of respondents from Wales, Scotland and Northern Ireland were close to the percentage of holdings that these countries make up in the UK (see Table 4.7).

Table 4.7: The proportion of respondents to the farmer survey from the countries in the UK (DEFRA England, 2017; NI GOV, 2018; SCOT GOV(a,b) 2017; WELSH GOV, 2018).

Country	Average Area (Hectares)	No. of Holdings	% of total Holdings	No of Responses (N = 836)	% of responses (N = 836)
England	86.6	105,900	48.0	528	63.2
Wales	48.5	38,470	17.4	88	10.5
Scotland	112.5	51,138	23.2	138	16.5
Northern Ireland	41.1	25,000	11.3	82	9.8
	Total*	220,508	100	836	100

*Percentages have been rounded to one decimal place.

Victimisation – Wildlife & Livestock Crime Rates

As shown in Table 4.8, 28% (238) of respondents reported having experienced Livestock crimes and 21% (170) experienced Wildlife crimes, with 7% (59) having experienced both Livestock and Wildlife crime in the previous two years.

Table 4.8: Number of respondents that have experienced a) Livestock and b) Wildlife crimes in the previous 2 years.

	Have LIVESTOCK crimes occurred?		Have WILDLIFE crimes occurred?	
	n = 831	%	n = 800	%
Yes	238	28.6	170	21.3
No	593	71.4	630	78.8

The geographic distribution of respondents that have experienced a) Livestock and b) Wildlife crimes in the previous 2 year, are shown in Table 4.9.

Table 4.9: Proportions of respondents that have/have not experienced Livestock and Wildlife crimes in the previous two years.

	All Respondents (N = 836)		Experienced Livestock Crime (n = 831)				Experienced Wildlife Crime (n = 800)				Experienced Livestock & Wildlife Crime (n = 530)			
			Yes (n = 238)		No (n = 593)		Yes (n = 170)		No (n = 630)		Both (n = 59)		Neither (n = 471)	
Country/Region	N	%	N	%	N	%	N	%	N	%	N	%	N	%
England	528.0	63.2	184.0	34.8	348.0	65.9	126.0	23.9	379.0	71.8	48.0	9.1	264.0	50.0
East Midlands	47.0	5.6	13.0	27.7	34.0	72.3	9.0	19.1	36.0	76.6	1.0	2.1	26.0	55.3
East of England	49.0	5.9	14.0	28.6	35.0	71.4	13.0	26.5	34.0	69.4	3.0	6.1	25.0	51.0
North East	76.0	9.1	32.0	42.1	44.0	57.9	28.0	36.8	45.0	59.2	12.0	15.8	28.0	36.8
North West	82.0	9.8	25.0	30.5	56.0	68.3	21.0	25.6	59.0	72.0	12.0	14.6	47.0	57.3
South East	64.0	7.7	29.0	45.3	35.0	54.7	14.0	21.9	47.0	73.4	4.0	6.3	25.0	39.1
South West	131.0	15.7	42.0	32.1	89.0	67.9	23.0	17.6	100.0	76.3	9.0	6.9	72.0	55.0
West Midlands	79.0	9.4	26.0	32.9	52.0	65.8	18.0	22.8	58.0	73.4	7.0	8.9	41.0	51.9
Wales	88.0	10.5	16.0	18.2	71.0	80.7	9.0	10.2	75.0	85.2	1.0	1.1	59.0	67.0
North Wales	41.0	4.9	10.0	24.4	30.0	73.2	4.0	9.8	35.0	85.4	1.0	2.4	25.0	61.0
South Wales	47.0	5.6	6.0	12.8	41.0	87.2	5.0	10.6	40.0	85.1	0.0	0.0	34.0	72.3
Scotland	138.0	16.5	31.0	22.5	107.0	77.5	24.0	17.4	107.0	77.5	8.0	5.8	89.0	64.5
Northern Ireland	82.0	9.8	10.0	12.2	70.0	85.4	11.0	13.4	69.0	84.1	2.0	2.4	59.0	72.0

In total 365 respondents experienced either Livestock or Wildlife crime, with 59 respondents experiencing both. Figures 4.4 & 4.5 show the geographic distribution of the responses that identified themselves as having experienced Livestock and/or Wildlife crimes respectively.

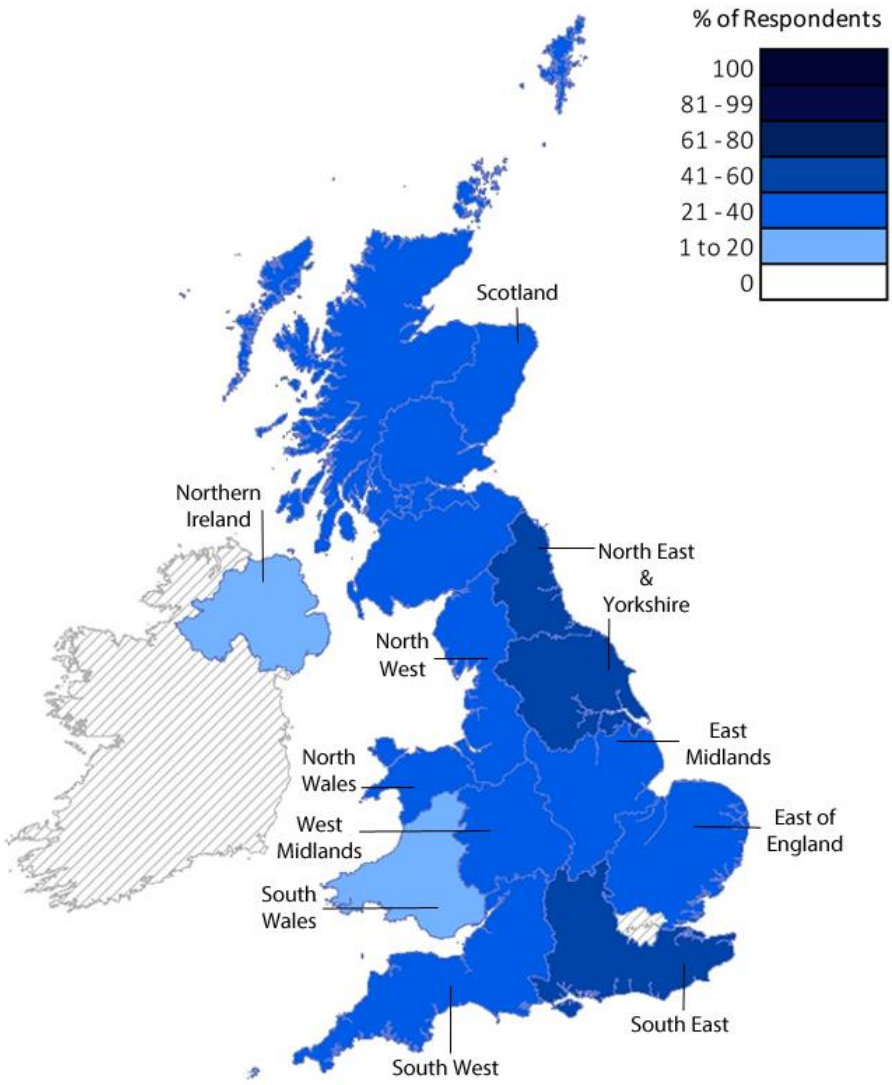


Figure 4.4: Map of the proportion of respondents from each region that experienced Livestock crime.

For Livestock crimes (Figure 4.4) the highest proportion of survey respondents that experienced this crime were in the South East, North East and Yorkshire. The remaining areas of England and Scotland showed similar proportions of respondents being affected by Livestock crime, with Northern Ireland and South Wales the lowest proportions.

For Wildlife crimes (Figure 4.5) the highest proportion of survey respondents that experienced this crime were in the East of England, South East, West Midlands, North West, North East and Yorkshire. The remaining areas of the UK showed similar proportions of respondents being affected.

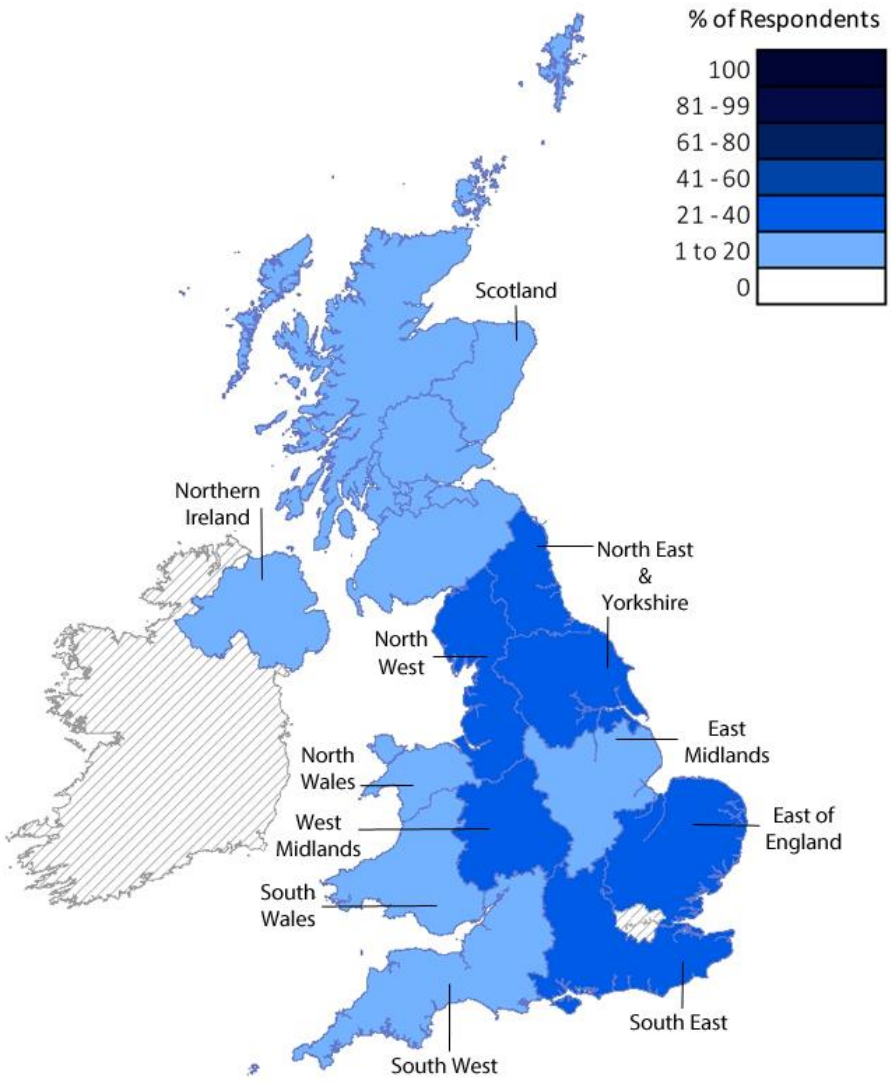


Figure 4.5: Map of the proportion of respondents from each region that experienced Wildlife crime.

Table 4.10 indicates that farms which were victims of Livestock Crime were 1.4 times more likely to have been the victim of Wildlife Crime. A chi-square test of independence confirmed this association was statistically significant $X^2(df = 1, n = 832) = 7.816$, $p = 0.005$. However, the value of Phi (0.097) indicate that the strength of the association between the occurrence of

Livestock and Wildlife crimes is very weak. This indicates that the occurrence of Livestock crime on farmland does not determine that the farm will also experience Wildlife crime and vice versa, but that an association exists, which would be expected given that both species can be found on farmland.

Table 4.10: The occurrence of wildlife and livestock crimes on the farmland.

		Wildlife Crime					
		Yes		No		Total	
		N	%	N	%	N	%
Livestock Crime	Yes	59.0	34.9	155.0	24.8	214.0	26.9
	No	110.0	65.1	471.0	75.2	581.0	73.1
	Total	169.0	21.3	626.0	78.7	795.0	100.0

The respondents were asked to indicate the number of livestock (by type) that were on the farmland (see Table 4.11). These values were then used in combination with other survey results to identify the number of livestock impacted by crimes occurring on the farmland. In addition to the binary questions of whether Livestock or Wildlife crimes had occurred on the farm land, respondents were asked to provide details on specific types of incidents (Stolen livestock or Worried/Attacked/Killed (WAK) Livestock) that had occurred on the farm in the previous 2 years. The results from respondents that provided sufficient information are shown in Table 4.12.

For Pigs, Cattle (Dairy & Beef), Poultry and Other, the percentage of respondents that experienced theft ranged from 5% to 21%, with the number of Livestock impacted by theft ranging from 6 (Other) to 88 (Poultry).

The proportion of respondents that experienced WAK crimes for Pigs, Cattle (Dairy & Beef), Poultry and Other, ranged from 5% to 21%, with the number of Livestock impacted by WAK ranging from 5 (Cattle - Diary) to 403 (Cattle – Beef).

It is important to note that despite the number of farms identifying themselves as being victims of crime appearing to be relatively low, the number of Livestock impacted can be large in number. The results suggest that 2.2% of Cattle (Beef) livestock owned by respondents experienced “WAK” crimes, but this equates to about 200 animals per year (i.e. respondents provided information on incidents experienced in the previous two years).

Table 4.11: Number/Proportion of respondents and number of livestock (by type).

No. Livestock	Livestock Type											
	Pigs		Cattle (Beef)		Cattle (Dairy)		Sheep		Poultry		Other	
	N	%	N	%	N	%	N	%	N	%	N	%
1 – 50	33.0	63.5	53.0	39.0	3.0	16.7	28.0	17.4	35.0	74.5	12.0	85.7
51 – 250	12.0	23.1	62.0	45.6	9.0	50.0	63.0	39.1	8.0	17.0	2.0	14.3
251 – 500	1.0	1.9	17.0	12.5	3.0	16.7	25.0	15.5	2.0	4.3	0.0	0.0
501 – 1000	1.0	1.9	4.0	2.9	3.0	16.7	30.0	18.6	0.0	0.0	0.0	0.0
1001 – 5000	4.0	7.7	0.0	0.0	0.0	0.0	15.0	9.3	2.0	4.3	0.0	0.0
5001 - 10000	1.0	1.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	52.0		136.0		18.0		161.0		47.0		14.0	

The data relating to sheep are discussed separately from the other results as these findings are of particular interest. For farms with sheep 28% (n = 45) of respondents experienced 'theft', which equated to over 1,200 sheep being stolen. The number of respondents affected by theft is almost three times higher for respondents with Sheep (28.0%) compared to the other specific livestock types (Pigs, Cattle, Poultry) which ranged from 5.6%-12.8%.

Table 4.12: Number of Livestock crime incidents (Stolen, WAK) and number of livestock affected, separated by Livestock type.

Livestock	Crimes	No of Respondents		No of Livestock	
		N	%	N	%
Pigs	Total		52		23,463
	Stolen	6	11.5	23	0.1
	WAK	10	19.2	83	0.4
Cattle (Beef)	Total		136		18,247
	Stolen	10	7.4	34	0.2
	WAK	23	16.9	403	2.2
Cattle (Dairy)	Total		18		4,406
	Stolen	1	5.6	13	0.3
	WAK	1	5.6	5	0.1
Sheep	Total		161		75,371
	Stolen	45	28.0	1,282	1.7
	WAK	110	68.3	2,085	2.8
Poultry	Total		47		6,494
	Stolen	6	12.8	88	1.4
	WAK	10	21.3	133	2.0
Other	Total		14		244
	Stolen	3	21.4	6	2.5
	WAK	3	21.4	23	9.4

In addition to a comparatively higher level of theft amongst farms containing sheep, the results for worried/attacked/killed (WAK) crimes indicated that close to 70% (n = 110) of respondents experienced WAK crimes, which equated to 2,085 sheep. The number of sheep impacted is over five times the next largest number of livestock impacted by WAK crimes (Cattle – Beef). These results will be discussed further in the following section relating to reporting of crimes to Police.

Of the total number of Livestock reported to have been affected by "Theft" and/or "WAK" crimes, sheep represent 4.5%, which equates to 3,367 individual sheep being victimised over

the previous 2 years. These results highlight that whilst the percentage of farms impacted by theft and persecution appear low, the number of livestock impacted were in the hundreds and in some cases thousands.

Livestock & Wildlife Crime – Victimisation

The variation in proportions of respondents that have experienced Livestock and Wildlife crime from the existing literature shows a general inconsistency between the results from studies not solely focused on Livestock and Wildlife crime. The difference in the number of respondents that experienced these crimes compared to other surveys/reports, highlights that the true incidence rates of these crimes may be being underestimated nationally.

The results of the survey indicated that 28.6% of respondents experienced Livestock crime (either Theft or Worried/Attacked/Killed) and 21.3% experienced Wildlife crime (Poaching, Coursing, Attacked/Killed/Persecuted).

According to the survey results, 7.8% (n = 66) of respondents experienced Livestock Theft in the last two years, which lies between existing estimates: NRCN Rural Crime Survey and the Commercial Victimisation Survey (1 - 4%) and the Scottish Farm Crime Survey found (10 - 14%).

Approximatively 15.8% (n = 132) of respondents had experienced Worried/Attacked/Killed crimes on their farmland. This supports the findings of the Commercial Victimisation Survey (13-15%) but is well above the results of the Scottish Farm Crime Survey and the NRCN Rural Crime Survey (1 and 5%).

It should be noted that whilst 28.6% of respondents initially indicated they had experienced some form of livestock crime in the earlier binary question, only around 20% of respondents continued to specify in the survey which types of crimes they had experienced. Consequently, the figures provided for the specific crimes may under-estimate the total impact of Livestock crimes experienced.

The NRCN Rural Crime Survey (2018) and the Commercial Victimisation Survey (2013, 2014) found the proportion of respondents that experienced wildlife crime was between 14% and 18%, whilst the Commercial Victimisation Survey (2017) found the proportion of respondents that experienced Wildlife crimes was between 24% and 26%. The results of this survey found

that 21% of respondents experienced Wildlife crime, and therefore fell between the proportions noted in the other surveys/reports.

It should be noted that the first NRCN Rural Crime Survey reported a far lower proportion of respondents experiencing wildlife crime. However, the survey — in its first year — did not separate out the types of respondents. Therefore, the results were diluted by the different rural participants taking part.

Victimisation – Perceived Change in Livestock & Wildlife Crime

Respondents were asked to indicate whether the incidence of Livestock and Wildlife crimes had changed over the previous 2 years. In relation to Livestock crime, 55.4% of respondents (n = 213) perceived Livestock crime to have increased '… a little' or '… a lot'. Respondents that perceived 'No Change' in Livestock crime accounted for 23.5%, those that 'Didn't Know' accounted for 12.2%, leaving only 8.9% believing that Livestock crime had decreased '…a little' or '…a lot'.

Similarly, 44.2% of respondents (n = 163) perceived Wildlife crimes to have increased '… a little' or '… a lot'. The respondents that perceived 'No Change' in Wildlife crime accounted for 35.0%, those that 'Didn't Know' accounted for 11.0%, leaving only 9.8% believing that Wildlife crime had decreased '…a little' or '…a lot'.

These results indicated that for both Livestock and Wildlife crime, close to half the respondents felt there had been an increase (be it a little or a lot) in the previous 2 years. Little over 10% of respondents perceived these crimes to have decreased over the same period of time. The remaining respondents have seen no change or are unsure of how the incidence rates of these crimes have changed.

Victimisation – Annual Variation in Crime Occurrence

H1: Farms experience a variation in the number of a) Livestock crimes and b) Wildlife crimes depending on the month of the year (January to December).

To identify seasonal patterns in crimes, respondents were asked to indicate which months Livestock and Wildlife crimes occurred. To do this, farmers were asked to provide the

information for the past two years, and to also provide a more general overview of when these crimes have occurred historically (see Figure 4.6).

Figure 4.6 presents the pattern of Livestock and Wildlife crimes over the last two years and historically. The plotted lines for each of these crime types show a similar trend, with Livestock crimes showing an increase between January and May, with a drop in June (particularly prominent in data from the last two years) followed by a steady decline between July and December. In contrast, the annual pattern of Wildlife crimes exhibited a decline between January and June before increasing between June and December. The results indicate that Wildlife Crimes are most commonly experienced on farmland between October and February.

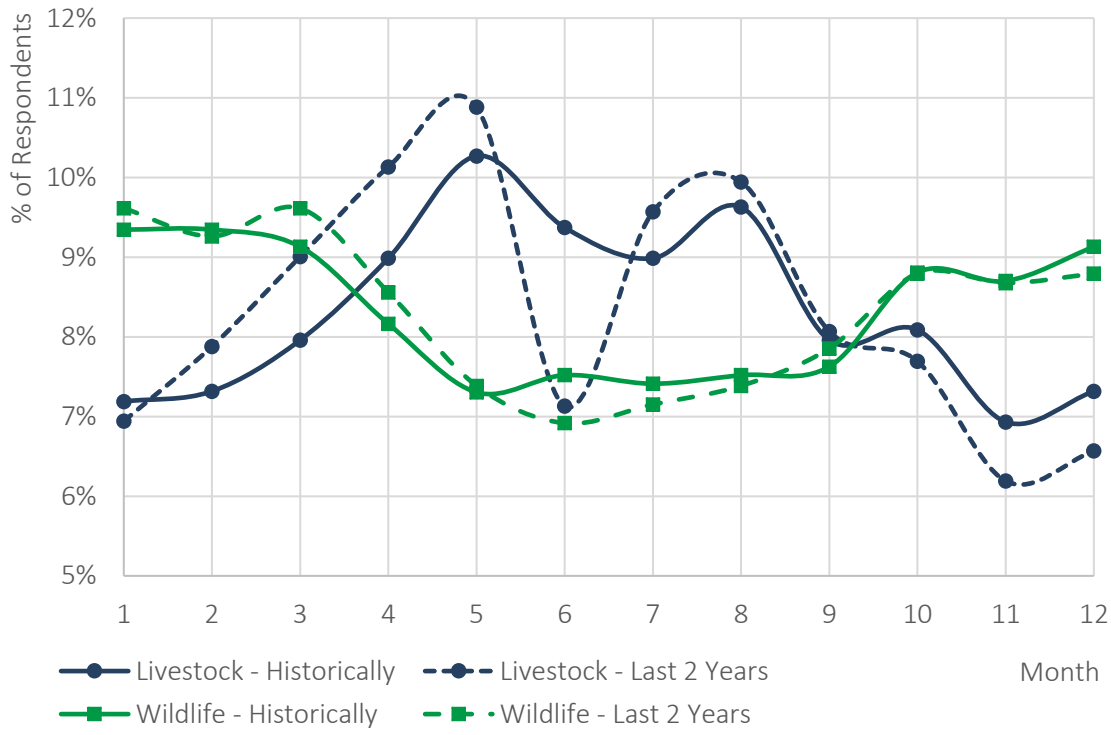


Figure 4.6: Seasonal patterns of Livestock (Historically – n = 184, cases = 779, Last 2 Years – n = 138, cases = 533) & Wildlife (Historically – n = 142, cases = 931, Last 2 Years – n = 129, cases = 853) crimes (for the previous 2 years and historically) excluding those who answered 'Don't Know' and 'N/A'.

Analysis of the trend lines for Livestock and Wildlife crimes indicated a strong positive correlation (r = 0.79) between "Livestock – Historically" and "Livestock – Last 2 Years". There is also a strong positive correlation (r = 0.95) between "Wildlife – Historically" and "Wildlife – Last 2 Years", indicating that farmers do not perceive there to have been any significant variation in the seasonal patterns of these crimes over time. However, the results clearly suggest different seasonal patterns for the two types of crime.

When Livestock and Wildlife crime trends were compared, the results showed a strong negative Pearson's correlation between these crime types historically (r = -0.84) but only weak to moderate (r = -0.39) in the last two years, which is primarily due to the dip in Livestock related crimes in June. The results of this survey appear to be the first to explicitly identify the seasonality of Livestock and Wildlife crime in the UK. The patterns of these crime types appear to have an inverse correlation to one another.

Annual Crime Patterns & Seasonal Staff Patterns

H2: Farms experience more a) Livestock crimes and b) Wildlife crimes during the months identified as typical for Seasonal Staff to be present on the farmland.

Survey respondents were asked to indicate when seasonal staff were present on farmland during the year (shown in Figure 4.7).

The results of the correlation coefficient indicated a moderate to strong correlation between the presence of temporary staff on the farmland and the occurrence of Livestock crimes - Historically (r = 0.76) and Last 2 Years (r = 0.70), with a strong negative correlation found for Wildlife crimes – Historically (r = -0.70) and Last 2 Years (r = -0.61).

The results were compared with the annual patterns of Livestock and Wildlife crimes, to identify if any correlation existed between the presence of temporary staff on the farmland and the seasonal patterns of Livestock and Wildlife crime. However, the strong correlation between the seasonal pattern of Livestock crime and temporary staff being present on the farmland, does not mean the temporary staff are responsible.

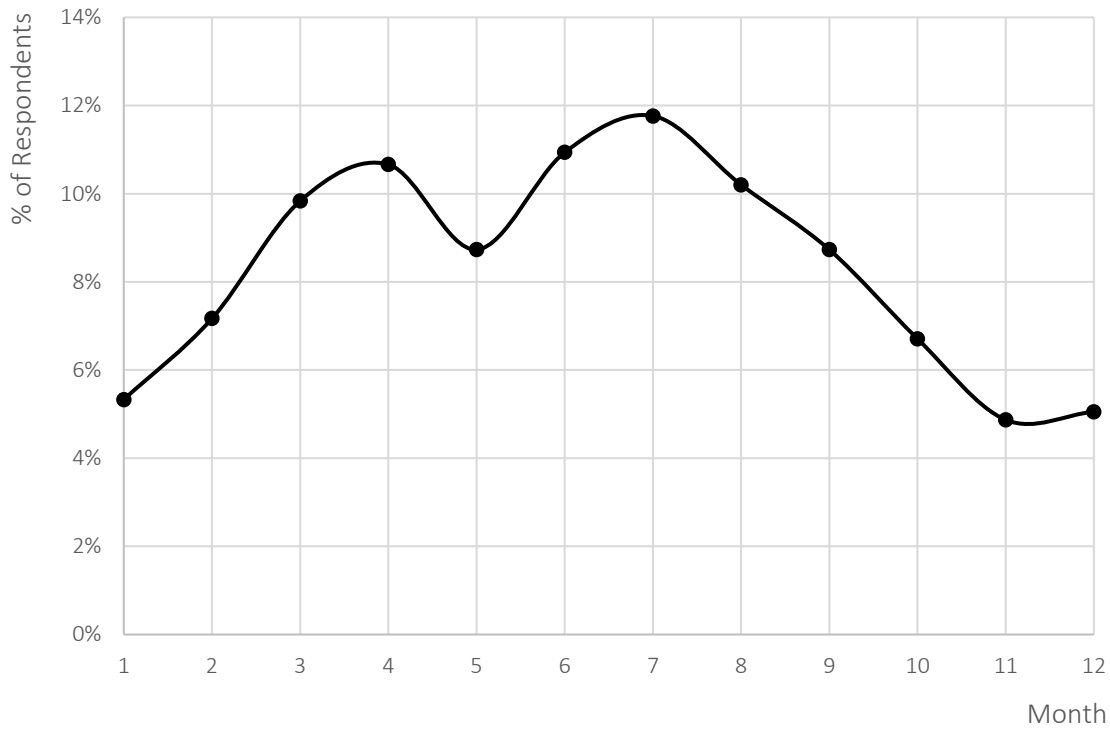


Figure 4.7: Graph showing the change in number of temporary staff throughout the year (n = 253, cases = 1088).

There are a number of confounding factors that would need to be taken into account to address this issue. The agricultural cycle provides some insight into the potential causes for seasonal variation in livestock and wildlife crimes, which will be discussed further in Chapter Six. By understanding when these crimes are likely to occur seasonally, prevention techniques could potentially be targeted to high-risk periods/locations.

Supervision

Many of the questions included in the survey aimed to establish the levels of guardianship on the farmland. There were a number of factors identified as influencing the level of supervision including: farm size, number of staff, residence on farmland and pluriactivity (additional employment outside of the farm).

Supervision – Farm Size & Staff Numbers

Respondents were asked to provide information relating to the number of Full Time, Part Time and Seasonal Staff. In total, 431 respondents provided information relating to the number of staff working on their farmland. Over 50% of those who answered the staffing questions had

only one full time (53.1%) or part time (62.4%) member of staff, with just under 50% of respondents having one seasonal (41.9%) member of staff on the farm. The majority of respondents had between 1 and 2 members of Full time (78.4%), Part time (91.9%) and Seasonal (74.2%) members of staff. The frequencies of staff indicated that the majority of respondents have limited numbers of staff, irrespective of farm size.

Supervision – Permanent Residence (Living on Farm)

H3: Farms experience more a) Livestock crimes and b) Wildlife crimes when no one lives on the farm permanently.

Respondents were asked about the amount of supervision the farmland typically received. One of the questions asked respondents to indicate if anyone lived on the farm permanently. The results indicated that 89.4% (n = 743) of respondents' farms were permanently occupied.

Table 4.13 (a) & (b) show the results of a chi-square test of independence to examine the association between permanent residence on the farm and the experience of Livestock crime X2 (df = 1, n = 826) = 1.337, p = 0.248; and Wildlife crime X2 (df = 1, n = 795) = 3.157, p = 0.076.

Table 4.13: Results for Livestock Crimes (a) and Wildlife Crimes (b) and the presence of a permanent residence on the farmland.

a)

		Livestock Crimes					
		Yes		No		Total	
		N	%	N	%	N	%
Live on Farm Permanently	Yes	208.0	87.4	530.0	90.1	738.0	89.3
	No	30.0	12.6	58.0	9.9	88.0	10.7
	Total	238.0	28.8	588.0	71.2	826.0	

b)

		Wildlife Crimes					
		Yes		No		Total	
		N	%	N	%	N	%
Live on Farm Permanently	Yes	156.0	92.9	552.0	88.0	708.0	89.1
	No	12.0	7.1	75.0	12.0	87.0	10.9
	Total	168.0	21.1	627.0	78.9	795.0	

The association between these variables was non-significant. Indicating that the presence of a permanent residence on the farmland is not associated to the occurrence of Livestock and Wildlife crime.

Supervision – Pluriactivity (Employment away from the Farm)

H4: Farms experience more a) Livestock and b) Wildlife crimes when the farmer is involved in pluriactivity away from the farm.

Survey respondents were asked to provide information relating to any additional employment. Pluriactivity was assessed amongst respondents to gauge how additional employment — which would lead to their absence on the farmland — may be related to Livestock and Wildlife crime. Additional employment that removes them from the farmland is hypothesised to contribute to a decline in supervision, and in turn make the farmland more vulnerable to victimisation. The results from the survey indicated that close to half the respondents (45.8%) have additional employment that removes them from the farmland.

A chi-square test of independence was performed to examine if an association existed between employment away from the farm and Livestock crimes (see Table 4.14) $X2$ ($df = 1$, $n = 825$) = 0.197, $p = 0.657$, where the association between these variables was non-significant.

Table 4.14: The Chi Square analysis results comparing employment and Livestock crime occurrences.

		Livestock Crimes					
		Yes		No		Total	
		N	%	N	%	N	%
Employment	Yes	111.0	47.0	267.0	45.3	378.0	45.8
	No	125.0	53.0	322.0	54.7	447.0	54.2
	Total	236.0	28.6	589.0	71.4	825.0	

A chi-square test was also performed to examine if an association existed between employment away from the farm and Wildlife Crimes $X2$ ($df = 1$, $n = 794$) = 7.967, $p = 0.005$ (shown in Table 4.15). The relationship between these variables was significant.

Table 4.15: The Chi Square analysis results comparing employment and Wildlife crime occurrences.

		Wildlife Crimes					
		Yes		No		Total	
		N	%	N	%	N	%
Employment	Yes	60	35.7%	300	47.9%	360	45.3%
	No	108	64.3%	326	52.1%	434	54.7%
	Total	168	21.2%	626	78.8%	794	

Whilst the results indicate that there is an association between additional employment beyond the farm and the occurrence of Wildlife crime, the value of Phi (-0.1) indicates that the effect of additional employment on the occurrence of Wildlife crime is very weak. This would indicate that additional employment away from the farm has a limited association to the incidence of Wildlife crimes on the farmland.

Supervision – Farm Land Unsupervised

H5: Farms experience more a) Livestock and b) Wildlife crimes as the number of hours the farmland is unsupervised increases.

Respondents were also asked to indicate the number of hours on average the farmland was left unsupervised (no one on the farmland). The results identified that 57.2% of the respondents (N = 760) left the farmland unsupervised for less than 4 hours per day (see Figure 4.8).

A chi-square test of independence was performed to examine the relationship between the number of hours the farm was left unsupervised and Livestock crime $X2$ ($df = 6$, $n = 756$) = 5.609, $p = 0.468$, and Wildlife crime $X2$ ($df = 6$, $n = 728$) = 8.756, $p = 0.188$. The relationship between these variables was found to be non-significant.

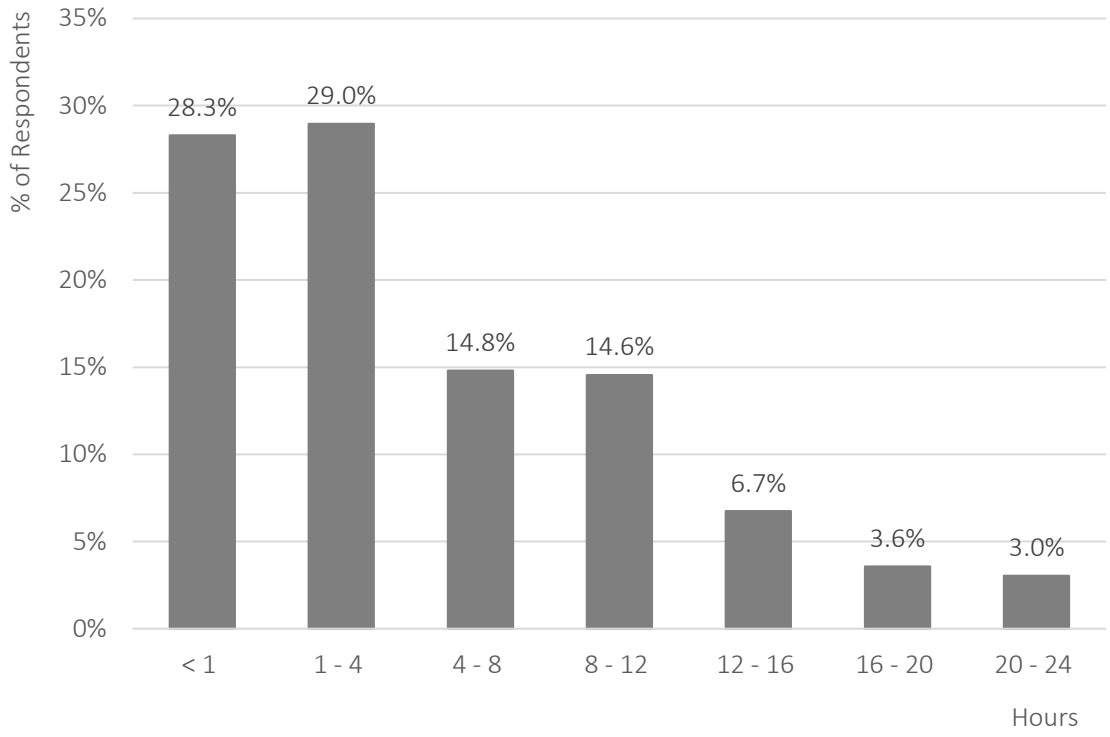


Figure 4.8: Number of hours farmland is left unsupervised (no one present on farmland) on average.

Supervision – Farm Livestock Unsupervised

In addition to asking about the number of hours the farmland was left unsupervised, respondents were asked to indicate how often livestock were left unsupervised. As discussed before, a large proportion of the farms that responded to this survey were 'Mixed' type, therefore one type of livestock were not the sole focus of the farm. In comparison to the information provided above, where 57.2% of respondents left the farm unsupervised for less than 4 hours; in relation to supervision of livestock 53.4% of respondents left livestock unsupervised for 12 hours or more per day as shown in Figure 4.9. There existed variation in number of hours livestock were unsupervised throughout the year, which reflects seasonal factors (e.g. calving, lambing, etc).

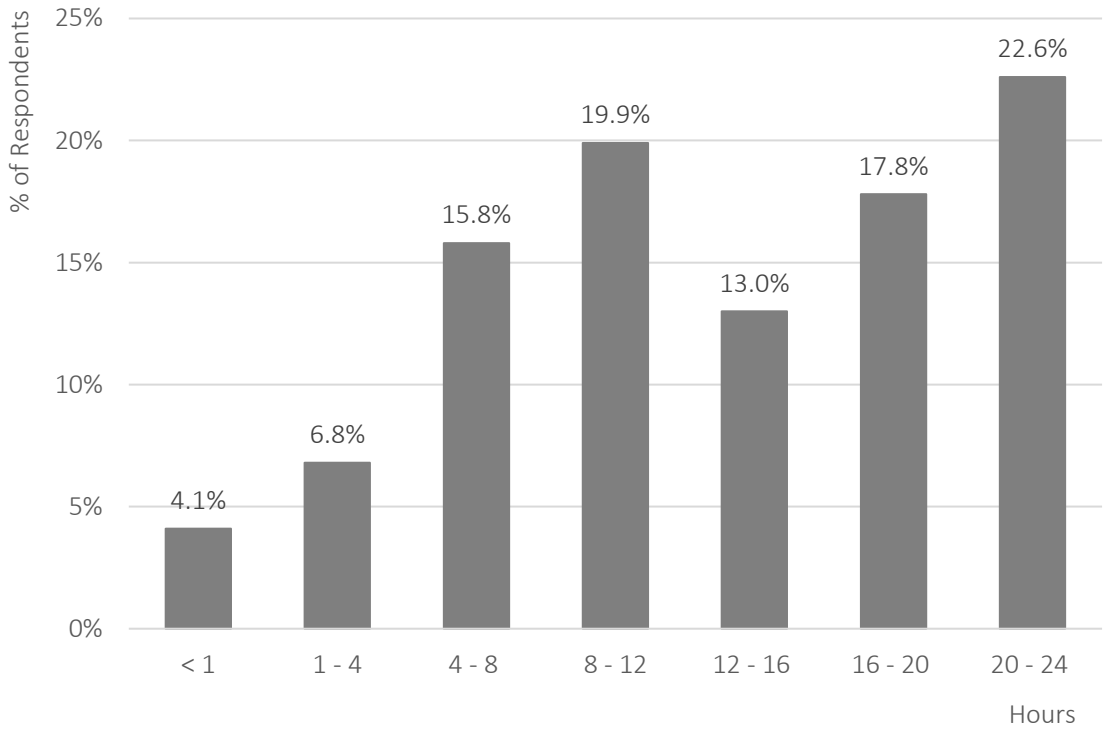


Figure 4.9: Percentage of respondents with median hours livestock are left unsupervised.

Permeability – Distance to Roads/Villages

H6: Farms experience fewer a) Livestock crimes and b) Wildlife crimes with increasing distance from main roads.

H7: Farms experience fewer a) Livestock crimes and b) Wildlife crimes with increasing distance from the nearest village.

To examine if any association exists between permeability of farmland and victimisation, respondents were asked to provide information relating to the location of the farm, including the distance of the farmland to a Main Road and to the Nearest Village. The results showed that almost 80% (n = 654) of respondents' farmland was within one mile of the nearest main road (N = 819; Mean = 0.88; Range = 0 – 15). The proportion of respondents whose farm was within 1 mile of the Nearest Village was 52%, and 75% were within 2 miles (N = 824; Mean = 1.67; Range = 0 – 11).

A chi-square test of independence was performed to exam the relationship between the Distance to the Main Road nearest the farm and Livestock crime X2 (df = 9, n = 815) = 7.331, p = 0.603, LR = 0.425; and Wildlife crime X2 (df = 9, n = 785) = 5.735, p = 0.766, LR = 0.708. The relationship between these variables was non-significant.

A chi-square test of independence was performed to examine the relationship between the Distance to the Nearest Village from the farm and Livestock crime X2 (df = 11, n = 820) = 15.300, p = 0.169, LR = 0.069; and Wildlife crime X2 (df = 11, n = 789) = 9.456, p = 0.580, LR = 0.487. The relationship between these variables was non-significant.

Permeability – Rights of Way

H8: Farms will experience more a) Livestock crime and b) Wildlife crime if they contain Rights of Way.

Rights of Way (RoW) exist throughout the UK landscape, and provide additional routes of access by vehicle and foot onto farmland. The survey asked respondents whether their farm contained Rights of Way, with 63% of respondents (N = 835) indicating they have Rights of Way on their farmland.

A chi-square test of independence was performed to examine the relationship between the presence of Rights of Way on the farm and Livestock crimes X2 (df = 1, n = 830) = 9.154, p = 0.002 (shown in Table 4.16). The relationship between these variables was found to be significant.

Table 4.16: The Chi Square analysis comparing the presence of Rights of Way and Livestock Crimes.

		Livestock Crimes					
		Yes		No		Total	
		N	%	N	%	N	%
RoW	Yes	169.0	71.0	354.0	59.8	523.0	63.0
	No	69.0	29.0	238.0	40.2	307.0	37.0
	Total	238.0	28.7	592.0	71.3	830.0	

The results indicate that there is an association between the presence of Rights of Way and the occurrence of Livestock crime, with the farms containing Rights of Way being 1.2 times more likely to experience Livestock crimes. However, the value of Phi (0.105) indicates that the effect of the presence of Rights of Way on the occurrence of Livestock crime is weak.

A chi-square test of independence was also performed to exam the relationship between the presence of Rights of Way on the farm and Wildlife crimes X2 (df = 1, n = 798) = 7.083, p = 0.008 (shown in Table 4.17). The relationship between these variables was found to be significant. However, the value of Phi (0.008) indicates that the association between Rights of Way and the occurrence of Wildlife crime is fairly weak.

Table 4.17: The Chi Square analysis comparing the presence of Rights of Way and Wildlife Crimes.

		Wildlife Crimes					
		Yes		No		Total	
		N	%	N	%	N	%
RoW	Yes	121.0	71.2	377.0	60.0	498.0	62.4
	No	49.0	28.8	251.0	40.0	300.0	37.6
	Total	170.0	21.3	628.0	78.7	798.0	

Several environmental factors were assessed to identify any that may be linked to the likelihood of farms becoming victims of Livestock and Wildlife crimes. The factors included: 1) Pluriactivity, 2) Permanent Residence on the Farm 3) Distance to Main Road, 4) Distance to Nearest Village, and 5) Rights of Way on farmland. The results showed there was no significant relationship between the occurrence of Livestock and Wildlife crimes for three of the factors: 1) Permanent Residence on the Farm, 2) Distance to Main Road and 3) Distance to Nearest Village.

The survey results indicated no relationship existed between victimization and the proximity of the farm to the nearest main road or village. The survey by Smith (2018) also assessed factors such as proximity to roads, urban centres and neighbouring farms, and found these had no significant association to victimisation. These findings are in contrast to the Scottish Farm Crime Survey (SFCS, 1999) which found that farms 'near to a small town' or 'near a large town/city'

were victimised more than those in more isolated locations. These factors deserve further analysis in future research to identify what spatial features may be influential to the occurrence of not just Livestock and Wildlife crime but other crimes on farmland.

Rights of Way were found to show a significant relationship with the occurrence of Livestock crime. Of the total respondents (N = 835) 32.3% of farms with Rights of Way experienced livestock crimes, compared to 22.5% that didn't have Rights of Way on the farmland. However, the results also showed that the size of this effect was found to be weak for both Livestock (Phi - 0.002) and Wildlife (Phi - 0.008) crimes. The higher level of livestock crimes for farms containing rights of way may be indicative of the influence of additional access points and permeability. As the permeability of the farmland increases access and allows potential criminals to move more freely within the farmland, providing increased opportunities for criminal activities, in the same way that increased permeability of urban areas is associated to an increased levels of victimization for certain crime types (e.g. burglary). To confirm whether features such as Rights of Way are influential on the occurrence of crimes, would need these findings to be replicated in future studies.

Two factors, Pluriactivity and Rights of Way were found to show a significant relationship with the occurrence of Wildlife crime. However, the results showed that the size of the effect of these factors were weak.

The higher level of wildlife crimes for farms containing RoW may be indicative of the influence of additional access points as discussed previously for Livestock crime, however as mentioned above, replication of these results in other studies would be needed to confirm the association of these features on the occurrence of crime.

Security Measures

Whilst the factors so far considered relate to features of the physical environment, security measures are specific situational measures that farmers choose to use. The respondents were asked to indicate the number of security measures used, to assess if an association exists between the number of security measures and the incidence of Livestock and Wildlife crimes. Respondents were asked to identify the types of security measures used on the farmland. The respondents who completed this question (N = 813) were able to select as many of the options

as they wished. The results provided 2,403 responses (cases), and Table 4.18 presents the frequency of the security measures used by farmers.

Table 4.18: The different types of security measures used by respondents on the farmland.

Security Measures	Respondents (N = 813)	% Respondents (N = 813)	% Responses (N = 2,403)
Locks	643.0	79.1	26.8
Security Lights	425.0	52.3	17.7
Watch Dog / Guard Dog	248.0	30.5	10.3
CCTV	233.0	28.7	9.7
Maintaining Secure Boundaries	206.0	25.3	8.6
Neighbourhood / Farm / Horse Watch	207.0	25.5	8.6
Electronic Gates / Other Gates	122.0	15.0	5.1
"No Trespass" Signs	114.0	14.0	4.7
Alarms	116.0	14.3	4.8
Geese	52.0	6.4	2.2
Other	37.0	4.6	1.5

Of the security measures presented to respondents, 55% of the responses identified locks, security lights and watch/guard dogs as the most commonly used prevention methods. Of particular interest is that only 25.5% of survey respondents were involved with "Watch" (Neighbourhood/Farm/Horse) schemes as a security measure for the farm.

As shown in Figure 4.10, the majority of respondents (82.7%) used between one and four crime prevention methods on the farm. The responses for the 82.7% of respondents that used between one and four methods of crime prevention, were analysed to identify the most common method or combination of methods used by respondents (see Appendices 3a-d).

Single Prevention Method – For the respondents who indicated that they used one crime prevention method on the farm, the results showed that 50.3% of respondents (n = 167) used locks as their main crime prevention method. The following main methods included Watch Dog/Guard Dog (12.6%) and Maintaining Secure Boundaries (10.2%).

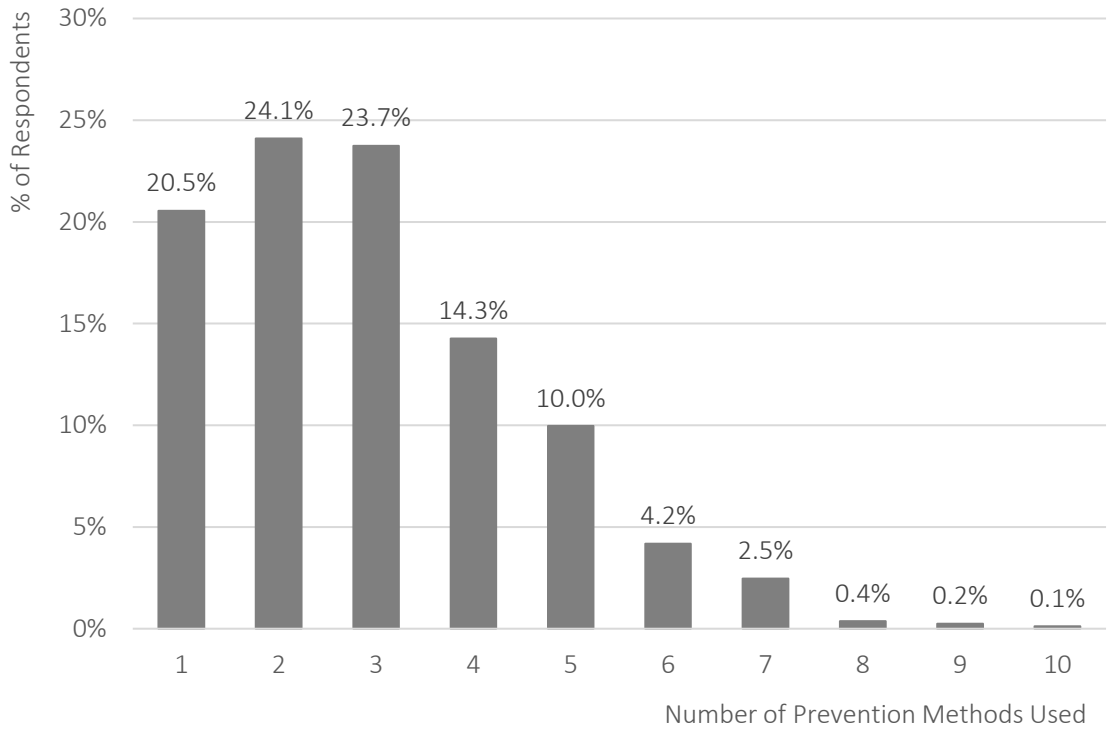


Figure 4.10: The number of prevention methods used by respondents (n = 813)

Two Prevention Methods – For respondents who indicated that they used two crime prevention methods on the farm, the results showed that 24.0% of respondents (n = 196) used the combination of 'Locks & Security Lights'. The next most popular combination of methods used were 'Locks & Watch Dog/Guard Dog' (14.8%) and 'Locks & Maintaining Secure Boundaries' (11.7%).

Three Prevention Methods – For respondents who indicated that they used three crime prevention methods on the farm, the results showed that 12.4% of respondents (n = 193) used the combination of 'Locks, Security Lights and CCTV'. The next most popular combination of methods used were 'Locks, Security Lights & Watch Dog/Guard Dog' (11.4%) and 'Locks, Security Lights & Neighbourhood/Farm/Horse Watch' (9.3%).

Four Prevention Methods – For respondents who indicated that they used four crime prevention methods on the farm, the results showed that 10.3% of respondents (n = 116) used the combination of 'Locks, Security Lights, CCTV & Alarms'. The next most popular combination of methods used were 'Locks, Security Lights, Watch Dog/Guard Dog &

Neighbourhood/Farm/Horse Watch' (7.8%) and 'Locks, Security Lights, CCTV and Watch Dog/Guard Dog' (6.9%).

The main security measures used by respondents included locks, security lights, and watch/guard dogs. The top methods selected by respondents were comparatively low-tech solutions compared to CCTV which was the fourth most commonly selected security measure on the farms. The results of the survey are similar to those from other studies where the low-tech prevention methods were most commonly selected by participants. The results also showed that Electronic Gates and Warning Signs were amongst the least used methods by respondents, which is somewhat supported by the findings of the National Rural Crime Survey.

The number of crime prevention methods used were compared for the different regions and sizes of farms to identify if the location or size of farm was associated to the number of prevention methods used. This may have indicated geographical variation in the security of farms, or that larger farms may invest more in security compared to smaller farm sizes.

Figure 4.11 shows that the majority of respondents used between one and four security methods irrespective of farm size, with 50% of respondents using between 2 and 4 methods.

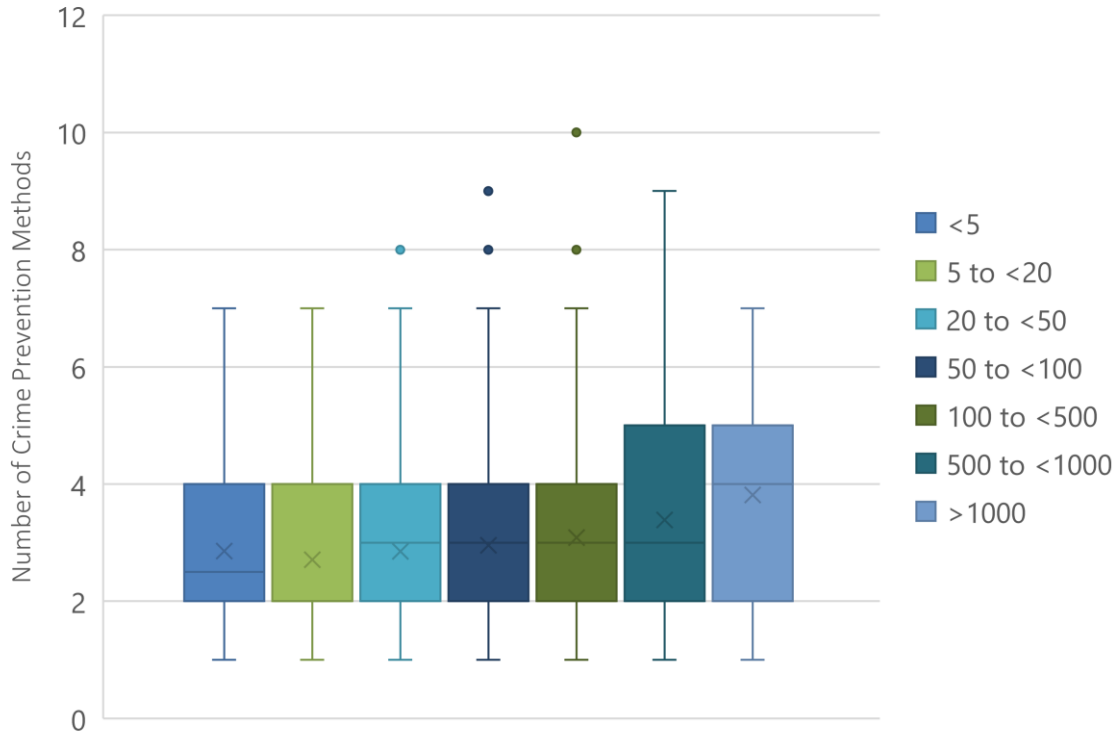


Figure 4.11: The number of prevention methods used by the size of the farmland.

Farms between 1 and <500 hectares used between 2.5 and 3 methods, whilst Farms exceeding 500 Hectares used between 3.0 and 3.8. Similar to farm size, the number of crime prevention methods used did not vary much between many of the respondents locations (see Figure 4.12) with the North East, North Wales, North West, Northern Ireland, South West and West Midlands with a range of between one and seven methods, and an average of between 2.0 and 3.0, with 50% using between 2 and 4 methods.

The East Midlands, East of England and South East had a slightly larger range in comparison to the other locations, ranging from one to eight methods. However, the average was close to that of the other locations at 3.0, with 50% of respondents from the East Midlands using between 1 and 4 methods. Overall the average number of methods used remained fairly constant for locations where responses were received.

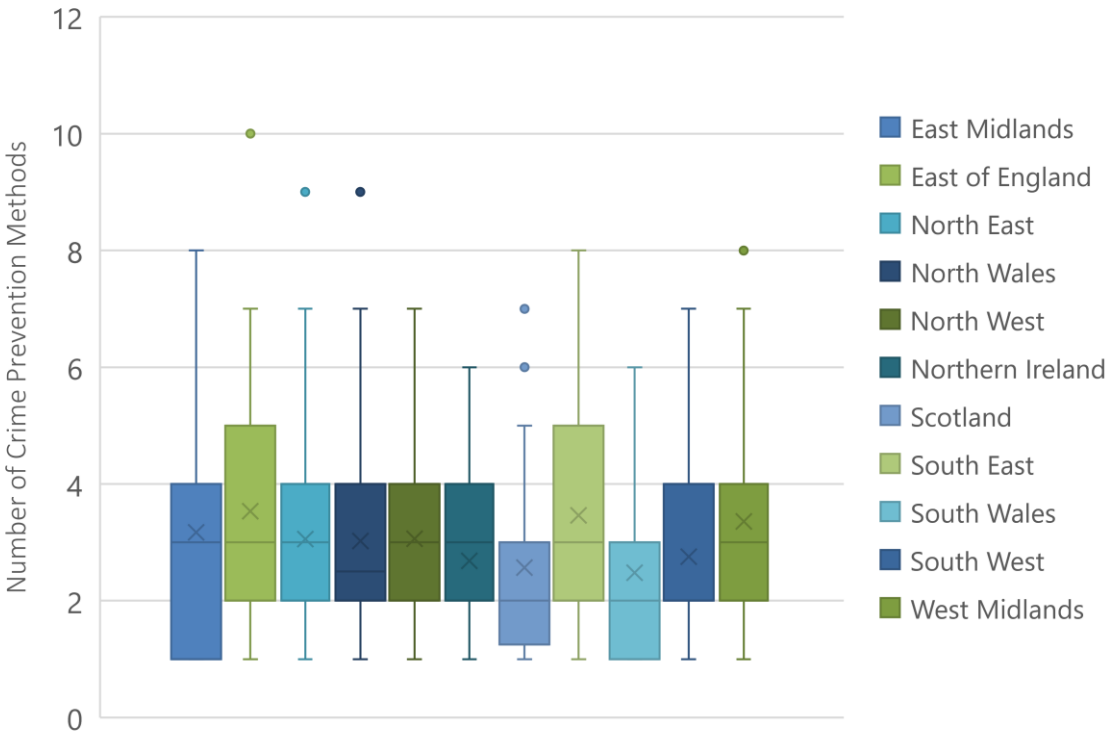


Figure 4.12: The number of prevention methods used by the location of the farmland.

Reporting of Livestock & Wildlife Crimes to Police

To better understand the reporting practices of Livestock and Wildlife crimes, respondents were asked whether they reported these crime types, the number of specific incident types (e.g. WAK, Theft etc.) they had experienced in previous 2 years, and the number of these specific incidents that were reported to the Police, with the results shown in Table 4.19 for Livestock and Table 4.20 for Wildlife. This question aimed to estimate the 'dark figure' of crimes that, due to not being reported to authorities, fail to be accounted for in official figures on the incidence of these crime types.

The results show that approximately 39.5% of Livestock incidents (N = 618), and 20.3% of Wildlife incidents (N = 1,504) were reported to the Police, leaving between 60% and 80% going unreported to the Police and therefore not recorded within official figures.

Table 4.19: Number of Livestock crimes experienced by respondents, and reporting rates.

Livestock Crime (General)						
Crime Type	No. of Respondents	No. of Respondents that Reported to Police		No. of Incidents	No. of Incidents Reported	
		n	%		n	%
WAK	106.0	70.0	66.0	440.0	170.0	38.6
Theft	46.0	33.0	71.7	178.0	74.0	41.6

Of the 152 respondents that indicated they had been the victims of Livestock crimes approximately 70% reported Theft of Livestock, whilst just over 60% reported the Worrying/Attack/Killing (WAK) of Livestock on the farmland. Of the 618 incidents that occurred, 41.6% of Theft and 38.6% of WAK incidents were reported. The results show the low level of reporting of Livestock crimes to Police.

For the three types of Wildlife crimes assessed in this survey, Poaching, Coursing and Attack/Killed/Persecuted (AKP) collectively accounted for 1,504 incidents experienced by 153 respondents in the previous 2 years. The proportion of incidents reported to Police showed a low reporting rate with between 8% and 25% of incidents reported to Police.

Table 4.20: Number of the incidents of Wildlife crime respondents experienced, and reporting rates.

Wildlife Crime						
Crime Type	No. of Respondents	No. of Respondents that Reported		No. of Incidents	No. of Incidents Reported	
		n	%		n	%
Poaching	44.0	18.0	40.9	418.0	74.0	17.7
Coursing	73.0	49.0	67.1	801.0	207.0	25.8
AKP	36.0	12.0	33.3	285.0	25.0	8.8

The rates of reporting for Wildlife crimes are far lower than for Livestock crimes, which may relate to the Livestock having a more tangible value (e.g. commercial value of the livestock) to respondents. Reporting livestock crimes is also necessary for farmers to acquire a Police crime reference number, which is required for an insurance claim for the loss of livestock or any associated damage to farm property.

To further assess reporting practices, the proportion of crimes respondents indicated that they reported were compared for the different crime types. The proportion of incidents reported to Police for Livestock crimes are presented in Table 4.21(a) and Wildlife crimes are shown in Table 4.21(b).

Table 4.21 (a) & (b): Proportion of Livestock and Wildlife incidents respondents reported to Police.

(a)

Livestock Crime (n = 152)				
Proportion Reported	Livestock Theft (n = 46)		Livestock Worried/Attacked/Killed (n = 106)	
	n	%	n	%
0%	13.0	28.3	36.0	34.0
1% - 25%	3.0	6.5	8.0	7.5
26% - 50%	3.0	6.5	17.0	16.0
51% - 75%	1.0	2.2	6.0	5.7
76% - 99%	1.0	2.2	0.0	0.0
100%	25.0	54.3	39.0	36.8

(b)

Wildlife Crime (n = 153)						
Proportion Reported	Wildlife Poaching (n = 44)		Wildlife Coursing (n = 73)		Wildlife Attacked/Killed/ Persecuted (n = 36)	
	n	%	n	%	n	%
0%	26.0	59.1	24.0	32.9	24.0	66.7
1% - 25%	6.0	13.6	12.0	16.4	2.0	5.6
26% - 50%	3.0	6.8	14.0	19.2	0.0	0.0
51% - 75%	2.0	4.5	2.0	2.7	0.0	0.0
76% - 99%	0.0	0.0	0.0	0.0	0.0	0.0
100%	7.0	15.9	21.0	28.8	10.0	27.8

The results presented in Tables 4.21 (a) & (b) are also presented in Figure 4.13 and show in general, that proportionally Livestock crimes are reported more than Wildlife crimes to the Police.

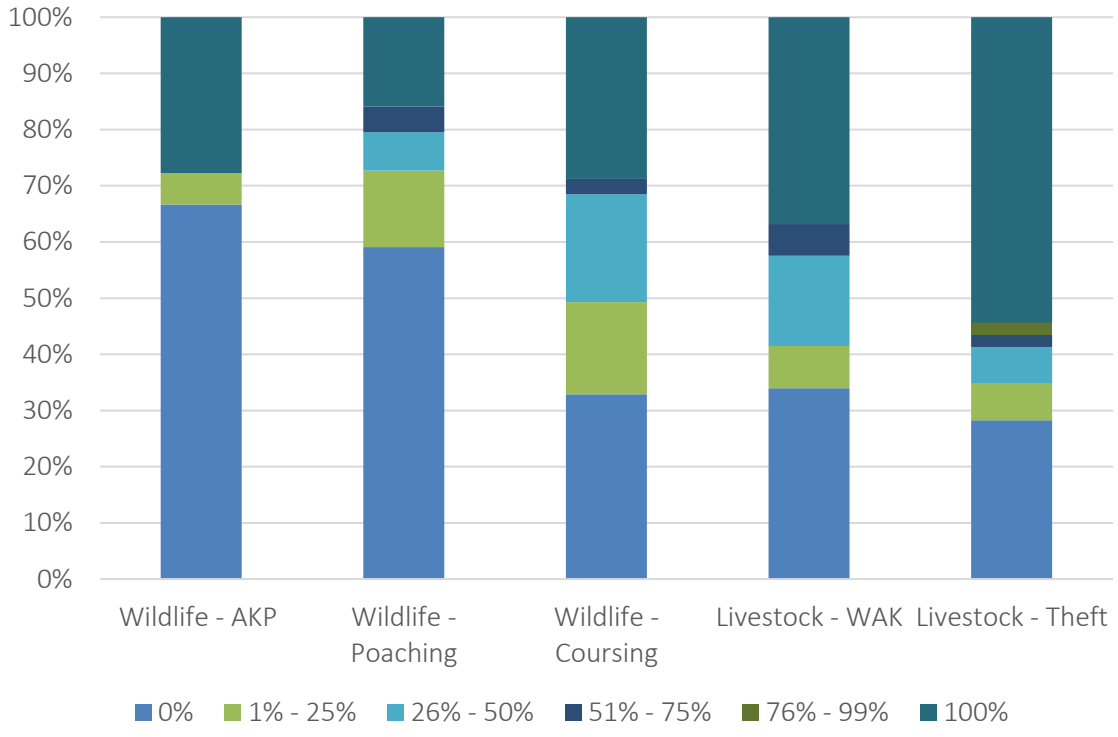


Figure 4.13: Proportions of Livestock and Wildlife crimes experienced by farmers that were reported to Police.

Over half of respondents reported 100% of Livestock Theft (54.3%) to the Police compared to just under half of respondents reporting 100% of the Livestock WAK (36.8%) incidents. Close to one third of the respondents failed to report any of the Livestock Theft (28.3%) and WAK (34.0%) crimes that occurred on the farmland. The results highlight the extremes between farms reporting all or none of the incidents relating to livestock to the Police, which combined account for over 70% of the responses.

Just over a quarter (28.8%) of respondents (n = 73) reported all of the incidents of coursing to the Police, with a third (32.9%) failing to report any incidents of coursing to the Police. Of the remaining responses 36% of respondents reported between 1% and 50% of incidents to the Police. Overall, the results indicate that rarely are the majority of coursing incidents reported.

The results for Poaching identified that only 15.9% of respondents reported all of the incidents experienced on the farmland. Just over 20% of respondents reported between 1% and 25% of the incidents of poaching to the police. Overall, the vast majority (59.1%) of the respondents failed to report any of the poaching incidents to the Police.

Finally, of the respondents who experienced AKP incidents involving wildlife, just over a quarter of respondents (27.8%) reported all the incidents to the Police. Of all the crimes involving wildlife (and livestock), those involving the attack, killing or persecution of wildlife had the largest proportion (66.7%) of the respondents report none of these crimes to the Police.

For both Livestock and Wildlife crimes, the reporting data indicates the situation is one of extremes, where the majority of the incidents are either always reported or never reported. The results for Wildlife crimes highlight that a far greater number of farms fail to report any crimes to the Police. The results importantly identify that a third of Livestock crimes and between a third and two thirds of Wildlife crimes are never reported, and therefore will not be represented in the Police crime data.

There was a large variation in the number of crimes experienced by farmers. It is worth noting that the reporting practices of those who experience very few crimes may differ to those that experienced many crimes on their farmland, this is an avenue for further analysis, but is not dealt with further in this section/chapter. In addition to this, the survey did not account for the

farmers reporting any of the incidents to other authorities or sources of help (e.g. vets, wildlife charities etc.).

Despite the limitations associated with these results, they provide an overall idea of the reporting practices of those that identified themselves as having experienced Livestock and Wildlife crimes.

Reasons for not Reporting Livestock & Wildlife Crimes to Police

H9: There is a significant difference between the reasons for not reporting crimes for Livestock crimes and Wildlife crimes.

Respondents were presented with a list of 18 reasons for not reporting crimes to the Police, this list provided the same options as those used in the Crime Survey of England and Wales (CSEW 2017), to allow for ease of comparison, and an additional farm specific reason ('Although this was a crime, it was not regarded as a problem affecting the farm'). Survey respondents could choose multiple answers from the list if there were multiple reasons that deterred them from reporting Livestock and Wildlife crimes.

The reasons respondents chose to not report livestock and wildlife crimes to the police were found to be very similar to each other, and were predominantly due to respondents believing that the Police could not do anything, were not interested/bothered about these crimes, or believed these crimes were too trivial or not worth reporting.

The most frequent reasons for not reporting Livestock and Wildlife crimes, were found to be similar to those given in the 2017 Crime Survey for England and Wales (see Table 4.22).

An exception in relation to Wildlife Crimes was 'Fear of reprisals', which was the joint third (11.3%) most chosen reason for not reporting crimes. Organisations such as the NRCN, CLA and numerous police forces anecdotally recognise the link between wildlife crimes such as Hare coursing and poaching with Organised Crime groups. The President of the CLA Tim Breitmeyer has reiterated the need for these crimes to be taken more seriously due to the link between these crime types and 'hardened criminals – often using threats, intimidation and in some cases

violence' (CLA, 2018). Anecdotal evidence suggests that the threat to farmers from these criminals is thought to contribute to the farmers concerns about reprisals and may explain what deters them from reporting crimes to Police (Hansard, 2017; NRCN: The Fight Against Hare Coursing, 2019).

Table 4.22: Top reasons for not reporting Livestock and Wildlife crimes to Police, compared to the same reasons provided in the CSEW 2017 (ONS Reporting Reasons, 2017).

	Proportion of Respondents (%)		
Reason	Livestock (n = 158)	Wildlife (n = 151)	CSEW (n = 3,217)
Police could not do anything	22.9	17.9	31.0
Police not interested / bothered	21.9	18.9	18.0
Private / dealt with themselves	8.9	5.2	18.0
Too trivial / not worth reporting	7.0	11.3	32.0
Common occurrence	7.3	10.3	5.0
Other (Please Specify)...	6.7	5.8	7.0
No loss / damage	5.1	9.6	4.0
Inconvenient to report	4.4	2.1	8.0
Tried to report, but unable to contact the police	3.8	2.1	0.0
Reported to other authorities	2.9	2.7	5.0
Dislike or fear of the police / previous bad experience with the police or courts	2.2	0.0	2.0
Fear of reprisals / intimidation	2.5	11.3	2.0
Although this was a crime, it was not a regarded as a problem affecting the farm	1.9	-	-
Happened as part of job	1.9	0.7	1.0
Attempt at offence unsuccessful	1.0	1.0	2.0
Own / family member / friend's fault	1.0	0.0	2.0
Offender not responsible for actions	0.3	0.0	1.0
Thought had already been reported	0.3	1.0	1.0

The overall results highlight the general distrust of Farmers towards Police and their efficiency with dealing specifically with Livestock and Wildlife crimes, which are similar to the results from the Crime Survey of England and Wales (CSEW, 2017).

Estimates of livestock and wildlife crimes based on police reports and insurance claims are influenced by the 'dark figure of crime'. Whilst reports using these sources of data are informative, they are not the best method for identifying the actual rates of crimes. The survey

results indicated that less than half (39.5%) of livestock crimes and only a fifth (20.3%) of wildlife crimes were reported to Police. The overall low level of reporting – based on survey respondents free text comments (see Thematic Analysis Chapter Five) – appears to be due to issues associated with rural Policing practice. The lower level of reporting of wildlife crimes is likely due to livestock being a business asset and having a commercial value to the farmers, therefore damage that may require an insurance claim would be more likely reported to the Police.

Whilst the NFU Mutual report provides an indication of the level of livestock theft in the UK, there are no annual reports providing a resource on the incidence of wildlife crimes in the UK. Most of the information about wildlife crimes is collected and produced by statutory and non-governmental organisations such as the Wildlife and Countryside Link (WCL, 2018), PAW Northern Ireland, and RSPB, as well as intelligence-based reports produced by the NWCU which collates data from Police forces in the UK . Neither of these report types provide an overview of wildlife crimes based on land-owners experiences in the UK.

The results showed that only a fifth of the wildlife crimes which occurred were reported to the Police, one of the lowest reporting levels of all the studies reviewed. It can therefore be expected that wildlife crime incidence rates based on Police data or on more general surveys asking about the reporting of all crime, provides an inadequate picture of the reality of these crimes.

The survey results combined with the large proportion of respondents believing these types of crimes are increasing to some extent, highlights the need for the Police and other agencies to encourage the reporting of these crime types and improve the recording practices (discussed in Chapter Six).

Discussion

The chapter presents the findings from the first survey specifically focused on Livestock and Wildlife crimes in the UK. Table 4.23 presents some of the main findings alongside data from other surveys and studies on farm crime. The results of the survey provide more detailed information about the experience of different Wildlife and Livestock crimes as well as the rate of reporting to the Police and complement the more general findings of the Commercial Victimisation Survey, NRCN Rural Crime Surveys and other farm crime surveys. Of the overall findings, three areas of particular interest are expanded upon in the discussion.

Environmental Factors

Previous surveys and studies that have looked for association between environmental and physical features on farm crime have produced mixed results. While the study by Smith (2018) found no statistically significant relationship between distance to roads, urban centres or nearest neighbours and the occurrence of crimes on farms, the Scottish Farm Crime Survey (SFCS, 1999) found the opposite, with farms found near small towns or large towns being victimized more than farms in isolated locations. The findings from this survey showed that factors such as proximity to roads and villages were not statistically significant predictor variables for the occurrence of Livestock and Wildlife crimes. It may be that these factors are significant in relation to other crime types on farmland, but there was no evidence that these factors were associated with the occurrence of Livestock and Wildlife crimes here.

Of the environmental and physical variables examined, the only factors found to be statistically significant in relation to Livestock and Wildlife crimes were the presence of RoW and farmer Pluriactivity. These factors have a particular relevance to rural landscapes and therefore present the first assessment of their relevance to criminal exploitation of farmland.

The influence of permeability has been addressed in urban areas and on housing estates internationally, but until now no similar analysis has been conducted within the rural environment to explore the influence of RoW on the exploitation of farmland. The results showed that RoW showed a significant association with Livestock and Wildlife crime. However, while the association was reliable it was weak.

In addition to RoW, Wildlife crime appeared to be experienced more by respondents that do not have additional employment away from the farm (pluriactivity). The increased presence of the farmer on the farmland potentially improves the likelihood of wildlife incidents being detected by those farmers. The literature on Situational Crime Prevention and Guardianship identifies how the presence of informal social control in the form of the presence of guardians can act as a deterrent for potential criminals, as the presence of people or the implication that people are present increases the perception of risk associated to a crime. However, the influence of guardianship on farms is complicated by the scale of farmland. The presence of a property or owner/workers on farmland is unlikely to provide a uniform level of guardianship over the entirety of the farmland at any one time. Whilst one field may be positively influenced by the presence of a farmhouse or farmer, other fields remain exposed to potential exploitation by criminals. The influence of guardianship in relation to rural crime and farm crime presents an exciting avenue for future research.

Examples of schemes used to encourage informal social control and guardianship in rural areas to protect wildlife, but could be applied to any crime impacting species, include the 'Turn in a Poacher' scheme used to deter Trout poaching in Pennsylvania, where anglers were given a priority number to contact the local authorities to report suspicious or illegal activity, which is similar to some of the farm watch schemes employed in the UK; and the Participatory Forest Management programme in Tanzania, where successfully reporting illegal activity can result in the informant receiving a share of any resultant fine/penalty (McSkimming & Berg, 2008; Robinson & Lokina, 2012). Such schemes could be trialled in the UK to encourage the engagement of rural communities in reporting suspicious activities to the relevant authorities.

Hopefully, the results from this survey will motivate future research into how the permeability of rural landscapes, and pluriactivity of farmers might influence victimisation.

Seasonality

To the authors knowledge this is the first study to examine the seasonal pattern of livestock and wildlife crimes. There is much anecdotal knowledge of seasonal variation in the occurrence of specific wildlife crimes, such as hare coursing, which is known to occur around harvest, when the farm fields are being cleared (see Chapter Six for further information), however, published or grey literature specifically assessing the seasonal patterns of these crimes nationally could not be found in the process of completing the literature review.

The results therefore present a preliminary analysis of Livestock and Wildlife crime patterns, with the responses providing clear seasonal variation for Livestock and Wildlife crimes, with these crime types showing a strong inverse correlation.

As discussed above the agricultural calendar is likely to be a major contributor to the seasonal variation of these crime types, which includes breeding seasons, movement of livestock within the farmland, grazing rotation, as well as changes in wildlife associated to breeding season, migration, hibernation, circadian rhythm and sleep patterns. The variation in these factors throughout the year are likely to influence the situational risks, effort and rewards associated with criminal opportunities on farmland. All these variables need to be examined as potential contributors to variation in the exploitation of Livestock and Wildlife species, which will be explored further in Chapter Six (POP Centre, 2019).

The identification of seasonal variation in both Livestock and Wildlife crime is important for policy and policing decision-making purposes. As discussed, whilst it appears those involved in agriculture and policing are aware of these seasonal patterns, the explicit identification of their presence has not previously been empirically demonstrated. The survey findings should be developed upon to assess what situational crime prevention techniques could be utilized to disrupt the seasonal exploitation of Livestock and Wildlife.

Reporting

Finally, the survey looked at the reporting of Livestock and Wildlife crimes. Other surveys that have examined rural or farm crime have assessed reporting practices for all crimes on agricultural farmland, with the proportions of crimes reported to Police ranging from 15% to 68% (see Table 4.23). The variation in reporting rates across studies may be due to variation in the crime types considered. The benefit of this survey is that it asked respondents to indicate their reporting practices for the specific crimes relating to Livestock and Wildlife. The results of the survey indicated that about 39% of Livestock crimes and 20% of Wildlife crimes were reported to the Police. More specifically, Wildlife crimes (poaching, coursing and AKP) ranged from 9% to 25%; whilst Livestock crimes (WAK and theft) ranged from 39% to 41%.

The results highlight the overall lack of reporting of these crime types by farmers to Police. However, it does not take into account the number of crimes reported to other authorities (e.g. insurance companies, charities, etc.). The results indicate how even with access to Police data,

and ignoring the associated issues related to extraction of these crime types, the data would provide less than half of the incidents actually experienced on farms in the UK, therefore cannot be considered representative of the actual incidence.

Of the two types of offences considered, Wildlife crime was found to be reported to a lesser extent than Livestock crime. The differing reporting practices are likely due to Livestock crimes being comparatively easier to detect and having more of a direct financial impact on farmers (e.g. cost of livestock and damage to property). In contrast, wildlife crime only tends to result in financial impacts to the farmer when farm property or produce is affected (e.g. damage to field gate/fencing to access field to chase hares). Taken together, the survey findings suggest that Police data is unlikely to adequately represent the true rate of Livestock and Wildlife crime in the UK, which has implications for policy and practice that is based on Police data.

The findings of this survey represent the first analysis of Livestock and Wildlife crimes on farmland in the UK. The results highlight the need to better understand the true extent and impact of these crimes, and the need for further research into the physical and environment factors may influence exploitation of farmland.

Table 4.23: Results of Surveys and Reports relating to farm crime in the UK (CVS, 2014,2015,2016,2018; CVS Technical Report, 2018; NFU Mutual, 2018; NRCN, 2015,2018; SFCS, 1999; Smith, 2018).

Survey/Report	Year	No. Respondents	Proportion of Respondents that Experienced Livestock Crimes (%)		Proportion of Respondents that Experienced Wildlife Crimes (%)			% of All Crime Reported to Police		% of Respondents Satisfied with Police
			Chasing/Worrying Livestock	Livestock Theft	Poaching, Hare Coursing or Illegal hunting					
Commercial Victimisation Survey	2013	1,085	14.0	4.0	18.0			19.0		66.0
	2014	1,019	13.0	2.0	15.0			15.0		65.0
	2015	1,098	-	2.0	-			19.0		61.0
	2017	1,019	15.0	2.0	26.0			18.0		48.0
Rural Crime Survey (NRCN)	2015	13,193	0.8	1.1	Poaching 1.3 Wildlife crime/Hare coursing 0.8			23.0		36.0
	2018	16,191	5.0	1.0	Wildlife crime/ Hare coursing 14.0			38.0		26.0
Rural Crime Report (NFU Mutual)	Annual	n/a	-	-	-			-		-
Farm Crime in England & Wales (Smith, 2018)	2017	126	-	-	-			68.0		>80.0
The Scottish Farm Crime Survey	1993 - 1998	1,022	1.0	14	-			Commercial Incidents in previous 15 months 47.0		62.0
			Livestock Crime (28.6%)		Wildlife Crime (21.3%)			Livestock	Wildlife	
			WAK	Theft	Poaching	Coursing	AKP			
SURVEY RESULTS	2018	836	12.7	5.5	5.3	8.7	4.3	39.5	20.3	-

Limitations of the Research

There are a number of limitations with the research presented here which are discussed below:

Compulsory Question Completion – Completing the questions was not compulsory to progress through the survey, and as a result there is variation in the number of respondents that completed each of the questions. This means that whilst 836 individuals completed at least 20 of the survey questions, for each individual question the number of responses varied from 17% to 100% of total respondents. The questions were optional to promote completion of the survey and avoid respondents breaking off whilst completing the survey due to fatigue or not wanting to answer a particular question. However, this issue should be acknowledged.

Question Number Limitations – There were some topics briefly touched upon in the survey, such as prevention techniques used by respondents on their farm, which would have benefitted from further questions. However, these were not expanded upon to limit the length of the survey. The limited number of questions on certain topics such as prevention methods, mean the results are not comprehensive enough to provide detailed information on the topic.

Another question in the survey relating to boundary types (i.e. fences, walls, hedges, none etc.) predominantly used on the farm aimed to assess the influence of boundary type on crime occurrence. However, the majority of respondents identified themselves as having mixed boundary types, making it impossible to assess whether specific boundary types influenced victimization. The question relating to boundary type could be an interesting topic for inclusion in a future survey.

Livestock & Wildlife Crime vs Other Crimes on Farm – To limit the number of questions respondents were asked, the survey focused exclusively on Livestock and Wildlife crimes and did not ask respondents about their experiences of other crimes on the farmland. The survey results could therefore not identify whether the farms experienced higher levels of crime generally, or if they were being specifically targeted by poachers, coursers, rustlers etc. Future surveys should include additional questions about the overall experiences of crime, within the context of which the occurrence of Livestock and Wildlife crimes can be framed.

Weighting of the Results – The survey results presented have not been weighted, as would be expected to make the results representative. The results of the survey were used to test the

nine hypotheses and should not be considered as nationally representative in there current form.

Sample Selection Bias (External Validity) – Web-based surveys tend to produce results that are limited in representativeness due to using non-random and non-probabilistic sampling methods (Ganassali, 2008). The sample was determined using several criteria including farmers having specific livestock breeds, being registered on an online livestock society website or livestock database and having an active email address.

Arable farms such as those producing horticulture and cereal products were not represented in the results of the survey due to the difficulty of finding contact details for these types of farms on open source websites/databases, and the main focus of the survey relating to livestock and wildlife. As such, the findings reported here may apply only to the types of farms sampled (farms with Livestock). Replication is the key to external validity and therefore future research should look at the experiences of wildlife crime on arable farms, to establish whether the findings reported here are representative of the experiences of agricultural properties generally in the UK.

The variation in the location of different farms types in the UK (see Maps of Livestock Distribution in Chapter Two – *Figure 2.6*), means that the survey sample selection method, which used livestock breed websites, may introduce a geographical bias, not only through the exclusion of arable farms, but also the potential for a particular region to be overrepresented in the results due to regional differences in the number of farms/farmers registered with the livestock breed societies.

Coverage Error/Issues – There exist numerous ways, particularly when using internet-based tools, that participants may be prevented from taking part that are discussed below:

- Internet Access – Using a web-based survey mode can be fast and cost efficient but introduces the potential for coverage issues. Coverage issues are due to variation in internet access amongst participants, the reality being that not everyone has access to the internet (Fan & Yan, 2010). As of 2018, 73% of premises without decent broadband were located in rural areas. Access to 4G mobile phone networks is comparatively even more patchy and unreliable in rural areas. OFCOM (2018) identified that whilst 83% of urban premises (homes and offices) have complete 4G coverage, but that in rural areas, the

number of premises with complete 4G coverage is less than half (41%), and in the more remote areas, there can be no coverage at all. As the focus of this research was rural areas of the UK, it is important to take this potential source of bias into account, as the population who can access the online survey would be limited to those with adequate internet coverage (Fan & Yan, 2010). The percentage of countries in the UK without internet and mobile services are presented in Table 4.24. Even those with internet access, may not have the same opportunity to participate in the survey as others due to the internet service being insufficient or temporarily unavailable (Fan & Yan, 2010).

- Web Literacy – The web literacy of participants acts as a limiting factor on the response rate and a source of bias for the final sample. Variation in the ability of participants to navigate the internet is likely to impact the number of potential participants accessing and completing the web-based survey (Manfreda et al 2008).
- Email Access – A source of sample bias was introduced by only including those with email addresses. This limited the sample to those with email facilities available to them. Access to email facilities also relates to the technology required to access their email inboxes (e.g. access to a computer/phone) and internet access (as discussed above).
- Spam Filters – Another factor impacting the use of email invitations for completing the web-based survey are spam filters. The email invitations sent from an academic institution, could be interpreted as spam and result in a reduced response rate (Manfreda et al 2008).

Table 4.24: Broadband and Mobile Coverage in the UK (OFCOM, 2018; OFCOM, 2019).

Broadband Services	Unable to access a download speed of 10Mbit/s and an upload speed of 1Mbit/s (Universal Service Obligation minimum)	Number of Premises that cannot get decent broadband
England	2%	619,000
Wales	3%	
Scotland	4%	
Northern Ireland	5%	
4G Mobile Services	Geographic area not covered by any operator	Geographic Area of UK NOT covered by Mobile Operators (not-spots)
England	2%	8%
Wales	8%	
Scotland	18%	
Northern Ireland	2%	

Non-Response Bias (Internal Validity) – Unbiased subject sampling is important when trying to achieve generalisability of survey results. Non-response bias is a significant issue associated with survey studies that rely on self-selection and voluntary participation. The characteristics (demographic and geographic) of respondents to the survey can differ to those who do not respond and should be taken into consideration when analysing the results (Ganassali, 2008). In the case of this survey, the spread of respondents and number returned (N = 836) was not representative of the farming community in the UK.

Implications of research on Policy

The results of this survey suggest that Livestock and Wildlife crimes are underreported and therefore under-represented in Police data, which may mislead stakeholders involved with determining what Police priorities are in the UK. This survey contributes to the small amount of literature that aims to provide a better understanding of the true incidence and impact of Livestock and Wildlife crimes in the UK. The results support the need for more intelligence and units like the NWCU to better understand these crimes and protect rural areas.

As the National Wildlife Crime Unit funding is due to end in 2020, the results of this survey highlight the need for further investment and resources to be provided to units and research into these crime types in the UK. The work of such units and further research could then provide government bodies with more accurate information on the occurrence of these crimes and what changes in national policy need to be made to improve the prevention, detection and prosecution of these crime types.

Implications of the Research on Practice

The survey provides a variety of findings associated to Livestock and Wildlife crime, as well as providing potential solutions for issues such as data quality, which should encourage discussions between stakeholders such as Farmers, Police and the other enforcement authorities.

- Implications for Farmers & Police:

  This survey presents an overview of how Livestock and Wildlife crimes are impacting farmers nationally and associated issues (e.g. Police engagement issues). The survey results provide evidence that can be used to support the ongoing dialogue between farmers, police and government over how these types of crimes need to be handled and what changes to policy and practice are needed moving forward.

  The results of this survey highlight poor reporting practices for Livestock (39%) and particularly Wildlife (20%) crimes. Farmers and Police should be working together to develop improved methods for reporting and recording these crime types. The collection of more representative data could lead to a more appropriate allocation or Police resources to tackle these issues. The accurate representation of these crimes could benefit both Police and Farmers if rural Policing were to receive additional support to tackle these crimes.

- Implications for Food Safety – A potential result of Livestock and Wildlife crimes is the presence of trespassers and other animals (e.g., dogs) on farmland. The potential exists for these crimes to seriously impact the security of the Food Supply chain. Livestock on farms produce (e.g., eggs, milk, wool) or are (e.g., meat) commercial products that are legally required to meet certain standards to meet the quality level for public sale and consumption. It is important that the general public are aware that Livestock and Wildlife crimes pose a threat to the security of the food chain. If farmland is easily exploitable by those committing Livestock and Wildlife crimes, due to the low likelihood of detection and prosecution if caught, then there exists an opportunity for the food supply chain to be easily targeted by those wishing to cause disruption on a larger scale (e.g. agro-terrorism (Byrne, 2009)).

Implications of Research on Theory

Despite much of the UK being classified as Rural, there exists a limited amount of research on the occurrence of crimes in rural areas, and subsequently limited research on theories that can explain crimes in rural environments in the UK.

The survey results identified only two environmental factors that show an association (albeit weakly) to victimisation of farms: Rights of Way and Pluriactivity. These factors relate to guardianship and permeability of the farmland, and these features should be investigated further in future work relating to farms and other rural areas. In particular this is the first study to evaluate the influence of Rights of Way on the incidence of Livestock and Wildlife crimes, and further work should be conducted to identify the strength of association between the presence of rights of way on victimisation.

Recommendations for Future Research

Surveys – Regular surveys (annual or bi-annual) should be conducted to assess the impact of Livestock and Wildlife crimes nationally. The addition of specific Livestock and Wildlife questions to already existing surveys sent to farmers would reduce the need for contacting farmers multiple times and increase the likely number of respondents. The results could then be compared to situational crime prevention strategies used by Police and other agencies to determine what methods may be best at deterring crimes from occurring.

Due to the wide variation in the terminology used by other surveys and reports, this survey used specific crime type categories such as 'Theft' and 'Worrying/Attacking/Killing' to provide a simple set of options for farmers and presents a simplified terminology for future surveys. The use of a predetermined and common set of terms in surveys addressing livestock and wildlife crimes, would allow for comparison of results, this could allow data from different time periods, regions or countries to be compared, which may highlight variations in these crime types.

Field Boundaries – The responses to this survey provided insufficient information for analysing whether an association existed between farm boundaries and victimization. However, this is an important avenue for further research. By getting specific information on the boundary types of targeted fields it may be possible to identify specific boundaries or methods used that make fields and farms more vulnerable to being targeted by offenders (e.g. wire fencing vs. ditches).

Funding – Funding is limited generally for conservation and species related research, but even more so when looking at Livestock and Wildlife from a crime science perspective. Funding needs to be secured for national research to better understand livestock and wildlife crimes in the UK.

The victimisation survey of farmers has provided a number of findings that may be of use to stakeholders and decision makers. There is limited information on Livestock and Wildlife crimes in the UK, with the only routine publications assessing crimes impacting farms being the Commercial Victimisation Survey, Rural Crime Survey and NFU Rural Crime report. However, none of these publications separate Livestock and Wildlife crimes, but instead combine them with other crimes such as Anti-Social behavior, which means the potential exists for species crimes to be overshadowed by more ubiquitous crimes such as theft of vehicles and burglary. The findings of this survey provide the first empirical evidence to determine the extent of these specific crimes in the UK.

CHAPTER FIVE

Thematic Analysis of Victimisation Survey Responses

Introduction

In the last five years, the National Rural Crime Network has conducted two surveys that have aimed to better understand the impact of crime for rural residents, businesses and visitors. The results indicated that rural crime is significantly underestimated and does not receive the attention it requires. As Police resources are reducing and an increasing number of Police stations are closed in rural areas, it is important to understand the impact of rural crime.

The impact of Livestock and Wildlife crimes on farms in the UK, especially, has received no specific attention, with only a few studies on farm crime addressing Livestock and Wildlife crime as an addition to the more ubiquitous crimes such as burglary and vehicles crimes. In response to this research gap, a survey was conducted of farmers (Chapter Four) to assess the impact of Livestock and Wildlife crimes in the UK.

In addition to the sections designed for quantitative analysis, the survey included an open question allowing participants to provide qualitative information on their experiences and opinions about crime on their farms. Thematic Analysis of the data indicates the variety of crimes experienced by farmers, with a number of respondents highlighting their frustration with the Police response to crimes on their farms.

Literature Review

Farm Crime

As discussed in detail in Chapter Two (Literature Review) and Chapter Four (Victimisation Survey of Farmers) there exists limited studies on the impact of farm crime internationally, with the literature being further reduced when looking for information about the problem in the UK. The existing surveys on farm crime predominantly focus on how crime has impacted farms generally, and rarely goes into detail about specific crime types, particularly those involving Livestock and Wildlife.

The Scottish Crime Survey (SFCS, 1999) is arguably the most comprehensive survey of farm crimes but its date and geographical scope raises questions over its relevance and generalisability. The aim of the victimisation survey of Farmers in Chapter Four, was to conduct an up to date survey, assessing the occurrence of Livestock and Wildlife crime in the UK. The survey results produced quantitative and qualitative information which is presented in this thesis.

The quantitative part of the survey aimed to assess the occurrence of Livestock and Wildlife crime in the UK. The results indicated that approximately a fifth of farmers have experienced Wildlife crime, and close to a third have experienced Livestock crime in the previous 2 years. The survey identified the low level of reporting of these crime types to the Police, with the survey answers indicating there was an overall sense that Police were unable to do anything about farm crime, which supports the results of other studies both on Farm crime (Smith, 2018) and the more general results from the CSEW (ONS Reporting Reasons, 2017).

The survey also assessed numerous environmental factors to establish if physical features such as Buildings, Roads and Rights of Way were associated to the occurrence of these crime types, but only two features (Rights of Way and Pluriactivity) were found to have a weak association to the occurrence of these crimes. Information on what features farmers believe make the land more vulnerable to crime would be useful for targeting future analysis and research.

Overall the quantitative results highlight the need for more research into these crime types and a better understanding of farmers experiences of crime, as well as what reasons or experiences prevent farmers from reporting these crimes to the Police.

A qualitative free-text question was included at the end of the victimisation survey to give respondents the opportunity to provide additional information about their experiences, and opinions on crime on their farmland. The benefit of including a free text question asking for respondents' experiences and perceptions of crime, is that the information could potentially provide contextual information absent from the quantitative findings of the survey. This chapter presents the results of a qualitative thematic analysis of the comments provided by farmers in the victimisation survey.

Thematic Analysis

Qualitative data can come in a variety of formats including focus groups, texts, survey responses, general documents, policy manuals and photographs to name a few (Nowell et al, 2017). Thematic analysis is considered a fundamental method of qualitative analysis and can be used to systematically identify, organize, analyse and report on theme/s identified within a variety of qualitative data sources (Braun & Clarke, 2006; Nowell et al, 2017).

The thematic analysis process involves detailed and repeated assessment of data sources, allowing the researcher to identify patterns and themes within the data, these themes are then used to organize the data for further analysis (Fereday & Muir-Cochrane, 2006; Nowell et al, 2017).

Thematic analysis is used to identify similarities and differences, as well as unanticipated insights in data and can be used to answer research questions using data unsuitable for quantitative analysis, including people's perspectives or descriptions of a given topic/phenomenon (Braun & Clarke, 2006; Vaismoradi et al, 2013). Thematic analysis has been used in a variety of fields which support the utility of this type of analysis in qualitative research (Vaismoradi et al, 2013).

The six general stages of the thematic analysis process (as shown below) were described by Braun & Clarke (2006):

1. *Familiarising with Data* – Transcribing data, reading and rereading data, noting down initial ideas.
2. *Generating initial Codes* – Coding interesting features of the data systematically across the entire data set, collating data relevant to each code.
3. *Searching for Themes* – Collating codes into potential themes, gathering all data relevant to each potential theme.
4. *Reviewing Themes* – Checking if the themes work in relation to the coded extracts and the entire data set, generating a thematic map.
5. *Defining and Naming Themes* – Ongoing analysis for refining the specifics of each theme and the overall story that the analysis tells us, generating clear definitions and names for each theme.

6. *Producing the Report* – The final opportunity for analysis. Selection of vivid, compelling extract examples, final analysis of selected extracts, relating back on the analysis to the research question and literature, producing a report of the analysis.

Method

The data analysed in this chapter were responses to the final question in the aforementioned web-based survey on wildlife and livestock crime in the UK: "*Is there anything else you would like to tell us about crime on the farm?*". This question was presented to the respondents as an opportunity to highlight issues that were pertinent to them, that may not have been already elicited through the survey. The data collected in the free text field was explored using thematic analysis.

Survey Sample

As explained in Chapter Four, invitations to take part in a web-based survey was directly emailed to 12,616 farmers registered with a selection of breeding societies in the UK. Of those, 836 individuals completing the survey, and 395 went on to complete the open question discussed in this chapter.

The survey responses were anonymous, but information from other survey questions were used to provide demographic information about the farmers who provided comments (shown in Table 5.1). The demographic information indicates that 82.5% of comments came from farmers over the age of 45, with the largest proportion of comments coming from the 55 to 64 age group. Whilst the location information indicated that 79.7% of respondents came from England (North east, South East, North West, West Midlands and South West) and Scotland.

Table 5.1: Demographic information about the age and location of respondents that provided additional comments at the end of the victimisation survey of Farmers.

Age Range	N = 395	%
18 to 24	11.0	2.8
25 to 34	16.0	4.1
35 to 44	42.0	10.6
45 to 54	78.0	19.7
55 to 64	142.0	35.9
65 and older	106.0	26.8
Location	N = 395	%
North Wales	20.0	5.1
East Midlands	24.0	6.1
East of England	27.0	6.8
South Wales	27.0	6.8
Northern Ireland	33.0	8.4
North East	34.0	8.6
South East	34.0	8.6
North West	36.0	9.1
West Midlands	38.0	9.6
Scotland	54.0	13.7
South West	68.0	17.2

Themes & Coding

Themes are used to highlight an important pattern or topic within the data set that relates to the research question. The importance of a theme is not directly related to the number of times the theme is repeated, but instead is based on its relevance to the research question (Braun & Clarke, 2006; Fereday & Muir-Cochrane, 2006).

The first stage of conducting a thematic analysis requires themes by which to organise the data to be identified. Researchers can use inductive (bottom up) or deductive (top down) methods to identify themes relevant to the research question (Braun & Clarke, 2006; Nowell et al, 2017). Inductive thematic analysis is typically used for topics where limited literature exists, which is the case in relation to farm crime in the UK (Vaismoradi et al, 2013). As the survey question related to crime on the farmland, general themes were used initially as these were expected to be included in the respondents' answers, these themes included: 'Crime', 'Prevention' and 'Non-Crime Issues'. In addition to these, the theme category 'Other' was created and used for

responses that did not seem directly related to the topic of interest (Braun & Clarke, 2006; Nowell et al, 2017).

As the survey data was acquired from an open ended question, the potential existed for a significant variety in the responses received; therefore an inductive process was used to allow new themes to be identified by the content of the data, rather than trying to fit it into a strict pre-existing coding framework. Identifying themes and coding the data extracts was an iterative process with the theme hierarchy evolving throughout the data analysis process (Braun & Clarke, 2006; Fereday & Muir-Cochrane, 2006; Nowell et al, 2017).

Braun & Clarke (2006) provides a hierarchy of the data involved in a thematic analysis as shown below:

- *Data Corpus* – all data collected for the research project.
- *Data Set* – all data from the corpus that is being used for a particular analysis (a data set can be determined by either a particular source of data (e.g. interviews, articles, survey responses, etc.), or data on a particular topic within the data corpus).
- *Data Item* – each individual piece of data collected (e.g. an individual interview, or a particular website).
- *Data Extract* – an individual coded piece of data, extracted from a data item. A selection of the data extracts will be presented in the final analysis. It is the data extracts that are coded.

The coding of the data provided by respondents to the survey involved identifying relevant 'Data Extracts' in the text, and coding these to the relevant theme (Fereday & Muir-Cochrane, 2006; Nowell et al, 2017). Where a 'Data Item' contained information relating to multiple themes (e.g. Police presence on farm and items stolen) or separate incidents within the same theme (e.g. descriptions of two instances of sheep worrying), the 'Data Extract/s' would be coded for each relevant theme or as multiple extracts within the same theme (Nowell et al, 2017).

NVivo 12 Pro - Software

The qualitative data from the Farmer Survey was imported into the NVivo 12 Pro software to aid in the organising and coding of the data extracts contained in the text. The data imported into NVivo were initially used to create a word frequency graphic (as shown in Figure 5.1) which highlighted the most commonly used words once conjunction, connecting and linking words were removed. The word frequency graphic provided an indication of the types of terminology present in the respondents' comments and identify potential themes.

Figure 5.1: A word cloud showing the most prominent words used in the data from the survey after cleaning/removal of conjunction, connecting and filler words.

The word frequency graphic provides no context in which these words were used, therefore the data extracts were coded and organised by theme for qualitative analysis. The NVivo software allowed for systematic and accurate coding of the large amount of text (Fereday &

Muir-Cochrane, 2006; Nowell et al, 2017). The framework of the thematic analysis is presented in Table 5.2.

Table 5.2: Thematic analysis framework of parent and sub-themes used to code the data extracts.

Parent Theme	Sub-Theme (Level 2)
Crimes Associated to:	Anti-Social Behaviour
	Arson
	Assault or Abuse
	Farm Property Break In
	Field Equipment/Materials Stolen
	Fly Tipping
	Fuel Theft
	General Theft
	Livestock • Cattle • Dogs • Poultry • Sheep
	Machinery and Equipment
	Property Damage
	Scrap
	Suspicious Activity
	Trailers /Vehicles (e.g. ATV, Tractors)
	Trespass • Animal Activists • Metal Detecting / Night Hawking
	Wildlife • Poachers • Hare Coursing • Lamping • Other
Causes & Concerns	Causes
	Concerns
Excluded	Declined to Comment
	Negative Comment re: Survey
	No Crime
Non-Crime Issues	Drones
	Travellers
	Walkers on Land
Other Information	Other Information
Prevention, Protection & Compensation	Community Action
	Council
	Insurance
	Police • Negative • Positive • Reporting
	Prevention Methods

Results

In total 822 individual 'Data Extracts' were identified and allocated into five main Themes: 1) Crimes on Farmland, 2) Prevention, Protection & Compensation, 3) Non-Crime Concerns, 4) Causes & Concerns, 5) Other Information, and an Excluded (N = 55) category (see Table 5.3).

Table 5.3: Breakdown of data extracts separated by Theme.

Data Extracts by Parent Themes	Number of Data Extracts in Total	
	N = 822	%
CRIMES ON FARMLAND	538.0	65.5
PREVENTION, PROTECTION & COMPENSATION	139.0	16.9
NON-CRIME ISSUES	39.0	4.7
CAUSES & CONCERNS	24.0	2.9
OTHER INFORMATION	27.0	3.3
EXCLUDED	55.0	6.7

The following sections present the findings from the free text question in the survey, with a further breakdown of data by specific themes, and information/quotes provided by farmers/respondents. The thematic analysis does not qualify the relevance of the themes by the number of times it appears in respondents' comments, but the following sections for the different Themes provide tables and graphs to visualise the proportion of data extracts.

THEME 1: Excluded

Of the 822 data extracts, 55 (7%) were excluded as they did not discuss information relevant to the research topic (farm crime), declined to provide additional information, or left a negative message about the survey as shown in Table 5.4.

Table 5.4: Categories for why data extracts were excluded and proportions.

EXCLUDED	Total Number of 'Excluded' Extracts = 55		Proportion of Total Number of Extracts = 822
	N	%	%
Declined to Comment	28.0	50.9	3.4
No Crime	19.0	34.5	2.3
Negative Comment re: Survey	8.0	14.5	1.0

The majority (50%) of the excluded extracts were respondents declining to comment. The decision to not provide further information may indicate that the survey participants did not have any further information to share, or may be due to farmers feeling uncomfortable providing further information about their experiences of crime. In addition, roughly 35% of excluded responses indicated that they had not experienced crime on their farmland. Many of those reporting that they had not been the victim of crime, identified that their remote position (particularly in relation to respondents from Islands such as Orkney) had a significant influence on the incidence of crime, with crime on farmland being an uncommon occurrence in general.

"We live on a small island within the Orkney Isles. Crime is not a problem."

"As reside on an Orkney Island (600 persons approx) there is very little crime."

The small number of respondents from the mainland who claimed they had not been the victim of crimes often commented that whilst they had not been victims, they were aware of the threat of such crimes, which will be discussed later in the section 'Other Concerns'.

The eight negative extracts about the survey that represented 1% of the total number of extracts, were frustrated that the survey did not cover other crimes such as those involving machinery and equipment. The intention of the final question was to allow respondents to provide information about other crimes that impact farmland nationally. The survey could not ask about all crime types in sufficient detail without asking an exorbitant number of questions, which may have negatively impacted the response rate. The open ended question at the end was intended to not only identify factors relating to Livestock and Wildlife crime that the author was not aware of, or failed to ask respondents about, but also to act as a guide for future research and potential topics of future surveys.

THEME 2: Crimes on Farmland

Of the 822 extracts 65.5% (538) detailed types of crimes that had occurred on farmland (as shown in Table 5.5). Subthemes were created for the Livestock, Wildlife and Trespass themes, as farmers provided sufficiently detailed information about their experiences to be able to differentiate the specific species or criminal activity.

The data extracts indicated that farmers experienced a wide variety of crimes on their farmland. Whilst this information cannot be used to quantitatively assess crime prevalence, it can be used as a general indication of the variety of crime types being experienced by farmers in the UK.

Table 5.5: 'Crimes on Farmland' themes and number of data extracts relating to crimes that have occurred on the farmland.

CRIMES ON FARMLAND	Total Number of 'Crimes on Farmland' Data Extracts = 538		Proportion of Total Number of Extracts = 822
	N	%	%
Trailers/Vehicles Stolen (e.g. quads)	94.0	17.5	11.4
Machinery and Equipment	91.0	16.9	11.1
Livestock	67.0	12.5	8.2
• Dogs	34.0	6.3	4.1
• Sheep	20.0	3.7	2.4
• Cattle	3.0	0.6	0.4
• Poultry	3.0	0.6	0.4
Farm Property Break In	43.0	8.0	5.2
Property Damage	39.0	7.2	4.7
Fly Tipping	34.0	6.3	4.1
Fuel Theft	33.0	6.1	4.0
General Theft	28.0	5.2	3.4
Wildlife Crime	30.0	5.6	3.6
• Poachers	13.0	2.4	1.6
• Hare Coursing	10.0	1.9	1.2
• Lamping	4.0	0.7	0.5
• Other	3.0	0.6	0.4
Field Equipment/Materials Stolen	21.0	3.9	2.6
Trespass	20.0	3.7	2.4
• Animal Activists	2.0	0.4	0.2
• Metal Detecting	1.0	0.2	0.1
Scrap	12.0	2.2	1.5
Suspicious Activity	12.0	2.2	1.5
Arson	8.0	1.5	1.0
Assault or Abuse	5.0	0.9	0.6
AntiSocial Behaviour	1.0	0.2	0.1

THEME 3: Prevention, Protection & Compensation

Of the remaining 294 extracts, 47.2% (139) were allocated to the theme Prevention, Protection and Compensation (as shown in Table 5.6). Within these 56.8% related to the Police and their approach to crime on farmland.

Police

Extracts on the Policing of farm crime accounted for 9.6% of the total extracts (N = 822) provided by survey respondents. The extracts on Policing were coded into three categories: 1) Negative, 2) Positive and 3) Reporting Practices.

Police - Negative

Of the 79 extracts relating to Policing 81% (64) were negative. The reasons given for this negative perception of the Policing of farm crime includes the reduction in Police presence in rural areas and the increasing closure of rural Police Stations.

Table 5.6: 'Prevention, Protection and Compensation' themes and number of extracts from respondents who completed the survey.

PREVENTION, PROTECTION & COMPENSATION	Total Number of 'Prevention, Protection and Compensation' Extracts = 139		Proportion of Total Number of Extracts = 822
	N	%	%
Police	79.0	56.8	9.6
• Negative	64.0	46.0	7.8
• Positive	10.0	7.2	1.2
• Reporting Practices	5.0	3.6	0.6
Prevention Methods	42.0	30.2	5.1
Community Action	16.0	11.5	1.9
Council	2.0	1.4	0.2
Insurance	1.0	0.7	0.1

Police numbers and Police stations have reduced in rural areas, resulting in fewer local Police patrols, and knowledge of the local community. The absence of Police due to resource restraints is making it increasingly difficult for farmers to report crimes and reducing the likelihood of officers attending crime scenes. The increased distance Police officers have to

travel to reach more isolated areas is a concern for farmers who know they will have wait longer times for officers to reach them if an incident does occur.

"I have upmost respect for the police and what they do, and appreciate they are subject to public money budget cuts too but what happened to common sense?"

Respondents indicated that the media portrayal of rural policing does not match up to farmers experiences. The absence of rural officers is leading farmers to resort to accepting they must protect their property themselves, at their own risk, because Police are unlikely to attend. The confidence of criminals is increasing due to the knowledge that farmers cannot defend themselves without risking being prosecuted, and the lack of a quick police attendance at scenes of crimes.

"Should a crime occur, there is absolutely no chance that the police would attend - definitely not immediately and probably not at all."

Whilst some farmers perceive the reduction in Police interest/attendance at scenes, as a product of increasing resource pressures, many other extracts indicated that the lack of assistance from Police was perceived to be an indication of their lack of interest in rural crime in general. Several farmers indicated that they are only ever given crime or incident numbers and are referred to their insurance company. The belief by many of the respondents is that due to the minimal sentencing powers for crimes that occur on farmland and low conviction rate, Police are inclined to ignore reports to avoid 'wasting their time'.

"Small scale rural crime is not important to the police, understandably, but is important to the livestock/poultry owner."

"Police are totally uninterested in the main issues of trespass, damage and threatening behaviour - their response every time is "its a civil matter", "there is no proof" or "the people have gone"."

Several farmers noted that when they did report crimes to the Police, follow up was absent or significantly delayed. Respondents could wait days to weeks before Police contacted or attended the farm about the reported issue.

"I tried reporting it to the local police, but the station is not often open. I tried using their telephone system outside the station again without success. Having previously served as a police officer for 32 years and knowing what they would require for a theft report I sat at the computer and did out a report for them. I then took it to the police station and posted it through their letter box, to date no one has made contact with me from the police."

Police - Positive

Of the extracts giving a positive review of Police in relation to farm crime, the Police were found to show a quick and effective response.

"The police have always been very responsive and come when called."

"We greatly appreciate the efforts of the police to combat crime on the farm - they have been here twice to security mark plant and equipment."

Several farmers described assisting officers in apprehending poachers and other criminals on the farmland.

"Met on drive we chased pochers [SIC] for 1 to 2 hours traveling 15 miles on roads and fields including a helicopter police dogs and about 10 police cars and we got the bastards. Haven't had pochers [SIC] since as police didn't have a 4x4 used mine"

"…when it came to wildlife crime they were like flies round poop."

Farmers who worked collaboratively with the Police to organise 'Watch' groups (such as Farm Watch and Neighbourhood Watch) had a positive opinion about the efforts made by rural police forces to tackle farm crime, as shown in the quote below.

"We are a close community and watch for each other. We have a good, police led, online watch using email."

"I am the co-ordinator for the local neighbourhood watch and if an unknown white van arrives uninvited into a farmers yard it is reported directly through a priority phone line

to the community police officer responsible for the area. If a crime has taken place in the locality I would expect to also be advised but unfortunately being at the perimeter of our police area something close but in the next Divisional area would not be advised."

Reporting Practices

The analysis suggests that whilst respondents would have previously reported crimes, unless they have directly witnessed the crime occurring or have physical evidence, they perceived no point in reporting the crime as they did not believe it would be taken seriously by the Police. The effect of limited success rates in detection and prosecution on farmers' inclination to report incidents is illustrated by the quote below:

"Crimes that once would have shocked and upset me have now become the norm and my acceptance and tolerance of crime has increased. It would need to be something pretty extreme for me to even report it to the police."

The time it takes to report crimes to the Police was also highlighted as a deterrent for reporting. Processing of reported incidents is slow, with the 101 line often having severe delays making it difficult to get information to Police, particularly when an incident is in progress but not a life or death emergency.

"…it takes half an hour to get through to 101 when the questions asked such as 'is the crime ongoing', 'did you get a vehicle description and registration', etc. By this time the coursers have left. There is little point in spending time reporting this when nothing will be achieved."

The inconsistency in Police responses to farm crime is resulting in fewer farmers reporting crimes to the Police.

These findings are somewhat supported by the quantitative results of the main survey, which asked respondents to indicate reasons for not reporting Livestock and Wildlife crimes to the Police. The main reasons given were that the Police could not do anything or were not interested, these reasons were also found to be the main ones given in the Crime Survey for England and Wales (CSEW) which implies that dissatisfaction with Policing is not unique to rural areas.

Community Action

Of the extracts provided on this topic (n = 139) 11.5% described examples of how collective efficacy assisted in the prevention of crimes on the farmland. Respondents described how locals and other farmers watch over one another's land and inform each other if they notice any issues, and neighbours with houses overlooking the farm provide additional levels of supervision.

"Eyes of local people and recording details number plates etc. often a helpful deterrent"

"We work closely with the local community. Their eyes assist our eyes. We welcome people onto the farm and believe that it is very much to our benefit (as well as to theirs) as little happens without us getting to know about it."

"The land I farm is in and around a village and many of the residents keep an eye on my stock and telephone if they see any problems."

In addition to the general supervision by those in proximity to the farmland, several respondents mentioned being involved in 'Watch' schemes, such as 'Neighbourhood Watch' and 'Farm Watch'. The 'Watch' schemes allow locals to work together and often in conjunction with the local police, to provide additional supervision and protection of farmland and other parts of the rural landscape.

"…We have a good, police led, online watch using email."

"…I am the co ordinator for the local neighbourhood watch and if an unknown white van arrives uninvited into a farmers yard it is reported directly through a priority phone line to the community police officer."

"We have a vey [SIC] neighbourhood watch system in place and that helps us to be secure on are farm…"

New email and mobile phone text chains organised by Police & 'Watch' members, aimed to share information about suspicious activity or incidents in the local areas more quickly.

Respondents who used these methods of communication in relation to suspicious activity, noted that the levels of crime and suspicious activities in their local areas seemed to have decreased.

Prevention Methods

Of the extracts on prevention methods (n = 42), CCTV was frequently mentioned by farmers, with numerous respondents noting the CCTV was installed in response to being victimised. Other electronic security methods employed by respondents included electric gates, alarm systems and security lights; as well as security marking and trackers on vehicles (e.g. quads). Several respondents described locking equipment away when not in use. However, they also mentioned how this process was historically unnecessary and is inconvenient due to the need to use equipment frequently and in isolated locations.

"Years ago, we never locked any gates on the farm, today we have several chain and padlocks on gates with roadside access!!!"

Whilst locks were used to secure gates, this was not thought to be a particularly effective prevention technique against thieves due to ease of breaking them, but generally thought to help prevent trespassing by the general public. Fencing and signage was also used to try and prevent trespass and damage to crops, livestock and general environment.

"Measures (fencing, gate locks, signage) put in to encourage people to stay on footpaths and so prevent damage to the environment, crops, livestock, etc."

Guard animals are used by several farmers and thought to be a major deterrent to potential criminals, with types of guard animals including guard dogs and geese.

"We increased the farm security using good quality locks, clutched bolts etc. We also introduced geese."

"Attempted theft of a trailer containing livestock was stopped when I was alerted by our farm dogs."

Prevention methods were adopted by respondents due to feeling vulnerable to crime and concerned about the absence of Police. However, the inconvenience and financial cost of some security measures can reduce uptake of crime prevention techniques.

"We go through phases of locking external gates but this drops off as time goes on from initial incident due to inconvenience of locking etc. We select equipment to reduce chance of theft or vandalism. Our main equipment is kept in closed and locked barns."

"It is a nightmare, what I have to spend on security is horrendous"

"We have had to invest in all the security measures because the police in rural areas are not effective in preventing rural crime. We have been burgled 3 times and have had to invest heavily in appropriate security measures to protect our business and property."

The comments from farmers on the security methods used on their farmland, indicated that some have invested heavily in technological solutions to try and prevent crime on their farms. The comments about how historically farmers did not need to use prevention methods, correlates with the general findings of the main survey, with the majority of respondents using between 2 and 4 security methods on the farm, with the vast majority using locks, security lights and guard dogs.

THEME 4: Causes & Concerns

Respondents provided explanations for the occurrence of crimes on the farmland as well as their personal feelings and concerns relating to becoming victims in the future. The 27 extracts provided as shown in Table 5.7 were coded into concerns and causes and the information collected is presented below.

Table 5.7: 'Causes and Concerns' themes and number of extracts from respondents who completed the survey.

CAUSES & CONCERNS	Total Number of 'Causes & Concerns' Extracts = 24		Proportion of Total Number of Extracts = 822
	N	%	%
Concern	19.0	79.2	2.3
Causes	5.0	20.8	0.6

Concerns

The extracts made by respondents highlighted the isolation and vulnerability felt by farmers. The inability to effectively monitor the farm 24 hours a day means there was a general sense of concern and inevitability to crimes occurring on the farmland. In addition to this, several farmers indicated that when working early and late hours in darkness with farm livestock there is a general sense of anxiety due to being uncertain if there are opportunists on the farmland without their knowledge. Respondents stressed that they remain vigilant to suspicious activity in their local area, several noted that they were suffering from high stress levels due to the constant threat of being targeted.

"We bought this farm which is more remote because our previous farm suffered 10 serious thefts in 30 months, mostly machinery and equipment but the continuous threat of intrusion and further losses was unbearable. This caused a partner to have a nervous breakdown and stop farming. As a consequence we left and moved to this farm."

"We are very aware that we have been lucky and our luck may run out."

"It is always a worry but due to the extensive nature of the farm it would be impossible/uneconomic to patrol 24 hrs a day."

"The fear of crime is always there and poisons our attitude to callers as they are possibly planning to return to rob us."

"We have been lucky up til now as there have been a growing number of crimes on farms local to us. Being up through the night in the dark outside myself calving and lambing etc is more unsettling than it used to be as you're never quite sure who might be creeping around at that time of night but It's all part of the job and unavoidable."

"Crime is massively on the increase in rural areas, I spend my working life selling products to farmers so spend a lot of time on farm and it is a concern for everyone."

Causes

The exorbitant costs of some security measures were identified as causes for farms to become targets, as those which cannot afford or cannot implement such measures are subsequently more vulnerable. In addition to the cost many prevention techniques are incompatible with certain types of farm or methods of farming or require upkeep that is impossible to maintain.

"One major issue is that the best security can cost thousands and also potentially make the processes on the farm very awkward e.g. if you have to carry lots of keys and continually secure and unsecure [SIC] items it adds hassle. Tools need to be used and trailers at numerous times for example so if you had to keep clamping items it would get very onerous."

The farmers comments did not include specific details about the costs associated to the prevention techniques aimed at preventing livestock or wildlife crimes, but instead commented on the overall expense of security. It can be assumed that the cost of crime prevention methods is a deterrent for farmers irrespective of the target being protected.

The school holidays were implicated as being associated to the targeting of farms. One reason given as to why crimes appear to increase at these times include that criminals require additional finances at these times of year.

"Break-ins are more common in September (when the criminals have children going back to school and need cash after the summer holidays?) and around other holiday times such as Christmas."

"Most of our farm crime takes place during the school holidays. Unfortunately the livestock is easily got at and because they are friendly will come up to you rather than run away."

The seasonal relationship between the School holidays and the occurrence of Livestock and Wildlife crimes were not considered in the analysis of the main survey data but could be a potential predictor of the times of year when these crimes are more likely to occur. Factors related to seasonal variation in Livestock and Wildlife crimes will be discussed further in Chapter Six.

THEME 5: Non-Crime Issues

Respondents provided information about issues affecting the farmland which did not directly relate to crime which were separated into three themes as detailed in Table 5.8.

Table 5.8: 'Non-Crime Issue' themes and number of extracts from respondents who completed the survey.

NON-CRIME ISSUES	Total Number of 'Non-Crime Issues' Extracts = 39		Proportion of Total Number of Extracts = 822
	N	%	%
Travellers	19.0	48.7	2.3
Walkers on Land	17.0	43.6	2.1
Drones	3.0	7.7	0.4

Travellers

The complexities associated to the presence of outsiders and seasonal workers integrating with rural communities was highlighted as an issue when trying to deal with crimes on farmland. Of the 19 respondents that wrote about Travellers/Gypsies (as they termed them) in the areas around the farmland, 18 of these perceived travellers as having a negative impact and believed the traveller community were complicit in most farm crime.

"Seems to be seasonal, coinciding with travellers arriving in the area."

"Gypseys [SIC] are the biggest cause of rural crime in our area. The police or council want to avoid confrontation and will not get involved to uphold the law."

"The majority of thefts, livestock, machinery tools etc and illegal coursing and killing of deer is carried out by the Travelling fraternity"

"A continuing threat by marauding travellers looking for an opportunity to commit crime and often threatening personnel"

However, one respondent supported the travelling community, highlighting that many travellers were seasonal workers on farms, and completed numerous tasks on farmland. They perceived the travelling community as a benefit and felt that most farmers blamed this group as it was an easy target, rather than contemplate or accept that crimes were completed by others within the local community.

"One last thing, travellers [SIC] (gypsies) get blamed for everything, and this just isn't the case. The travellers have a long tradition of seasonal working on farms, from harvesting to wall building and laying of drains. It just suits the real thief's (always locals) to blame them."

Walkers on Land

The impact of the general-public walking on farmland included people walking off public paths, gates left open, and dogs off leads.

People walking off Public Paths – Majority of extracts highlighted the issue of the public walking off public paths or directly onto private land, believing they have the right to walk anywhere. Respondents indicated that despite using fencing and signage to discourage the public from entering private land, they regularly found people trespassing on the farmland and damaging the fencing and signage put in place to prevent trespassing.

"Public footpaths give people a reason to be on the farm. they often become 'lost' even though they are well signed and can be found wandering where they like with their dogs. although not a crime, it's annoying and I do wander if they are just looking around for any opportunities."

Gates left Open – Gates being left open by those using public paths or have trespassed onto farmland was discussed as having a significant impact on livestock and farmers. The risk of livestock escaping and wandering onto nearby roads and into other fields increases the risk of loss and injury to livestock.

"Walker leaving gates open. Causes big problems and danger to livestock. Directly from danger of escaping on to roads, also when stock is let out into other fields can be injured, buy other stock and the damage to the animals by colliding with fencing and gates in the chaos that always occurs."

Dogs off Leads – Public out walking dogs were asked directly by farmers or via signage to keep dogs on leads. However, farmers indicated that a large proportion of dog walkers believe their dog would never chase livestock. However, the instinct to chase livestock is an always present threat with dogs on or near farmland.

"We have an area of land near a small village which we rent every winter for sheep grazing. It has many footpaths. This winter we put up signs on every stile saying that in lamb ewes were grazing and to please keep dogs on a lead. It did not seem to make any difference. There were dogs off the lead nearly every day. When challenged owners just said their dogs wouldn't chase sheep. They did not understand that a fog [SIC] dog running through the field would upset sheep"

"Sheep worrying is a massively escalating problem in the countryside with inadequate sanction system. We have a bridleway through our Farm regularly used by dog walkers, dogs are off the lead and allowed to foul everywhere despite a dog bin at the end of the lane. We walk in the lakes and are horrified by the amount of dogs off leads amongst the livestock."

"No 'right of access' to the fields involved - just people 'walking their dog' more awareness is needed we have signs on all access gates alerting to livestock/close gates but still these are not enough, people are usually aggressive to being spoken to regarding their responsibility for their actions (even when approached carefully and in good humour!)"

Incidents where dogs chase livestock can have devastating impacts on livestock and farmers, yet despite increased media attention about the issue of livestock worrying by dogs, the public continues to fail to keep dogs on leads when walking in or near farmland.

Drones

Despite only three extracts relating to drones, these extracts raise interesting concerns over drone use in the rural environment. Two of the extracts related to an increasing number of drones flying over the respondents' farmland. Respondents showed concern as to what they were doing and whether they were scouting out farmland for potential opportunities to commit crime. In addition to this, one farmer described an incident where an individual was using a drone to worry sheep in a field.

> "No crime as such but increasing number of unwanted drones seem to visit us. What are they looking at? I would like to see drones banned from flying over land without the landowners permission."

> "Neighbouring farmer very recently observed a drone snooping around buildings and their machinery yard"

The Civil Aviation Authority (CAA) regulations relating to the use of UAVs for recreational use, state these should not come within 50 metres of private land without prior permission. However, the enforcement of these rules is complicated by the Police not dealing with unauthorised drones over farmland. A farmer whose livestock were being frightened by a drone over the farmland was informed by Police that this was not considered a crime and only the CAA could handle the issue. The farmer was also informed that if he shot the drone to protect the livestock, he would be prosecuted for criminal damage (CAA, 2019). The farmers who commented about drones impacting their farms, highlight an emerging issue that needs to be accounted for by Police, CAA and rural crime researchers.

THEME 6: Other Information

The 'Other Information' extracts were limited in number and presented issues not directly dealt with within the survey. Of the 27 extracts (representing 3.3% of the 822 total extracts), four themes were identified which related to: 1) the impact of conservation work, 2) unusual

livestock deaths, 3) specialist knowledge of criminals and 4) the fragmented nature of farmland. Further details about these extracts are presented below:

Impact of Conservation Work

Several farmers identified issues with the conservation and protection of predator species over other wildlife and livestock. One farmer gave the example of the protection of the buzzard over other wildlife such as the Oyster Catcher or Lark.

> "Yes protected predators are also damaging livestock and killing lambs."

> "RSPB are protecting predators such as badgers and buzzards to the detriment of our farmland birds such as the Lapwing Oystercatcher and Lark we see this on our farm."

Another farmer highlighted the issue of night-time hedge cutting. Hedge cutting during breeding seasons is restricted under the Wildlife & Countryside Act of 1981 (RSPB Hedge Cutting) to protect birds nesting in hedges. The farmer stressed that night-time hedge cutting whilst birds were roosting was having a damaging impact and should be properly enforced to protect bird species.

Unusual livestock deaths

A couple of extracts described discovering killed livestock, alongside evidence of skilled carvery, finding only the heads and skins on farmland. Another statement by a respondent detailed how several farms in the local area had been victimised numerous times with sheep being mutilated and killed in specific ways, which was believed to be associated to occult practices. The respondent noted that local Police were ignoring the issue and recording it as fox attacks, despite numerous livestock being found with surgically performed amputations and throats slit. Whilst these types of extracts were limited there exists numerous newspaper reports of livestock being mutilated, which was assumed to be for religious/ritual purposes. Further research into the occurrence of such activities would identify at the very least the occurrence of these incidences of animal cruelty.

> "These 'satan worshippers' have attacked animals from many farms but it is in the dead of night and police generally dismiss it. I was even told that a ewe that had had its leg 'surgically' removed (i.e. cut carefully between muscles and the bone removed from

the socket) its ears sliced off and throat cut and the blood swirled in a definite pattern had been killed by a fox!! This was pronounced even before the police had seen the photos. It was a retired police officer who had alerted me to the fact that this was in fact the work of devil worshippers (the maximum amount of suffering inflicted supposedly giving the most potency to the spell). These people are sick - you should have a dedicated small team that collate information across the country in order to catch them…..Two years ago my neighbour had 3 lambs killed on [SIC] night - throats slit and gutted."

Specialist Knowledge

Numerous crimes that occur in rural areas require specialist knowledge of equipment or livestock to investigate the crime effectively and increase the likelihood of achieving a successful prosecution. The specificity of the equipment and machinery stolen was thought to indicate the 'Steal to Order' nature of some farm crime.

An issue highlighted by several respondents was the targeting of elderly farmers and remote farms, where scammers are using their agricultural supplier accounts with local shops to purchase goods against their names. This resulted in several farmers losing thousands of pounds due to fraud. The respondents who highlighted this issue said it is disproportionately impacting the elderly farmers and they receive little to no support from the authorities.

"Insidious theft e.g. use of an older farmers account in a local store 'he asked me to get him x' so the goods are charged to the farmer and often he doesn't notice. When reported the police say can you prove it? Even if you can they don't care 'borrowing' machinery 'borrowing' diesel getting goods for older people in isolated areas and not giving the correct change - again the police don't care - we reported theft of over £3000 over 18 months from an elderly lady and social services say 'we think there's no crime' What??????"

Fragmented Farmland

Farmers can have numerous areas of land separated by miles which they cannot supervise simultaneously. In addition to the difficulty of monitoring disconnected areas of land, other farmers highlighted the issue of gaining permission to build property on their farmland.

"My Farm is split into several separate parcels across various Parishes of differing sizes - so NO RING FENCE"

Preventing farmers from living on the land, is perceived by the respondents to contribute to the risk of their land being victimised in their absence.

Discussion

In the absence of interviews or focus groups with farmers and other guardians of the rural landscape (e.g. national park rangers or gamekeepers), an effective method for collecting qualitative data on farmers experiences and opinions of farm crime, was by using a free-text question in the victimisation survey of farmers, discussed in detail in Chapter Four. The thematic analysis identified 822 data extracts from the 395 comments provided by respondents.

The extracts were separated into themes, with the main topics identified relating to the types of crimes farmers experiences, and the prevention of crime and protection of the farmland

Surveys that have assessed the variety of crimes on farmland (NRCN, 2015,2018; SFCS, 1999; Smith, 2018) provide useful information on the incidence and impact of these crimes in general, but the aim of this thesis was to specifically address Livestock and Wildlife crime. However, the open text question provided an opportunity for farmers to indicate the variety of crime types that had impacted the farmland. The results can be used to identify the variety of crimes that could be included in future research and identifies areas that could be addressed in interviews of focus groups.

The negative comments from farmers in relation to the Police and their management of rural and farm crime, reiterates the findings of other surveys and studies conducted by groups such as the National Rural Crime Network (NRCN, 2015,2018). The results reinforce the need for improved dialogue between farmers and Police to improve the effective policing of crimes impacting farms, livestock and wildlife. The positive comments relating to the Policing of farm crime, highlight how such improvements to farmer and police relations exist in several locations, therefore, the opportunity exists for a transfer of knowledge and practice from the areas where farmers feel supported and protected to those areas where farmers feel they are being ignored by the Police (Smith, 2018).

The expense of crime prevention measures was highlighted as an issue for respondents, with the initial cost and upkeep deterring some farmers from adopting security measures. The use of guard animals (such as dogs and geese) were identified as a major deterrent for potential criminals, and the positive perception of guard animals compared to more technological solutions, calls into question whether the technological security measures developed and

promoted are practical in a rural setting. These findings are supported by the results from the main survey which found that most respondents used locks, security lighting and guard animals for protecting their farmland.

The data extracts did produce some unexpected results with descriptions of crimes involving the ritualistic killing of livestock and the use of drones to scope farmland and scare livestock. Crimes such as these would not have been identified without the addition of an open text question to the survey. These specific crime types deserve further work to not only identify the true prevalence of these crimes, but how they are impacting farmers nationally.

Additional issues that are not immediately thought of as a crime, such as walkers with dogs on farmland were identified as creating significant issues for farmers. In particular farmers mentioned the frustration caused by walkers damaging fencing and signage, and the general disregard for farmers and their land. Whilst many of the walkers were not technically breaking the law and walking on public rights of way, the issues emerged when walkers ignored signage about keeping dogs on leads, or left the public rights of way on the farmland and then became trespassers, walking in fields and potentially damaging crops.

The combination of quantitative and qualitative questions has provided support for the findings of the main survey and in addition to this highlighted areas that require further research and analysis.

Limitations of the Research

The thematic analysis is based on the responses to a single question asked in the victimisation survey of farmers (Chapter Four). The resulting data extracts therefore could not be refined through further questioning of the respondents. Other methods such as interviews or focus groups would have provided an opportunity to ask structured questions and gather more information.

The question used in the survey allowed farmers to respond with information about any crime occurring on their land, which resulted in a variety of responses. Whilst a Thematic analysis does not focus on the number of data extracts made in relation to a given theme, it is important to consider the influence of having information on some themes based on the responses of only one or two farmers.

The analysis and coding of the extracts from respondent farmers was conducted by the researcher only and did not incorporate additional individuals in the development of the themes and coding process, or in the assessment of the data to identify errors or missed information. In future work involving a thematic analysis, an additional researcher or expert should be involved in the development and analysis of the thematic analysis to try and prevent any loss of information or mis-allocation of data extracts that can occur when assessments of information are not completed in duplicate.

Recommendations for Future Research

The information collated from the survey responses confirms the variety of crimes impacting farms in the UK. The research available on farm crime particularly in the UK is limited, therefore, any further work in the future on this topic would help increase the knowledge base relating to rural/farm crime.

Further research gathering the experiences and opinions of farmers and members of the public whose leisure time is spent in the rural environment walking in farmland, might highlight issues and potential solutions to the problem identified by farmers of the general public trespassing on farmland.

Future research should look at the stress caused by the farmers fear of crime, which was mentioned in several of the data extracts.

Additional topics highlighted in the extracts included issues with the increasing presence of drones over farmland and stressing livestock. Future research into the use of drones in rural areas and associated legislation would be beneficial to address how prevalent this issue is in rural areas.

Additional factors potentially influencing the seasonality of crimes on farms were mentioned in the data extracts (e.g. school holidays). Future research should look at whether school holidays correlated with any seasonal patterns found in Livestock and Wildlife crimes.

The survey asked farmers to email their contact details to the researcher if they would be willing to be interviewed, or potentially take part in a focus group on the topic of farm crime. An insufficient number of participants (3) responded with their details to justify conducting

interviews or focus groups. Anecdotally it is acknowledged that due to the nature of farm work and the geographic distance between farms makes bringing farmers together for focus groups or conducting face-to-face interviews extremely difficult. Future work should look to find ways to bring farmers together across the UK to gather information on a variety of questions to gather more targeted information. Farm Shows and Farming Insurance events may provide opportunities where farmers are already gathered together and information can be collected.

Conclusion

The results of the Thematic analysis were not aiming to answer a specific research question but were instead aiming to identify whether information provided by respondents differed to what is already known about the types of crime impacting farmers in the UK.

One of the main themes that emerged from the farmers comments was that farmers felt that Police did not show an interest in farm related crimes. These comments support the findings of the victimisation survey in Chapter Four, and other surveys on farm crime, and highlight an important issue with farmer-police relations that needs to be addressed.

The responses also contained information about crimes that were not prominent in the existing literature such as the potential use of drones to scope farmland for opportunities to commit crime, and the ritual killing of livestock.

Qualitative information relating to farm crime provides a better understanding of the potential causes of crime and can help to towards explaining why farmers do not always report crimes to the Police.

The thematic analysis in combination with the victimisation survey, highlight the need for more research using surveys, interviews and focus groups with farmers, to build upon these findings and those from other surveys, to provide a contextual background within which other sources of data on farm crime can be orientated.

CHAPTER SIX

Seasonal Analysis of Livestock & Wildlife Crime in Dorset, UK.

Introduction

The chapter presents an analysis of the seasonal trends in Livestock and Wildlife crimes in Dorset between 2010 and 2015. Of the quarter of a million data points provided by Dorset Police force between 2010 and 2015, 569 individual crimes were identified that related to Livestock or Wildlife.

Comparison of the seasonal variation in crimes for Livestock and Wildlife, highlighted the importance of disaggregating the data to understand the individual seasonal patterns in crimes specific to or associated to each species. Findings from the crime data in relation to Deer and Poaching activity on farmland, corresponded closely to the seasonal trends identified in the answers to the victimisation survey of farmers (see Chapter Four), with Wildlife crimes peaking at the beginning and end of the year.

Factors that may influence the seasonal patterns of Livestock and Wildlife crime are presented, including Temperature, Livestock prices and an extension of Crime Pattern theory is discussed, where the routine activities of Livestock (AgriRA) and Wildlife (WildRA) are considered in relation to seasonal variation in victimisation.

In addition to seasonality the chapter assessed the accuracy of the location information accompanying the police records for Livestock and Wildlife crimes. The findings highlight that there is a need to future proof the data being recorded by Police, to improve the ability of Police and researchers to extract the relevant crime data, and more precisely record crime locations to allow for more accurate analysis of these crime types in the future.

Seasonality

The seasonality of crimes has been the focus of research for over a century. Existing research has looked at the seasonal variation of a variety of crime types including robbery, murder, vehicle theft, domestic violence and many more. Most crimes show seasonal variation, however, the mechanisms underlying the seasonal change in the occurrence of crime are still debated (Baumer & Wright, 1996; Dong et al, 2017; Hird & Ruparel 2007; McDowall et al, 2012).

Despite researchers being aware of seasonal variation in crime occurrence, the causes of this oscillation are still debated (Dong et al, 2017; Linning et al, 2017). Explanations for the seasonal patterns observed in crimes have been based on two main theories: Temperature Aggression theory and Routine Activities (RA) theory.

Seasonal variation due to temperature/aggression has been found to correlate with some crimes, particularly those involving physical violence, however, the influence of temperature and aggression have not been found to explain patterns in other crime types (Hipp et al, 2004).

Routine Activity theory is based on variation in behavioural patterns of individuals, where an offender, suitable target and absence of capable guardians converge in space and time (Cohen & Felson 1979). Whilst temperature can be a factor within Routine Activity theory, it is not the only predictor for the seasonality of crimes (Hipp et al, 2004). Routine Activity theory unlike Temperature/Aggression theory, allows for other factors to be taken into account which can provide an explanation for the seasonal variation of numerous crime types. An example of the how Routine Activity theory can explain the seasonal variation in crime, is the increase in the number of burglaries during the summer months, which is hypothesised to be the results of an increase in the amount of time people spend outdoors, meaning houses are emptier for longer compared to the winter months, and other factors such as windows being more likely to be left open (McDowall et al, 2012; Linning et al, 2017).

The existing research into the seasonal variation in crime often uses large data samples (e.g. multiple states/counties/cities etc.) over multiple years, even decades, to try and identify hourly/daily, weekly, monthly and yearly patterns (McDowall et al, 2012).

The disaggregation of data into its respective crime types to assess seasonal variation, is vital to identify whether individual patterns exist, which may have been masked if the data were assessed as a combination of different crime types (Farrell & Pease, 1994; Linning et al, 2017). In addition to this, the range of potential environmental factors that may influence seasonal patterns are likely to differ for different crime types, supporting the need to disaggregate crimes to assess the influence of specific exogenous factors (Linning et al, 2017; McDowall et al, 2012). Previous research has disaggregated crimes to examine the seasonal patterns of murder/homicide, rape, robbery, aggravated assault, burglary, motor vehicle theft and vandalism, which have shown individual variation in there seasonal patterns (Dong et al 2017; McDowall et al, 2012; Towers et al, 2018).

The results of seasonal analysis can be used to identify when certain crimes are more likely to occur and in turn what policy changes may be required to adequately tackle these crime types, as well as when and where prevention resources and personnel (e.g. Police) should be utilized to maximum effect. The targeting of resources based on intelligence, such as seasonality of crimes, is particularly important for under-resourced Police services, such as those found in rural areas of the UK, with small numbers of officers charged with protecting large areas (Dong et al, 2017; Farrell & Pease, 1994; Hird et al, 2007; Linning et al, 2017). A better understanding of when crimes occur seasonally and what factors may influence the occurrence of these crimes, would improve the ability of landowners/guardians and Police to predict and prevent these crimes from occurring (Cohn, 1990; Hipp et al, 2004). Identifying the seasonal variation in crimes would make it possible to accurately assess the effectiveness of prevention strategies, as it would then be possible to identify whether the change in the occurrence of crime was due to seasonal variation or the result of the implemented prevention strategy (Dong et al, 2017; McDowall et al, 2012).

The existing literature has identified that seasonal patterns in crimes vary geographically, highlighting the importance of identifying local/national seasonal patterns and whether these correlate with patterns found in other studies (McDowall et al, 2012). Barclay (2001) is the only study to directly assess the seasonal pattern in Livestock theft and found that Livestock were more likely to be stolen at the time of year when they were at their most valuable. However, this study was based on farms in Australia. To the authors knowledge there have been no studies attempting to assess seasonal variation in Livestock and Wildlife crime in the UK. Whilst anecdotal evidence exists that indicates the time of year when Livestock and Wildlife crimes

increase/decrease (e.g. Hare coursing during Harvesting of fields), there is a lack of empirical research to support the anecdotal evidence.

The aim of this chapter is to use Dorset Police data, to assess whether seasonal trends exist in Livestock and Wildlife crimes between 2010 and 2015, to answer the research question: *Do different Livestock and Wildlife crime types (species) exhibit distinct seasonal patterns throughout the year?*

If seasonal variation in Livestock and Wildlife crimes in the UK do exist, it is important to then look at what factors may be influencing the occurrence of these crimes. Factors that may influence seasonality of Livestock crimes on farmland, include the agricultural/farming calendar, which indicates the timing of activities on farms (dependent on produce type and farming method) and movement of people and livestock throughout the year.
Seasonality of wildlife crimes on farmland may also be influenced by the agricultural/farming calendar, as well as other biological and ecological factors such as migration and hibernation. The seasonal patterns associated with Livestock and Wildlife, as well as routine activities associated to the farmland itself (e.g. harvest making fields more accessible) should be compared to any seasonal patterns identified, to try and establish whether these factors can explain any patterns identified for crimes involving Livestock and Wildlife.

Method

Police Data

In 2016, after email communications a meeting was held with Chief Constable Simon Prince who was then ACPO lead for Rural and Wildlife Crime. The meetings were useful in gaining a better understanding of the issues faced by Police forces tasked with effectively managing large areas of rural landscapes and preventing incidents on farms including Livestock and Wildlife crimes with limited budgets and staff numbers.

Communication with CC Prince resulted in a letter (Appendix 4) being sent to Police Forces in the UK that were members of the National Rural Crime Network (31 Forces) asking them to comply with a request for Police data. The letter of support from CC Prince was sent by email

with an official data request to all forces in the UK. The email requesting data contained documents detailing the information required for the proposed research (Appendices 5 to 8). To prevent insufficient data being provided by the Police, the request asked for all crime data excluding sexual assault and violent crimes. This was to a) make data extraction simpler for the police force and b) to allow for mining of the crime data provided to find crimes that may be missed if a more specific extraction was completed by the Police force.

Discussions were held with several forces about accessing their crime data, but the only Police force to provide appropriate data for the proposed research was Dorset Police Force, for the period 2010 to 2016.

The Dorset constabulary were asked to additionally provide incident data for this same time period. However, their current system only allowed incidents to be kept on record for the previous five years, which would mean the data would only go back to 2012. In addition to this, the contact at the Police force indicated that the incident database contained insufficient information to allocate the incidents to discrete places such as farms, or differentiate between incidents involving livestock and wildlife, and therefore would not be of use for the proposed research.

Data Storage

The Police data provided by Dorset Police Force contained personal and sensitive information and due to this required additional data protection. The information when provided on an encrypted disk was transferred into the JDI Research Laboratory at UCL. The Police Assured Secure Facility at UCL was specifically designed to provide a safe location for the transfer, storage, analysis and deletion of data from numerous sources that contain personal or sensitive information (JDI Research Laboratory, 2019).

Dorset Crime Data (2010 – 2016)

The data provided by Dorset Police force contained 250,518 individual crime records for the period between 2010 and 2016. The data was separated into each of the years provided by Dorset Police force, before the data was then filtered and searched for the relevant crimes to this study. As the data relating to 2016 was partial (January to May) the data used was limited to the years 2010 to 2015 where data was available for the full year. This was particularly important for analysing the seasonality of the crime types.

Data Filtering and Searching

To extract the relevant crimes recorded by Dorset Police, relevant terms were searched in the free text field which contained a description of the crime that took place and any further relevant details.

Keyword Search and Filtering

The 250,518 crime records were separated into their respective years from 2010-2015. The next stage used keywords to identify crimes relating to Livestock and Wildlife. The Livestock keywords were chosen based on the main Livestock types in the UK, and then using synonyms used to describe the species, males, females and young of the species.

Wildlife keywords were identified using the national priorities as stated by the National Wildlife Crime Units Tactical Assessment to identify the species and types of crimes/actions of interest (NWCU Tactical Assessment, 2017).

Keywords relating to actions such as 'Theft', 'Attacked' and 'Killed' were not used as they would irrelevant crimes to those of interest to this study, and too many to practically review and filter.

Livestock Keywords:

Actions	Rustling, Rustled, Worrying, Worried, Mutilat*, Slaughter*
Species/Crop	Livestock, Herd, Flock, Goat, Pig (Sow/s, Hog/s, Swine/s, Barrow/s, Gilt/s, Boar/s), Cattle (Bull/s, Steer/s, Springer/s, Ox, Cow, Heifer, Calf, Calves), Sheep (Ewe, Ram/s, Mutton/s, Wether/s, Yearling/s, Lamb), Chicken (Hen/s, Cockerel/s), Poultry, Bird, Duck, Game, Pheasant, Turkey, Partridge, Geese, Crop (Barley, Wheat).

Wildlife Keywords:

Actions	Poach, Coursing, Baiting, Baited, Trap*, Snare*, Hunt*, Poison*, Lamping, Lamped, Persecution, Persecuted
Species	Wildlife, Fox, Badger, Hare, Bat, Bats, Deer (Stag/s, Buck/s, Doe, Fawn/s)

Keyword Searching Issues

Spelling - Issues associated to keyword searching included the recurrent incident of spelling differences in relation to species descriptive words, such as Hefer/Heifer/Heffer. Several of the

misspelt keywords, were only discovered as the text field contained additional keywords, had the text field not contained additional keywords then without checking for potential spelling variations, some of these crimes could have been overlooked.

Multiple Meanings – Several of the keywords were found to present a large number of returned crimes, with only a small number actually related to Livestock or Wildlife crimes. Examples of keywords that returned a large number of crimes, included 'Bull' which returned a large number of crimes relating to the theft of Red bull, and dog issues relating to Bull Terriers. Similarly to the keyword 'Bull', the keyword 'Hen' presented a large number of crimes relating to Hen Do's. Several keywords were also associated to Pub names and Road names, as well as Bicycle and Car brands (e.g. Fox, Cow, etc). The lack of specificity of these keywords to Livestock and Wildlife alone, highlights the importance of having a system to easily extract such crimes, for future research.

Searching explicitly for animal types produced its own issues, with numerous accounts of frozen chickens stolen from shops being returned.

Wildcard Difficulties – Filtering of records was achieved using keywords (as described above), and it is often recommended when filtering records to use wildcards that help narrow down the returned results. Whilst this method was used for some words which were comparatively unique (e.g. poach*), it did not work well for words that could potentially return a large number of results due having duel meanings, an example being 'crop*' which showed up in a number of other records relating to 'cropping' of locks etc.

The lack of unique identifiers allowing for easy extraction of Livestock and Wildlife crimes, or even easier extraction of crimes that had occurred on farms, meant that addressing the above keyword searching issues significantly increased the amount of time taken to accurately identify the relevant Livestock and Wildlife crimes.

Excluded Terminology/Crime Types

- Domestic animals excluded – numerous crimes were recorded relating to domestic animals, including theft, poisoning etc., but were not included due to not meeting the category of wild or livestock species, however, this would be a valuable avenue for future research.

- Crimes associated to Policy and Police Operations – e.g. Operation Manuka appeared several times when searching for Trap* particularly in 2015. Due to the policy association, these crime records were removed from the results.
- Outbuildings/Barns are not exclusive to farmland, and private properties can now have numerous outbuildings without functioning as an active farm, as a results several records could not be included, as the free text field was inconclusive as to whether the event related to farmland or not.

Extracted Livestock & Wildlife Crime Data

Tables 6.1 and 6.2 present the number of returned crimes for each keyword, as well as the initial number of specific and associated crimes (descriptions of these crime types are provided below) prior to filtering. The table presents the returned records in three categories:

- R = Returned from search using keyword (only in Appendix 9 a & b).
- S = Species/crop specific, where crimes have directly impacted the species/crop.
- A = Associated crimes to the species/crop (e.g. theft of fencing from field allowing sheep out).

Table 6.1: Keyword search terms used to identify records for specific (S) and associated (A) crimes related involving Livestock/Crops (1/2).

		YEAR	2010		2011		2012		2013		2014		2015		TOTAL
			S	A	S	A	S	A	S	A	S	A	S	A	
LIVESTOCK/CROP – TERMINOLOGY	ACTIONS	Rustling	-	-	-	-	-	-	0	0	0	0	0	0	0
		Rustled	-	-	-	-	-	-	-	-	-	-	-	-	-
		Worrying	-	-	-	-	-	-	-	-	0	0	0	0	0
		Worried	-	0	-	0	0	1	0	0	0	0	0	0	1
		Mutilat*	0	0	1	0	0	0	0	-	0	-	0	-	1
		Slaughter*	0	0	1	0	0	0	0	0	0	0	0	0	1
	SPECIES	Livestock	0	2	0	1	1	6	0	0	0	1	1	1	13
		Herd	0	0	0	0	0	0	0	1	0	0	0	0	1
		Flock	-	-	0	0	-	-	0	0	-	-	-	-	0
		Goat	0	1	1	0	0	0	0	0	0	0	0	0	2
		Pig	1	3	5	1	2	1	3	2	1	2	4	0	25
		- Sow/s	-	-	0	0	0	0	-	-	-	-	-	-	0
		- Hog/s	0	0	0	0	0	0	0	0	0	0	0	0	0
		- Swine/s	0	0	0	0	0	0	0	0	0	0	0	0	0
		- Barrow/s	0	0	0	0	0	0	0	0	0	0	0	0	0
		- Gilt/s	0	0	0	0	0	0	0	0	0	0	0	0	0
		- Boar/s	0	0	0	0	-	0	-	0	-	0	0	1	1
		Cattle	0	1	0	8	1	9	2	2	1	5	2	2	33
		- Bull/s	0	0	0	0	0	0	0	0	0	0	0	0	0
		- Steer/s	0	-	0	0	1	0	0	0	0	-	1	0	2
		- Springer/s	0	0	0	0	0	0	0	0	0	0	0	0	0
		- Ox	0	0	0	0	0	0	0	0	0	0	0	0	0
		- Cow	3	2	2	0	0	2	1	4	0	4	1	2	21
		- Heifer	1	0	1	0	0	-	0	-	0	0	0	-	2

Table 6.1 continued: Keyword search terms used to identify records for specific (S) and associated (A) crimes involving Livestock/Crops (2/2).

		YEAR	2010		2011		2012		2013		2014		2015		TOTAL
			S	A	S	A	S	A	S	A	S	A	S	A	
LIVESTOCK/CROP – TERMINOLOGY	SPECIES	- Calf	0	3	0	3	0	1	0	1	0	0	1	0	9
		- Calves	0	1	-	0	-	0	0	0	0	0	0	0	1
		Sheep	4	6	12	6	2	11	12	10	6	7	13	4	93
		- Ewe	1	0	4	0	0	0	2	0	1	0	3	0	11
		- Ram/s	0	0	0	0	0	0	0	0	0	0	0	0	0
		- Mutton/s	0	0	0	0	0	0	0	0	0	0	0	0	0
		- Wether/s	0	0	0	0	0	0	0	0	0	0	0	0	0
		- Yearling/s	0	0	0	0	0	0	0	0	0	0	0	0	0
		- Lamb	5	1	4	0	2	1	5	0	4	0	2	0	24
		Chicken	6	4	16	7	12	4	13	9	9	5	12	2	99
		- Hen/s	0	0	5	0	0	0	2	0	1	0	1	0	9
		- Cockerel/s	0	0	0	0	-	-	-	-	-	-	0	0	0
		Poultry	0	4	3	0	1	0	0	1	0	0	1	0	10
		Bird	2	0	0	1	2	0	0	0	0	0	2	0	7
		Duck	1	0	2	0	1	0	2	1	2	0	5	0	14
		Game	1	0	1	0	0	0	0	0	2	0	0	1	5
		Pheasant	7	0	4	4	0	0	2	4	4	3	7	5	40
		Turkey	2	0	1	0	1	0	2	0	1	0	0	0	7
		Partridge	1	0	1	0	0	0	1	0	2	1	1	0	7
		Geese	0	0	2	0	2	0	2	0	0	-	0	-	6
		Crop	5	2	9	0	1	2	1	1	9	0	6	0	36
		- Barley	0	0	0	0	0	0	0	0	0	0	0	0	0
		- Wheat	3	0	5	0	1	0	2	0	0	0	1	0	12
		TOTAL	43	30	80	31	30	38	52	36	43	28	64	18	493

Table 6.2: Keyword search terms used to identify records for specific (S) and associated (A) crimes involving Wildlife.

		YEAR	2010		2011		2012		2013		2014		2015		TOTAL
			S	A	S	A	S	A	S	A	S	A	S	A	
WILDLIFE – TERMINOLOGY	ACTIONS	Poach	0	-	8	0	3	0	11	1	13	0	31	0	67
		Coursing	-	-	-	-	-	-	-	-	-	-	-	-	0
		Baiting	-	-	-	-	-	-	-	-	0	0	-	-	0
		Baited	-	-	-	-	-	-	-	-	-	-	-	-	0
		Trap*	0	0	1	0	0	0	0	0	0	0	0	0	1
		Snare*	0	0	-	-	-	-	0	0	-	-	-	-	0
		Hunt*	0	0	0	0	0	0	0	0	0	0	1	0	1
		Poison*	0	0	0	0	0	0	0	0	0	0	0	0	0
		Lamping	0	0	1	0	0	0	0	-	0	0	1	0	2
		Lamped	0	0	0	0	0	0	0	0	0	0	0	0	0
		Persecution	-	-	-	-	-	-	-	-	-	-	-	-	0
		Persecuted	-	-	-	-	-	-	-	-	-	-	-	-	0
	SPECIES	Wildlife	1	0	0	0	1	0	1	0	1	3	0	-	7
		Fox	0	0	0	0	0	0	0	0	0	1	0	0	1
		Badger	1	0	0	0	0	-	0	0	0	0	1	5	7
		Hare	0	0	0	0	0	0	0	0	0	0	1	0	1
		Bat	0	0	1	0	0	0	0	0	0	1	0	0	2
		Bats	0	0	0	0	0	0	0	0	0	0	-	-	0
		Deer	3	0	4	0	1	1	6	2	1	0	4	0	22
		- Stag/s	0	0	0	0	0	0	0	0	0	0	0	0	0
		- Buck/s	0	0	0	0	0	0	0	0	0	0	0	0	0
		- Doe	0	0	0	0	0	0	0	0	0	0	0	0	0
		- Fawn/s	0	0	0	0	0	0	0	0	0	0	0	0	0
		TOTAL	5	0	15	0	5	1	18	3	15	5	39	5	111

Filtering of Crimes

The crimes were filtered for duplicates using the crime identification number, and then by date to identify any crimes that may have been recorded twice but under separate crime identification numbers (as shown in Table 6.3).

Initial removal of duplicates did not exclude concatenated crimes (e.g. deer poaching damaging crops) that appeared in multiple keyword searches. However, during the subsequent analysis of Livestock and Wildlife crimes, concatenated crimes were removed from all but one keyword category, so when crimes were totaled the same incident was not counted multiple times, e.g. three times in POACH, DEER and CROPS.

Table 6.3: Number of returned crimes when using Keywords to search Free Text Fields of Crime Data.

Year	Specific Crimes	Associated Crimes
2010	47	60
2011	103	43
2012	41	59
2013	74	57
2014	61	54
2015	106	38
Total	432	311
Grand Total		743
Filtering/Reallocation of Returned Results		
2010	48	30
2011	95	31
2012	35	39
2013	70	39
2014	58	34
2015	103	25
Total	409	198
Grand Total After Crime Number Duplicate Removal/Reallocation		607
Grand Total After Removal of Crimes without Date Information		606
Grand Total After Duplicate Removal (Concatenated Crimes)		569

Results of Data Extraction

In addition to being separated by Specific and Associated crime types, the returned results were separated into Livestock (473) and Wildlife (96) crimes. The total number of crimes recorded were separated by year to assess whether there was a significant variation between the years. The proportion of Livestock crimes varied from 14% to 22% between 2010 and 2015 (see Figure 6.1).

However, a greater difference was observed for Wildlife crimes over this same period, with over 50% of the total Wildlife crimes reported to Dorset police being recorded between 2014 and 2015 (see Figure 6.1). This may be the result of increasing attention being paid to Wildlife crimes in recent years, encouraging the reporting of these crimes, or may indicate an increase in these crimes over the data period, however, the true reason cannot be inferred from the data alone.

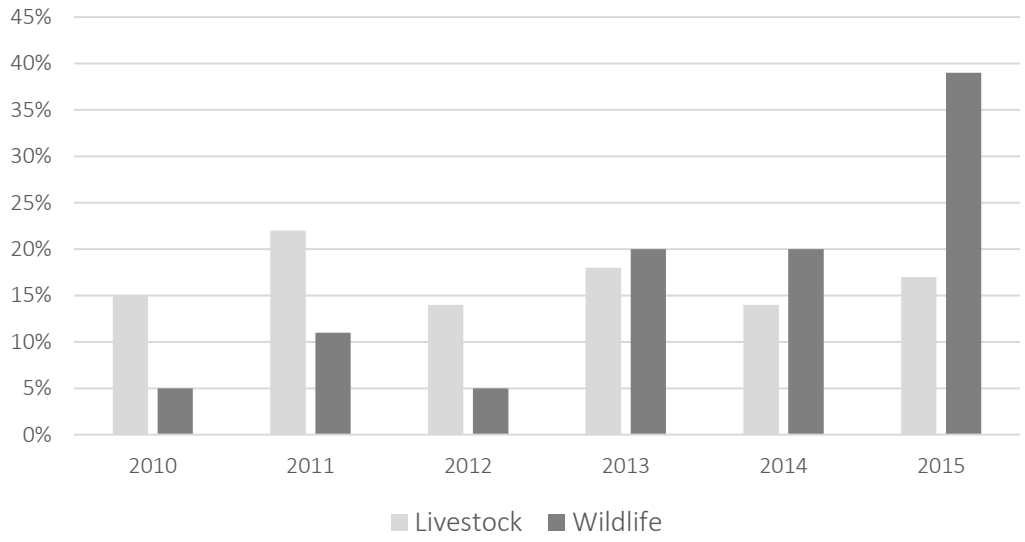


Figure 6.1: Proportion of all Livestock & Wildlife crimes over a five-year period (2010-2015).

Seasonal Analysis

In total over the six-year period (2010-2015) there were 569 crimes recorded by Dorset Police force that contained one of the keywords. The returned crimes were filtered (as described earlier in the chapter) into species specific crimes and associated crimes. These were then

further separated into Livestock (473) and Wildlife (96) groups, with 4.9 times as many Livestock crimes recorded over the six-year period compared to Wildlife crimes.

Other studies that have Investigated crime seasonality have used thousands of records over decades to identify seasonal trends. Once the 569 crimes were separated by species, the count of crimes for each species per year became very small in number (see Table 6.4), therefore the data was insufficient to perform analysis such as seasonal decomposition with any level of accuracy. Whilst the data sample was too small to assess seasonality for each individual year between 2010 and 2015, the monthly crime total for all years combined was used to identify any potential crime trends, and to see whether individual species crime patterns may be masked by only looking at the overall figures for Livestock and Wildlife species together. If variation in these crime types exists compared to the pattern for All Livestock and Wildlife crime, it would highlight the need for accurate disaggregation of these crime types.

The date recorded with each crime was used to identify the month in which the crimes occurred. To address the issue that there may be a delay between when the crime occurred and when it was reported to the Police, the 'Crime Start Date' value was used instead of the 'Crime Reported Date' which could differ by days or even weeks.

The percentage variation from the mean was calculated for the disaggregated Livestock and Wildlife species, as well as the disaggregated species specific and associated crimes (shown in Figures 6.2 – 6.4, 6.8 – 6.14). The Pearson correlation analysis was calculated using the percentage variation from the annual mean for all of the species included in the analysis.

Table 6.4: Number of species specific crimes and associated crimes between 2010 and 2015.

Species	Crime Type	Number of Crimes (n = 537)
Livestock: Pigs	Specific	16
	Associated	10
	Total	26
Livestock: Cattle	Specific	18
	Associated	50
	Total	68
Livestock: Chicken	Specific	77
	Associated	31
	Total	108
Livestock: Other Birds	Specific	66
	Associated	26
	Total	92
Livestock: Sheep	Specific	82
	Associated	46
	Total	128
Wildlife: Poaching*	Specific	66
	Associated	1
	Total	67
Farm Produce: Crops	Specific	43
	Associated	5
	Total	48

*Note: The total number of crimes is lower than N = 569, as certain species only returned a small number of crimes (e.g. badger, hare, etc.) over the six year period.

Seasonal Variation in Livestock and Wildlife Crimes

Figure 6.4 presents the annual trend of all the crimes involving or related to Livestock and Wildlife prior to the data being disaggregated (N = 569).

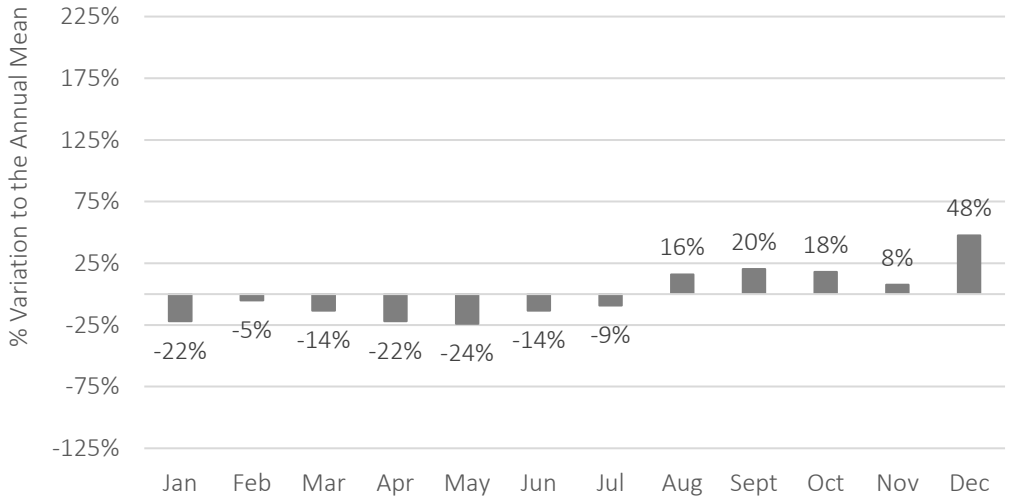


Figure 6.2: Percentage variation around the annual mean of all Livestock and Wildlife Crimes (both species specific and associated crimes) (N = 569).

The correlation between Livestock and Wildlife crimes were assessed and the results indicated that a weak positive correlation (r = 0.37) existed between the annual variations.

Figures 6.5 and 6.6 present all Livestock and Wildlife related crimes and their variation from that of all crimes. Wildlife crime shows a more pronounced variation to the Livestock crime, which is likely due to the smaller number of crimes recorded for Wildlife in comparison to Livestock. Wildlife crime appears to peak towards the end of the year which is similar not only with anecdotal evidence about wildlife crime (such as hare coursing), but also with the data collected in the victimisation survey of farmers (Chapter Four), where farmers indicated a higher level of wildlife crime occurring at the start and end of the year (see Figure 6.7).

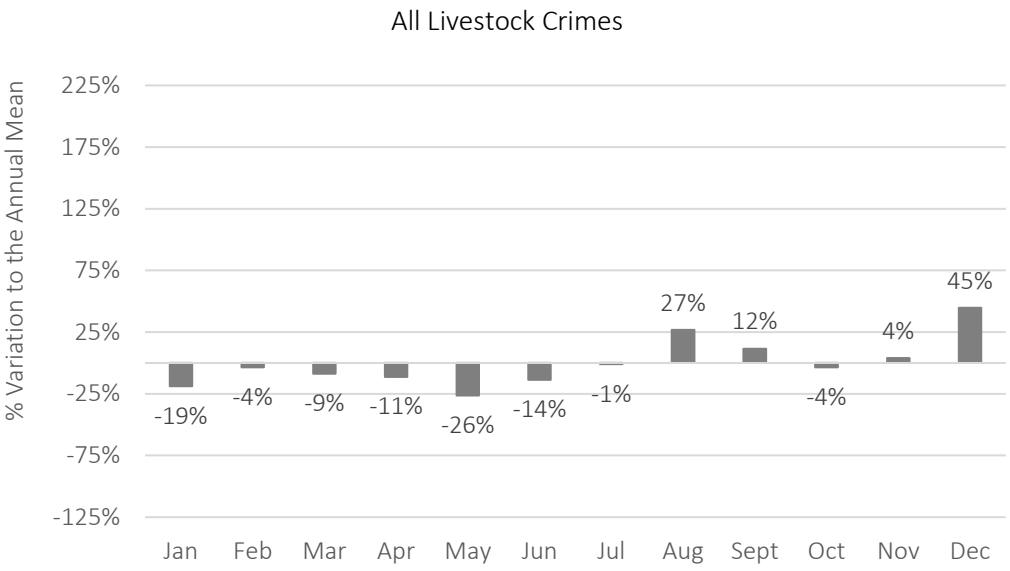


Figure 6.3: The percentage variation of All livestock crimes (n = 473) between 2010 and 2015.

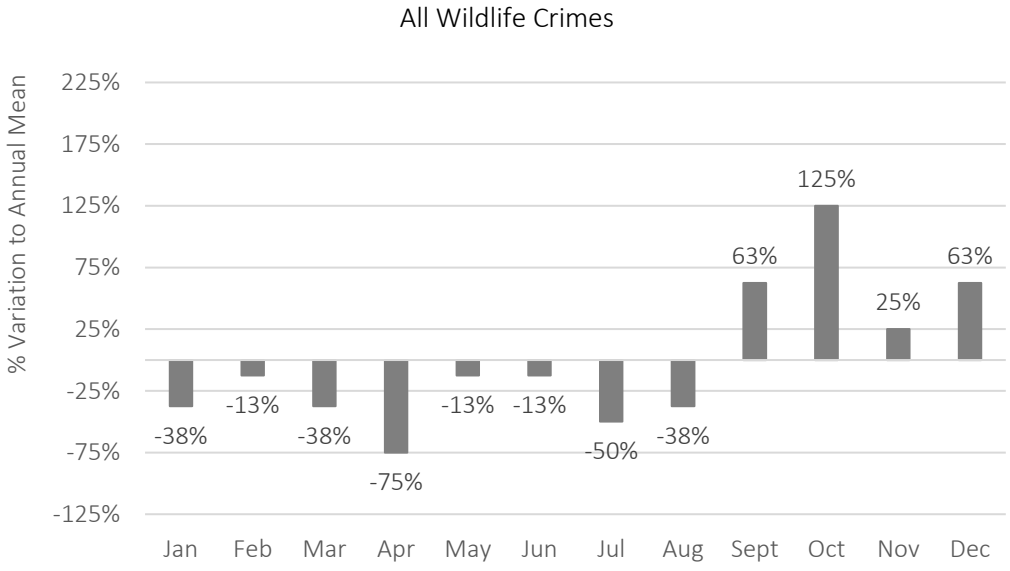


Figure 6.4: The percentage variation to the annual mean of All wildlife crimes (n = 96) between 2010 and 2015.

The victimization survey of farmers (Chapter Four) asked respondents to indicate when they experienced Livestock and Wildlife crimes during the year. The results (shown in Figure 6.7) indicated that these crime types had opposing annual patterns. The crime data did not show a distinct annual pattern for Livestock crimes, however, the annual trend in Wildlife crimes does

follow a similar pattern to that shown in the survey results, with more crimes occurring particularly towards the end of the year.

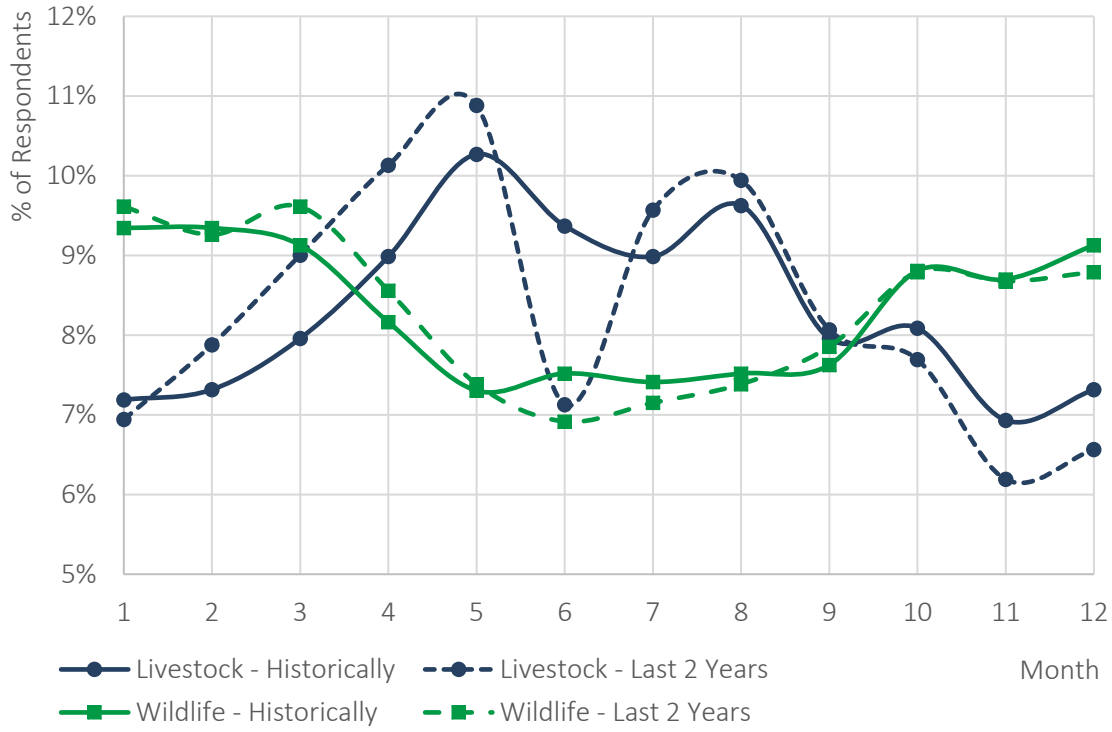


Figure 6.5: Seasonal patterns of Livestock (Historically – n = 184, cases = 779, Last 2 Years – n = 138, cases = 533) & Wildlife (Historically – n = 142, cases = 931, Last 2 Years – n = 129, cases = 853) crimes (for the previous 2 years and historically) excluding those who answered 'Don't Know' and 'N/A'.

Livestock: Pigs

Crimes involving Pigs (see Figure 6.6) did not produce a visually discernable annual pattern. When species specific and associated crimes were combined, crimes involving Pigs (r = 0.36) was found to have a weak positive correlation to the annual pattern of All crimes.

When the species specific crimes and associated crimes were separately plotted, the species specific crimes for Pigs (r = 0.72) were found to have a strong positive correlation to the annual pattern of All crimes; whilst the associated crimes to Pigs (r = -0.36) showed a weak negative correlation to the annual pattern of All crimes.

Livestock: Cattle

Similarly to Pigs, all crimes involving Cattle when plotted (see Figure 6.7) did not produce a visually discernable annual pattern. When species specific and associated crimes were combined, crimes involving Cattle (r = 0.06) were found to have a very weak positive correlation to the annual pattern of All crimes.

When the species specific and associated crimes were separately plotted, the species specific crimes for Cattle (r = 0.31) were found to have a weak positive correlation to the annual trend of All crimes; whilst the associated crimes to Cattle (r = -0.20) showed a weak negative correlation to the annual pattern of All crimes.

Livestock: Sheep

When species specific and associated crimes were combined for Sheep (see Figure 6.8), crimes involving Sheep (r = 0.63) were found to have a moderate positive correlation to the annual pattern of All crimes. However, when the species specific and associated crimes were separately plotted, the species specific crimes for Sheep (r = 0.26) were found to have a weak positive correlation to the annual trend of All crimes; whilst the associated crimes to Sheep (r = 0.67) showed a moderate positive correlation to the annual pattern of All crimes. This highlights the need for disaggregation of these crime types.

Livestock: Chicken

Chicken related crimes produced a negative trend throughout the year, with crimes reducing in number as the year progressed (see Figure 6.9). This was found for both species specific crimes and associated crimes and had a weak correlation with the annual trend for All crime.

When species specific and associated crimes were combined, crimes involving Chicken (r = -0.48) were found to have a weak negative correlation to the annual pattern of All crimes.

When the species specific and associated crimes were separately plotted, the species specific crimes for Chicken (r = -0.50) were found to have a moderate negative correlation to the annual trend of All crimes; whilst the associated crimes to Chicken (r = -0.24) showed a weak negative correlation to the annual pattern of All crimes.

Livestock: Other Birds

The crime records for Chickens were intentionally separated from the records of other birds (e.g. Turkeys, Pheasant, Partridge, Geese etc.) to establish if any variation existed between the annual patterns in these crime types. Other Bird related crimes produced a distinct positive trend throughout the year, with the number of crimes increasing as the year progressed (see Figure 6.10).

When species specific and associated crimes were combined, crimes involving Other Birds ($r = 0.94$) were found to have a strong positive correlation to the annual pattern of All crimes.

When the species specific and associated crimes were separately plotted, the species specific crimes for Other Birds ($r = 0.92$) were found to have a strong positive correlation to the annual trend of All crimes; whilst the associated crimes to Other Birds ($r = 0.58$) showed a moderate positive correlation to the annual pattern of All crimes.

Produce: Crops

The crime records relating to crops were found to overlap with most crimes involving the poaching of deer, therefore these have been considered together. Crops showed an increasing number of crimes throughout the year (see Figure 6.11a), will a large peak around November/December, and showed a very weak positive correlation ($r = 0.28$) to the annual pattern found for All crimes.

Wildlife: Poaching & Deer

Poaching & Deer related crimes were found (similarly to Crops) to peak towards the end of the year (see Figure 6.11b,c) which was indicated by the responses from farmers in the victimisation survey of farmers (Chapter Four). The results for all crimes relating to Poaching ($r = 0.60$) and Deer ($r = 0.53$) showed a moderate positive correlation to the annual pattern of All crimes with an increase towards the end of the year.

Wildlife & Livestock Crimes

The results for all crimes relating to Livestock and Wildlife were compared to the results of the Farmer Survey, to assess where the patterns in crime data corresponded to the pattern in these crime types by respondents to the farmer survey. The results (see Table 6.5) show that the

annual patterns in crime types were not correlated to the patterns in Livestock and Wildlife crime from the survey.

Table 6.5: Correlation between the annual patterns of Livestock and Wildlife crimes and the annual patterns of Livestock and Wildlife crimes in the Victimisation Survey.

Livestock	L - Historically	L - Last 2 Years
All Livestock Crime	-0.30	-0.35
Pig (Specific)	0.03	-0.10
Pig (Associated)	0.09	-0.15
Pig (All Crimes)	0.11	-0.23
Sheep (Specific)	-0.26	0.09
Sheep (Associated)	-0.28	-0.53
Sheep (All Crimes)	-0.38	-0.26
Cattle (Specific)	-0.37	-0.26
Cattle (Associated)	0.13	0.17
Cattle (All Crimes)	-0.14	-0.05
Chicken (Specific)	0.35	0.35
Chicken (Associated)	-0.10	0.07
Chicken (All Crimes)	0.24	0.30
Other Birds (Specific)	-0.36	-0.46
Other Birds (Associated)	0.24	0.13
Other Birds (All Crimes)	-0.22	-0.35
Crops (All Crimes)	0.06	-0.20
Wildlife	W – Historically	W - Last 2 Years
All Wildlife Crimes	0.33	0.18
Poach (All Crimes)	0.45	0.32
Deer (All Crimes)	0.55	0.40

Livestock: Pigs

Figure 6.6: (a) Pig: All (n = 26), (b) Pig: Species specific crimes (n = 16), (c) Pig: Associated crimes (n = 10)

Livestock: Cattle

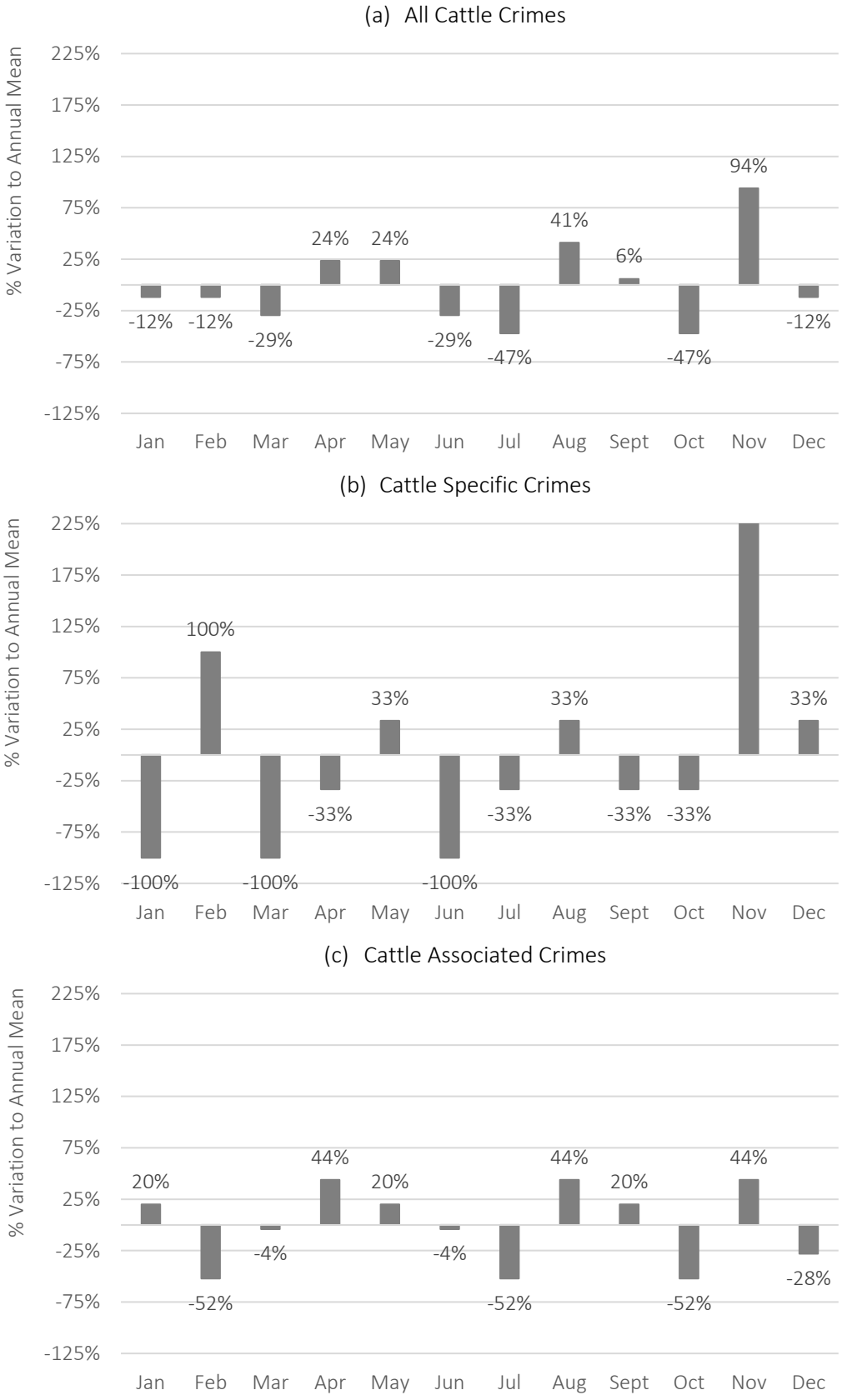


Figure 6.7: (a) Cattle: All (n = 68), (b) Cattle: Species specific crimes (n = 18), (c) Cattle: Associated crimes (n = 50).

Livestock: Sheep

Figure 6.8: (a) Sheep: All (n = 128), (b) Sheep: Species specific crimes (n = 82), (c) Sheep: Associated crimes (n = 46).

Livestock: Chicken

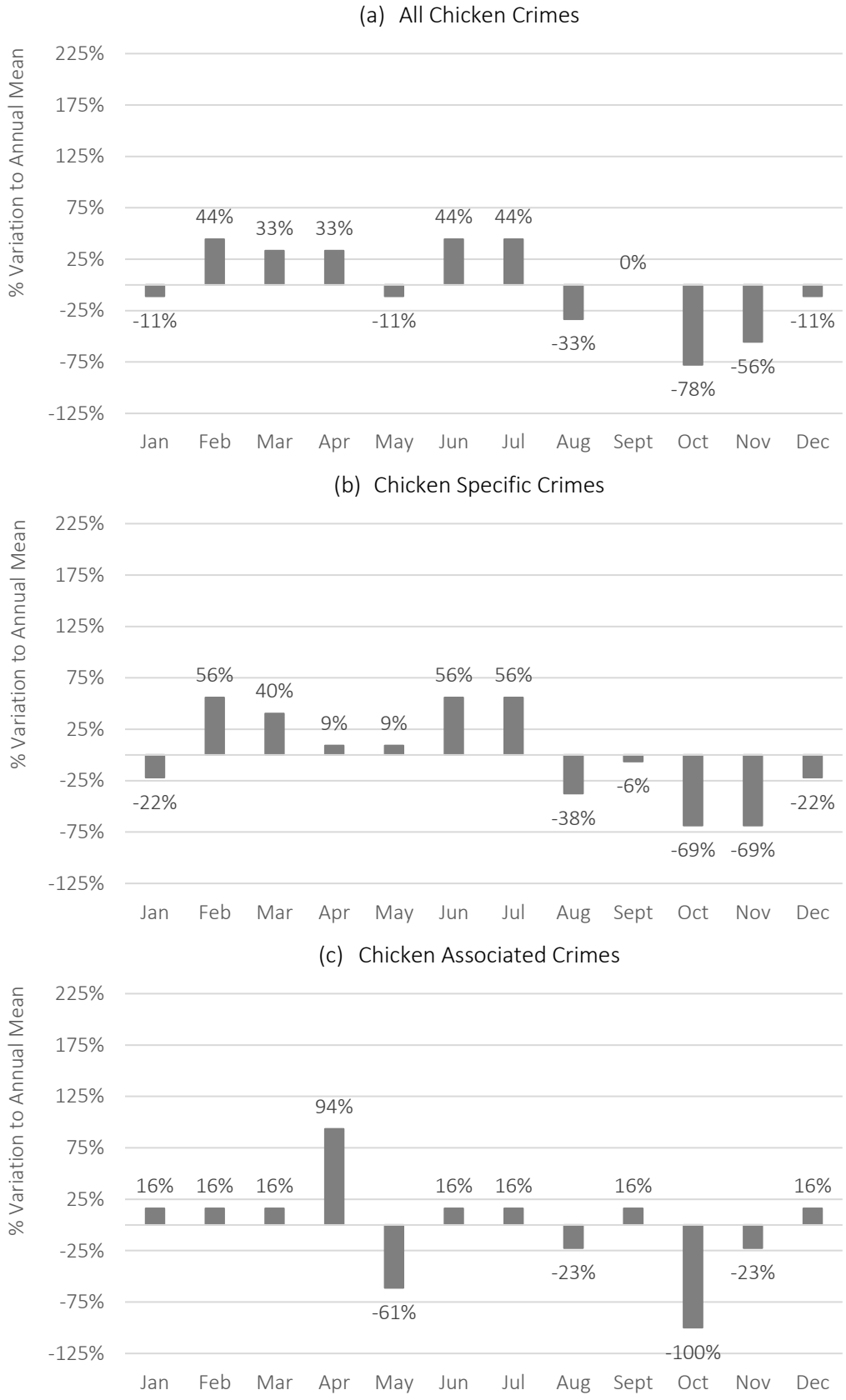


Figure 6.9: (a) Chicken: All crimes (n = 108), (b) Chicken Species specific crimes (n = 77), (c) Chicken: Associated crimes (n = 31).

Livestock: Other Birds

Figure 6.10: (a) Other Birds: All crimes (n = 92), (b) Other Birds: Species specific crimes (n = 66), (c) Other Bird: Associated crimes (n = 26).

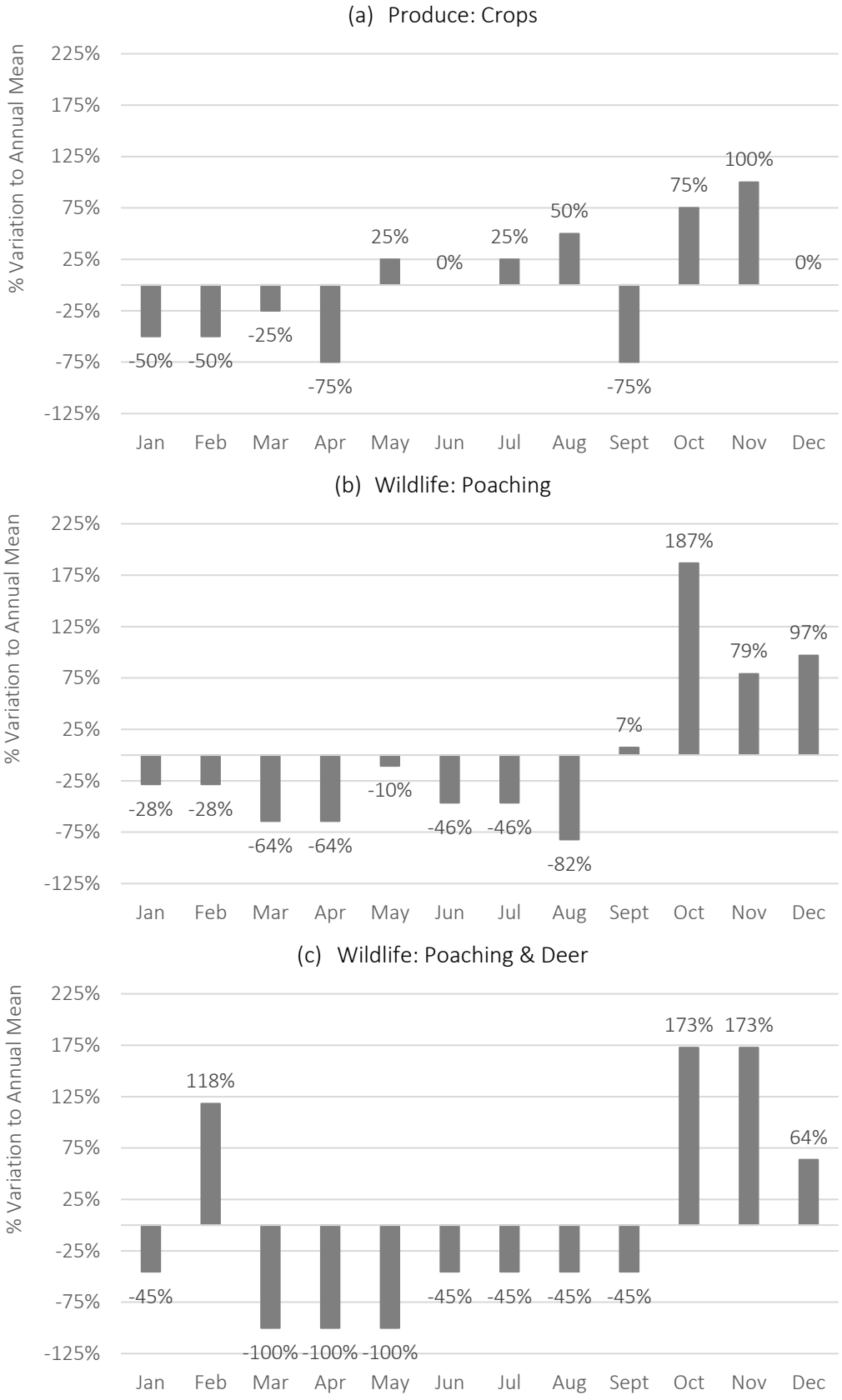


Figure 6.11: (a) Crop: All crimes (n = 48), (b) Poaching: All crimes (n = 67), (c) Deer: All crimes (n = 22).

Livestock: Chickens vs Other Birds

The annual patterns for Chicken and Other Bird related crimes were examined further by plotting these crime types together, which highlighted the inverse pattern in occurrence. The crime types were found to have a moderate negative correlation (r = -0.61) as shown in Figure 6.12.

The importance of disaggregating the variation in crime patterns between Livestock and Wildlife species types, is highlighted by Figure 6.12. Even when disaggregating the data into broader categories (e.g. Birds, Pigs, Cattle etc.) without further filtering the data (e.g. Dairy Cattle, Meat Cattle, Chickens, Other Birds etc.) annual crimes patterns may be masked.

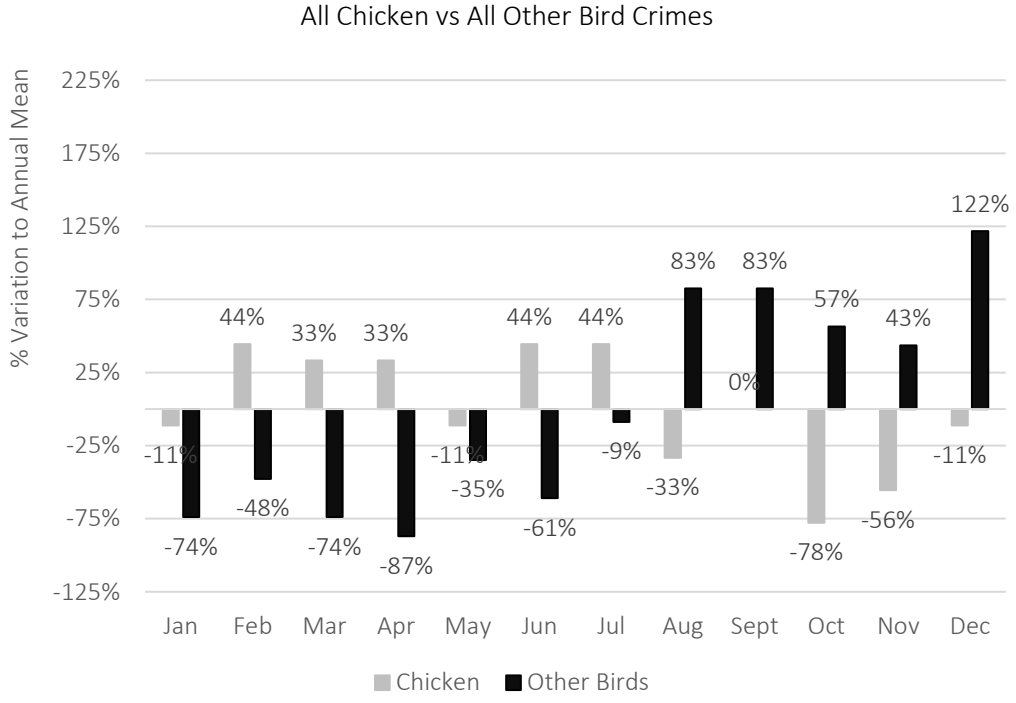


Figure 6.12: The seasonal pattern of all Chicken crimes (n = 108) vs All Other Bird crimes (n = 92).

Explanatory Variables

Seasonal variation in crimes has typically been compared to variation in temperature, and other variables that are associated to the routine activities of victims and offenders. The patterns that have emerged are compared to factors such as Temperature, Livestock Price, the routine activities of Livestock (AgriRA) and Wildlife (WildRA), and crop height, to assess whether there is any correlation between these factors and the patterns observed in the Farmer Survey and Crime Data.

Temperature

The temperature agression theory for seasonal variation in crime, hypothesizing that changes in temperature correlate with variation in crime occurrence. The rates of Livestock and Wildlife crimes were assessed in relation to the average temperature in South West England (see Figure 6.13). The results of the correlation for all species types showed a very weak or weak relationship with Temperature (shown in Table 6.6).

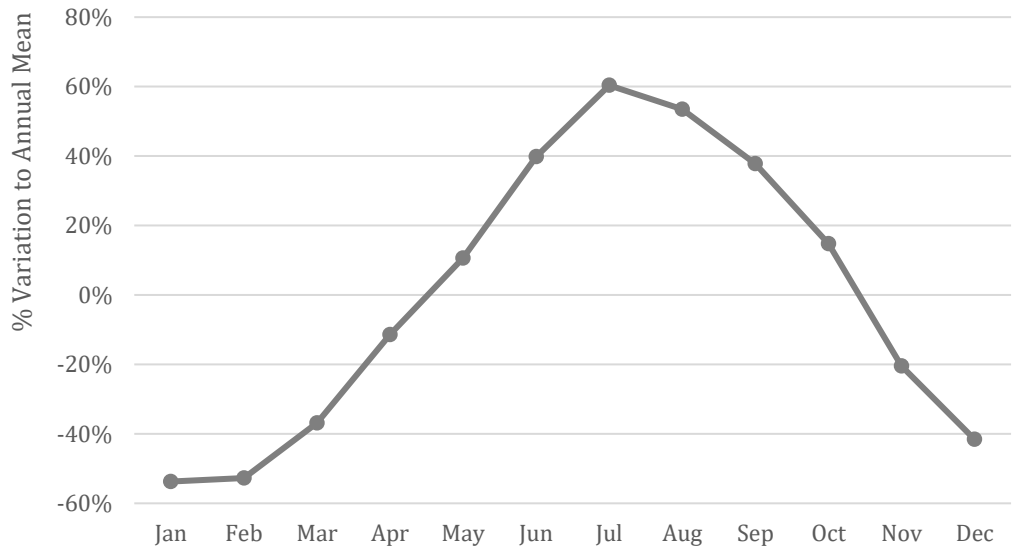


Figure 6.13: Average temperature in the South West of England between 2010 and 2015 (Met Office, 2019).

Table 6.6: Correlation (r) results for Temperature and Species types (All, Species specific and Associated)

	Temp	Strength of Correlation
All Crimes	0.059	Very Weak Positive
Livestock Crimes	0.071	Very Weak Positive
Wildlife Crimes	0.014	Very Weak Positive
Pig (All Crimes)	0.350	Weak Positive
Pig (Specific)	0.283	Very Weak Positive
Pig (Associated)	0.093	Very Weak Positive
Sheep (All Crimes)	-0.352	Weak Negative
Sheep (Specific)	-0.208	Very Weak Negative
Sheep (Associated)	-0.303	Weak Negative
Cattle (All Crimes)	-0.075	Very Weak Negative
Cattle (Specific)	-0.172	Very Weak Negative
Cattle (Associated)	0.047	Very Weak Positive
Chicken (All Crimes)	-0.019	Very Weak Negative
Chicken (Specific)	0.066	Very Weak Positive
Chicken (Associated)	-0.213	Very Weak Negative
Other Birds (All Crimes)	0.277	Very Weak Positive
Other Birds (Specific)	0.158	Very Weak Positive
Other Birds (Associated)	0.483	Weak Positive
Poach (All Crimes)	-0.152	Very Weak Negative
Poach (Specific)	-0.135	Very Weak Negative
Deer (All Crimes)	-0.260	Very Weak Negative
Deer (Specific)	-0.243	Very Weak Negative
Crops (All Crimes)	0.295	Very Weak Positive
Crops (Specific)	0.195	Very Weak Positive

Livestock Price

The commercial value of the livestock could be considered as a potential predictor of when livestock crimes are more likely to occur annually. To try and account for this the average price of livestock (Cattle, Pigs and Sheep) between 2015 and 2018 were averaged and the annual patterns were plotted (see Figure 6.14). The percentage variation to the annual mean was calculated and compared to the same figure for these three livestock types.

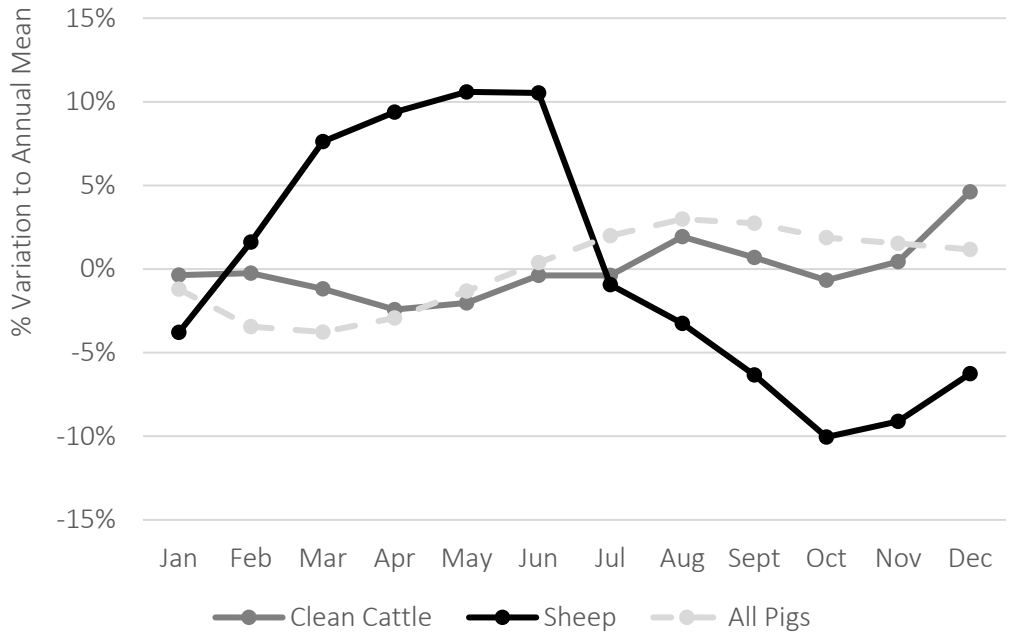


Figure 6.14: Average price of Livestock between 2015 and 2018 in Great Britain (GOV UK Livestock Prices, 2019).

The annual pattern in the price of Clean Cattle was found to have very weak to weak positive correlation to All crimes relating to Cattle (r = 0.08) and Species specific crimes (r = 0.26); whilst the Associated crimes to Cattle (r = -0.12) showed a very weak negative correlation to the annual pattern in price.

The annual pattern in the price of Sheep was found to have a weak negative correlation to All crimes relating to Sheep (r = -0.38), Species specific crimes (r = -0.29), and Associated crimes to Sheep (r = -0.25) to the annual pattern in price.

The annual pattern in the price of Pigs was found to have a weak to moderate positive correlation to All crimes relating to Pigs (r = 0.42) and Species specific crimes (r = 0.56); whilst Associated crimes to Sheep (r = -0.12) was found to have a very weak negative correlation to the annual pattern in price.

These results indicate that the price of livestock does not seemingly correlate with the annual pattern in Livestock crimes for Cattle, Pigs and Sheep.

Crime Pattern Theory (RAT) - AgriRA and WildRA

Previous research that has looked at crime pattern theory in relation to Wildlife crime has tended to focus on how the routine activities of the offender and witness/enforcement team affects the committal and detection locations of crimes (Ceccato & Uittenbogaard, 2013). Whilst it is important to consider how the movements of offenders and enforcement teams can influence the detection and interpretation of crime data, very few studies have acknowledged how the routine activities of species contribute to the occurrence of crime.

A select few studies that have looked at how ecological factors can influence the detection of poaching (Leader-Williams et al, 1990). Biological and ecological factors relating to animals such as migration, preferred habitats, and availability of food/water, influence the movement of species within the environment. The movement of species due to ecological factors such as migration and hibernation, would in turn influence the spatial availability of the species and the locations targeted by offenders.

The variation in movement results in variation in the accessibility of species to would-be offenders, where species can move from 'safer zones', where it may be too risky to commit a crime (e.g. area is supervised), harder to access the area, or difficult to remove them from the location; to areas where thy may be more vulnerable, due to easy access, less supervision and/or the ability to remove species more easily.

The following section looks at potential biological and ecological factors associated to Livestock and Wildlife in the UK, and how these factors may influence the likelihood of victimization.

The routine activity based explanations for Livestock and Wildlife crime, are complicated by the fact that the victim is non-human, and as such does not fit into the traditional 'awareness space'

model used to explain the convergence of victims and criminals in space and time, that looks at activities such as home, work, school and leisure activities.

The Routine Activities of Livestock and Wildlife (known as AgriRA and WildRA from this point on) can be understood based on biological and ecological information about the species of interest. This information can then be used to assess whether AgriRA or WildRA factors correspond with the seasonal patterns in the species crime types. Information relating to the daily seasonal routine activities of specific Livestock and Wildlife species were identified and compiled into Tables 6.7, 6.8 and 6.9.

AgriRA – If the animals are not being intensively farmed (indoor farming practices that mean the animals rarely go outdoors) then it is important to consider the movement of livestock around the farmland throughout the year. The agricultural calendar for Sheep, Cattle and Crops can provide an indication of why and how livestock move around the farmland. Table 6.7 provides a simplified overview of the typical livestock practices found in the UK, and should not be thought of as a comprehensive calendar of all farming practices.

Livestock Management Methods – Farming production methods in the UK can be broadly divided into Intensive and Extensive:

- Intensively farmed livestock spend the majority of their lives within the confines of their housing facility, meaning any crimes they are victim to, are likely to occur within or close to that building.
- Extensively farmed livestock spend a portion of the year outdoors (typically spring and summer) where they can graze and spend the colder months indoors. This results in seasonal variation in Livestock location on the farm, with livestock being moved variables distances from the housing facilities to graze over the summer months.

- Grazing – Livestock may also be moved periodically between different fields/paddocks on farmland for the purposes of grazing (e.g. 'rotational grazing'), Each field may have differing risk associated to it, by its environmental features (e.g. Rights of Way through field, proximity to roads etc.) which in turn may alter the level of risk to livestock may vary over time depending on the Livestock's location. Pigs cannot gain all their required nutrition from grazing, therefore they require supplementations of their diet. The provision of

supplementary food for all Livestock can influence the frequency of interaction between the farmers and the livestock.

Note: Alternative methods of farming have nuanced ways of managing livestock, the methods discussed in this section have been generalised to illustrate the movement of Livestock on farmland, which may influence their vulnerability to crime.

Breeding:

- Sheep/Cattle – Between February and May extensively farmed livestock are often brought down/closer to bye-land (nearer to farmer and farm buildings) or inside housing facilities in preparation for lambing/calving, to monitor the expectant livestock and protect newborns. Movement of Livestock to fields/housing where the farmers can better monitor them, may influence the associated risk to the Livestock.
- Pigs – Are typically housed around the time of birth, or have their movement restricted in their outdoor housing facilities. They typically remain indoors or within their pens till the piglets are weaned. This may occur within a field or within housing facilities on the farm.
- Chickens – Able to breed all year round and have numerous clutches/broods per year. Chickens do not move periodically (daily or seasonally) based breeding as these species spend much of the year in the same location, where the risk associated to environmental features can be assumed to be fairly constant.

Activities:

- Shearing – Routine tasks involving Livestock can include activities such as shearing the wool on sheep which can happen once or twice annually depending on breed.
- Milking – Milking of Dairy cattle may involve cattle being brought into Milking facilities multiple times a day, which in turn influences the distance from the facilities the livestock can be practically kept for grazing.

Seasonal variation in crimes involving Livestock and Wildlife species should take into consideration these seasonal factors influencing the movement and location of species. The findings from the seasonality analysis in this chapter did not produce distinct annual patterns for most livestock types, but based on the findings from the victimisation survey of farmers (Chapter Four), livestock crimes were more likely to occur between March and September, which corresponds to the period of time when extensively managed livestock are grazing outdoors.

WildRA – For crimes to be committed against species, the species themselves must be available and accessible to the criminals. Therefore, a seasonal factor to consider is whether the species of interest migrate during the year, thereby making themselves less if not completely accessible to the local criminals.

Another factor to consider that may alter the accessibility of species to crime would be if the species were known to hibernate. The impact on accessibility due to hibernation is likely to vary amongst species but should nevertheless be considered as a possible impediment to criminals. The information collected about some of the species of interest to this thesis (e.g. hares, deer etc) (see Table 6.7), indicate that these species neither hibernate or migrate and can be found across the UK. The species being active and available to offenders throughout the year would imply that alternative factors must influence the seasonal variation in the crimes against these species.

Crop Height & Accessibility – Harvest usually takes place in August/September with the weather determining the exact timing. The presence of crops has been highlighted anecdotally as a reason for the seasonal variation in wildlife crimes such as Hare Coursing, where the 'season' runs from September to March and is known to increase immediately around harvest. The increase in hare coursing incidents post-harvest is known anecdotally to be because the fields have been cleared, making detection of hares by sight-hounds (dogs typically used for chasing hares) possible and easier access to farmland via foot and with vehicles due to absence of crop (Lincs Police: Hare Coursing, 2019).

There were several instances of crop damage in the Dorset crime data that occurred at the end of the year, and were associated to poaching crimes, when crops were being sown or had been sown and therefore had not reached their optimal height, which for Barley, Wheat and Oilseed Rape can range from 50cm to 150cm (AHDB Wheat Growth, 2019; SRUC Oilseed Rape, 2012; TEAGASC The Spring Barley Guide, 2015).

The information presented above and in Tables 6.7 to 6.9 provides a very brief and simplified overview of the seasonal movement/availability of Livestock and Wildlife, and how biological and ecological patterns and livestock management practices may contribute to the risk of victimisation.

Table 6.7: Routine Activities of Livestock & Crops (Land/Crops and Sheep)) (1/3).

		Routine Activities of Livestock & Crops
Land/ Crops[1]	Jan – Mar	Spread slurry if the fields are dry and firm. These are the fields from which hay or silage will be taken later in the year.
	Apr	Fertiliser spread on grazing fields to aid spring growth.
	May	Livestock is stopped from grazing the silage fields
	Jun	Farmers will start haymaking around this time. The hay will be used to feed livestock in the winter
	Jul	Start of the combine season for cereal crops like barley and maize.
	Aug – Nov	Combine harvest cereals, bale and cart straw. Ploughing and general cultivations. Drill winter wheat, oilseed rape and barley for next years harvest.
	Dec	Farmers will be busy ploughing the fields.
Sheep[2]	Jan	Housed and Fed.
	Feb	Pregnant Sheep scanned.
	Mar – Apr	Lambing Time – Ewes and lambs often need round-the-clock attention so are brought to the in-bye land. Lowland – Indoor lambing is common. Most lambs spend their lives on pasture. Store lambs are transported to different areas to overwinter on grass. Hill & Upland – Hill or Upland flocks typically lamb outside. Flocks are usually gathered and brought down to lower, more sheltered land prior to lambing.
	May	Tagging and Castration.
	Jun	Sheep shearing.
	Aug – Sept	The lambs born in spring will be back out in the fields. Lambs will graze on the grass after the hay and silage crops have been taken which is known as aftermath grazing.
	Oct – Nov	Incoming colder temperatures, mean livestock will usually be housed. Alternatively, livestock will be brought lower down if on hills or closer to farm house (in-bye land). Active feeding of livestock rather than let them graze as grass is not growing and is deteriorating in quality.
	Dec	Housed and Fed
	Extensive	Sheep are extensively farmed as they are not suited to the intensive production methods that can be used with Pigs and Cattle.

Table 6.7: Continued – Routine Activities of Livestock & Crops (Cattle (Meat/Dairy) Pigs and Chickens (Broiler/Meat)) (2/3).

		Routine Activities of Livestock & Crops
Cattle (Meat/Dairy)[3]	Jan	Housed and Fed.
	Feb – May	Calving Time. Dairy cows are allowed outside between March and May if the weather is good enough and the ground is dry enough.
	Jun – Aug	Dairy cattle are mostly outside between June and August, except for bad weather and milking times (typically brought in twice daily for milking).
	Sept – Nov	As the temperature becomes colder, livestock will be housed indoors, with active feeding of livestock as grass is not growing and is deteriorating in quality.
	Dec	Housed and Fed.
	Intensive	Indoor systems where, in some cases, they may be housed throughout their lives.
	Extensive	Grazing-based systems where they are mainly kept in fields and may be housed for part of the year.
Pigs[4]	Indoor	Pig farming indoors accounts for 60% of herds in the UK. Pigs are placed into Farrowing crates a week prior to giving birth and remain there for a month afterwards till the piglets are weaned.
	Outdoor	Pig farming outdoors accounts for 40% of herds in the UK.
	Breeding	Pigs can breed all year round, therefore are not limited to a particular time of the year. Most pigs are housed indoors after weaning for growing/finishing.
Chickens (Broiler/ Meat)[5]	Indoor Reared	The majority of meat chickens are reared in large, closed buildings, where temperature, artificial lighting, ventilation, food and water are carefully controlled. A single building can house 25,000 birds, with some even housing up to 50,000 birds, with farms able to house several buildings.
	Improved Indoor Reared	A smaller proportion of meat chickens are reared in indoor systems with additional improvements such as: natural daylight through windows, reduced stocking densities and environmental enrichment such as straw bales for the birds to peck at.
	Free Range and Organic	Free-range and organic systems require improvements relating to space within the building and the age of the birds at slaughter. Free range and Organic systems allow chickens access to additional outdoor range area for part of their lives, accessed through ‘ popholes’ in the side of the building.

Table 6.7: Continued – Routine Activities of Livestock & Crops (Chickens (Laying Hens/Eggs)) (3/3).

		Routine Activities of Livestock & Crops
Chickens (Laying Hens/Eggs)[6]	Enriched & Colony Battery Cages	Cages are housed indoors and can contain up to 90 hens. ‘ Enriched’ & Colony Battery cages were used for the production of 44.2% of eggs in 2018.
	Barn Systems	In barn systems give hens freedom and space to move around within a building. Barn systems were used for the production of 1.4% of egg in 2018.
	Free Range	Most free-range hens live in buildings like the barn system but have access to the outside and vegetation during the daytime. Free range systems accounted for 51.9% of egg throughput in 2018, with Organic production accounting for an additional 2.5% in 2018

1 GWCT (2019); Chilterns AONB (2019); 2 RSPCA (2019e); 3 RSPCA (2019a); RSPCA (2019b); 4 RSPCA (2019d); 5 RSPCA (2019c); 6 RSPCA (2019f); The Game Farmers’ Association. Game Farming in the UK. (n.d.).

Table 6.8: Routine Activities of Wildlife (Brown Hare, Mountain Hare, Irish Hare, European Badger and Roe Deer) (1/2).

	Routine Activities of Wild Species	
Brown Hare[1]	Hibernation	Does not Hibernate.
	Movement	Arable farmland, create small depressions in ground called ‘ forms’ in which they lay down. Home range within approx. 1 km^2
	Day/Night	Nocturnal (feed at night and rest during the day)
Mountain Hare / Irish Hare[2]	Hibernation	Does not Hibernate.
	Movement	Lives in upland areas (above 300m to 400m) and is most common on Heathland and Moorland. Home range for Mountain Hares (Scotland) is 113 hectares for males and 89 hectares for females. Home range for Irish Hares is 50 hectares for males and 21.5 hectares for females.
	Day/Night	Nocturnal (active at night and rest during the day)
European Badger[3]	Hibernation	Do not hibernate but activity patterns change during the seasons. January to February - Badgers less active above ground. March to April - Cubs exploring but remain close to the sett. May to June - Badgers are emerging from sett more. Cubs are weaned and can leave sett alone. July to August - Badgers can sleep in day nests above ground. November to December - Badger activity reduces in colder months. Badgers sleep longer and deeper.
	Movement	Live above and below ground in setts and follow defined paths or ‘ runs’ between nodes (e.g. setts, latrines and food sources). Home range for Badgers can range from 30 – 150 ha.
	Day/Night	Nocturnal
Roe Deer[4]	Hibernation	Does not Hibernate
	Movement	Prefer woodland and forest locations and occasionally fields. Overlapping territories with other deer. Peak activity at Dawn & Dusk.
	Day/Night	Nocturnal (active throughout 24hrs but more active at night).
	Location	Abundant throughout the British Isles.

Table 6.8 continued: Routine Activities of Wildlife (Red, Fallow and Muntjac Deer) (2/2).

	Routine Activities of Wild Species	
Red Deer[5]	Hibernation	Does not Hibernate
	Movement	Descend to lower ground during the night). Peak activity at Dawn and Dusk.
	Day/Night	Nocturnal (active throughout 24hrs but more active at night).
	Location	Scottish Highlands, Lake District, New Forest, South West and East of England.
Fallow Deer[6]	Hibernation	Does not Hibernate
	Movement	Fallow Deer prefer deciduous or mixed woodland with large clearings. But can be found in other habitats such as Grassland, Heathland & Moorland, Farm/Arable Land, Woodland, Town and Gardens.
	Day/Night	Nocturnal
	Location	Fairly widespread in England, Wales, Ireland and southern Scotland
Muntjac Deer[7]	Hibernation	Does not Hibernate
	Movement	Muntjac Deer are notorious browsers, eating the shoots from shrubs, as well as woodland herbs and Brambles, and therefore can be found in a range of habitats including Grassland, Heathland & Moorland, Farm Land, Woodland, Towns and Gardens.
	Day/Night	Nocturnal
	Location	Common and increasing in southern England and spreading northwards.

The Deer Initiative. About Wild Deer. (n.d.); The British Deer Society. Deer Distribution Survey 2016. (n.d.); 1 The Hare Preservation Trust. Brown Hare History & Status. (n.d.); The Mammal Society. Species Fact Sheet: Brown Hare. (n.d.); The Mammal Society. Species – Brown Hare. (n.d.); Scottish Wildlife Trust. Brown Hare. (n.d.); GWCT (a) (n.d.); GWCT (b) (n.d.); The Wildlife Trusts. Brown Hare. (n.d.); 2 The Mammal Society. Species – Mountain Hare. (n.d.); Scottish Natural Heritage. Hares and Rabbits. (n.d.); The Wildlife Trusts. Mountain Hare. (n.d.); The Hare Preservation Trust. Irish Hare. (n.d.); 3 Badger Rescue. About Badgers. (n.d.); BadgerLand. Monthly Diary (n.d.); BadgerLand. Badger Setts. (n.d.); NWCU. Badger Persecution. (n.d.); NatureWatch Foundation. (n.d.); Badgers Trust. About Badgers. (n.d.); The Mammal Society. Species – Badger. (n.d.); The Wildlife Trusts. European Badger. (n.d.); 4 The Wildlife Trusts. Roe Deer. (n.d.); 5 The Wildlife Trusts. Red Deer. (n.d.); 6 The Wildlife Trusts. Fallow Deer. (n.d.); 7 The Wildlife Trusts. Muntjac Deer. (n.d.).

Table 6.9: Breeding patterns of Wildlife (Brown Hare, Mountain Hare, Irish Hare, European Badger, Roe Deer, Red Deer, Fallow Deer, Muntjac Deer).

	WINTER		SPRING			SUMMER			AUTUMN			WINTER
Breeding	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEPT	OCT	NOV	DEC
Brown Hare		Breeding season – 3 to 4 litters can be reared a year.										
Mountain Hare / Irish Hare		Breeding season – 3 to 4 litters can be reared a year.										
European Badger	Sows are pregnant.	Sows give birth. Mating peak after sows give birth.						Second mating peak.				
Roe Deer					Birthing Season		Breeding Season					
Red Deer					Birthing Season				Breeding Season			
Fallow Deer					Birthing Season				Breeding Season			
Muntjac Deer	Breed all year round.											

Dorset - Crime Location Accuracy Issues

The positional accuracy of the crime data was assessed to identify the quality of the data for potential spatial analysis, by plotting a sample of the crime data onto the base map layer of Dorset using the crime data eastings and northings.

Issues with geolocation accuracy can have a significant impact on subsequent spatio-temporal analysis. Errors associated with the accuracy of location information, can be introduced when the crime is reported by an individual providing incorrect information, and is reliant on the person recording the crime inputting the location information correctly. Additional issues associated to the recording of accurate location information is the difficulty with geolocating crimes that have not occurred at premises with an associated address, or in rural areas (Hart & Zandbergen, 2013; Ratcliffe, 2002).

The geographic Cartesian coordinates for the sample of crimes were found to relate to buildings (assumed to be the home address of the victim or witness to the crime), despite the crime descriptions indicating that these occurred in a field on farmland. Whilst the eastings and northings (which matched the recorded postcode) are the logical location to be recorded by the Police force, as this is where officers may attend to speak to the victim/witness about the crime they have reported, it is detrimental to the accuracy of any further analysis wishing to look at the spatial dimension of these crimes. Figure 6.15 illustrates the accuracy issues with the Police data.

Figure 6.15 shows two crosses (one red and one green) these represent two fictional crime records, recorded at properties (similar to the real crime data). The red cross highlights the complexity of attributing the building to surrounding farmland as the other houses in the surrounding area all share their boundary lines with the surrounding fields/farmland, making it impossible to identify whether the building the crime is linked to, is associated to the surrounding farmland; and which field/s, as there are several parcels of land in the surrounding area.

The green cross presents a similar issue, where again it is impossible to identify the actual location of the crime, or attribute it to a specific field/farmland. However, this example also

highlights that in some cases farm crimes were recorded/linked to houses in villages and more built up areas, again making it impossible to identify the actual location of crimes.

Figure 6.15: Section of the Dorset map (showing property and field boundaries) illustrating the difficulty in associating the location of properties to farmland/fields.

The geolocation accuracy issues were therefore found to prevent analysis at the field and farm level. The inability to accurately link crimes to specific fields, can be compared to analysing crimes occurring in a shopping mall. Without knowing the specific location of crimes within a shopping mall, it would be impossible to assess the influence of particular features such as stairwells, exits, parking areas, lifts, or toilets on the vulnerability of the different shops.

To understand the complexity of locating Livestock and Wildlife crimes within farmland and the rural landscape, it is important to understand the landscape of rural Dorset. Table 6.10 presents the number of farm holdings in the Local authorities in Dorset and Table 6.11 presents the number of farms based on farm size.

Table 6.10: Number of Holdings and Farmed Area (Hectares) for Local Authorities in Dorset (as of 2016) (DEFRA Structure 2019).

Local Authorities in Dorset	Number of Holdings 2016	Total Farmed Area 2016 (Hectares)	Average Farm Size (Hectares)
BOURNEMOUTH & POOLE & CHRISTCHURCH	33	2,840	86.1
EAST DORSET	241	24,097	99.9
NORTH DORSET	651	55,092	84.6
PURBECK	229	26,525	115.8
WEYMOUTH AND PORTLAND & WEST DORSET	1,195	94,355	78.9
TOTAL	2,349	202,909	86.4

Table 6.11: Number of Holdings and Farmed Area (Hectares) for Bournemouth and Poole & Dorset County Council (as of 2016) (DEFRA Structure 2017).

	Farm size					
	<5ha	5<20ha	20<50ha	50<100ha	>=100ha	Total
Number of Holdings	282	647	484	363	573	2,349
Farmed area (hectares)	668	7,159	15,795	25,882	153,407	202,910
Average Farm Size						86

The average farm size in Dorset (rounding down to 80 Hectares) is equivalent to 650 Olympic size swimming pools. Farms may be in a contiguous area or be made up of several separate areas owned or leased by the same farmer. Farmland can then be further subdivided into fields of different shapes and sizes, with different environmental features associated to each field (e.g. buildings, roads, right of way, rivers etc.).

The inability to accurately associate a crime to a specific field or farmland prevents performing informative analysis of how environmental features may or may not influence the likelihood of a farm/field being victimized.

Whilst information may be available for some crimes that detail the actual location of the crime, researchers are not always going to have full access to the crime record in its entirety, and the time and costs associated to extracting that information for each crime may not be practical or

possible for future research of this type. Therefore, based on the crime records supplied by Dorset Police force, it would not possible to identify the true location of Livestock and Wildlife crimes, and in turn what environmental features may influence the likelihood of victimization.

Livestock & Wildlife Crime - Data Accuracy Issues

To address the data accuracy issues discovered whilst processing the crime data, the following section provides a brief description of Police recording of crimes and incidents, and the findings of a Freedom of Information request to Police forces in the UK in relation to their recording practices.

Freedom of Information Request - Methods

Freedom of Information (FOI) requests were sent in November 2017 to all 45 Police forces within England, Wales, Scotland and Northern Ireland. FOI requests were made either by using online FOI request forms, or by sending an email to the FOI team within the force (Appendix 10) presents an example of the email sent to Police forces).

The Freedom of Information request asked the Police forces four questions that aimed to identify the recording practices of crimes in rural/farm areas by police forces, and whether it is possible to tag these crimes as occurring in these areas, and specifically whether police officers have access to equipment with which they can record the exact location of crimes in rural areas.

Freedom of Information Request - Results

Of all 45 forces sent requests, 39 (86.7%) responded partially or completely to the FOI questions, with six (13.3%) forces failing to respond. The following section presents the Police responses to the FOI requests.

Freedom of Information Request - Tagging of Rural Crimes

The first question asked Police forces whether the forces recording system/database provided a category/label that differentiated between rural and urban areas. Of the 45 Police forces approximately 29% had some form of rural tag/label, whilst approximately 53% of forces claimed to have no rural tag/label with which to identify the type of location of reported crimes (see Table 6.12).

Table 6.12: The proportion of Police forces that are able to tag/label crime/incident records as occurring in a Rural location.

	Yes		No		No Response to Question		No Response to FOI	
Number of Police Forces	N	%	N	%	N	%	N	%
45	13	29	24	53	2	4	6	13

Of those that said yes, several referred to their computer systems (Gazetteers) providing the identification of rural and urban areas using beats, location codes, GIS mapping etc. Gazetteers are databases of addresses which provide a grid reference (northings and eastings) based on property addresses (postcodes) and other location information. The emergency services use gazetteers to identify and direct personnel to the right location swiftly and accurately. The identification of locations using a Gazetteer becomes more complex, when a crime/incident has not occurred at a location easily identifiable by the gazetteers database such as crimes occurring in the street or open spaces.

There were overall inconsistencies with responses, with many forces indicating that the automated systems they use allocate crimes/incidents to beats (areas) which relies on the national classification system to assign reports to rural or urban locations. Of the 13 (29%) forces that indicated they had a rural label, seven of these proceed to indicate that the manner in which rural or urban classification was applied to the record was automated and used location/beat codes. Therefore, if we were to exclude these forces, it would take the total percentage of forces that can tag/label crimes/incidents as being rural down from 13 (29%) forces to six (13%).

The diversity of recording systems mentioned by responding forces highlights the difficulty in getting new and old systems within forces to work together, let alone working with systems from other forces nationally.

Kent Police force indicated that they use two different systems for when a crime/incident is initially reported, and when it is officially recorded, with one of these systems providing an

opportunity to tag/label it as rural, whilst the other recording system does not allow for this information to be added.

Several Police forces that indicated they could specifically tag crimes/incidents as being rural, acknowledged that this process was not mandatory and there were no prompts to do this, therefore it relied on staff proactively searching for the relevant location tag amongst the approximately 100 location tags that exist on their system. The same force went on to acknowledge that of the crimes/incidents that they believed should have this tag associated to them, only 40% had been tagged by the staff that recorded the information on the forces database.

Freedom of Information Request - Tagging of Farm Crimes

The second question asked about the more specific tagging/labelling of farm crimes/incidents, and if they were able to tag crimes that occur on farmland on their systems. Of the 45 forces, 51% indicated that they had a way to label crimes or incidents that occurred on farmland (as shown in Table 6.13).

Table 6.13: Number of responses to questions relating to farm specific tags on crime/incident databases.

	Yes		No		No Response to Question		No Response to FOI	
Number of Forces	N	%	N	%	N	%	N	%
45	23	51	15	33	1	2	6	13

The Police forces that did have farm specific tags/labels were asked to indicate how many crimes/incidents had been recorded using this label/tag between 2010 and 2017. Of the 23 (51%) forces that claimed to have a farm tag/label, thirteen (29%) forces provided the total number of crimes/incidents recorded under a 'Farm' related tag on their databases. The number of crimes/incidents recorded using a farm tag/label ranged from 1,315 to 10,616. Some police forces provided larger values but incorporated other labels/tags that did not directly relate to farmland. Some terminology used was not as straight forward as 'Farm' with

Surrey police force using the term 'Private Rural' (introduced in 2013) to identify rural crimes that have occurred in areas such as farmland.

Northumbria constabulary had one of the largest totals for 'Farmland' tagged records, and provided the values separated for Incidents (10,556) and Crimes (60). Very few of the forces provided totals separated for crimes and incidents, making it impossible to differentiate between these record types.

The FOI results highlighted that whilst some forces could label both crimes and incidents, other forces could only label crimes and not incident records. Several forces described how using different recording systems for crimes and incidents resulted in a variety of terms and labels being used that did not always correlate between the recording systems.

Terminology issues associated to the existing tags were discussed by several forces, where alternative definitions of rural crimes and the properties where rural crimes could occur, meant some forces definitions included farmland, whilst others categorized farmland as a 'Private Rural' location.

The term 'Farm' alone does not prevent terminology issues, as highlighted by Humberside Police force who described that searching records using 'Farm' also returned records for Health Farms. The lack of exclusivity of some of the tags being used by Police forces, resulted in the returned records to searches being large in scale, and impractical to filter with limited police resources and time for analysis. Warwickshire/West Mercia and West Yorkshire Police indicated that searching their databases using the term 'field' returned over 4,000 records, and they would have to manually assess each record to determine if this field was related to farmland. Several forces highlighted the significant manual work required to try and extract crimes relating to wildlife or farms from the central databases.

The Police Scotland response indicated that they would not tag crimes that occur on farmland, and to determine numbers of crimes each record would need to be read to identify its relevance. One force also described how subjective decisions by the person extracting the information from the Police database meant the resulting data would be made up of what that individual qualified as being rural or farm related crime. Kent Police force reiterated that the

accuracy of the tagging of crimes/incidents as occurring on farmland was subject to the accuracy of the inputting officer.

Of the 33% not having such a tag/label, some forces did not have the facility to tag records, whilst others had the facility but didn't have a tag for locations such as farms. Two (4%) Police forces indicated that the ability to tag 'Farm' crimes was only recently made available on their recording systems, therefore without complex extraction processes, there was no data that the force could provide. However, without systems providing simple and effective methods to tag and extract such data, it is unlikely that standard procedures for marking these systems will be adopted.

The accuracy and specificity of the records is determined by the systems being used by each force. The variety of systems in use, lack of uniformity in terminology, and inconsistent ability of Police forces to tag records, makes the effective tagging of farm crimes nationally complex, and subsequent data extraction for historical crime data almost impossible.

Crime Recording – Solutions

A potential solution for more accurately labelling crimes that occur on farms would be to add a unique identifier within the free text field itself (which could be added by the call handler or investigating officer). The terms would complement any existing categories/labels on the database, especially those that may be too ambiguous or broad in scope. Example terms could include '#Livestock#', '#Farm#', and '#Wildlife#', using alternative symbols would be based on the requirements of the database/recording system, but importantly incorporating such terms would not require amendments to the existing crime or incident database software, or take a significant amount of additional time to be added by call handlers or officers. The addition of such terms would potentially allow for crimes to be more easily searched for and extracted by officers and analysts (albeit depending on the capability of the systems being used), but especially for researchers in receipt of crime data.

Freedom of Information Request – GPS Equipment Access

The final question in the FOI request, enquired whether the Police forces officers had access to GPS equipment for recording the location of crimes. This question sought to determine whether the recording of crimes that have occurred in rural areas such as farm crime, could hypothetically have the specific crime location easting and northings recorded accurately by

officers. This was presented as a binary Yes/No question, but many of the forces provided additional information about the recording of crime locations. The results shown in Table 6.14 identifies that of the 32 police forces that provided sufficient information, 40% (n = 18) of all forces said their officers do not have access GPS equipment for recording the Eastings and Northings of crimes.

Table 6.14: Location of Police forces and whether officers have access to GPS equipment in the UK (six forces failed to respond and a further six provided insufficient information).

	Access to GPS Equipment (N = 45)			
	Yes		No	
Response	N	%	N	%
England (N = 39)	12	44	15	56
Wales (N = 4)	2	50	2	50
Scotland (N = 1)	1	100	0	0
Northern Ireland (N = 1)	0	0	1	100
Total	15	33	18	40

Many of the forces (e.g. Norfolk, West Mercia / Warwickshire) that indicated officers did not have access to this type of equipment, reiterated that when addresses were entered into the database, the computers generated the eastings and northings.

The question asked was aiming to identify how police officers can record accurate location information for crimes in rural areas particularly relating to farmland. Several forces indicated that if officers were carrying an Airwave terminal then they would have this information on their terminals. However, there was some discrepancy between responses as to whose responsibility it was to accurately record the location of a crime/incident, with some indicating it is the responsibility of the call handler, and other the responding/investigating officer.

The issue identified with the accuracy of the Dorset Police force crime data was that the input location appears to relate to the farmhouse or a location where the victim/witness lives, and does not account for the fact that the crime may have occurred at a location some distance away.

Several forces described how force analysts are only able to accurately map the location of crimes based on the quality of information provided by the initial report and investigating officers. Whilst accurate information about the location of Livestock and Wildlife crimes on farmland potentially exists within the records on Police databases, the ability to search for, extract and accurately map these incidents appears to be inconsistent across forces, and the accuracy of the resulting data may not allow for the type of spatio-temporal analysis that could provide valuable information about what environmental features may make farms/fields more vulnerable to crime.

Crime Mapping - Solutions

Expecting Police officers to go to the specific field where a crime has occurred to get the GPS locations may be impractical given the pressures on rural police forces, however technology now exists which could allow farmers, police staff and police officers to accurately record the specific crime location using the 'What3Words' mobile application and website (What3Words, 2019). The app has been recommended to the public by several emergency services as an important resource for specific location identification irrespective of whether the location is in an urban or rural setting, by assigning a unique 3 word address for each $3m^2$ location (see Figure 6.16) (BBC What3Words, 2019).

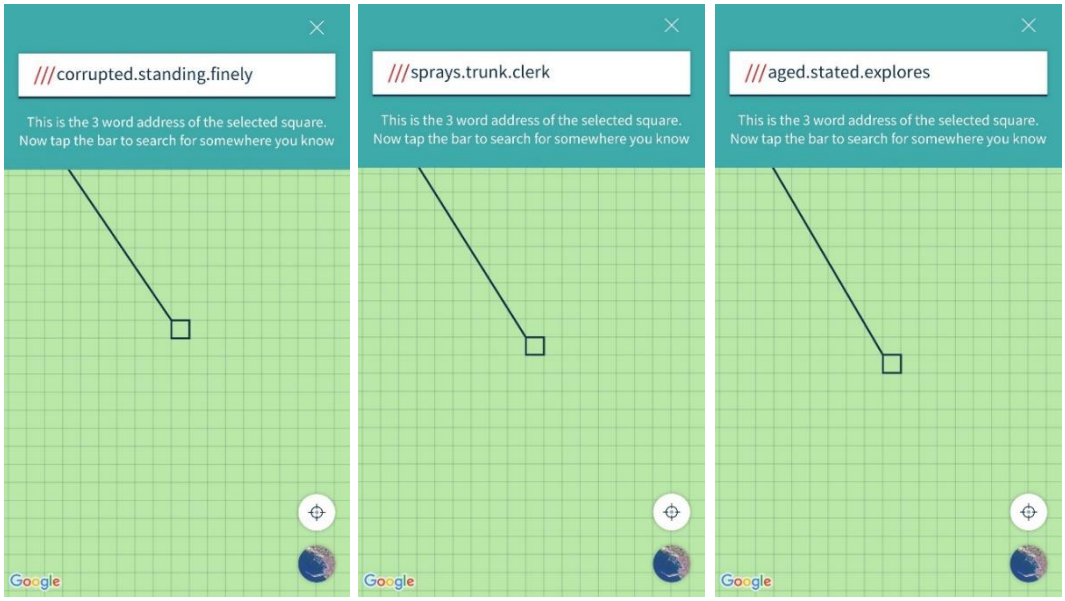


Figure 6.16: Screenshots of the What3Words app showing the different three word addresses linked to adjoining $3m^2$ areas within a rural area.

If the victim/witness can provide this information when reporting the crime, this could be added to the record by the call handler. Alternatively, the call handler recoding the incident/crime could ask the caller to provide location information and use the website/app themselves to identify the field/location and add the three word address to the information in the record. Additionally, any police officers that attend incident/crime scenes can use their smart phone and the free mobile app to accurately record the location. Alternatively, a police app could be created, or existing apps adapted to include a location identification section, as the what3words service can be built into other apps using a few lines of code.

Discussion

This chapter presented a preliminary attempt at analysing Police crime data on Livestock and Wildlife crime in Dorset, to identify whether seasonal variation existed for these crime types. Overall the findings can be separated into two main themes in the discussion: Seasonality of Livestock and Wildlife crimes and Police data quality.

Seasonal Variation and AgriRA/WildRA

There exists a large amount of research looking at the seasonal variation in different crime types. However, these crimes have predominantly been in urban or suburban areas, and focussing on crimes such as burglary, vehicle theft and assault. But to the authors knowledge no other studies have tried to empirically assess the seasonality of Livestock and Wildlife crimes in the UK.

The Police crime data from Dorset Police Force was used to assess seasonal variation in Livestock and Wildlife crime, and see if the patterns observed correlated to those anecdotally identified by Police, or with the responses from Farmer in the victimisation survey (Chapter Four).

The results indicate that many of these species (e.g. chicken, other birds, deer) show distinct patterns in the seasonal occurrence of crime. With Poaching/Deer crimes correlating closely to the seasonal pattern described by farmers in the victimisation survey (Chapter Four), showing an increase in crime towards the end of the year.

Aggregation bias has been found to negatively impact the interpretation of crime analysis, when individual crime types are not assessed independently of one another (Cherry & List, 2002). An important finding from plotting the seasonal variation in crime occurrences, was how the seasonal patterns changed once the species had been disaggregated. As well as separating by species, the crimes were also grouped into those crimes that directly affected the species (e.g. theft, killing) and those that were associated to them (e.g. theft of feeding equipment from barn; break-in to chicken shed etc). If the police crime data had simply been assessed as a single group made up of many species, or grouped all crimes affecting sheep together rather than disaggregating these into species specific and associated, the individual differences would not be visible. Whilst the overall sample size was very small for the crimes of interest, the results

highlight the importance of disaggregating the target species at the very least (Livestock and Wildlife) before assessing the seasonal variation.

Several factors were examined that could potentially influence seasonal patterns in Livestock and Wildlife crimes, including temperature and the price of livestock. The results indicated that the temperature and price of Livestock did not correlate with the seasonal pattern of any of the crime types. However, the seasonal variation in Crop Height (as described for wheat, barley and oilseed rape) does seemingly correlate with anecdotal evidence and the crime data as influencing the seasonal pattern in wildlife crimes like Deer poaching (crime data) and Hare coursing (anecdotal, not from data).

The chapter presented an overview of the routine activities of Livestock (AgriRA) and Wildlife (WildRA). The routine/seasonal activities of Livestock and Wildlife have been anecdotally linked by Police and Farmers to the seasonal variation of species crime on farms (e.g. sheep brought down from hills for lambing being targeted by thieves). The seasonality results in combination with the AgriRA and WildRA information, provide a variety of potential factors relating to breeding, activities and shelter, that could be used to identify local level risks associated to specific Livestock and Wildlife, and the potential for identification and tailoring of targeted prevention techniques (Cohen & Felson, 1979; Farrell & Pease, 1994; Linning et al, 2017).

Overall, the findings highlight the need for better quality data, and disaggregated analysis of Livestock and Wildlife crimes nationally. Simple measures can be used to make Police data more easily extractable and accessible to analysts and researchers and make the data more relevant for the types of analysis Police and stakeholders use to assess volume crimes and associated risk factors in urban areas. Improving the recording of crime data would allow research to be completed that would help to target the limited amount of rural resources where they will be most beneficial in tackling Livestock and Wildlife crime.

Data Quality - Location

Environmental risk factors in urban/suburban areas have been used to identify where vulnerability to certain crimes is highest, but no such analysis has been performed in rural areas. There are a number of environmental features in rural areas that may be contributing to the victimisation of farm properties, particularly in relation to Livestock and Wildlife crimes. However, to the authors knowledge no previous research has attempted to address this gap in

the literature, and without accurately recorded location data it is not possible to perform spatio-temporal analyses.

The issues identified with the data provided by Dorset Constabulary, are known to occur when dealing with geolocation information for rural areas, with researchers acknowledging the poorer quality of location information nationally and internationally due to the lack of easily identifiable postcodes/markers in rural areas. However, little evidence exists that efforts are being made by Policy makers or Police to address this issue. Whilst more detailed information may exist on the exact location of crimes within crime reports and associated documentation, for the purpose of analysis involving hundreds if not thousands of crimes, police analysts and researchers cannot be expected to have the time to extract/identify this information for each crime/incident. If crime data in rural areas continues to have inaccurate location information associated to it, future research into not only Livestock and Wildlife crime but other crimes impacting rural areas and farms could be made impossible.

Free apps such as What3Words could be used from the Police station or on a smart phone at the scene to more accurately record the location (within 3 metres) where crimes involving Livestock and Wildlife have occurred, such as fields on farms. The use of such apps would allow farmers/witnesses/police to record the exact location of rural crimes and add these to the crime record. This information will be invaluable in the future for crime scientists and police analysts to accurately assess victimisation at the micro level and assess what features may act as rural crime generators or attractors.

Data Quality – Tagging Livestock and Wildlife Crimes

The FOI results identified that Police crime recording systems offer variable levels of specification in relation to tagging crimes/incidents as having occurred on farmland or being related to livestock/wildlife. Recommendations made in this chapter highlight simple, zero cost ways to future proof the crime data collected from now on such as adding search terms to the crime record text (e.g. #Wildlife#, #Livestock#, #Farm#), until a new more effective system for recording these types of crimes can be implemented nationally. As noted in the victimization survey of farmers (Chapter Four), Police data is unlikely to represent the true rate of Livestock and Wildlife crime in the UK; and if what little data that does exist is suboptimal for the purposes of analysis, then without accurate figures on the rate of Livestock and Wildlife crime

in the UK, it is not possible for decision makers to make informed choices about policy and police priorities (Gosling, 2017).

Conclusion

Implications of research on Practice

Terminology & Add Search Terms to Text – A variety of terms can be used to describe different Livestock and Wildlife species, and the addition of spelling errors only further complicates the searching and filtering of crime data further. The research recommends the use of an additional search term for crimes relating to farms, livestock and wildlife, which would allow police and researchers to extract relevant data with greater ease from the vast number of crimes and incidents recorded. This would avoid users having to search using a variety of terms related to species such as Bull, Heifer, Calf, Steer etc.

In the absence of reforming the data recording process of Police Nationally, there should be attempts made to future proof data relating to rural crimes, including Livestock and Wildlife crimes, by making these more easily identifiable, extractable and more accurately geolocated on police systems. By applying these free and simple methods to current recording practices, would allow analysts and researchers in the coming years to be in a position to perform the types of analysis that could not be undertaken with the data in its current state.

Disaggregating Data – Any future analysis of data relating to Livestock and/or Wildlife crime should separate out the data by species to account for variation within and between Livestock and Wildlife crimes. The information can then be used more effectively to identify potential factors that may influence any seasonal or spatial variation in these crime types and more accurately target prevention resources.

Implications of research on Policy

Recording practices – The difficulty in searching, filtering and extracting data for the purposes of this study, highlighted the overall issues with recording of crime relating to Livestock and Wildlife. Incidents involving Livestock are often recorded under ‘Theft’ or ‘Criminal damage’ as these are technically property of the farm. The addition of a tag or search term (as discussed

above in the 'Terminology & Add Search Terms to Text' section) would allow for easier identification and extraction of these types of records, both in incident and crime databases.

There exists contention over how Wildlife crimes should be recorded on Police databases, and in particular whether crimes involving species should be given more nuanced recording codes to avoid the incidents and crimes being lost amongst the generic grouping of crimes found in the 'Miscellaneous Crimes Against Society' category. The Home Office recording code (96) 'Wildlife Crime' is not used to record all wildlife crimes in England and Wales, but instead is used for a group of comparatively niche crimes including:

- Shark Fin removal
- Sea fishing offences
- Conservation of whales
- Fisheries crimes
- Seals
- Eels
- Removal of hedgerow
- Trade in endangered species
- Introduction of new species
- Removal or disturbance of limestone
- Damage to Sites of Special Scientific Interest
- Pretending to be a wildlife inspector

(Home Office Counting Rules for Recorded Crime, 2019; Gosling, 2017)

To address this issue an additional question was included in the FOI request sent to all Police forces in the England and Wales as well as Northern Ireland who use the same code on their own systems to record Wildlife related crimes (PSNI, 2018). The FOI asked forces to identify how many crimes had been recorded under the 'Wildlife Crime' code between 2014 and 2017. The responses included some Police forces indicating they were unaware of the codes existence, and others stating they had zero crimes recorded under the code. Overall the number of crimes recorded over this period were minimal (see Table 6.15).

Whilst the crimes currently covered by the Wildlife Code (96) deserve to be effectively recorded, it is impractical to have a dedicated code for these crime types, and not one that can be added to other crimes that have a wildlife component (e.g. hare coursing, badger baiting etc.).

Gosling's (2017) report found that requests for data from official sources such as the Police and the Home Office received minimal information or were rejected due to these crimes not being

recorded/held and were advised to approach NGO's for the information they requested. Some government agencies and police forces approached indicated that the date was essentially unobtainable due to the large amount of time it would take to extract the information from the existing databases; this would require each individual crime record to be reviewed to ascertain its relevance. As this was performed for the current chapter to filter the Police data, the author can confirm that this process is time intensive and therefore impractical for force analysts and many other stakeholders to perform routinely to monitor these crime types (see 'Terminology & Add Search Terms to Text' above).

Table 6.15: Wildlife Crimes recorded using Home Office Code (96) between 2014 and 2017 by Police Forces in England and Wales. (Answers that were ambiguous or used other methods then using Code 96 to find wildlife related crimes did not have their values added to the table).

	Police Force	Home Office Code (96) – Wildlife Crime		Police Force	Home Office Code (96) – Wildlife Crime
1	Avon and Somerset	12	24	Merseyside	1
2	Bedfordshire	2	25	Metropolitan	121
3	Cambridgeshire	1	26	Norfolk	4
4	Cheshire	1	27	North Wales	-
5	City of London	No Response	28	North Yorkshire	1
6	Cleveland	0	29	Northamptonshire	597
7	Cumbria	9	30	Northern Ireland	0
8	Derbyshire	4	31	Northumbria	3
9	Devon & Cornwall	7	32	Nottinghamshire	No Response
10	Dorset	-	33	South Wales	11
11	Durham	4	34	South Yorkshire	1
12	Dyfed-Powys	3	35	Staffordshire	1
13	Essex	No Response	36	Suffolk	0
14	Gloucestershire	3	37	Surrey	3
15	Greater Manchester	8	38	Sussex	No Response
16	Gwent	0	39	Thames Valley	No Response
17	Hampshire	13	40	Warwickshire	3
18	Hertfordshire	-	41	West Mercia	14
19	Humberside	1	42	West Midlands	0
20	Kent	1	43	West Yorkshire	2
21	Lancashire	No Response	44	Wiltshire	0
22	Leicestershire	1	45	Scotland	n/a
23	Lincolnshire	2			

The recording process for different countries within the UK, vary in the quality of recording and therefore the ease of data extraction. Police Scotland uses alternative crime recording codes to those of England and Wales, which allow the Police service in Scotland to more accurately code not only that the crime involves wildlife, but the type of Wildlife crime (see Table 6.16).

Table 6.16: Crime recording code for Wildlife crime in recorded by Police Scotland (SCOT GOV Charge Codes, 2018; SCOT POLICE, 2016).

Code	Offence Type
51/01	Cruelty to animals (ex dogs) incl killing and maiming cattle
51/02	Rabies Orders
51/03	Animals, offences involving (ex dogs, birds else class)
51/04	Birds, offences involving
51/05	Pet and kept animals
51/06	Cruelty to dogs
51/08	Protection of livestock from dogs
51/09	Guard Dogs Act 1975
51/10	Dangerous Dogs, Failure to Control, Supervise, Destroy [Obsolete Code]
51/11	Dogs bred for fighting
51/12	Offences involving dangerous dogs
51/13	Hunting with Dogs
51/14	Cruelty to Wild Animals
51/15	Offences involving Badgers
51/16	Other Wildlife Offences
51/99	Dogs, other offences

The Police Service of Northern Ireland have a dedicated PSNI Wildlife Department that are contacted when any suspected Wildlife crimes occur. The Police Service of Northern Ireland and Police Scotland also produce reports on the incidence of specific (raptor persecution) and general wildlife crimes (GOV SCOT, 2018b; PSNI 2017 Report; 2018). Publications are not produced by the Police services in England and Wales, which is likely due to the absence of easily accessible data. The closest publication to that of Police Service Northern Ireland and Police Scotland, are reports produced by the National Wildlife Crime Unit and NGO's, however, no national overview of Wildlife crimes exists.

In 2018 the National Police Chief's Council published the 'Wildlife Crime Police Strategy for 2018-2021', which contained the recommendation of 'widening the number of recordable

wildlife crimes so as to better understand and reflect the range and scale of the portfolio' (NPCC, 2018).

Policies in relation to the manner in which Farm, Livestock and Wildlife crimes are recorded need to be reviewed to make sure relevant data is correctly allocated and retained by Police forces. Optimising the way in which information is recorded in relation to Wildlife crimes would allow for easier collation and analysis, not only by researchers, but would also allow official offices such as the Home Office, to provide reports on the incidence of these crimes nationally (HMIC, 2014; HMICFRS, 2017).

Implications of research on Theory

Crime Pattern Theory – Much of the existing research has focused on the routine activities of humans (victims and offenders), and the activity space they create around work, leisure and home. This chapter presented an additional branch to this analysis, by describing the (general) routine activities of Livestock (AgriRA) and Wildlife (WildRA). By combining information on ecological and biological factors such as breeding patterns, hibernation, migration etc., it is possible to account for how these could potentially influence the interaction between species and offenders. Unlike inanimate objects such as cars and mobile phones, Livestock and Wildlife should not be considered static objects targeted by moving criminals, and further research could identify the influence of the routine activities of species on crime pattern theory and offender mobility.

Limitations of the Research

Data Source – The data used in this Chapter was from one county in the UK (Dorset), to accurately assess the seasonality of Livestock and Wildlife crime, data from several counties across the UK should be assessed.

Data Sample Size – The sample of data from Dorset Police force had several limitations associated with its size and duration. Whilst the extracted data Dorset Police force provided had over a quarter of a million crime records, once extraction and filtering had been performed the number of relevant crimes were just over 500. In addition to this being a small sample size for the intended analysis, the 500 data points were spread over a seven-year period (2010 to

2016) (Note: 2016 was excluded as this was only a partial year of data). The small data sample meant that certain analyses such as seasonal decomposition analysis were not practical. Using a longer time range would potentially provide more data with which to perform a seasonal analysis, however this would rely on effective recording of these crimes historically, which may not be the case.

Combining Crime Data – Combining the crime data from 2010 to 2015 together to assess seasonal variation, means that any distinct differences between the individual year recorded crimes would not be identified. Additionally, the recording of crimes each year may be completely different, but in combination form a distinct pattern, creating spurious results. As already mentioned above, larger data sets may provide sufficient data for a more accurate analysis of seasonal variation in species crimes.

Crime vs Incident Data – The Dorset data only included crimes over the study period (2010 – 2016). The limited amount of data is unlikely to be indicative of low levels of these crimes, but more likely due to the low reporting rates (as found in the previous victimisation survey – Chapter Four), and the issue that anecdotal evidence from Police officers and the FOI indicates that the vast majority of crimes involving Livestock and Wildlife get recorded as incidents (Dong et al, 2017). An indication of the disproportionate number of incidents compared to crimes was highlighted by the response of Northumbria Police to the FOI request, where they recorded 10,556 incidents and 60 crimes occurring on farmland. Incorporating incident data could provide additional information about crimes which are poorly reflected in crime records (Farrell & Pease, 1994). In addition to this, the larger the data sample size about a specific crime, the more accurate any seasonality assessment is likely to be in determining patterns in crime occurrence (McDowall & Curtis, 2015; Ranson, 2014).

Future research should aim to acquire incident data (dependent on it containing sufficient information to be able to accurately allocate the records to farm location and species type) in addition to crime data from other counties to assess temporal and seasonal variation in these crime types nationally.

Data Accuracy – As discussed within the chapter, the poor accuracy of the location recorded with crimes has a significant impact on the type of analyses possible. The accuracy of crime

records may vary between Police forces, and between crime and incident records, which should be addressed when analysing data for rural crime in future.

Recommendations for Future Research

Police Data – Future research should aim to obtain Police data (including incident records) from other Police forces across the UK and compare the seasonal patterns of Livestock and Wildlife crimes, to identify if similar patterns emerge to those found in this study.

Interviews – Interviews, surveys and/or focus groups with farmers, gamekeepers and other land managers (e.g. national park rangers) to identify environmental, physical or other factors that may influence the occurrence of these crime types.

AgriRAT and WildRAT – The environmental, ecological and biological factors that may influence the victimisation of Livestock and Wildlife, provides a variety of avenues for future research. A focus on the movement of animals during their routine activities (e.g. rotational grazing and annual movement) in and around the farm deserves further analysis. An assessment on Livestock and Wildlife crimes in the UK, in relation to CRAVE would provide potentially useful information about the ability of criminals to dispose of species they may have taken from farmland (e.g. is it for personal use? Sold to abattoirs? Sold to pubs?).

Location Accuracy – An assessment of crime location accuracy should be performed across several Police forces, looking at the full records of Livestock and Wildlife crimes to establish if information about the exact location of the crime can be found within the records. Future research should complement this assessment by also trialling the use of alternative methods of recording information relating to Livestock and Wildlife crime, such as that proposed in this chapter, with the use of in-text search terms and What3Words location information.

Urban vs Rural – Comparison of the data available on physical attributes of the environment for Urban and Rural areas, to identify whether rural areas require additional data sets of interest produced for future research into rural victimisation.

Geospatial Analysis – If crime recording is improved by effective tagging of crimes, and accurate recording of crime locations, geospatial analysis such as Risk Terrain Modelling (RTM) could be

used to map crimes alongside information about the environment, to identify where risk factors are collocated (Brantingham and Brantingham 1995; Eck et al, 2005; Dugato et al, 2018; Caplan et al, 2011,2017; Valasik, 2018). By identifying where risk factors are collocated in an area an RTM model could calculate a relative risk score and this score could then be used to identify what locations are at greater risk of being victimised based on their environmental features (Caplan & Kennedy, 2011; Caplan et al, 2017; Dugato et al, 2017; Valasik, 2018).

The existing studies using the RTM approach have been completed in a variety of countries/places, looking at a variety of crime types, including burglary, vehicle load theft/parts theft robbery, violent crimes murder/homicide, shootings and terrorism (Dugato et al, 2017; Dugato et al, 2018; Kennedy et al. 2016; Moreto et al. 2014b; Ohyama & Amemiya; 2018; Onat, 2019). An assessment of Livestock and Wildlife crime in the UK using RTM or other mapping techniques has not been attempted, but could be an avenue for future research, to examine what features of farmland may make fields more vulnerable to exploitation by offenders (Minnis et al, 1999). Future research should also aim to Identify other environmental features that may be risk factors for the victimisation of farms, and if sufficiently detailed data resources exist, which could then be incorporated into an RTM analysis (e.g. field boundary types).

CHAPTER SEVEN

Thesis Synthesis

The thesis presents a quantitative and qualitative analysis of data relating to Livestock and Wildlife crime in the UK. Anecdotal evidence had highlighted the data limitations and absence of existing research on this specific topic in the UK. To address the absence of empirical evidence, this thesis attempts to access and collect data which may provide insights into the incidence, reporting and prevention of these crime types. The thesis utilises a variety of methods to gather information directly from victims (e.g. farmers) and official crime data. To the authors knowledge, this is the first attempt to use Police crime data and a victimisation survey of Farmers, to look at these specific crime types in the UK.

A key finding of this thesis is that there is a severe lack of information from both personal testimony, official records (Police and other official agencies) or empirical quantitative studies on the crimes affecting Livestock and Wildlife, particularly in the UK.

There exists a number of limitations associated to the methodological choices made in this thesis (as discussed later in this chapter), but the thesis collects and identifies a variety of data sources, and provides the first assessment of Livestock and Wildlife crime specifically, which the author believes outweighs the methodological imperfections, and which will hopefully be further refined, as research in this field gathers more interest and funding in the future.

The methods chosen include a survey, the use of Police crime data, and a review of existing research, and provides a broad overview of the extent and quality of the information that currently exists for other researchers and decision makers.

Environmental Criminology

The vast majority of existing environmental criminology literature is based on research conducted in urban areas, and as such, does not take into account the differences that exist between urban and rural areas, and how these may influence the occurrence of crime in the rural environment. The thesis assesses a variety of environmental factors that in the existing literature have been found to influence a locations vulnerability to crime, including the level of guardianship on farmland (e.g. presence of buildings, pluriactivity etc.), the permeability of the farmland (e.g. distance to roads and nearest village), as well as additional features that were

hypothesized to increase the influence of permeability of rural areas, such as the presence of Rights of Way.

Permeability - The study by Smith (2018) found no statistically significant relationship between distance to roads, urban centres or nearest neighbours, and the occurrence of crimes on farms, whilst yet the Scottish Farm Crime Survey (SFCS 1999) found the opposite, with farms found near towns having a higher likelihood of victimisation compared to farms in more isolated locations. The findings from the Smith (2018) survey indicated that proximity to roads and villages were not statistically significant predictors for the occurrence of Livestock and Wildlife crimes on farmland. Of the variables examined, one of the only factors found to be statistically significant in relation to Livestock and Wildlife crimes, were the presence of rights of way, although the association was found to be weak. This thesis presents the first assessment of the influence of these factors with a particular relevance to rural landscapes, and those working in rural areas such as farmers. If rights of way are found to increase the vulnerability of farmland, it would provide Police and Farmers with the ability to target particular crime prevention techniques to reduce the negative influence of such environmental features on the occurrence of crimes on farmland.

Guardianship - The literature on Guardianship indicates how the presence of informal social control such as the presence of guardians can act as a deterrent for potential criminals. The presence of or the implication that people are present increases the perceived risk associated to committing a crime.

The influence of guardianship within a rural setting, such as on farmland is complicated by the scale of farmland. The presence of a property or staff on farmland is unlikely to provide a uniform level of guardianship over the entire farmland. Whilst one field may be positively influenced, other fields may remain exposed to potential exploitation by criminals.

Identifying methods for improving guardianship of rural areas and farmland, would provide additional supervision of the rural landscape that supplements that of the landowners and the Police force. The identification and reporting of suspicious activity would hopefully allow for the deterrence of crimes rather than the detection after they have been committed.

The victimisation survey and police crime data additionally assesses the seasonal variation in the incidence of Livestock and Wildlife crime, and presents an outline of the routine activities

of farmers, livestock and wildlife, and how these variations might explain the seasonal variation in the crimes experienced on farmland.

Seasonality of Livestock and Wildlife Crimes - Anecdotal knowledge of the seasonal patterns of certain crimes involving Livestock and Wildlife (e.g. Hare coursing after harvest) exists, but there are no studies to empirically assess whether these patterns are observed nationally in the UK. The victimisation survey results provide an overview of the seasonal patterns in Livestock and Wildlife crime, with these crime types showing a strong correlation, with Wildlife crimes increasing after the harvest period, in line with existing anecdotal knowledge, and Livestock crimes increasing during the spring and summer months.

The Seasonality analysis (Chapter Six) attempts to investigate the seasonal patterns of these crimes further by disaggregating the crimes associated to Livestock and Wildlife into the respective animal species. If the original crime data had only been assessed as a single homogenous group, the seasonal variations between these crimes would not have been visible.

The results from this thesis clearly indicate that these crime types have seasonal patterns. Identifying the seasonal variation in Livestock and Wildlife crimes, provides stakeholders including farmers, police and decision makers with empirical evidence to support the targeting of resources such as prevention strategies and police officers to vulnerable areas at times of the year when they have been identified to occur more often on farmland.

Routine Activities of Farms, Livestock and Wildlife - Crime Pattern Theory and the routine activities of victims and offenders have largely focused on crimes and criminals within the urban environment. The activity space created between home, work and leisure activities are likely to differ significantly for those living in urban areas and those living in rural areas, and particularly those working on farms. A large proportion of farmers live on their farmland, and as such, whilst they may move around the farmland completing daily tasks, the need for them to leave the farmland depends mainly on if the farmland is contiguous or they are employed elsewhere. The differences in the routine activities of farmers within and beyond the farmland directly influences the level of guardianship.

This thesis presents an extension to crime pattern theory, by describing the generalised routine activities of Livestock (AgriRA) and Wildlife (WildRA). Information from the agricultural

calendar, and on the ecological and biological factors influencing species such as breeding patterns, hibernation, migration etc., can be used to theorise how the species routine activities could potentially influence the interaction between species and offenders.

Inanimate objects such as cars and mobile phones are often thought of as static objects that are vulnerable to the overlapping activity spaces of criminals and victims. However, Livestock and Wildlife are not static objects, as they move within and between farmland/buildings both daily and seasonally, therefore further research should identify the influence of their routine activities on crime pattern theory and offender mobility. The identification of how the routine activities of the Livestock (AgriRA) and Wildlife (WildRA) may increase their vulnerability to exploitation could then be used to identify local level risks and help in targeting situational prevention techniques.

The variation in the routine activities or farmers, Livestock and Wildlife throughout the agricultural year/seasons are likely to influence the situational risks, effort and rewards associated with criminal opportunities on farmland.

Information on the seasonal patterns of Livestock and Wildlife crime would be beneficial to Police forces who are working with limited budgets and staff numbers. By better understanding the routine activities of the victims and offenders, it may be possible to help to target the limited amount of rural resources where they will be most beneficial in tackling Livestock and Wildlife crime.

Finally, the victimisation survey and crime data is used to assess the reporting, recording and Policing of these crime types.

Reporting & Recording of Livestock and Wildlife Crimes – The Systematic Review (Chapter Three), Victimisation Survey (Chapter Four) and Seasonality (Chapter Six) chapters all identified the impact the low level of reporting of crimes involving wildlife in particular had on the accurate assessment of the impact of these crimes.

The results of the survey and seasonality chapters indicate that crimes recorded by Police are likely to represent only a fraction of the actual incidents experienced, which has direct implications for any policies or practices based on the available Police data. Without accurate

information about the incidence of these crimes in the UK, it is not possible for decision makers to determine what policies and priorities are reflective of the needs of the species or the rural areas (such as farms) experiencing these crime types.

The systematic review highlighted how, without accurate information on the incidence of crimes against species, it is difficult to assess the effectiveness of crime prevention strategies. Therefore, it is necessary for systems to encourage reporting and accurate recording of these crimes, so it is possible to accurately quantify the impact of such strategies, before significant sums are spent on inappropriate prevention techniques in the future.

Policing of Livestock and Wildlife Crimes – The Thematic Analysis (Chapter Five) identifies some of the reasons for the negative perception some farmers about the Police, and other reasons for them not reporting the crimes they have experienced. Some farmers believe that Police have no interest in farm related crimes, a perspective reported in other surveys of farm crime. The survey indicates the need for more support for rural Police, who have suffered significant reductions in resources and personnel but are tasked with managing large rural areas.

Improved communication channels between farmers and Police, examples of which were identified by some respondents to the survey as existing in their local areas, could improve reporting of suspicious activities in rural areas, and in turn the tackling of crimes impacting farms, such as those involving Livestock and Wildlife.

The thesis presents the first study of Livestock and Wildlife crimes on farmland in UK. Impacts associated to Livestock and Wildlife crimes go beyond the negative impacts on the species and can lead to negative impacts on the safety of food products from farms in the UK. The exploitations of farmland in the UK by those committing Livestock and Wildlife crime is undermined by the lack of deterrents including the low penalties for those caught committing these crimes. The thesis highlights the need for further research to tackle these crime types, by identifying the routine activities of farmers, Livestock and Wildlife, and addressing the potential vulnerabilities of farmland.

Limitations of Thesis Methodology

The data collected for the Victimisation Survey (Chapter Four), Thematic Analysis (Chapter Five) and Seasonality (Chapter Six) Chapters, have a number of associated limitations in relation to sample size and representativeness, which will be discussed in more detail below:

Sample Size and Representativeness

The victimisation survey (Chapter Four) identifies that most Livestock and Wildlife crimes are unreported to the Police, highlighting the limitations of officially recorded crime data, such as that used in the Seasonality analysis (Chapter Six) in representing the true incidence of Livestock and Wildlife crimes.

The thematic analysis is based on a single general question asking respondents if they have any other comments on their experiences of crime. The thematic analysis of the free text question responses in the victimisation survey, assessed the responses without determining the relevance, based on the number of comments on a given topic. The thematic analysis could have been improved by asking additional structured questions, or by conducting interviews or focus groups to expand upon topics and identify avenues of future research.

The seasonality analysis chapter (Chapter Six) aimed to access data from multiple counties in the UK, but was only able to acquire sufficiently detailed crime data from one county (Dorset). To ascertain if the seasonal variation identified for the different species is replicated in other areas of the UK, data from a number of other counties would need to be acquired and the results compared to establish the representativeness of the seasonal variation identified for the disaggregated species.

Of the quarter of a million crimes recorded by Dorset Police force over the study period (2010-2015), the number of crimes extracted by filtering for those related to Livestock and Wildlife, came to just over 500 across the six-year period. The sample of crime data may have been larger had the time frame been longer than six years, however, there is no certainty that the number of crimes would have significantly increased with the addition of more years, especially as the crime data indicated that the number of crimes recorded increased steeply between 2010 and 2015.

Data Accuracy

The thesis uses primary, secondary and tertiary data sources to assess the topic of Livestock and Wildlife crime in the UK, and the use of such data presented a number of limitations relating to accuracy and representativeness.

Historical Data – The use of historical crime data should take into account the variation in crime recording practices and accuracy over time. Variation in recording processes may be negatively influenced by the perception of the importance of certain crime types, which could explain why wildlife crimes have not historically been recorded with sufficient detail.

Spatial Variation in Crime Detection & Recording – The variation in access to technology used to detect and record crimes between different areas contributes to the variation in data quality between different areas.

Sample Selection – The sample for the victimization survey was identified using criterion sampling, which specifically required the respondents to be registered (with an associated email address) to one of the pedigree breed websites for the major livestock breeds in the UK. The resulting sample is therefore cannot be fully representative of farms throughout the UK which do not all have pedigree livestock.

In addition to the survey sample being restricted to those who were registered on the Breeders website, the sample specifically targeted farms that were thought to have livestock. Attempts to access contact details for arable farms proved more difficult due to the lack of open source websites/databases equivalent to the breeding societies identified for the major livestock breeds in the UK. Due to the focus of the survey and the difficulty in accessing contact details for arable farmers, the resulting sample did not include arable farms such as those involved in the production of horticulture and cereals.

The types of farm included in the survey will also have impacted on the location of respondents, as arable farms tend to be found in the Eastern areas of the UK. Although the survey did receive responses from farmers in the Eastern parts of the UK, it is important that the opinions of the farms typical of the given regions are represented in the resulting data. The results of the survey can therefore only be considered representative of the types of farms included in the sample.

Replication of the survey with the inclusion of respondents from arable farms in the UK would provide an opportunity to address Wildlife crime on arable farms, crimes impacting crops, and how representative the data from the victimization survey in this thesis is of Livestock and Wildlife crime in the UK.

Crime vs Incident Data – The Police data only included crimes over the study period (2010 – 2016). The limited amount of data is unlikely to be reflective of the fact that, anecdotally, Police acknowledge that the crimes involving Livestock and Wildlife get recorded as incidents. Future research would benefit from acquiring both crime and incident data as long as it contains sufficient information to be able to extract and analyse the relevant records.

Geospatial Accuracy – The existing literature and crime data highlighted the issues associated with the accurate recording of crime locations in rural areas, such as those related to Livestock and Wildlife. The issues associated with the accuracy of recording crime location directly impacts the types of analysis that could be used to identify what environmental factors contribute to the vulnerability of rural areas and species types to crime.

Future research should aim to overcome the limitations associated to the accuracy of data relating to Livestock and Wildlife crimes in the UK. Addressing the issues associated with primary data recording, would include standardising the terminology used by police forces to improve accuracy and ease of extraction, as well as the relevance of location information so that this reflects the precise location of a crime in the rural area, rather than the location where Police should attend to speak to victims (e.g. farm house address).

Legislation Variation

The legislation relating to Livestock and Wildlife crimes in the UK varies between the different countries. Countries in close proximity such as the Isle of Man and the Republic of Ireland, have independent legislation which would require independent assessment of the experiences of crime against Livestock and Wildlife. The variation in legislation means some actions that may be illegal in one country may not be in another. An example of this is that Hare Coursing is illegal in the UK but is still currently legal in the Republic of Ireland. The existing Legislation protecting farmed and wild species in the UK were briefly mentioned in the thesis but were not reviewed in detail, the effectiveness of the existing legislation should be addressed in future

research as this is likely to have a significant impact on the reporting, recording and sentencing of crimes involving livestock and wildlife.

Livestock & Wildlife Crimes

The thesis focused specifically on crimes against terrestrial species in the Systematic review, with the victimization survey and seasonality analysis chapters (Chapter Four, Five and Six respectively) focusing on Livestock and Wildlife crimes occurring on farmland in the UK. The survey and crime data did not examine other crimes that may have occurred on the farmland, and therefore could not determine whether the farms experienced a variety of crime, or if the farmland was specifically targeted by poachers, coursers or rustler etc.

To address this issue, future surveys or research should gather further information about the experiences of farm crime in general, to establish the context of the Livestock and Wildlife crimes experience by farms in the UK.

Farmers are not the only guardians of the rural landscape, and therefore future research should look to incorporate these other groups that work and protect large areas of the UK rural landscape to provide a more comprehensive picture of the incidence of these crime types. Gamekeepers and National Park Rangers in the UK were approached to provide additional information about their experiences of crimes against farmed (e.g. game birds) and wild species on the land they manage, however this was not achieved.

The occurrence of Livestock and Wildlife crimes was studied, but they are independent crime types, with variable motives and perpetrators involved in their commission. Examples such as Hare Coursing being linked to illegal gambling, and Livestock crimes being linked to the illicit meat trade. Whilst the motives and perpetrators of these crimes may be different, the outcome (persecution, theft or killing), neither crime type is subject to much deterrence in the way of penalties.

Future research should look at these crime types independently, particularly to identify sources of information that may not be readily available for both Livestock and Wildlife (e.g. data held by Wildlife charities on crimes involving wildlife) across the UK, beyond the limitations of farmland.

Lack of Duplicate Assessment of Data

The Systematic Review (Chapter Three) and Thematic Analysis (Chapter Five) used techniques that typically require multiple researchers in the development of the themes and coding process, and to perform independent assessments of the returned articles/data extracts to identify if there were any differences between separate assessors results, to prevent the loss or mis-allocation of information. Future systematic reviews and thematic analyses would be improved by having the returned information assessed in duplicate.

CHAPTER EIGHT

Discussion

The aim of the thesis was to provide a comprehensive overview of Livestock and Wildlife crime in the UK. The discussion chapter will summarise the findings from each of the chapters, and discuss three themes of this thesis (incidence, seasonality and reporting), and present potential avenues for future research.

Chapter Three presented the results of a systematic review assessing the effectiveness of situational crime prevention methods for crime involving terrestrial species using the EMMIE evaluation framework. Despite recent international investment in tackling crimes against terrestrial species, the chapter only identified two methods of crime prevention that had been assessed: 1) Community Engagement and 2) Anti-Poaching Patrols. The limited number of studies that evaluated prevention techniques evidences the need for more assessments as to how effective different methods of prevention are, to ensure that limited resources are targeted effectively, especially when attempting to protect species at increasing risk from persecution.

To overcome these limitations of the literature, a victimisation survey was conducted with farmers in *Chapter Four*. The survey produced a variety of findings on the victimisation of Livestock and Wildlife in the UK. The results answered a range of research questions on the rates of these crime types, reporting practices and features of farms that may influence victimisation. Features of the landscape (roads, and buildings) were not significantly associated to the occurrence of Livestock and Wildlife crimes on farmland, with the only exceptions being Rights of Way and Pluriactivity. The responses to the survey did produce some interesting results in relation to the incidence, seasonality and reporting of Livestock and Wildlife crime, which will be discussed later in this chapter.

In addition to the main survey findings, the final question of the victimisation survey provided farmers with the opportunity to write about any other crime issues they have experienced on their farms. The responses were separately assessed in *Chapter Five* using a thematic analysis of the farmers comments. Comments from farmers in interviews and focus groups have been assessed previously to identify common themes relating to crime and prevention on farmland. As the final question was optional and consisted of a single question, a thematic analysis

provided a useful method for qualitatively assessing the farmers comments, which contained information relating to the causes of crime, the Police response to farm crime and emerging issues (e.g. Drones worrying livestock).

Chapter Six assessed the seasonal/annual variation in Livestock and Wildlife crimes. Of the quarter of a million crimes between 2010-2015, 569 were found to relate to Livestock (473) and Wildlife (96); with Chickens, Other Birds, Poaching and Deer related crimes showing the most distinct seasonal patterns. The seasonal analysis highlighted the importance of disaggregating the data into the different species, as well as those crimes directly impacting the species and those associated (e.g. theft of sheep feeders, break-in to chicken shed).
Data quality issues identified during the analysis of the Police crime data were presented, with the chapter suggesting potential solutions for the issues associated with inaccurate location information in rural areas like farmland.

Finally, *Chapter Seven* presented a Synthesis of the findings from the chapters within the thesis, as well as the limitations associated to the research.

Each chapter presented a discussion of the individual studies results. However, several common themes were identified in the process of completing the research. The main themes identified related to the Incidence, Seasonality and Reporting of Livestock and Wildlife Crimes. In addition to these themes, two issues relating data quality, and the lack of existing research will be discussed.

Incidence

The true amount of crime is rarely reflected in Police data, with personal and commercial victimisation surveys conducted to address the level of unreported crime (Biderman et al, 1967; Skogan, 1977). The thesis aimed to estimate the incidence of Livestock and Wildlife crimes on farmland, using both crime data and a victimization survey of farmers in the UK. A comparison of the main findings is shown in Table 7.1.

The results constitute the first available incidence estimates specifically focused on Livestock and Wildlife crimes on farmland in the UK. It was found that 28.2% of respondents have experienced Livestock crime in the last 2 years, whilst 21% have experienced Wildlife crime. The results of the survey do not directly align with the findings of other surveys on farm crime,

due to most of these studies failing to separate out the different crime types, or the types of crimes assessed varying between each survey/study, but do indicate Livestock and Wildlife crime is underestimated in surveys including the NRCN Rural Crime Survey, and the Scottish Farm Crime Survey. Other surveys review the variety of crimes that impact farms, and are not solely assessing the incidence of Livestock and Wildlife crimes, highlighting the importance of disaggregating the types of crimes impacting farms, and in the case of this thesis, identifying the amount of farmers impacted by Livestock and Wildlife crime in the UK.

Seasonality

A large amount of research has been conducted on the seasonality of different crime types (e.g. burglary, robbery, assault etc.) aiming at identifying when and where crimes are most likely to happen, which can allow the targeting of resources and prevention strategies, however the links between seasons/time and crimes is still debated (Baumer & Wright, 1996; Dong et al, 2017; Hird & Ruparel 2007; McDowall et al, 2012). Barclay (2001) identified seasonal patterns in Livestock theft in Australia which aligned with the value of Livestock, but to the author's knowledge, no attempt has been made to assess the seasonal variation of Livestock and Wildlife crimes in the UK.

The analysis of the survey data support the anecdotal evidence of Police and other stakeholders as to the annual/seasonal patterns of these crime types, with Livestock crimes occurring more often in the spring and summer months, and Wildlife crimes showing an inverse pattern, with these crimes occurring more in the autumn and winter months (Linc Police: Hare Coursing, 2019).

The crime data was also assessed for seasonal variation and confirmed the importance of disaggregation of the crime data for Livestock and Wildlife crimes by species type to accurately identify seasonal/annual patterns, with several species showing annual variation in victimization. (e.g. Chicken and Other birds had inverse annual patterns). The crime data was also found to show further seasonal variation once disaggregated further by separating out the crimes that directly affected the species and crimes that were only associated (e.g. break-in to chicken shed, theft of cattle feeders etc.). For more accurate seasonal analysis of these crime types, data from a variety of Police forces across the UK over a longer time period would allow for verification of whether seasonal patterns in these crime types do exist.

Reporting of Livestock and Wildlife Crimes

Farm crime surveys that have assessed the rate of reporting (CVS, 2014,2015,2016,2018; CVS Technical Report, 2018; NRCN, 2015, 2018; SFCS, 1999; Smith, 2018), have typically grouped all crimes occurring on farms together, and provided an overall figure, which fails to acknowledge the variability between different crime types, with the proportion reporting farm crimes varying from 20%) to 39%. The research found that less than half of the Livestock crimes experienced by respondents were reported (39.5%), and even fewer Wildlife crimes (20.3%). The reporting disparity was supported by the finding within the Police data, which showed 4.9 times the number of Livestock crime records compared to that of Wildlife crimes.

The findings of the survey highlight's the disparity between the reporting of Livestock and Wildlife crimes, and even between the type of crimes (e.g. theft, attacked etc.) impacting Livestock and Wildlife. The disparity in reporting is likely due to the cost of the crimes varying depending on if the species are the farmers property or a wild species within the farm environment. The reasons for the low levels of reporting related largely to farmers feeling that nothing could be done by the Police, the Police were not interested, or the issue was handled by the farmer themselves. These reasons match closely with the reasons for not reporting crimes found within the Crime Survey of England and Wales. These findings are supported by the results of Smith (2018) discussion with farmers and Police, which highlighted the need for better communication between these two groups to tackle farm crime in future.

Table 8.1: Comparison of information gathered from the Farmer Victimisation Survey and Police Data on Livestock and Wildlife crimes.

Topic	Survey Data		Police Data	
Time Frame	Historically & Previous 2 Years		6 years (2010-2015)	
Species Type	Livestock	Wildlife	Livestock	Wildlife
Victimisation	Overall 28.6% of respondents experienced Livestock crimes. 12.78% experienced Worried/ Attacked/Killed crimes, and 5.5% experienced Theft of Livestock.	21.3% of respondents experienced Wildlife crimes. 5.3% experienced Poaching, 8.7% Coursing, and 4.3% Attacked/Killed/ Persecuted crimes.	Livestock – 0.19% of total crimes in sample data from 2010-2015. Livestock crime occurrence over the six-year period showed a steady trend.	Wildlife – 0.04% of total crimes in sample data from 2010-2015. Wildlife crime occurrence over the six-year period should an increase over the sample period.
Seasonality	Distinct seasonal trend with crimes increasing from start of the year, peaking in the spring/summer months (note: a dip appeared in June) and then decreasing into autumn and winter.	Distinct seasonal trend with an inverse relationship to that of Livestock crime, with crimes peaking in Autumn and Winter, and decreasing during the spring/summer months.	Chickens and Other birds showed distinct seasonal patterns with crimes against chickens increasing in the first six months of the year, before decreasing for the last six months, and the inverse being found for Other Birds. Other livestock crimes did not show distinct seasonal patterns.	Poaching and Deer related crimes showed a distinct seasonal pattern with more crimes occurring in the Winter months, corresponding with the survey findings.
			Overlap of crimes involving Deer Poaching and Crop Damage.	
Reporting & Recording	39.5% of all livestock crimes were reported to the Police.	20.3% of Wildlife crimes were reported to the Police. >70% of farmers that have experienced the attacking/killing or persecution of wildlife did not report it to the Police.	Over the six years of crime records, 569 records existed that related to Livestock and Wildlife crimes. Livestock crimes (n = 473) accounted for 4.9 times the number of records of Wildlife crimes (n = 96).	

Data quality issues

Issues associated to variable terminology/spelling of Livestock and Wildlife names, made extraction and filtering complex. In the absence of technological reform of recording services in the UK, methods must be adopted to help Police analysts and researchers accurately extract and filter the data. This might involve developing advanced data extraction tools or improving recording practices. As described in Chapter Six, the latter could be achieved in the immediate future by adding specific search terms (e.g. '#Wildlife#, #livestock#, #farm#') in the text fields, which would allow for easier and more accurate extraction. By adding these search terms, it should be possible to improve the access of data to Police analysts and researchers, and prevent any further loss of information due to an inability to access the already known to be limited number of incidents/crimes that have been reported to the Police.

The issues with accurately recording the location of crimes in rural areas, have been known for some time, with crime scientists accepting the limitations in data quality for rural areas. The literature on spatio-temporal analysis of crimes has subsequently been predominantly conducted in urban or suburban areas in Western countries.

Researchers advise conservationists and local authorities in Africa and Asia to keep detailed records and accurate spatial data relating to crimes involving wildlife, so that they can better understand the spatial component of these crime types, yet the same technologies and ethos is not employed in the UK. The existing research therefore fails to assess the influence of features within the rural environment. Chapter Four identified and explained the potential factors on farmland that may influence victimization, by increasing the permeability of the landscape (e.g. roads, rights of way) or by potentially increasing the influence of guardianship (e.g. buildings), however, the content of the Police data as it currently exists makes empirical assessment of these features impossible.

The crime data provided was referenced to locations that would be relevant to the Police officer/s who may be required to meet with individuals/victims/witnesses about crimes that have occurred. However, for the spatial analysis it was not the home address of the victim/witness that was required but the true location of the crime. Recording the location of crimes to the field level is now possible using the 'What3Words' mobile application or website, and recommendations for its use by Police and farmers have been made in Chapter Six. By recording the three word address for the field in which incidents/crimes have been reported,

would mean that crime records being created can be future proofed, so that spatial analysis could potentially be conducted in the coming years, once crime data exists containing sufficient information.

The data quality issues are not due to poor recording on behalf of the Police force, as illustrated by the findings of a freedom of information request made to all police forces asking about their ability to tag crimes on farmland, and access to GPS equipment. The proposed methods for improving the accuracy of crime data for crimes occurring on farmland, could be easily applied in all forces, and at zero to minimal cost. The resultant records could provide improved spatial data that can be applied to variety of other crimes occurring on farmland and in rural areas.

Lack of empirical research

The initial aim of the thesis was to establish what literature existed internationally on effectiveness of prevention methods for crime against terrestrial species. The results identified that whilst a number of potential ideas are proposed and their implementation described in the available literature, there is a dearth of empirical assessment of the effectiveness of prevention methods. The only methods for situational prevention of crimes against terrestrial species empirically assessed were community engagement and anti-poaching patrols. It is not possible to determine if these are the best methods for preventing crimes against species compared to other methods without assessments with which to compare the results. It is not clear whether the absence of assessments of effectiveness are the results of a lack of data, or lack of targeted studies. The systematic review highlights the need for more evidence as to what works for preventing crimes against species, that can be used by decision makers to more accurately target the limited resources and personnel that are available for the protection of species.

Research relating to the incidence of Livestock and Wildlife crime in the UK were found to be limited, with the limited amount of available information relating to Farm crime in general. This limited number of studies that examined crime on farms, was surprising given that agricultural premises cover the vast majority of the landscape in the UK.

In the process of completing the research, meeting Police, Farmers and other stakeholders, highlighted that there was established knowledge of the seasonal variation in certain crimes involving Livestock and Wildlife, and factors of farms that influenced the likelihood of

victimisation, but this knowledge was largely anecdotal, or part of intelligence reports by Police which were not available to the general public or researchers. Empirical research cannot be substituted for anecdotal evidence, and as such the area of Farm crime requires much more research to provide a strong information base on which stakeholders can reliably base their decisions.

Understanding the true state of Livestock and Wildlife crime in the UK is undermined by the lack of existing empirical research, which is why this thesis attempts to provide the first comprehensive study to specifically address these crime types.

The link between Livestock and Wildlife crimes and other crime types

The importance of detecting, accurately recording and monitoring crimes involving Livestock and Wildlife go beyond the impact to the species. Farm crime, including Livestock and Wildlife crime has been linked to organised crime groups.

In addition to organised crime links, psychological research has identified the link between animal harm and human harm, with individuals convicted of violent crimes being more likely to have harmed animals in their childhood and/or adulthood. The escalation of abuse from animals to other people is often found with domestic abusers.

The connection between crimes involving Livestock/Wildlife and Domestic animals, and other crime types considered more 'serious' such a drug dealing and domestic violence, reiterate the need for improved recording and intelligence on Livestock/Wildlife harm, which could then be used to identify individuals that may be involved in other criminal activity (Nurse 2016).

Support for Research and Intelligence into Livestock & Wildlife crimes

The tackling and enforcement of Wildlife crime in the UK is through the dedication and determination of a small number of NGO's, wildlife charities and Police officers that have actively worked to highlight the importance of these issues in the UK.

The UK government invests large sums into the protection of threatened species internationally, but this investment is not reflected in the UK, where the NWCU continues to appeal for funding to remain open. The lack of certainty over the future funding of units like

the NWCU, highlights the disparity between the UK governments support of tackling international wildlife crime/trade and its recognition of the problems facing wildlife at home.

The evidence in this thesis supports the need for the Government to provide increased, long term funding for the NWCU, to allow it to expand its remit to include data collection, collaborate with researchers, and make sure the UK is able to monitor and manage its own native species.

Recommendations for Future Research

There exist a variety of potential avenues for future research in Farm, Livestock and Wildlife crime, in the UK and internationally.

Research on community engagement in Rural areas of the UK may be particularly important to identify ways of increasing the likelihood of residents and farmers reporting Livestock and Wildlife crimes to the Police, thereby improving the accuracy of crime data to reflect the actual incidence of these crime types.

The collation and analysis of data from all Police forces nationally, in combination with more large-scale surveys like the victimization survey in this thesis, could be used to identify and monitor trends or displacement in Livestock and Wildlife crimes. The ability to monitor the trends in these crimes, within and beyond Police data, would allow stakeholders such as the Police to identify existing trends, have advanced warning of developing issues and target resources and prevention methods efficiently.

Further research is needed to examine the criminal history of individuals identified or successfully prosecuted for Livestock and Wildlife crimes or trespassing on farmland. The research would look to assess the links between “small” crimes occurring on farmland and “larger” crimes to which they may be linked (Nurse, 2016; Roach, 2007).

Future research should assess the existing situational crime prevention methods used internationally to prevent species crimes and provide a review of the effectiveness of the different techniques that are being used. The assessment and subsequent review of prevention techniques could identify where knowledge may be transferred and used to inform the advice the UK provides at home and abroad.

Future research should identify and trial methods for recording the location of crimes in rural areas such as farms more accurately and establish how this can be made more easily accessible by the public and Police.

Appendices

Appendix 1: Victimisation Survey of Farmers – Survey introduction page and questions.

SECTION 1 / PAGE 1

The UCL Department of Security and Crime Science is conducting research into Rural crime in the UK, with a particular focus on Wildlife and Livestock crimes.

This survey aims to elicit the opinion of those who own or work on farms in the UK. The information provided is anonymous and will remain so throughout the research.

You have been invited to take part as you were a registered member of one of the national livestock breeders' societies in the UK or Ireland.

This survey should take no longer than 10 - 15 minutes to complete.

The majority of the questions you will be asked are multiple choice, requiring you to select the appropriate answer by checking a box. A progress bar is shown at the bottom of the page to show you how far you are through the survey.

You can save and return to the survey at any time.

Participation is entirely voluntary. If you decide to take part, you will be asked to indicate your consent (by checking the 'Consent Confirmation' box on the first page of the survey) to use the information you provide for the intended research.

No personal or identifying information will be taken. All the data collected during the course of the research will be kept strictly confidential and anonymous.

To begin please click the 'Start' button at the bottom right hand corner of the screen.
Thank you for participating.

If you have any queries or need to contact the researcher please use the contact details given below:

PhD researcher: Dorothea Delpech ([redacted])
PhD supervisor: [redacted]

[redacted]

All personal information of respondents is protected by the Data Protection Act (1998).
No identifiable information will be included in the final analysis or future publications

SECTION 2 / PAGE 2 – Farm Information

Question 1
Consent confirmation:

- ☑ By checking this box you are consenting for the answers to be used in the intended research

Question 2
Gender:

- ☑ Male
- ☑ Female

Question 3
Age

- ☑ Under 18
- ☑ 18 - 24
- ☑ 25 - 34
- ☑ 35 - 44
- ☑ 45 - 54
- ☑ 55 - 64
- ☑ 65 or older

Question 4
How many years have you been working on the farm?
Years _____

Question 5
Location of Farm:

- ☑ East of England
- ☑ East Midlands
- ☑ North East
- ☑ North West
- ☑ West Midlands
- ☑ South East
- ☑ South West
- ☑ London
- ☑ Northern Ireland
- ☑ Republic of Ireland
- ☑ North Wales
- ☑ South Wales
- ☑ Scotland
- ☑ Other (Please Specify)...

Question 6
What is your association to the farm?

- ☑ Farmer/Director/Spouse (Full Time)
- ☑ Farmer/Director/Spouse (Part Time)
- ☑ Farm Manager
- ☑ Farm Worker (Full Time)
- ☑ Farm Worker (Part Time)
- ☑ Casual Worker
- ☑ Other (Please specify)...

Question 7
How large is the farmland?
Hectares _____
Acres _____

Question 8
What is the farm type?

- ☑ Grazing Livestock (Lowland)
- ☑ Grazing Livestock (Less Favourable Land)
- ☑ Specialist Pigs
- ☑ Specialist Poultry
- ☑ Dairy
- ☑ Mixed
- ☑ General Cropping
- ☑ Cereals
- ☑ Horticulture
- ☑ Unclassified
- ☑ Other (Please Specify)...

Question 9
The farm produce is mainly intended for?

- ☑ Commercial Sale (Grown to Sell)
- ☑ Subsistence (Personal Use Only)
- ☑ Other (please specify)...

SECTION 3 / PAGE 3 – Farm Employee Information

Question 10
How many staff are permenantly employed on the farm?
(excluding temporary staff)

- ☑ Full Time Staff _____
- ☑ Part Time Staff _____
- ☑ Seasonal Staff _____

Question 11
When do temporary/seasonal staff work on the farm?
(tick all that apply)

- ☑ January
- ☑ February
- ☑ March
- ☑ April
- ☑ May
- ☑ June
- ☑ July
- ☑ August
- ☑ September
- ☑ October
- ☑ November
- ☑ December
- ☑ Don't Know
- ☑ N/A - no temporary staff

Question 12
Does anyone live on the farm permanently?

- ☑ Yes
- ☑ No
- ☑ Don't Know

Question 13
How many hours per day is the farm land left unsupervised (no one on the land)?
Please tick the average number of hours per day for each month.

	< 1 hour	1 - 4 hours	4 - 8 hours	8 - 12 hours	12 - 16 hours	16 - 20 hours	> 20 hours
January	☑	☑	☑	☑	☑	☑	☑
February	☑	☑	☑	☑	☑	☑	☑
March	☑	☑	☑	☑	☑	☑	☑
April	☑	☑	☑	☑	☑	☑	☑
May	☑	☑	☑	☑	☑	☑	☑
June	☑	☑	☑	☑	☑	☑	☑
July	☑	☑	☑	☑	☑	☑	☑
August	☑	☑	☑	☑	☑	☑	☑
September	☑	☑	☑	☑	☑	☑	☑
October	☑	☑	☑	☑	☑	☑	☑
November	☑	☑	☑	☑	☑	☑	☑
December	☑	☑	☑	☑	☑	☑	☑
All Year Round	☑	☑	☑	☑	☑	☑	☑

Question 14
Do you have any other employment separate to the farm? (e.g. office work, factory work)

- ☑ Yes
- ☑ No

SECTION 4 / PAGE 4 – Farm Security Information

Question 15
Which of these boundary types are mainly used around the perimeter of the farm?

- ☑ Wooden Fence
- ☑ Wire Fence
- ☑ No Barriers / Boundaries
- ☑ Stone Wall
- ☑ Electric Fence
- ☑ Hedges
- ☑ Mixture
- ☑ Other (Please Specify)...

Question 16
What security measures are used on your farm to prevent crimes on the farmland?

- ☑ Locks
- ☑ Security Lights
- ☑ CCTV
- ☑ Alarms
- ☑ Electronic Gates/Other Gates
- ☑ Maintaining secure Boundary
- ☑ "No Trespass" Signs
- ☑ Watch Dog / Guard Dog
- ☑ Geese
- ☑ Neighbourhood / Farm / Horse Watch
- ☑ Other (Please Specify)...

Question 17
Does the farmland contain public rights of way (e.g. public footpaths, byways or bridleways)?

- ☑ Yes
- ☑ No
- ☑ Don't Know

Question 18
How far is the farm from a main road?
Miles _____

Question 19
How far are you from the nearest village?
Miles _____

Question 20
Have Livestock crimes occurred on the farm?

- ☑ Yes
- ☑ No

SECTION 5 / PAGE 5 – Livestock Crime

Question 21
Which months have livestock crimes occurred on the farm?

- ☑ January
- ☑ February
- ☑ March
- ☑ April
- ☑ May
- ☑ June
- ☑ July
- ☑ August
- ☑ September
- ☑ October
- ☑ November
- ☑ December
- ☑ All Year Round
- ☑ Don't Know
- ☑ N/A - no crimes

Question 22
Please provide (in the relevant boxes below) the average number of livestock on the farm, as well as the number stolen and attacked over the last 2 YEARS:

LIVESTOCK TYPE	Number of livestock on Farm	Number Stolen (Theft of Livestock)	Number Worried / Attacked / Killed
Pigs			
Cattle (Beef)			
Cattle (Dairy)			
Sheep			
Poultry			
Other (Please Specify)			

Question 23
How many livestock crimes have occurred on the farm in the last 2 YEARS?
Please indicate the types of livestock involved and how many of the incidents were reported to the police.

LIVESTOCK CRIME TYPE	Number of Incidents (total)	Number of Incidents Reported to Police
Worried / Attacked / Killed		
Theft of Livestock		

Question 24
Which months have livestock crimes occurred on the farm in the last 2 YEARS?
(tick all that apply)

- ☑ January
- ☑ February
- ☑ March
- ☑ April
- ☑ May
- ☑ June
- ☑ July
- ☑ August
- ☑ September
- ☑ October
- ☑ November
- ☑ December
- ☑ All Year Round
- ☑ Don't Know
- ☑ N/A - no crimes

Question 25
Which of the reasons below best explain why livestock crimes have not been reported to the police in the past?
(tick all that apply)

- ☑ Too trivial / not worth reporting
- ☑ Inconvenient to report
- ☑ Dislike or fear of the police / previous bad experience with the police or courts
- ☑ Police not interested / bothered
- ☑ Private / dealt with themselves
- ☑ Attempt at offence unsuccessful
- ☑ Police could not do anything
- ☑ Fear of reprisals / intimidation
- ☑ No loss / damage
- ☑ Although this was a crime, it was not a regarded as a problem affecting the farm
- ☑ Thought had already been reported
- ☑ Tried to report, but unable to contact the police
- ☑ Common occurrence
- ☑ Offender not responsible for actions
- ☑ Reported to other authorities
- ☑ Own / family member / friend's fault
- ☑ Happened as part of job
- ☑ Other (Please Specify)...

Question 26

How has Livestock Crime changed in your area in the last 2 YEARS?

- ⊗ Increased a lot
- ⊗ Increased a little
- ⊗ No Change
- ⊗ Decreased a little
- ⊗ Decreased a lot
- ⊗ Don't Know

Can you suggest a reason for this? _____

Question 27

How many hours per day (out of 24) are the livestock unsupervised (no one physically with them)? Please tick the average number of hours per day for each month.

	< 1 hour	1 - 4 hours	4 - 8 hours	8 - 12 hours	12 - 16 hours	16 - 20 hours	> 20 hours
January	☑	☑	☑	☑	☑	☑	☑
February	☑	☑	☑	☑	☑	☑	☑
March	☑	☑	☑	☑	☑	☑	☑
April	☑	☑	☑	☑	☑	☑	☑
May	☑	☑	☑	☑	☑	☑	☑
June	☑	☑	☑	☑	☑	☑	☑
July	☑	☑	☑	☑	☑	☑	☑
August	☑	☑	☑	☑	☑	☑	☑
September	☑	☑	☑	☑	☑	☑	☑
October	☑	☑	☑	☑	☑	☑	☑
November	☑	☑	☑	☑	☑	☑	☑
December	☑	☑	☑	☑	☑	☑	☑
All Year Round	☑	☑	☑	☑	☑	☑	☑

Question 28

Have Wildlife crimes occurred on the farm?

- ☑ Yes
- ☑ No

SECTION 6 / PAGE 6 – Wildlife Crime

Wildlife Crime is any action that goes against current legislation protecting wild animals and plants.

Wildlife Crimes in the UK include: Hare Coursing, Deer poaching, Fish poaching, Badger persecution – including baiting, snaring, shooting, and disturbance of setts, Bat persecution, Egg theft / collection, Bird of Prey persecution – through poisoning, trapping, shooting, disturbance of nest and/or theft of chicks.

Question 29
Which months have wildlife crimes occurred on the farm?
(tick all that apply)

- ☑ January
- ☑ February
- ☑ March
- ☑ April
- ☑ May
- ☑ June
- ☑ July
- ☑ August
- ☑ September
- ☑ October
- ☑ November
- ☑ December
- ☑ All Year Round
- ☑ Don't Know
- ☑ N/A - no crimes

Question 30
How many wildlife crimes have occurred on the farm in the last 2 YEARS? and how many of the incidents were reported to the police.

WILDLIFE CRIME TYPE	Number of Incidences (total)	Number of Incidences Reported to Police
Poaching		
Coursing (chasing with dogs) e.g. hare, deer		
Attack / Kill / Persecute (e.g. baiting, snaring, shooting, disturbance of nests/setts)		

Question 31
Which months have wildlife crimes occurred on the farm in the last 2 YEARS?
(tick all that apply)

- ☑ January
- ☑ February
- ☑ March
- ☑ April
- ☑ May
- ☑ June
- ☑ July
- ☑ August
- ☑ September
- ☑ October
- ☑ November
- ☑ December
- ☑ All Year Round
- ☑ Don't Know
- ☑ N/A - no crimes

Question 32
Which of the reasons below best explain why wildlife crimes have not been reported to the police in the past? (tick all that apply)

- ☑ Too trivial / not worth reporting
- ☑ Attempt at offence unsuccessful
- ☑ Thought had already been reported
- ☑ Own / family member / friend's fault
- ☑ Reported to other authorities
- ☑ Private / dealt with themselves
- ☑ Common occurrence
- ☑ Tried to report, but unable to contact the police
- ☑ Police not interested / bothered
- ☑ No loss / damage
- ☑ Fear of reprisal
- ☑ Dislike or fear of the police / previous bad experience with the police or courts
- ☑ Happened as part of job
- ☑ Offender not responsible for actions
- ☑ Inconvenient to report
- ☑ Police could not do anything
- ☑ Other reasons (Please Specify)...

Question 33
How has Wildlife Crime changed in your area in the last 2 YEARS?

- ⊗ Increased a lot
- ⊗ Increased a little
- ⊗ No Change
- ⊗ Decreased a little
- ⊗ Decreased a lot
- ⊗ Don't Know

Can you suggest a reason for this? _____

SECTION 7 / PAGE 7 – Thank You

Question 34
Is there anything else you would like to tell us about crime on the farm?
_____

Thank you very much for taking part in this survey on farm crime.
To SUBMIT your answers please click the 'FINISH' button in the bottom right hand corner.

Thank you again for your time, your participation will help us to better understand how farm crime is impacting farmers across the UK.

If you would consider being interviewed about your experiences of farm crime, please send your name and contact details to:
[redacted]

Appendix 2: Open source data identification and extraction for Farmer Victimisation Survey.

Open Source Livestock Breeder and Farmer Details

Identifying the farmers to contact was achieved using a three-stage process. Stage One: Identifying the livestock farmed in the UK and mainstream breeds. Stage Two: Establishing whether contact details were available for farmers/breeders through open source channels. Stage Three: Extracting the open source contact details and collating these in a single database in preparation for disseminating the survey.

Stage One: Main Livestock Types & Breeds in the UK.

Information on the main farming output in the UK is recorded as part of the Eurostat farming survey carried out every ten years. The 2010 survey identified the main output of the UK farming industry by type: Specialist Dairying (22.7%), Specialist Cereals, oilseed and protein crops (13.4%), General field cropping (12.3%), Specialist Poultry (12.1%), Others (9.6%), Sheep, goats and other grazing livestock (8.3%), Specialist cattle-rearing and fattening (7.7%), Field crops-grazing livestock combined (4.9%), Specialist pigs (3.5%), Other horticulture (2.8%) (EUROPA Farming UK, 2013). Once the farming outputs had been identified, the accessibility of open source contact details was reviewed. Some of the main produce types did not have readily accessible producer/breeder databases, and as such the search was limited to three of the main livestock types farmed in the UK. The main breeds of cattle (dairy and beef), sheep and pigs were then identified and are detailed below:

CATTLE

Beef – Ten beef breeds make up 92% of the current beef producing species in the UK. The ten breeds include: Limousin (29%), Aberdeen Angus (16%), Charolais (13%), British Blue (11%), Simmental (10%), Hereford (6%), Blonde D'Aquitaine (2%), South Devon (2%), Shorthorn (2%), Salers (1%), Others (8%) (NFU Beef Document, 2014).

Dairy – The Holstein-Friesian is the most common breed of Dairy cow in the UK constituting approximately 90% of dairy cows in the UK. Other breeds include: Guernsey, Dairy Shorthorn, Ayrshire and Jersey (This is Dairy Farming, n.d.).

SHEEP

The typical breeds of sheep bred in the UK for differing landscapes and resultant produce (e.g. meat vs wool) include: Hill – Welsh Mountain, Swaledale, Scottish Blackface, Cheviot, Rough Fell, Dalebred, Derbyshire Gritstone, Herdwick. Upland – Bluefaced Leicester, Border Leicester, Teeswater, Wensleydale, Devon & Cornwall Longwool. Lowland – Texel, Suffolk, Charollais, Clun Forest, Romney, Hampshire Down, Oxford Down, Dorset Down (NSA: UK Sheep Farming, n.d.).

PIGS

The British Pig Association contains an online Herdbook of pig owners/breeders in the UK. The details available included contact information for breeds including: Berkshire, British Saddleback, Duroc, Gloucestershire Old Spot, Hampshire, Landrace, Large Black, Large White, Mangalitza, Middle White, Oxford Sandy & Black, Pietrain, Tamworth, Welsh (British Pig Association, n.d.). The majority of pigs reared in the UK are hyrbids of the large white pig breed, which is an international favourite for the pork trade (AHDB, 2019). The 12 native british pig breeds (as detailed above) with the addition of the British Lop, Mangalitza and Pietrain breeds, resulted in the extraction of contact details for farmers/breeders for a total of 15 pig breeds.

The breed information allowed the targeting of specific breed society pages to identify additional members. The members varied from those with smallholdings to megafarms and as a result can be considered a sufficiently varied group to administer the survey.

Stage Two & Three: Web-Scrapping & Data Extraction

To streamline the extraction of contact information from the website/databases that were compatible, the Chrome browser extension Web Scraper was utilised. Web Scraper is a free browser extension for website data extraction (Web Scraper, n.d.). A sitemap was created for the websites/databases relating to livestock and used to extract contact information into CSV files. These files were then combined into a single database of farmer/breeder contact information and collated with data extracted by hand from websites that did not allow for automated extraction.

Cattle Data Extraction

BREEDPLAN is a genetic database that is used to record and compare livestock. The database was developed by the Animal Genetics & Breeding Unit (AGBU) which is a joint venture by the University of New England (UNE) and the NSW Department of Primary Industry (BreedPlan, n.d.). The database has been used as the national beef recording scheme in Australia, New Zealand, Namibia, Thailand and the Philippines. The database software is increasingly being used in other countries including the United States, Canada, Hungary, South America and South Africa. The UK has also increasingly used the system to record cattle and breeder information (see Table a).

The BREEDPLAN database website (agri.une.edu.au) offered multiple ways to mine the information, including Animal Enquiry, EBV (Estimated Breeding Value) Enquiry, Mating Predictor, Member Enquiry, Sale Catalogues, Semen Catalogues, Downloadable Files and Online Transactions. For the purposes of this survey the aim was to acquire contact information for farmers and breeders of livestock, so to achieve this the 'Member Enquiry' function was used. Table (a) details the number of contacts identified and extracted from the BreedPlan Website for Cattle.

Pig Data Extraction

The Grassroots database used by the British Pig Association to record pig breeders is run by Grassroots Systems Ltd, which has been developing livestock register software since 1997 and works with over 100 breeds. This database was incompatible with the previously used web scraping tool, therefore the contact details were extracted by hand (Grassroots, n.d.). Table (b) details the breeds and number of contacts extracted by hand from the database.

Sheep Data Extraction

BASCO database was used to extract contact details for the sheep breeds. BASCO was founded in 2004 by the Texel, Suffolk sheep societies and the Limousin Cattle Society (BASCO, n.d.). The BASCO online database holds a comprehensive list of sheep farmers/breeders and continues to add other breeds. In addition to sheep the database now includes beef breeds and allows users to search by 'EBV' (estimated breeding values) and 'Breeder'. Similar to the Grassroots database, BASCO and the society websites were incompatible with the web scraping tool, therefore extracting the data was completed by hand. Breed types and number of contacts extracted are detailed in Table (c).

Where the contact details of society members and breeders were not available in an open access format (e.g. online database or member list), the secretaries of these societies were contacted to establish if they would consider forwarding the survey onto their members. Too

few society secretaries/representatives replied or agreed to make this a viable method for reaching a broader sample of farmers/breeders.

Table a: Cattle breeds and number of contact details extracted (BreedPlan, n.d.).

CATTLE			
BREED	METHOD	No. RECORDS	No. EMAIL
British Blue	Web-scraped	570	378
South Devon	Web-scraped	625	469
Salers	Web-scraped	212	48
Limousin	By Hand	2295	1666
Shorthorn (dairy)	By Hand	132	136
		13	
Shorthorn (beef)	Web-scraped	864	650
Hereford	Web-scraped	1480	929
Guernsey	By Hand	82	52
Simmental	Web-scraped	1141	687
Blonde D'Aquitaine British	Web-scraped	437	209
Blonde D'Aquitaine Irish	Contacted via Email	-	-
Aberdeen Angus		2353	1421
Scotland	Web-scraped	662	
England		865	
Wales		80	
Northern Ireland		299	
Charolais		>5,000	987
Isle of man	Web-scraped	67	
South Wales		573	
North Wales		1331	
South Western		805	
South Eastern		576	
Lancashire		267	
Anglia		371	
South Midlands		472	
North Midlands		674	
East Midlands (South)		56	
East Midlands (North)		428	
Yorks & North East		814	
Northern		893	
Scotland		>2000	
Northern Ireland		>2000	
		TOTAL	7,632

'#' = large number of records not counted, but emails addresses extracted.
'-' = no online database details about members available

Table b: Pig breeds and number of contact details extracted (Grassroots, n.d.).

PIG			
BREED	METHOD	No. RECORDS	No. EMAIL
Berkshire	By Hand	#	104
British Saddleback	By Hand	#	103
Duroc	By Hand	#	15
Gloucestershire Old Spots	By Hand	#	167
Hampshire	By Hand	#	14
Landrace	By Hand	#	18
Large Black	By Hand (Website 1)	107	123
	By Hand (Website 2)	25	
Large White	By Hand	#	33
Mangalitza	By Hand	#	24
Middle White	By Hand (Website 1)	56	67
	By Hand (Website 2)	14	
Oxford Sandy & Black	By Hand (Website 1)	161	226
	By Hand (Website 2)	109	
Pietrain	By Hand	#	23
Tamworth	By Hand (Website 1)	82	102
	By Hand (Website 2)	34	
Welsh	By Hand	#	54
		TOTAL	1,073

‘#‘ = large number of records not counted, but emails addresses extracted.
‘-‘ = no online database details about members available

Table c: Sheep breeds and number of contact details extracted (BASCO, n.d.).

SHEEP			
BREED	METHOD	No. RECORDS	No. EMAIL
HILL			
Welsh Mountain (several types)	By Hand	8	8
Swaledale	By Hand	4	4
Scottish Blackface	By Hand	10	10
Cheviot	By Hand	3	3
Rough Fell	-	-	-
Dalesbred	-	-	-
Derbyshire Gritstone	-	-	-
Herdwick	-	-	-
UPLAND			
Bluefaced Leicester	By Hand	#	231
	By Hand	26	26
Border Leicester	By Hand	4	4
Teeswater	-	-	-
Wensleydale	-	-	-
Devon & Cornwall Longwool	By Hand	18	15
LOWLAND			
Texel	By Hand	#	3009
Suffolk	By Hand	#	1731
Charollais	By Hand	58	57
Clun Forest	By Hand	70	59
Romney	By Hand	6	6
Hampshire Down	By Hand	#	107
	By Hand	#	573
Oxford Down	By Hand	2	2
Dorset Down	By Hand	5	4
		TOTAL	5,849

'#' = large number of records not counted, but emails addresses extracted.
'-' = no online database details about members available

Appendix 3a-d: The proportion of respondents that identified as using one to four (Tables a – d) crime prevention methods on their farmland, based on the type of methods.

Table a: The proportion of respondents that identified as using one crime prevention method on their farmland, based on the type of methods.

Methods Used (1)	N	%
Locks	84	50.3
Watch Dog/Guard Dog	21	12.6
Maintaining Secure Boundary	17	10.2
Security Lights	11	6.6
Other	9	5.4
Neighbourhood/Farm/Horse Watch	9	5.4
CCTV	7	4.2
No Trespass "Signs"	5	3.0
Electronic Gates/Other Gates	3	1.8
Geese	1	0.6
Alarms	0	0.0
Grand Total	167	100

Table b: The proportion of respondents that identified as using two different crime prevention methods on their farmland, based on the combination of methods.

Methods Used (2)	N	%
Locks - Security Lights	47	24.0
Locks - Watch Dog/Guard Dog	29	14.8
Locks - Maintaining Secure Boundary	23	11.7
Locks - CCTV	17	8.7
Locks - Neighbourhood/Farm/Horse Watch	12	6.1
Security Lights - CCTV	8	4.1
Security Lights - Watch Dog/Guard Dog	5	2.6
Locks - Alarms	4	2.0
Electronic Gates/Other Gates - Maintaining Secure Boundary	4	2.0
Maintaining Secure Boundary - Neighbourhood/Farm/Horse Watch	4	2.0
CCTV - Watch Dog/Guard Dog	4	2.0
Locks - Geese	4	2.0
Locks - Other	4	2.0
Security Lights - Electronic Gates/Other Gates	3	1.5
Locks - Electronic Gates/Other Gates	3	1.5
CCTV - Neighbourhood/Farm/Horse Watch	3	1.5
Maintaining Secure Boundary - Watch Dog/Guard Dog	3	1.5
Security Lights - Neighbourhood/Farm/Horse Watch	2	1.0
Security Lights - No Trespass "Signs"	2	1.0

Watch Dog/Guard Dog - Neighbourhood/Farm/Horse Watch	2	1.0
Watch Dog/Guard Dog - Geese	2	1.0
Security Lights - Geese	1	0.5
Security Lights - Other	1	0.5
Security Lights - Maintaining Secure Boundary	1	0.5
Electronic Gates/Other Gates - Watch Dog/Guard Dog	1	0.5
CCTV - Other	1	0.5
Locks - No Trespass "Signs"	1	0.5
Geese - Neighbourhood/Farm/Horse Watch	1	0.5
Neighbourhood/Farm/Horse Watch - Other	1	0.5
CCTV - No Trespass "Signs"	1	0.5
No Trespass "Signs" - Neighbourhood/Farm/Horse Watch	1	0.5
CCTV - Geese	1	0.5
Grand Total	196	100

Table c: The proportion of respondents that identified as using three different crime prevention methods on their farmland, based on the combination of methods.

Methods Used (3)	N	%
Locks - Security Lights - CCTV	24	12.4
Locks - Security Lights - Watch Dog/Guard Dog	22	11.4
Locks - Security Lights - Neighbourhood/Farm/Horse Watch	18	9.3
Locks - Security Lights - Maintaining Secure Boundary	13	6.7
Locks - Watch Dog/Guard Dog - Neighbourhood/Farm/Horse Watch	13	6.7
Locks - Security Lights - Alarms	10	5.2
Locks - Security Lights - No Trespass "Signs"	9	4.7
Locks - Maintaining Secure Boundary - Neighbourhood/Farm/Horse Watch	9	4.7
Locks - Security Lights - Electronic Gates/Other Gates	5	2.6
Locks - Maintaining Secure Boundary - Watch Dog/Guard Dog	4	2.1
Locks - CCTV - Electronic Gates/Other Gates	4	2.1
Security Lights - CCTV - Watch Dog/Guard Dog	4	2.1
Locks - Security Lights - Geese	3	1.6
Locks - CCTV - Watch Dog/Guard Dog	3	1.6
Locks - Alarms - Neighbourhood/Farm/Horse Watch	3	1.6
Locks - CCTV - Maintaining Secure Boundary	3	1.6
Locks - No Trespass "Signs" - Neighbourhood/Farm/Horse Watch	3	1.6
Locks - Watch Dog/Guard Dog - Geese	2	1.0
Security Lights - CCTV - Maintaining Secure Boundary	2	1.0
Locks - CCTV - Neighbourhood/Farm/Horse Watch	2	1.0
Security Lights - Maintaining Secure Boundary - Watch Dog/Guard Dog	2	1.0
Locks - Alarms - Maintaining Secure Boundary	2	1.0
Locks - Electronic Gates/Other Gates - Maintaining Secure Boundary	2	1.0
Security Lights - Watch Dog/Guard Dog - Neighbourhood/Farm/Horse Watch	2	1.0

Locks - Electronic Gates/Other Gates - Watch Dog/Guard Dog	1	0.5
Locks - Maintaining Secure Boundary - Other	1	0.5
Maintaining Secure Boundary - Watch Dog/Guard Dog - Geese	1	0.5
CCTV - Alarms - Maintaining Secure Boundary	1	0.5
CCTV - Alarms - Electronic Gates/Other Gates	1	0.5
Alarms - Maintaining Secure Boundary - Watch Dog/Guard Dog	1	0.5
Locks - Watch Dog/Guard Dog - Other	1	0.5
Locks - Alarms - No Trespass "Signs"	1	0.5
Security Lights - Alarms - Watch Dog/Guard Dog	1	0.5
Locks - No Trespass "Signs" - Other	1	0.5
Security Lights - Maintaining Secure Boundary - Geese	1	0.5
Locks - No Trespass "Signs" - Watch Dog/Guard Dog	1	0.5
Locks - Electronic Gates/Other Gates - Neighbourhood/Farm/Horse Watch	1	0.5
Locks - Alarms - Other	1	0.5
Locks - Maintaining Secure Boundary - Geese	1	0.5
Locks - Alarms - Watch Dog/Guard Dog	1	0.5
Maintaining Secure Boundary - No Trespass "Signs" - Geese	1	0.5
CCTV - Electronic Gates/Other Gates - Neighbourhood/Farm/Horse Watch	1	0.5
Maintaining Secure Boundary - Watch Dog/Guard Dog - Neighbourhood/Farm/Horse Watch	1	0.5
CCTV - Electronic Gates/Other Gates - Watch Dog/Guard Dog	1	0.5
Electronic Gates/Other Gates - No Trespass "Signs" - Neighbourhood/Farm/Horse Watch	1	0.5
CCTV - Maintaining Secure Boundary - Neighbourhood/Farm/Horse Watch	1	0.5
Security Lights - Electronic Gates/Other Gates - Maintaining Secure Boundary	1	0.5
CCTV - Watch Dog/Guard Dog - Geese	1	0.5
Security Lights - Maintaining Secure Boundary - Neighbourhood/Farm/Horse Watch	1	0.5
Electronic Gates/Other Gates - Maintaining Secure Boundary - Watch Dog/Guard Dog	1	0.5
Locks - Security Lights - Other	1	0.5
Locks - Neighbourhood/Farm/Horse Watch - Other	1	0.5
Locks - No Trespass "Signs" - Geese	1	0.5
Grand Total	193	100

Table d: The proportion of respondents that identified as using four different crime prevention methods on their farmland, based on the combination of methods.

Methods Used (4)	N	%
Locks - Security Lights - CCTV - Alarms	12	10.3
Locks - Security Lights - Watch Dog/Guard Dog - Neighbourhood/Farm/Horse Watch	9	7.8
Locks - Security Lights - CCTV - Watch Dog/Guard Dog	8	6.9
Locks - Security Lights - CCTV - Neighbourhood/Farm/Horse Watch	6	5.2
Locks - Security Lights - CCTV - No Trespass "Signs"	5	4.3

Locks - Security Lights - CCTV - Electronic Gates/Other Gates	5	4.3
Locks - Security Lights - No Trespass "Signs" - Watch Dog/Guard Dog	4	3.4
Locks - Security Lights - Maintaining Secure Boundary - Watch Dog/Guard Dog	4	3.4
Locks - Security Lights - Electronic Gates/Other Gates - Watch Dog/Guard Dog	4	3.4
Locks - Security Lights - Alarms - Watch Dog/Guard Dog	3	2.6
Locks - Security Lights - Maintaining Secure Boundary - Neighbourhood/Farm/Horse Watch	3	2.6
Locks - Security Lights - CCTV - Maintaining Secure Boundary	3	2.6
Locks - Security Lights - Maintaining Secure Boundary - Other	2	1.7
Locks - CCTV - No Trespass "Signs" - Watch Dog/Guard Dog	2	1.7
Locks - Security Lights - Electronic Gates/Other Gates - No Trespass "Signs"	2	1.7
Locks - Security Lights - Alarms - Electronic Gates/Other Gates	2	1.7
Locks - Security Lights - Maintaining Secure Boundary - No Trespass "Signs"	2	1.7
Locks - Security Lights - Alarms - Maintaining Secure Boundary	2	1.7
Locks - Security Lights - Electronic Gates/Other Gates - Maintaining Secure Boundary	2	1.7
Locks - Electronic Gates/Other Gates - Maintaining Secure Boundary - Watch Dog/Guard Dog	2	1.7
Locks - Security Lights - Electronic Gates/Other Gates - Neighbourhood/Farm/Horse Watch	1	0.9
Locks - Security Lights - No Trespass "Signs" - Geese	1	0.9
Locks - CCTV - Watch Dog/Guard Dog - Neighbourhood/Farm/Horse Watch	1	0.9
Locks - No Trespass "Signs" - Watch Dog/Guard Dog - Neighbourhood/Farm/Horse Watch	1	0.9
Locks - CCTV - Alarms - Neighbourhood/Farm/Horse Watch	1	0.9
Locks - Electronic Gates/Other Gates - No Trespass "Signs" - Neighbourhood/Farm/Horse Watch	1	0.9
Locks - Maintaining Secure Boundary - No Trespass "Signs" - Watch Dog/Guard Dog	1	0.9
Locks - Maintaining Secure Boundary - Neighbourhood/Farm/Horse Watch - Other	1	0.9
Locks - Maintaining Secure Boundary - Watch Dog/Guard Dog - Other	1	0.9
Locks - Security Lights - Alarms - Neighbourhood/Farm/Horse Watch	1	0.9
Locks - No Trespass "Signs" - Watch Dog/Guard Dog - Geese	1	0.9
Locks - CCTV - No Trespass "Signs" - Neighbourhood/Farm/Horse Watch	1	0.9
Locks - Maintaining Secure Boundary - No Trespass "Signs" - Geese	1	0.9
Locks - Alarms - Maintaining Secure Boundary - Neighbourhood/Farm/Horse Watch	1	0.9
Locks - Maintaining Secure Boundary - No Trespass "Signs" - Neighbourhood/Farm/Horse Watch	1	0.9
CCTV - No Trespass "Signs" - Watch Dog/Guard Dog - Geese	1	0.9
Locks - Security Lights - Geese - Neighbourhood/Farm/Horse Watch	1	0.9
Locks - Security Lights - No Trespass "Signs" - Other	1	0.9
Locks - Maintaining Secure Boundary - Watch Dog/Guard Dog - Neighbourhood/Farm/Horse Watch	1	0.9
Locks - CCTV - Electronic Gates/Other Gates - Maintaining Secure Boundary	1	0.9

Locks - Electronic Gates/Other Gates - Maintaining Secure Boundary - Neighbourhood/Farm/Horse Watch	1	0.9
Security Lights - CCTV - Alarms - Watch Dog/Guard Dog	1	0.9
Locks - Security Lights - No Trespass "Signs" - Neighbourhood/Farm/Horse Watch	1	0.9
Security Lights - Electronic Gates/Other Gates - Watch Dog/Guard Dog - Neighbourhood/Farm/Horse Watch	1	0.9
Locks - Electronic Gates/Other Gates - Neighbourhood/Farm/Horse Watch - Other	1	0.9
Locks - Security Lights - CCTV - Geese	1	0.9
Locks - Watch Dog/Guard Dog - Neighbourhood/Farm/Horse Watch - Other	1	0.9
Security Lights - No Trespass "Signs" - Watch Dog/Guard Dog - Neighbourhood/Farm/Horse Watch	1	0.9
Security Lights - CCTV - Watch Dog/Guard Dog - Geese	1	0.9
Locks - CCTV - No Trespass "Signs" - Geese	1	0.9
Security Lights - Maintaining Secure Boundary - No Trespass "Signs" - Neighbourhood/Farm/Horse Watch	1	0.9
Locks - Alarms - No Trespass "Signs" - Neighbourhood/Farm/Horse Watch	1	0.9
Locks - Security Lights - CCTV - Other	1	0.9
Locks - Alarms - Maintaining Secure Boundary - Watch Dog/Guard Dog	1	0.9
Grand Total	116	100

Appendix 4: Letter from CC Simon Prince to Police forces in the National Rural Crime Network.

Heddlu•Police
DYFED-POWYS
Diogelu ein Cymuned - Safeguarding our Community

Eich cyf/Your ref :
Ein cyf/Our ref :
Gofynnwch am/Please ask for :

To: The Chief Constable:
Member Forces
National Rural Crime Network

Dear Colleague,
As the NPCC lead for Rural and Wildlife Crime, I sit on the Executive Board of the National Rural Crime Network (NRCN). The NRCN has a membership of 31 Police and Crime Commissioners with the aim of recognising and understanding the problems and impact of crime in rural areas so that more can be done to keep people safer.

The NRCN has now commissioned the University College London to carry out academic research into crime in rural areas. In order for this research to be carried out thoroughly, Dorothea Delpech (PhD Researcher) will need to request relevant crime data from the NRCN membership forces.

On behalf of the NRCN I am collating a list of SPOCs to enable Dorothea to contact the right person in each force. Dorothea will subsequently make a formal request to each SPOC to disclose data.

Data Processing Agreements will be a matter between individual forces and the UCL.

The crime areas that the research project will cover are
- Arson & Criminal Damage
- Burglary
- Miscellaneous Crimes Against Society
- Possession of weapons
- Public Order
- Robbery
- Theft
- Vehicle Offences
- Violence against the person

I would be grateful if you could respond with your SPOC details to _____

Yours sincerely
Simon Prince, National lead for Wildlife and Rural Crime.

Appendix 5: Data request email sent to Police forces.

Dear ,

Chief Constable Simon Prince recently sent a letter to the Police Forces that are members of the National Rural Crime Network, regarding a piece of research being conducted on rural and wildlife crime in the UK.

The letter asked that an appropriate contact be provided for each police force, to whom formal data requests could be made. I am sending you this email, as you are the contact provided by ……. Police Force.

My name is Dorothea and I am a PhD researcher undertaking research on rural and wildlife crime. I have attached 3 documents to this email:

1) Data Request Letter
2) Data Processing Agreement (Example)
3) FAQ's relating to the Data Request & Research

The FAQ's have been provided to answer some of the questions relating to the request and the research. If you have any other questions about the research or any other matter please feel free to contact me: [redacted]

The Data Processing Agreement is an example of the type of contract that would be developed between each force and myself/UCL in relation to the research and provision of data.

Thank you very much for your time.

Yours Sincerely

Dorothea Delpech
PhD Researcher
UCL Department of Security & Crime Science

E: [redacted]
@RcrimeW

Appendix 6: Data request letter attached to email sent to Police forces.

1st August 2016

Dear ,

Chief Constable ------ and Sergeant ------ recently contacted the National Rural Crime Network (NRCN) member forces, with regards to research being carried out by a PhD student at the Department of Security & Crime Science at University College London (UCL). This research project is focused on Rural and Wildlife Crime within the UK.

In order to facilitate this research, I would be extremely grateful if ------ Police Force could provide Police Recorded Crime Data, and data for detected offences for the geographic areas and crime types listed below.

The data requested would be for the period between 1st January 2010 and 30th June 2016, and include all data/free text fields. For the data for detected offences, I do not want the names of the individuals involved but an anonymised identifier would be helpful.

Using the Local Authority (for Police in England) Classification of rural and urban areas, crime data from the following areas are required:

- Large Market Town
- Rural Town
- Village
- Dispersed

Offence types (Including crimes against businesses):

- Arson & Criminal Damage
- Burglary
- Miscellaneous Crimes Against Society
- Possession of weapons
- Public Order
- Robbery
- Theft
- Vehicle Offences
- Violence against the person

Additional information is provided in the FAQ document, and any other queries can be emailed to: [redacted]

Yours Sincerely
Dorothea Delpech

Appendix 7: Example Data Processing Agreement send with Data Request

DATA PROCESSING AGREEMENT

This Agreement dated the - -/- -/2016 sets out the terms and conditions under which data held by the specified data controller will be disclosed to the specified data processor. This Agreement is entered into with the purpose of ensuring compliance with the Data Protection Act 1998. Any disclosure of data must comply with the provisions of this Act.

1. The Parties

1.1. This Agreement is between ------ Police Force, (herein after called the "Data Controller") of ------ Police HQ, (Insert Address); and The Chancellor, University College London (herein after called the "Data Processor"), of The UCL Department of Security and Crime Science, [redacted].

2. Purpose

2.1. The purpose of this Agreement is to allow for the undertaking of PhD research regarding Rural and Wildlife crime in the UK specifically incorporating geographic and statistical analysis. ------ Police Force has been asked to provide recorded crime data from 2010 to 2016, relating to the crime areas:

- Arson & Criminal Damage
- Burglary
- Miscellaneous Crimes Against Society
- Possession of Weapons
- Public Order
- Robbery
- Theft
- Vehicle Offences
- Violence Against the Person

For areas designated by the Local Authority (Police in England) Classification as:

- Large Market Town
- Rural Town
- Village
- Dispersed

2.2. This Purpose of the request is consistent with the original purpose of the data collection: The findings from the research will ultimately assist with the development of knowledge about

crime in rural areas. This information is generated to assess the extent and patterns of rural crime, identify more effective measures to reduce rural crime, and better deploy law enforcement resources.

2.3. This research is consistent with the Data Controller's obligations under Section 17 Crime and Disorder Act 1998 to exercise its functions with due regard to the likely effect of the exercise of those functions on, and the need to do all that it reasonably can to prevent crime and disorder in its area.

3. Definitions

3.1. In this Agreement, the expressions "Data Controller", "Data Processor", have the same meaning as in Sections 1, 2, and 6 of The Data Protection Act 1998, as amended by The Freedom of Information Act 2000.

3.2. "Aggregated Data" is defined as Research Data grouped together to the extent that no living individual can be identified from that Aggregated Data or any other data in the possession of, or likely to come into the possession of any person obtaining the Aggregated Data.

4. Information provision

4.1. It is recognised that the Purpose requires access to Police Data, protectively marked by the Data Controller under the ACPO Protective Marking Scheme.

4.2. Ownership of the Research Data shall at all times remain with the Data Controller. For the avoidance of doubt, the Data Processor undertakes to ensure that no response to any request for information whether pursuant to the Freedom of Information Act 2000 (FOIA), the Data Protection Act 1998 (DPA) or any request to utilise the information for further research purposes will be acceded to without the consent of the Data Controller and consideration by him of any exemptions, in respect of FOIA or DPA requests, or appropriate reservations and safeguards in respect of research requests.

4.3. Aggregated Data compiled from the Research Data, and processed pursuant to this Agreement, will come entirely under the control of the Data Controller and may only be processed in accordance with this Agreement the terms of which shall apply to all other such research projects commissioned by the Government and seeking to utilise this aggregated data.

4.4. The recipient(s) of the research findings (including Aggregated Data) for the purposes of this Agreement is/are: ------ Police Force and University College London.

4.5. The Principle Evaluator: The "Principle Evaluator" is [redacted] at the UCL Department of Security and Crime Science, [redacted].

5. Use, Disclosure and Publication

5.1. The Research Data will be used solely for the Purpose set out at clause 2, above.

5.2. The Research Data shall not at any time be copied, broadcast or disseminated to any other third parties, except in accordance with this Data Processing Agreement.

5.3. The Research Data will NOT be matched with any other Personal Data otherwise obtained from the Data Controller, or any other source, unless specifically authorised by the Data Controller.

5.4. The Research Data will NOT be disclosed to any third party without the written authority of the Data Controller.

5.5. Access to the Research Data will be restricted to those researchers of the Data Processor as approved by the Data Controller, directly involved in the processing of the Research Data in pursuance of the Purpose.

6. Retention, Review and Weeding.

6.1. All Research Data will be retained by The Data Processor until no later than the end of October 2023. At the conclusion of this period the research data will be returned/destroyed. [redacted] at the UCL Department of Security and Crime Science (the Principal Evaluator) will be responsible for deciding on a specific date within this timeframe, and informing the Data Processor of this date.

6.2. The Principal Evaluator will be responsible for ensuring the safe subsequent disposal of the Research Data.

6.3. The Data Processor undertakes to ensure that all research data and copies thereof are secured when not in use and that upon termination of the Agreement, all such documents or copies thereof shall be securely disposed of or destroyed in a manner to make retrieval or reconstruction not possible.

12. Termination and Variation

12.1. This Agreement shall terminate in October 2023 or the completion of the Purpose, whichever be the later.

12.2. The Data Controller may at any time by notice in writing terminate this Agreement forthwith if the Data Processor is in breach of any material obligation under this Agreement.

12.4. In the event that any party wishes to exit from this Agreement, that party shall serve a notice, in writing, to the offices of the other party of a date not less than 30 days from the date of the said notice, on which the party proposed to exit the Agreement.

Undertaking of Confidentiality

I Dorothea Delpech as a researcher involved in the research as defined in the Agreement between _____ Police Force, The Chancellor, UCL Jill Dando Institute of Crime Science, [redacted] to which this Undertaking is appended, hereby acknowledge the responsibilities arising from this Agreement.

I understand that my part in fulfilling the Purpose means that I may have access to the Research Data and that such access shall include

a) reading or viewing of information held on computer or displayed by some other electronic means, or

b) reading or viewing manually held information in written, printed or photographic form.

I undertake that; -

1. I shall not retain, extract, copy or in any way use any Research Data to which I have been afforded access during the course of my duties for any other purpose.

2. I will act only under instruction from the Principle Investigator or other relevant official in the processing of any Research Data.

I understand that the Research Data is subject to the provisions of the Data Protection Act 1998 and that by knowingly or recklessly acting outside the scope of this Agreement I may incur criminal and/or civil liabilities.

I undertake to seek advice and guidance from the Principal Evaluator or other relevant official of the Data Controller in the event that I have any doubts or concerns about my responsibilities or the authorised use of the Research Data and/or Aggregate Data defined in the Agreement

I have read, understood and accept the above.

Name…….

Signed……..

Date…….

Appendix 8: Information document provided with Police Data Request Email

General Information Relating to Data Request

Crime theories consider how people's routine activities and the urban environment affect offender mobility. Specific research into how/why criminals choose some areas in which to offend but not others has examined the influence of characteristics of the community, land uses, transportation links and the structure of the road network.

Studies have focused exclusively on crime in urban environments, largely neglecting offending in a rural context. In rural areas, land use and mobility (e.g. road networks) differ significantly to that in urban environments, and consequently it is unclear if these studies findings apply in rural settings. The proposed research project is intended to fill this gap in the literature on rural crime.

Examples of questions the data will be used to research includes:

- What current methods of land and animal protection are effective in preventing crime?
- Does farm crime and wildlife crime occur more frequently on rural land bordering or close to arterial roads compared to private or infrequently used roads?
- How does the farm boundary (territoriality – electric fences, trees, land banks) influence the likelihood of a rural area being targeted?
- How far do criminals travel from their home location to commit farm and wildlife crime.

---

1. Who is information being processed for?

   The research is funded by the Engineering & Physical Sciences Research Council (EPSRC). The findings will be disseminated to the Police Forces that contributed to the research. Those who choose to take part will be invited to a seminar where the research findings will be presented. They will also receive an executive summary of the work.

2. Will the information be processed for each individual force?

   The data provided by individual police forces will be analysed individually and collated with

those in other areas to provide a wider and more comprehensive view of rural crime across England and Wales.

3. Will something be provided back from the research to each individual force?

   The benefits for the Police Forces taking part include:
   - The research is fully funded by the ESPRC and therefore we are not seeking financial support to undertake the proposed work. The work requires access to data ONLY.
   - The university has a Secure Data Centre accredited by the Metropolitan Police. The PhD student also possesses SC level clearance.
   - The research will produce systematic findings about where rural crimes occur and why they might do so. This will inform understanding of these problems, how they might be prevented, and offenders detected.
   - This will be of value to landowners and other law enforcement agencies. Recommendations will be made as to how the findings should inform crime reduction strategies and who might contribute to such strategies.

   As a minimum, the following deliverables would result from the research:
   - PhD thesis.
   - Easily digestible executive summary of the research findings, including recommendations for police practitioners.
   - Presentation of the findings.

4. Who is the Data Controller?

   Individual Police Forces who choose to take part will have control of their data contributions to the proposed research, and the agreement between the researcher (Dorothea Delpech) and Police Force will determine what the data can and cannot be used for.

5. What geographic areas will the research and data relate to?

   The focus of the research is on rural areas. For the purpose of this research the use of the Police specific groupings, incorporating crimes committed in areas defined as 'Large Market Town', 'Rural Town', 'Village' and 'Dispersed'.

   It is understood that not all Police records are recorded with this level of specificity and therefore the exact methods to filter data can be discussed between individual Police Forces and the researcher. In cases where data extraction cannot be done easily, the researcher (Dorothea Delpech) would propose to apply a simple filter (allowing a quicker extraction process) in the first instance, and leave it to the researcher to allocate offences to their appropriate geographic area.

6. What does the researcher mean by 'all data'?

   The research requires all input fields on the Police databases relating to recorded crimes. This should include free text and any addresses of individuals involved. The specific locations of crimes are of particular importance (in the form of address, postcode, longitude/latitude etc.) including any location information for suspects or those prosecuted.

7. Does this include names and addresses?

   The research does not require names of individuals. If capabilities exist to apply a coding system to the records that can identify crimes involving the same individuals this would be beneficial but is not necessary for the research.

8. Would a Freedom of Information request be sufficient?
   The aim of the research is to explore the features of the environment that may influence the likelihood of rural, farm and wildlife crime occurring. The exact locations of crimes and suspects are of particular importance and cannot be accessed within Freedom of Information requests.

9. Does the request include a request for personal information?

   The information requested requires addresses of victims and suspects, for the reasons specified in (8).

10. What time frame does the request cover?

    The data requested should cover the period between and 1st January 2010 and 30th June 2016.

11. How long will the research take to complete?

    The aim is to have the research completed by October 2018, with several intermediary milestones. Throughout this period forces will be kept up to date with the works progression. Police Forces are also welcome to contact the researcher directly to enquire about the progression of the research. As per usual academic practice, the data will be kept for an additional period of 5 years to allow for verification if the validity of the findings is challenged.

Appendix 9: Tables a & b show the number of returned records of Livestock and Wildlife species specific (S) and associated (A) crimes separated by Keyword.

Table a: Number returned records of Livestock Species specific and Associated crimes separated by Keyword (1/2).

	LIVESTOCK/CROP TERMINOLOGY	2010			2011			2012			2013			2014			2015		
		R	S	A	R	S	A	R	S	A	R	S	A	R	S	A	R	S	A
ACTIONS	Rustling	0	-	-	0	-	-	0	-	-	2	1	0	1	0	0	2	0	0
	Rustled	0	-	-	0	-	-	0	-	-	0	-	-	0	-	-	0	-	-
	Worrying	0	-	-	0	-	-	0	-	-	0	-	-	1	0	0	4	3	0
	Worried	0	-	-	0	-	-	9	0	1	13	0	0	6	0	0	11	0	0
	Mutilat*	4	0	0	1	1	0	1	0	0	0	-	-	0	-	-	0	-	-
	Slaughter*	1	0	0	3	1	0	1	0	0	2	1	0	1	0	0	1	1	0
SPECIES	Livestock	3	0	3	2	0	1	7	1	6	3	2	1	4	1	3	6	4	2
	Herd	8	1	2	4	0	2	6	1	2	6	1	1	8	0	2	3	1	0
	Flock	0	-	-	1	1	0	0	-	-	2	2	0	0	-	-	0	-	-
	Goat	2	0	1	3	1	0	1	0	0	8	0	0	5	0	0	6	0	0
	Pig	21	1	3	22	5	4	21	2	1	26	3	2	14	3	3	22	5	0
	- Sow/s	0	-	-	1	1	0	1	0	0	0	-	-	0	-	-	0	-	-
	- Hog/s	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0
	- Swine/s	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
	- Barrow/s	7	0	0	13	0	0	10	0	0	10	0	0	7	0	0	6	0	0
	- Gilt/s	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	- Boar/s	2	0	0	1	1	0	0	-	-	0	-	-	0	-	-	2	0	1
	Cattle	2	0	2	8	0	8	14	1	11	5	2	3	7	2	5	7	3	4
	- Bull/s	25	0	0	29	0	0	20	0	0	17	0	0	22	0	0	17	0	0
	- Steer/s	0	-	-	2	1	0	2	1	0	2	1	0	0	-	-	1	0	0
	- Springer/s	3	0	0	0	0	0	1	0	0	1	0	0	1	0	0	2	0	0
	- Ox	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0
	- Cow	74	3	2	67	2	1	31	0	2	31	1	4	15	0	4	21	1	3
	- Heifer	1	1	0	1	1	0	0	-	-	0	-	-	1	1	0	0	-	-

Table a continued: Number returned records of Livestock Species specific and Associated crimes separated by Keyword (2/2).

LIVESTOCK/CROP TERMINOLOGY		2010			2011			2012			2013			2014			2015		
		R	S	A	R	S	A	R	S	A	R	S	A	R	S	A	R	S	A
SPECIES	- Calf	17	0	3	17	0	2	9	0	1	16	0	1	11	1	0	6	1	0
	- Calves	1	0	1	0	-	-	0	-	-	2	0	0	1	0	0	1	1	0
	Sheep	14	4	7	23	12	6	13	2	11	24	11	10	13	6	7	23	16	4
	- Ewe	358	2	0	446	5	2	508	0	0	508	4	3	437	3	0	313	4	0
	- Ram/s	7	0	0	13	1	0	3	0	0	4	0	0	9	1	0	3	1	0
	- Mutton/s	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
	- Wether/s	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
	- Yearling/s	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	2	1	0
	- Lamb	31	7	1	18	5	0	36	2	2	50	6	0	37	7	0	41	4	1
	Chicken	32	11	6	61	20	10	50	18	4	66	14	11	51	11	6	63	13	3
	- Hen/s	1	0	0	13	9	0	6	2	0	12	4	0	4	2	0	8	4	0
	- Cockerel/s	2	1	0	3	3	0	0	-	-	0	-	-	0	-	-	1	1	0
	Poultry	4	0	4	7	6	1	7	3	1	2	0	1	1	0	0	4	1	0
	Bird	38	3	2	35	4	0	29	2	3	39	3	1	35	3	2	23	3	1
	Duck	9	2	2	12	3	0	4	1	0	14	3	1	9	2	0	14	6	0
	Game	171	1	1	125	1	0	103	0	0	96	0	0	78	2	1	52	0	2
	Pheasant	7	7	0	10	5	4	1	1	0	5	2	3	7	4	3	14	7	6
	Turkey	6	3	0	6	1	0	2	1	0	7	2	0	5	1	0	8	0	0
	Partridge	1	1	0	1	1	0	1	1	0	1	1	0	3	2	1	1	1	0
	Geese	1	1	0	2	2	0	2	2	0	2	2	0	0	-	-	0	-	-
	Crop	112	7	24	86	11	5	127	2	10	115	4	7	89	9	15	67	7	3
	- Barley	2	2	0	0	0	0	0	0	0	0	0	0	2	1	0	1	1	0
	- Wheat	2	2	0	5	5	0	1	1	0	2	2	0	3	0	0	1	1	0

Table b: Number returned records of Livestock Species specific and Associated crimes separated by Keyword

WILDLIFE TERMINOLOGY		2010			2011			2012			2013			2014			2015		
		R	S	A	R	S	A	R	S	A	R	S	A	R	S	A	R	S	A
ACTIONS	Poach	0	-	-	8	8	0	3	3	0	12	11	1	13	13	0	35	33	1
	Coursing	0	-	-	0	-	-	0	-	-	0	-	-	0	-	-	0	-	-
	Baiting	0	-	-	0	-	-	0	-	-	0	-	-	1	0	0	0	-	-
	Baited	0	-	-	0	-	-	0	-	-	0	-	-	0	-	-	0	-	-
	Trap*	66	0	0	71	1	0	36	0	0	39	0	0	48	0	0	59	0	0
	Snare*	3	0	0	0	-	-	0	-	-	1	0	0	0	-	-	0	-	-
	Hunt*	7	0	0	11	0	0	14	0	0	12	0	0	23	0	0	37	1	1
	Poison*	2	0	0	2	0	0	2	0	0	1	0	0	5	0	0	10	0	0
	Lamping	7	0	0	6	2	0	1	0	0	0	-	-	1	0	0	2	2	0
	Lamped	4	0	0	7	0	0	5	0	0	1	0	0	3	0	0	4	0	0
	Persecution	0	-	-	0	-	-	0	-	-	0	-	-	0	-	-	0	-	-
	Persecuted	0	-	-	0	-	-	0	-	-	0	-	-	0	-	-	0	-	-
SPECIES	Wildlife	1	1	0	2	2	0	6	1	3	5	1	1	6	1	3	0	-	-
	Fox	40	0	0	28	0	0	41	0	0	34	3	0	30	0	1	32	0	0
	Badger	1	1	0	1	0	0	0	-	-	3	0	2	1	0	0	7	1	5
	Hare	46	0	0	49	0	0	61	0	0	62	0	0	62	0	0	60	1	0
	Bat	43	0	0	33	1	0	26	0	0	29	0	0	19	0	1	14	0	0
	Bats	1	0	0	4	1	0	1	0	0	11	0	0	1	0	0	0	-	-
	Deer	13	4	3	15	5	3	5	1	1	20	7	6	15	1	5	12	4	0
	- Stag/s	1	0	0	2	0	0	2	0	0	9	0	0	4	0	0	3	0	0
	- Buck/s	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	3	0	0
	- Doe	3	0	0	0	0	0	2	0	0	2	0	0	2	0	0	2	0	0
	- Fawn/s	0	0	0	3	0	0	0	0	0	2	0	0	1	0	0	0	0	0

Appendix 10: Freedom of Information request sent to Police Forces about recording of rural crimes.

Dear Sir or Madam,

I am writing to ask that the following information be provided via this Freedom of Information Request. The specifics of the information being requested are provided below.

Details of Person:
Dorothea Delpech

Requesting Information:
Dept. of Security & Crime Science, [redacted]

Specifications of Request:
Please provide answers to the below questions.

1) Do you have a category/label on your crime/incident database that differentiates if they occurred in rural or urban areas? Yes / No

i) If *Yes*, What classification system do you use to differentiate between urban and rural areas when recording crimes/incidents? *(e.g. the National system or local one, please specify the categories)*

2) Are you able to tag/label crimes/incidents that occur on farmland on your database? Yes / No

i) If *Yes*, what is this tag/label?
ii) How many times has it been used since 2010?
(Please provide a breakdown of the recorded offences under this tag/label if applicable e.g. sheep worrying, rustling/theft of livestock, farm equipment theft etc.)

3) Since 2014 how many crimes have been recorded by the force under the Wildlife Crime Home Office Code (96)?
(Please provide a breakdown of the recorded offences under this code e.g. CITEs Offences, Poaching, Hare Coursing etc.)

4) Do all officers in your force have access to GPS equipment to record the Eastings and Northings of where crimes have occurred? Yes / No

Time Period:
Please could the information be given for the period between 2010 to present where applicable.

Return Address:
Please could information be sent via email to [redacted]

Many thanks for your help with this.
Yours Faithfully
Dorothea Delpech

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