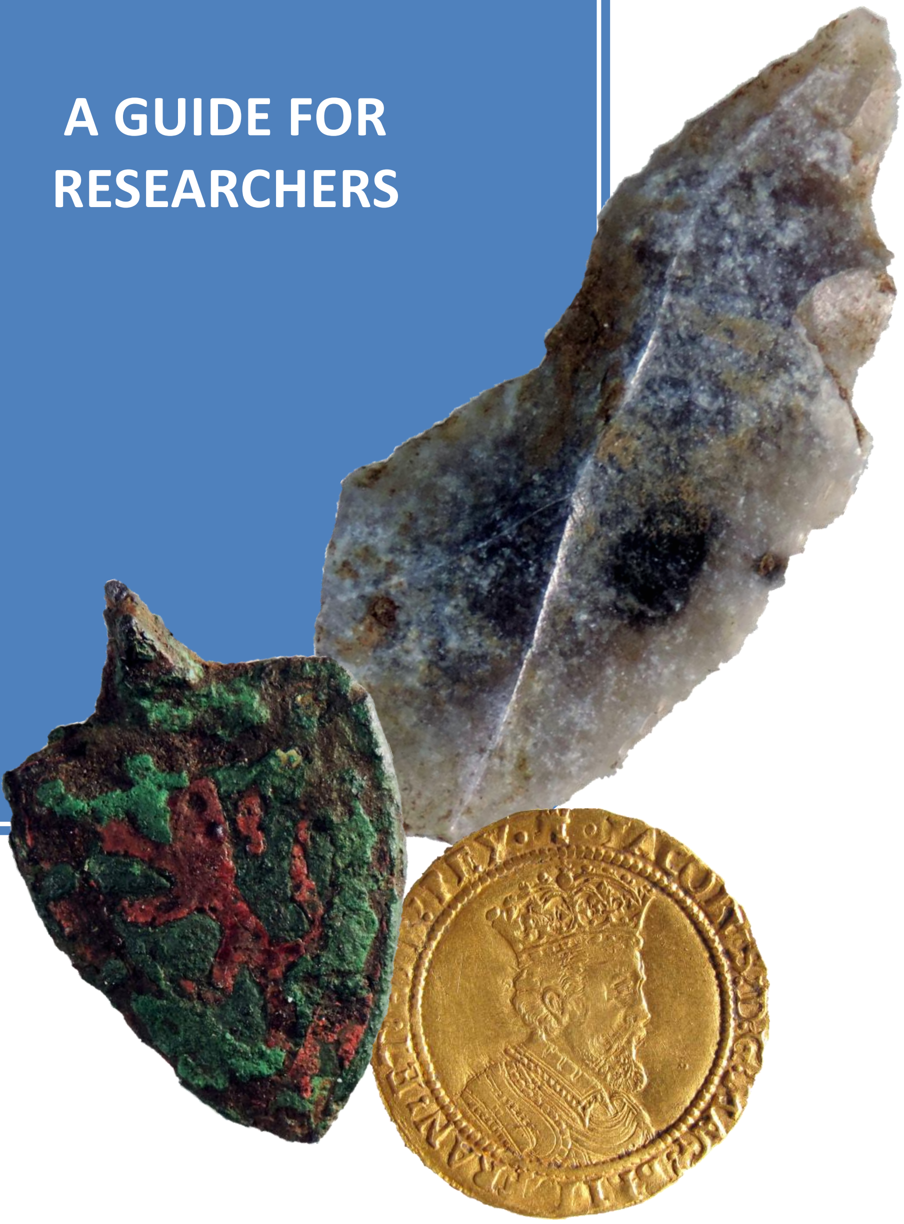
PORTABLE ANTIQUITIES SCHEME

A GUIDE FOR RESEARCHERS



Portable Antiquities Scheme
www.finds.org.uk

The Leverhulme Trust

THE BRITISH MUSEUM

This guide has been produced as part of the Leverhulme Trust funded project *'The Portable Antiquities Scheme as a tool for archaeological research'.* It builds upon a thesis funded by the University of Southampton and the 'Arts and Humanities Research Council'

Dr Katherine Robbins

August 2014

Front page images (not to scale):

NMS-FB1B14
YORYM-8D1453
YORYM-691CA3

CONTENTS

TABLE OF FIGURES

PURPOSE OF THE GUIDE

The data collected by the Portable Antiquities Scheme (PAS) has the potential to revolutionise the way in which we research our past, by providing us with a vast online collection of data which can be used to examine a wide range of archaeological artefacts.

However, data collected by humans is far from impartial – the reasons for collecting the data, the methods used, and the choices behind what data to collect, will all have an impact on the representativeness of the results. Defined here as 'bias', these choices must be understood before the dataset can be confidently used. It is easy to turn a blind eye to these biases and to skim over the impact that they can have on the distributions of archaeological objects, but to do so distorts our understanding of the past, for it is only with full appreciation of the factors that control the creation of our datasets that we can begin to interpret what these data tell us about past societies.

As it grows in size, the PAS database (PASD) is increasingly being used by those researching the archaeology of England and Wales, and its data are known to be incorporated into hundreds of projects (see http://finds.org.uk/research) including undergraduate and postgraduate dissertations, PhD theses, conference papers, and large scale research projects. Contained within this body of research are a wide variety of projects focusing on specific objects, archaeological periods, or locations. However, only a few explore the collection and sampling bias inherent in the PASD, despite the fact that such background is an essential part of any analysis of this dataset. This guide therefore aims to:

(1) discuss the factors that shape amateur-collected data and
(2) identify a range of techniques for illustrating the effect of these factors on the spatial distribution of the finds.

This guide is intended to be an overview for those using the PAS data in their research. For further information please use the Bibliography and the references provided throughout. A pilot study looking at finds from Hampshire, Northamptonshire and the Isle of Wight is available at http://eprints.soton.ac.uk/360475/ and a project monograph will be published in late 2015 as a British Museum Research Publication.

GUIDE OUTLINE

This guide is divided into sections covering both sampling/collection theory and techniques for exploring amateur-collection bias:

- ***'Metal Detecting and the PAS'*** *introduces the collectors who provide the majority of the finds recorded by the PAS. It looks at the history of metal detecting and archaeology, and considers how this affects finds reporting today.*
- ***'Understanding amateur collection bias'*** *is divided into seven stages, each exploring one aspect of sampling bias in amateur collection.*
- ***'Methods for exploring bias in the PASD'*** *presents 5 themes of analysis, each using a series of examples taken from across England and Wales to illustrate different ways of exploring the PAS data.*
- ***'Approaching an analysis of the PASD'*** *highlights the key questions that need to be considered before incorporating the PAS data into your research.*

METAL DETECTING AND THE PAS

Although the specific aims of the PAS have evolved over the years, the main purpose of the scheme is, and always has been, to encourage and facilitate the recording of archaeological objects uncovered by members of the public. Most finds are recovered by metal detector users, but some come from amateur fieldwalkers and people who find objects whilst out walking, gardening or going about their daily work.

The distribution of PAS data is therefore subject to chance and the decisions of the amateur collector – there is no obligation for them to sample in any particular way, nor a need for a strategy that ensures systematic coverage. Amateurs can search wherever they wish, however often they wish and in whatever form they wish, focusing on a particular area if it is productive, or moving quickly on if not. Understanding these collectors, and how their experiences, knowledge and interests affect collection, is therefore an important part of understanding the PAS dataset.

With over 90% of artefacts attributed to metal detectorists, it is the process of metal detecting and the relationship between metal detectorists and archaeologists that has principally affected the development of the PASD – a summary of the main events is given here, along with an outline of developments since the 1960s.

PAS: AIMS AND OBJECTIVES

The Portable Antiquities Scheme is a partnership project which records archaeological objects found by the public in order to advance our understanding of the past.

In order to do this the Scheme

- *promotes the maximum public interest and benefit from the recovery, recording and research of portable antiquities;*
- *promotes best practice by finders/landowners and archaeologists/museums in the discovery, recording and conservation of finds made by the public*
- *in partnership with museums and others, raises awareness among the public, including young people, of the educational value of recording archaeological finds in their context and facilitate research in them*
- *creates partnerships between finders and museums/archaeologists to increase participation in archaeology and advance our understanding of the past*
- *supports the Treasure Act, and increase opportunities for museums to acquire archaeological finds for public benefit.*

PAS is run by the British Museum and works through a number of principal partners which employ staff and many more local partners which contribute to each of the posts. There is a network of Finds Liaison Officer posts, based in museums and county councils throughout England and Wales, National Finds Advisers and a team at the British Museum. The data gathered by the Scheme is published on an online database (www.finds.org.uk).

In order to fulfil the aims of the Scheme, staff

- *maintain an online database and promote it as a resource for education and research*
- *hold outreach events, such as finds days, attend metal detecting club meetings and give talks to national and local group and societies;*
- *facilitate displays of finds recorded by the Scheme in museums and elsewhere*
- *help finders to fulfil their obligations under the Treasure Act*
- *and publish an annual report and other publications in print and online.*

THE GROWTH OF METAL DETECTING (1960 – 1980)

- Metal detecting really took off in the mid-1970s[1] - its rapid growth after this time, and the potential threat this posed to the preservation of the archaeological record, caused archaeologists much concern.
- Friction between the metal detecting community and archaeologists reached a head in 1980 with the formation of two opposing campaign groups that each sought to persuade public opinion to their side: STOP (Stop Taking Our Past – The Campaign against Treasure Hunting) and DIG (Detector Information Group).
- Exceptions to this did exist – e.g. the well cited work by Tony Gregory and Barbara Green[2] recording finds with detectorists in Norfolk and Suffolk, and relationships between individual archaeologists and metal detector users in South Wales, Hampshire, North Lincolnshire, London, Lancashire and Yorkshire.

PORTABLE ANTIQUITIES LEGISLATION (1970 – 2010)

- Attempts to draft an antiquities bill from the 1950s – 1980s were generally unsuccessful, culminating with the 'Abinger Bill' in 1981 which failed to make it through Parliament.
- In 1983, the nighthawking of the Roman temple at Wanborough initiated what became a thirteen year effort to change portable antiquities law in this country.[3] It remains a contentious topic for many metal detectorists and archaeologists today, but proved to be a turning point in the relationship between the metal detecting community and heritage professionals. The damage committed to the site at Wanborough, and the inability of the legislation to prosecute those involved, showed up the faults in the ancient system of Treasure Trove and led to further calls for the law to be reformed.
- In 1986 the Surrey Archaeological Society initiated an examination of the law of Treasure Trove, with the view of introducing reforms that would offer greater protection to portable antiquities and archaeological sites.
- A new Bill was informed by comments from the archaeological and museum community, landowners, the police, coroners and dealers - it received strong support in the Lords, and finally it passed through both Houses without opposition, coming into force on 24th September 1997.[4]
- A requirement of the new Treasure Act was that a Code of Practice was drawn up through consultation with 'interested parties' – 250 responses were received, and used to revise the code to take account of all concerns. This collaboration between the metal detecting community and heritage professionals on portable antiquities law was a marked change from the era of STOP and DIG.

The Battle of Wanborough Temple

A number of gold & silver Iron Age coins were recovered at Wanborough by metal detector users, and reported to the local museum - thought to be 'Treasure Trove', an inquest was held at which the findspot location was revealed publicly.

Large scale looting of the site followed, with as many as forty individuals illegally digging there at a time.

Thousands of archaeological artefacts were removed from the site, and although some of the alleged night-hawkers were convicted, these were overturned as the ensuing trials could not prove that the finds were Treasure Trove (i.e. buried with the aim of recovery) and therefore Crown property (Bland 1996).

[1] In Bland & Loriot's (2010) corpus of Roman coins, the earliest metal detected coin was found in1973
[2] Green & Gregory 1978
[3] Cited countless times as a classic example of the effects of looting, e.g. Addyman 2001; Hobbs 2003
[4] Bland 1999

METAL DETECTOR USERS AND ARCHAEOLOGISTS

The relationship between metal detector users and archaeologists is ever evolving - the PAS was formed through collaboration between them, and the strengthening of that relationship has been a key aim for the scheme ever since. For most involved, this amounts to the acceptance and following of 'best practice' by metal detector users,[1] and the acknowledgment of the experience, expertise and interests of metal detectorists by archaeologists. Recent recoveries provide clear examples of the growing awareness by metal detectorists of the importance of archaeological context, for example the case of the much publicised Frome Hoard, where the finder allowed archaeologists to excavate the container and its contents resulting in a far greater knowledge of the context of the burial.[2]

Equally, archaeologists are increasingly inviting responsible detectorists to archaeological excavations, e.g. at the site of Brading Roman Villa on the Isle of Wight where for several seasons members of the local metal detecting clubs have been involved in the summer excavations.

The relationship between the metal detecting community and the archaeologists has changed so much since the 1980s, that in 2008, a review of the PAS confidently stated that, the *"PAS has overcome the scepticism of archaeologists and the mistrust of finders to create a partnership in the understanding of the past".*[3]

Whilst this may be the case, it is important to acknowledge that there are still some archaeologists[4] who believe that metal detecting should not be condoned and that the PAS is "too indulgent towards the metal detectorists".[5] Many are also concerned about the number of finds going unrecorded – there are indeed many metal detector users who are not interested in reporting their finds to archaeologists, resulting in thousands of archaeological artefacts being sold or lost to private collections each year, even with the most conservative estimates – these metal detector users are acting quite legally, but just choosing not to volunteer their non-Treasure finds to the PAS for recording.

Although there is a now a strong partnership between the scheme and many metal detector users, it is important to remember that the history summarised here will still be influencing the reporting of finds, and therefore the PAS dataset, today.

METAL DETECTORISTS TODAY

Although the numbers involved in metal detecting today are thought to be considerably lower than they were in the 1970s and 1980s, estimates of the total number of metal detector users spread across England and Wales still vary considerably - the highest estimate suggests that there may be between 30,000 and 50,000 metal detector users across the UK. The basis for this number is unclear, but it is generally thought to be a rather overambitious figure.[6]

In 2011 the NCMD suggested that "the number of metal detectors [sic] in the country has increased to around 20,000"[7]. The distribution lists of the popular magazines 'Treasure Hunting' and 'The Searcher' suggest a similar figure, but the numbers are difficult to interpret as some of the total will be free distribution copies, some detectorists may buy both magazines, and others may buy the magazines but may not be 'active' detectorists.

---

[1] See the Code of Practice for Responsible Metal Detecting, provided at the end of this guide and available online (http://finds.org.uk/getinvolved/guides/codeofpractice)
[2] Booth 2010
[3] Clark 2008
[4] Often those who have little or no contact with metal detectorists
[5] Personal comment from Cleere (2006) in Thomas (2010)
[6] Grove 2005; Critchley (pers comm in Thomas 2010)
[7] Gray 2011

The PAS calculates that total numbers of metal detectorists are a little lower:

In 2007, Bland estimated that there were ~7000 club members, and 1300 independents. Estimating that around half of independents are not in contact with the PAS gives a total of ~9,500 active metal detectorists across England and Wales.

A survey of FLOs undertaken by Vomvyla (2008) found that they were in contact with ~6000 club members, and 1300 independents. Using the same formula as before, this equates to ~8600 detectorists.

An update of the FLO survey, conducted in 2014 (figures not yet final), gave an estimate of ~6700 club members and 1800 independents, and a total of 10,300 active metal detectorists.

Estimates have also been made by a number of other archaeologists: in 2009, Thomas calculated that there were ~12,500 detectorists[1]; in 2011 Barford suggested a figure equating to around 9,000 detectorists[2]; whilst Heritage Action uses an estimate of 8000 detectorists[3]. Based on all of these figures, we estimate that there are around 9,600 metal detector users across England and Wales. Of these, only 75% are likely to recover finds that could be recorded by the PAS, as it is a thought that around 25% never find any 'recordable' artefacts.[4]

The number of artefacts collected is affected by the amount of time devoted to artefact recovery, which in turn depends on the time available to searchers and the amount of land accessible to them:

- Many metal detectorists only search ploughed land and, due to the demands of agriculture, these fields are only available for a few weeks each year.[5]
- Some metal detectorists search on pasture or set aside land as well as arable land, which means they are able to detect throughout the year, subject to weather conditions.[6]
- A survey of metal detectorists suggests that most go out each weekend, but some are able to search every day of the week, whilst others are limited to one weekend a month.[7]

Calculating the number of finds recovered is tantamount to guesswork - one rate, suggested in Robbins (2012), equates to ~265,000[8] artefacts per year, whilst Bland & Loriot[9] suggest a figure of 117,000 – 205,000[10] artefacts per year, based on the PAS recording 40-70% of finds. In either case, the PAS now records around 80,000 finds per year, of which 90% are attributed to metal detectorists.

For further information see Robbins (2012) Chapter 4, which provides a summary of metal detecting methods based on a survey of metal detectorists and metal detecting literature.

---

[1] Thomas (2009; 258) calculated a total of 12,000 – 14,000 regular metal detector users across the UK - a figure for England and Wales was calculated using UK population statistics, and the maximum value used in the above estimates.

[2] A figure of 1 detectorist in every 6000 people is quoted in Barford 2011.

[3] http://www.heritageaction.org.uk/erosioncounter/

[4] In part because not all metal detectorists search on farmland – some search beaches instead where archaeological objects are rare (pers. comm. Bland March 2012)

[5] Whitehead 1997

[6] Webb 1996

[7] Robbins (2012): 3 potential rates were calculated –84.4 days per year (from magazine data), 52 days per year and 12 days per year (metal detectorists survey). This averages out at 50 days metal detecting per person per year.

[8] 7250 detectorists * 50 days per year * 0.73 recordable finds per visit (figure based on Robbins 2012)

[9] Bland & Loriot (2010)

[10] 2013 = 82,071 artefacts recorded – at 40% this = 205,177 finds, at 70% this = 117,244 finds

SUMMARY OF KEY DEVELOPMENTS SINCE THE 1960S

Year	Event	Further Details	References
1960s	Growth of metal detecting	The metal detecting hobby became increasingly popular due to the availability of portable and affordable metal detectors.	Bland, 2005a Gregory, 1986
	Growth of metal detecting clubs (MDCs)	Originally very much an individual activity, metal detector users began to form into clubs in the 1960s.	Bland, 2005b Oxford Archaeology, 2009
1970s	Some archaeologists and metal detector users working together to record finds	Pioneering attempts on both side to work together – notably by metal detector users Dave Haldenby, Chris Marshall, Irene McGrath and Jim Halliday, and archaeologists Tony Gregory and Kevin Leahy.	Green & Gregory, 1978 Clark, 2008
	'Treasure Hunting' published	First issue of the popular metal detecting magazine, 'Treasure Hunting', published in 1977. 62 MDCs listed in this magazine in 1978.	Treasure Hunting Magazine Oxford Archaeology, 2009
1977	Treasure Trove Reviewing Commission established	This committee had a remit of providing independent advice on the valuation of Treasure Troves. Previously, such advice had been provided by the British Museum.	Pers. comm. Bland July 2011
1979	Ancient Monuments and Archaeological Areas Bill	It was now a criminal offence to use a metal detector on a Scheduled Ancient Monument (SAM) without permission.	UK Government, 1979
	Formation of DIG	DIG resented interference with their hobby and sought to protect metal detecting from an outright ban or licensing scheme.	Oxford Archaeology, 2009
1980	Launch of STOP campaign	The CBA launched the STOP campaign to draw attention to the damage that was being done by uncontrolled detecting. Campaign effectively ended in 1981.	Thomas, 2010
	Kent Bill petition	DIG successfully campaigned against Clause 100 of the Kent Bill, which would have given the county council more power to control metal detecting in the county.	Hammond, 1998
	Modification of the Wireless and Telegraphy Act 1949	It was now no longer necessary to have a license for operating a metal detector.	Thomas, 2010

Year	Event	Further Details	References
1981	Formation of the NCMD	The National Council for Metal Detecting (NCMD) is considered the principal body representing metal detector users in the UK (excluding Northern Ireland). It aims to: - promote, protect and encourage the hobby of metal detecting. - protect the metal detecting hobby from any attack, control or legislation which compromises existing freedoms.	NCMD, 2007
	Abinger Bill	Lord Abinger introduced an Antiquities Bill in the House of Lords that sort to reform Treasure Trove. This was not supported by the Government. The bill was given a second reading, but ran out of time and was not revived.	Palmer, 1993
1983	NCMD 'Code of Conduct' issued		NCMD, 2007b
	"The Battle of Wanborough Temple"	Looting of the archaeological site and the subsequent trials resulting in questioning of the adequacy of the old system of Treasure Trove.	Thomas, 2006
1986	Examination of Treasure Trove requested	Surrey Archaeology Society, who had been heavily involved in Wanborough, called for a review of the old law of Treasure Trove.	Thomas, 2010
1988	'Consultation Paper of Portable Antiquities' published	Paper published by the Department of the Environment (DoE), which summarised key issues with the current legislation concerning portable antiquities. The recommendations made by the paper were limited, and in the end were not implemented.	House of Lords, 1989
1992	'The Searcher' published	First issue of the popular metal detecting magazine, 'The Searcher' published.	Searcher Publications
1994	Treasure Bill	Despite the change in Government position from initial opposition to support of this bill, it failed to pass through Parliament, as it did not go far enough in its reforms of Treasure Trove.	Pers. comm. Bland July 2011
	Formation of the FID	The Federation of Independent Detectorists (FID) was formerly part of the NCMD with responsibility for individual members, but separated from them in 1994 when the two groups' interests diverged. One point of contention was that the FID disagreed with the NCMD's decisions to talk to the DCMS over the Treasure Trove reforms.	Thomas, 2010 Pers. comm. Bland July 2011

Year	Event	Further Details	References
	CBA Survey published	This report attempted to establish the present position of metal detecting in England, by surveying both metal detecting clubs and heritage organisations.	Denison & Dobinson, 1995
1995	Norfolk SMR recording ~24,000 metal detected objects per year	The scheme in Norfolk was to provide a model for the development of the PAS.	Denison & Dobinson, 1995
1996	FID issue Code of Conduct		FID, 1996
	Treasure Act (1996) replaces the ancient law of Treasure Trove	Law came into force in September 1997 Treasure is now defined as: single objects of at least 10% silver or gold which are over 300 years old; hoards of two or more coins of 10% silver or gold found in association; hoards of ten or more base metal coins found in association; all objects found in association with Treasure; any object previously classed as Treasure Trove.	UK Government, 1996
	Publication of 'Portable Antiquities. A Discussion Document'	This Government discussion document called for comments on two proposals – one a voluntary scheme for recording finds, the other legislation for enforcing recording.	DNH, 1996
1997	PAS Pilot scheme initiated in 6 areas	Kent, Norfolk, the West Midlands, North Lincolnshire, the North West (Cheshire, Lancashire, Merseyside, Greater Manchester and Cumbria) and Yorkshire FLOs recording data on Excel spreadsheets	PAS, 1999 Cassely, 1998
1997 - 1998	PAS Annual report	13,500 objects recorded	PAS, 1999
1998	First PASD launched	Based on a series of forms, the database enabled FLOs to record information on finders, findspots, finds, organisations and relevant publications. Each FLO worked on separate databases which were then collated annually in a central database and published online.	Cassely, 1998 Pett, 2010
	PAS Annual Statistics	555 finders' objects recorded on the PASD	PAS website
1999	Expansion of PAS pilot scheme across 5 further areas	Northamptonshire, Hampshire, Dorset & Somerset, Suffolk and Wales.	PAS, 2001
	PAS Annual Statistics	723 finders' objects recorded on the PASD	PAS website

Year	Event	Further Details	References
1998 - 1999	PAS Annual report	11.5 FLOs cover ~half of England and all of Wales 20,698 objects recorded since the first report 59% of objects recorded to the nearest $100m^2$ or better	PAS, 2000
1999 – 2000	PAS Annual report	31,783 objects recorded since the second PAS report 60% of objects recorded to the nearest $100m^2$ or better	PAS, 2001
2000	PAS Annual Statistics	1111 finders' objects recorded on the PASD	PAS website
	Best Archaeological Project Award	The PAS are awarded the 'Best Archaeological Project' award by the British Archaeological Awards.	Pers. comm. Bland July 2011
2000 – 2001	PAS Annual report	37, 518 artefacts recorded since the third PAS report 68% of objects recorded to the nearest $100m^2$ or better	PAS, 2002
2001	Chitty's review of the pilot PAS	Found the scheme had achieved much through liaison with finders, but that there were some problems with the quality of the data being recorded.	Chitty, 2001
	PAS Annual Statistics	1128 finders objects recorded on the PASD	PAS website
2002	The Treasure (Designation) Order	Revision of the Treasure Act following its first review. The definition of Treasure now included hoards of two or more prehistoric base metal objects and single prehistoric objects which contain any amount of precious metal.	UK Government, 2002
	Revision of the Treasure Act Code of Practice	To reflect changes in the 1996 Treasure Act.	DCMS, 2002
	PAS Annual Statistics	910 finders' objects recorded on the PASD	PAS website
2001 – 2003	PAS Annual Report	12 FLOs covering ~half of England and all of Wales 49,590 objects recorded since the fourth report Over 60% of objects recovered using a metal detector 70% of objects recorded to the nearest $100m^2$ or better	PAS, 2004
2003	PAS extended to cover all of England and Wales	36 FLOs now cover a total of 32 recording areas across England and Wales (see Appendix A for a list of recording areas).	PAS, 2005

Year	Event	Further Details	References
	Specialist Finds Advisors (FAs) employed to monitor data quality	As recommended by the Chitty review, FAs employed from this point onwards to review all finds recorded onto the PASD and ensure accuracy of information.	
	Second PASD launched	Oxford ArchDigital created new database online, enabling live updating of the PASD.	Pett, 2010
	PAS Annual Statistics	1843 finders' objects recorded on the PASD	PAS website
2003 – 2004	PAS Annual report	36 FLOs covering all of England and Wales 47,099 objects recorded since the fifth report Nearly two-thirds of these objects were recovered using a metal detector 73% of objects recorded to the nearest $100m^2$ or better	PAS, 2005
2003-2006	Funding from the HLF	For the first three years of national coverage, funding for the PAS was provided through the Heritage Lottery Fund (HLF)	Pers. comm. Bland July 2011
2004	Hawkshead review of the PAS		Chitty & Edwards, 2004
	PAS Annual Statistics	2903 finders' objects recorded on the PASD	PAS website
2004 – 2005	PAS Annual Report	67,213 objects recorded since the sixth report – of these, 27,280 are paper records of finds from Norfolk Nearly 79% discovered using a metal detector Just under 75% of objects recorded to the nearest $100m^2$ or better	PAS, 2006
2005	Launch of the UKDFD	The UK Detector Finds Database (UKDFD) was created by Gary Brun. Finds are recorded directly onto the database by finders.	UKDFD website
	PAS Annual Statistics	3181 finders' objects recorded on the PASD	PAS website
2005 – 2006	PAS Annual Report	57,556 objects recorded since the seventh report Just under 70% discovered whilst using a metal detector Nearly 86% of objects recorded to the nearest $100m^2$ or better	PAS, 2007
2006	'A Code of Practice for Responsible Metal Detecting in England and Wales' published	An objective statement defining 'responsible' metal detecting, endorsed by archaeological, metal-detecting and land-owners' organisations	PAS, 2008
	PAS User Survey		Edwards, 2006

Year	Event	Further Details	References
	PAS Annual Report	37 FLOs covering all of England and Wales 58,290 artefacts recorded in 2006 More than 77% recovered by metal detectorists Almost 90% of objects recorded to the nearest 100m² or better	PAS, 2008
	PAS Annual Statistics	4209 finders' objects recorded on the PASD	PAS website
2006 - 2011	Funding from the MLA	Funding from 2006 to 2011 was provided through the Museums and Libraries Association	
2007	PAS Annual Report	66,311 artefacts recorded in 2007 Of these, just under 85% recovered by metal detectorists 90% of objects recorded to the nearest 100m² or better	PAS, 2009
	PAS Annual Statistics	4741 finders' objects recorded on the PASD	PAS website
2008	Survey: how MDCs facilitate the work of the PAS	The PAS is aware of 153 MDCs in operation across England and Wales. 2241 individuals from 134 clubs record finds with the PAS. FLOs are in contact with a further 1320 independent detectorists.	Vomvyla, 2008
	Clark's review of the PAS	States that the most significant outcome of the PAS has been to rebuild trust between metal detector users and archaeologists. Found that the workload for FLOs is too high.	Clark, 2008
	PAS Annual Report	40 FLOs (some part time) covering England and Wales 53,346 objects recorded in 2008 Over 87% discovered by metal detectorists Over 89% of objects recorded to the nearest 100m² or better	PAS, 2011
	PAS Annual Statistics	4469 finders' objects recorded on the PASD	PAS website
2009	Oxford Archaeology 'Nighthawking' Report published	Found a reduction in two measures of nighthawking which were surveyed by the CBA in 1995: (1) the number of Scheduled Monuments that were damaged. (2) the number of archaeological units reporting attacks.	Oxford Archaeology, 2009

Year	Event	Further Details	References
	Coroners and Justice Bill	Further amendments to the 1996 Treasure Act proposed – this bill includes provisions for a single Treasure Coroner to speed up the Treasure process, and extends the need to report Treasure to anyone coming into procession of it.	Bland & Lewis, 2009
	PAS Annual Statistics	67,066 artefacts recorded in 2009. This includes the Staffordshire Hoard (493 artefacts) 88% recovered by metal detectorists 90% of objects recorded to the nearest 100m² or better 4099 finders' objects recorded on the PASD	The PAS Annual Report 2009 & 2010
2010	Crosby-Garrett Roman helmet sold for over £2million	The sale of this helmet at Christie's auction house to an unknown bidder increased pressure for another review of the 1996 Treasure Act.	Worrell et al, 2011
	Third PASD launched	New database created for the PAS by Dan Pett, the ICT advisor for the scheme, with improved searchability and speed, enhanced record content with improved spatial representation. Database now part of main PAS website and includes provision for self-recording.	
	CCI incorporated into the PASD	Celtic Coin Index, which has been recording Iron Age coins since 1960, combined with the PAS dataset .	Pett, 2007b
	IARCW database incorporated into the PASD	Iron Age and Roman Coins from Wales – database of over 50,000 coins incorporated into the PASD.	Pett, 2010b Guest & Wells, 2007
	PAS Annual Statistics	90,099 artefacts recorded on the PASD in 2010. Also recorded were: 1. Celtic Coin Index (CCI): 37,931 coins 2. Iron Age and Roman Coins from Wales database (IARCW): 52,812 coins 3. Frome Hoard: 52,503 coins plus pot 62% recovered by metal detector users 82% of objects recorded to the nearest 100m² or better 4433 finders' objects recorded on the PASD	The PAS Annual Report 2009 & 2010
2011	'Best of the Web' Award	PASD awarded the 'best of the web' for research/collections by the Museum and Web conference.	Pett, 2011
	Funding through the BM	In 2011, funding of the PAS was transferred to the British Museum	Pers. comm. Bland (July 2011)

Year	Event	Further Details	References
	PAS Annual Statistics	97,509 artefacts recorded in 2011 83% of finds found on cultivated land 91% of finds recorded to the nearest $100m^2$ or better	The PAS Annual Report 2011
2012	PAS Annual Statistics	73,903 artefacts recorded in 2012 90% recovered by metal detector users	The PAS Annual Report 2012
	Britain's Secret Treasures (Series 1)	ITV programme hosted by Michael Buerk and Bettany Hughes featuring the top 50 archaeological discoveries from across England, Wales and Scotland (primarily from the PASD) Objects selected based on historical and cultural significance, and their aesthetic merit	
2013	PAS Annual Statistics	82,072 artefacts recorded in 2013, in 54,981 records 45.3% of artefacts dated to the Roman period 87% recorded to 6-figure NGR or better, 60.3% to 8-figure NGR or better	PAS website
	Britain's Secret Treasures (Series 2)	Second ITV series in collaboration with the British Museum and PAS, again hosted by Michael Buerk and Bettany Hughes Focus on groups of artefacts from the various regions of England, Wales, Scotland and Northern Ireland	
2014	Heritage Lottery Funding	The PAS receives funding of a 5 year project to enhance its volunteer programme nationwide Community Finds Recording Teams will be recruited from local communities across England and Wales New sections of the PAS website will be devoted to the history and archaeology of local areas	PAS website

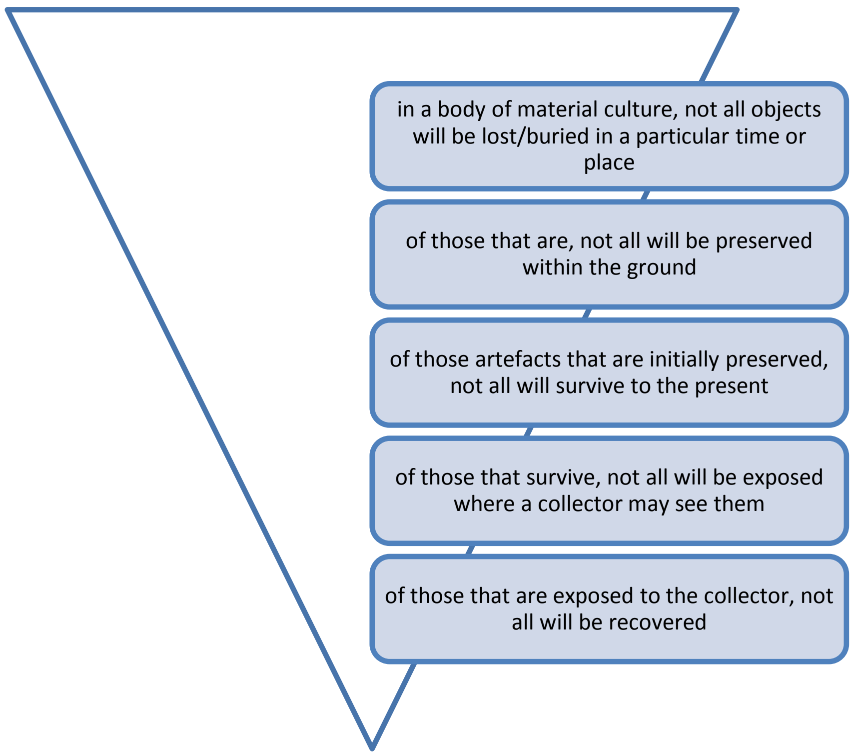
No data that is collected by humans can be without some form of bias, a fact which has been recognised since the earliest days of archaeological research. But what is bias, and how does it affect the data that we collect? Where do biases come from and do they affect data equally? Can they be influenced and altered by other factors or do they act independently of one another? The following pages will explore bias in the context of amateur-collection and, through examples drawn from many aspects of archaeology, will summarise the different stages at which bias enters the archaeological record.

THEORIES OF SAMPLING BIAS

Although the issues surrounding sampling bias have been somewhat side-lined in recent years in the British archaeological literature, they were widely discussed in the 1970/80s, and a number of theories were developed that recognised the influence of various physical and human factors on the archaeological record.

The first general analysis of these ‘formation processes’ was by Ascher[1] - he suggested that time was the principal controlling factor in the preservation of sites, with older sites being more degraded and disturbed than those from a more recent period (termed ‘the entropy view’). Although this theory had some merit, it failed to capture the complex nature of formation processes, as it assumed that sites laid down at the same time were influenced by the same processes.

A more detailed theory was offered by Collins[2], who identified a series of contingencies that intervene between a living specimen and its appearance in a palaeontologist’s collection. Transformed to represent an archaeological dataset, these contingencies adeptly define the process of moving from an object in use in the past, to its recovery in the present:



[1] Ascher 1968
[2] Collins 1975

Collins's contingences, named the 'sampling bias conception', recognised the patterned nature of formation processes and were the foundation of another concept developed in the 1970s called the 'transformation position'. This theory explicitly incorporated a spatial dimension, acknowledging that the 'transformations' occurring at one site may vary from those affecting another nearby. Schiffer[1] defined these transformations as either cultural (c-transforms), or non-cultural (n-transforms):

- C-transforms = processes that result from human activity e.g. the reuse and deposition of artefacts in the past, or the disturbance of artefacts in the ground through mechanical processes in the present
- N-transforms = environmental processes e.g. the deterioration of different materials in the ground, or the agitation of soil through natural processes.

Schiffer's work has become the principal reference for those exploring the creation of the archaeological record, but his discussions are principally confined to professional collection practices. Any discussion of the formation processes that influence the distribution of PAS findspots must consider the bias inherent in data collected by amateur archaeologists, metal detector users and members of the public, a body of collectors overlooked by the theories developed in the 1970s and 1980s.

A new framework is therefore required, that combines the detailed analysis of formation processes conducted by Schiffer with the more recent identification of bias within amateur datasets[2]. Such a framework can be created by adding two further contingencies to Collins's sampling bias conception:

Thus in seven stages, one moves from a complete body of material culture in use in the past, to a professional dataset of amateur collected finds such as the PASD, recorded in the present. Each stage is considered a sample of the previous stage, with the final recorded dataset a small proportion of the original body of material culture.

[1] Schiffer 1987,1996
[2] Seen in projects such as Walton 2012 and Brindle 2014

Stage 1: Deposition

- objects enter the archaeological record by being buried, as rubbish, grave goods or part of a hoard, or by being accidently lost
- all these processes have strong biases towards certain types of objects /certain locations

Stage 2: Preservation

- once an object has been deposited in the ground, it must be preserved for future generations to recover
- preservation (or decay) is dependent on an object's physical properties and the physio-chemical conditions of the surrounding environment

Stage 3: Survival

- preservation in the past does not guarantee survival to the present, particularly if an object is removed from its original context
- this could be caused by both cultural and non-cultural (environmental) processes
- e.g. through the natural erosion of soil from above an object by wind or water movement,
- e.g. by the large scale movement of soil and its associated artefacts through industrial or building works, animal burrowing or agriculture

Stage 4: Exposure

- for an object to class as "exposed" it must be in a position from which it can be perceived by a collector
- perception may be by eye, as with field walkers, excavators or specimen collectors, or through the use of machinery such as metal detectors or geophysical equipment
- exposure"is therefore both dependant on the artefact's position and the technique used

Stage 5: Recovery

- these biases are more easily quantifiable, ras they result from the choices made by individuals in the present
- they can be broken down into a number of themes – recovery techniques, site choices, sampling methods, an objects' 'visual apparency', and individual interests

Stage 6: Reporting

- the reporting of artefacts to a professional database by an amateur collector can be highly variable, as it is reliant on the wishes and knowledge of the finder i.e. the finder must want to report the object, and then must know how to do this

Stage 7: Recording

- bias can be introduced during the recording of data, both through the decisions of what, and what not, to record, and through the recording process itself

STAGE 1: DEPOSITION – LOSS AND BURIAL

The deposition of artefacts is closely linked to the cultural practices and beliefs of the originating society or individual, but is also controlled by the object's properties and the location: cultural beliefs control an object's value, and in turn patterns of discard, loss, deposition with the dead, and hoarding, whilst location and object visibility influence the retrieval and reuse of items.

Loss

The loss of objects in the past has strong biases towards certain types of objects and certain locations. The key factors to consider are →

A gold coin is therefore more likely to be recovered than a copper one, whilst artefacts dropped in a cess pit or deep water more likely to be left than those dropped on the floor of a house[1]. Outside the settlements, the casual loss of any type of single artefact may have occurred whilst the owner worked in the fields or as they marched along a road.

The likelihood of an item being lost

- How securely was the artefact attached to the carrier?
- How mobile was the artefact during its life?

The likelihood of a lost item being recovered

- What was the artefacts colour, size and texture?
- How valuable was it to the owner?
- How easily could it be recovered from where it was lost?

Burial

The selection of items buried may be dependent on the reason for burial →


Burial as part of a hoard for ritual, symbolic or dedicatory purposes - there is no intention to return.


Burial as part of a hoard to keep valuable artefacts safe until they can be recovered.


Burial as part of a grave assemblage, where objects will have significance to either the deceased or the living.


Burial as refuse, when artefacts are broken or no longer required.

Burial has a strong spatial component, with the siting of artefacts influenced by the reasons for deposition and the beliefs of the depositor.

Deposition in any form may occur within or well beyond the limits of occupation e.g. the deliberate deposition of artefacts as grave goods is likely to be outside the boundaries of the settlement, whilst hoards have been recovered from within settlements, their immediate environment, and from further afield.[2]

Deposition of broken objects as rubbish often occurred within settlements, before the discarded artefacts were then spread on the fields with the manure[3] e.g. the large numbers of Post Medieval buttons on fields is attributed to the process of 'shoddying', where rags of poor cloth (or shoddy) were spread on the fields as manure,[4] and a number of studies have found spreads of ceramics on fields, moved there as part of the manuring process in the Medieval period.[5]

---

[1] Schiffer 1996 and Drewitt 1999
[2] Brindle 2011
[3] Jones 2009
[4] Wheeler 1914
[5] Hinton 2010

STAGE 2: PRESERVATION

Preservation/decay is dependent on both the object's physical properties, and the physio-chemical conditions of the surrounding environment. The rate of decay of an artefact is controlled by a number of chemical, physical and biological 'agents':[1]

PHYSICAL AGENTS

- e.g. sunlight, wind, and rain/water
- these cause pre-burial decay through cycles of expansion and contraction (through extremes of heat or cold) or through physical erosion or weathering (by wind and water)

BIOLOGICAL AGENTS

- e.g. bacteria and fungi
- these aid the degradation of organic matter within artefacts, such as fabric or leather

CHEMICAL AGENTS

- things found within soils or the atmosphere that are required for chemical reactions to occur
- these can alter the state of artefacts before and after burial through processes such as oxidation or corrosion

Together, these chemical, biological and physical agents work to alter and modify the discarded or deposited artefacts both before and after burial.

Environmental Conditions

Evans and O'Connor[2] define four main environmental conditions prevalent in the soils of the British Isles – each will have a different effect on the artefacts contained within them.

ACID-OXIC

- low (acid) pH
- aerated soils
- generally found in heathlands, moorlands, some river gravels
- also found on the lower uplands
- the acidity of this environment generally destroys mollusc and bone remains, but pollen and plant remains survive well

BASIC-OXIC

- higher (alkaline) pH
- calcareous soils
- generally found in areas of chalk/limestone and also in alluvium
- particularly found in the upper reaches of river valleys
- organic matter decays rapidly in this environment, but mollusc shells and bone can be well preserved

NEUTRAL-OXIC

- neutral pH
- aerated soils
- found in areas of clay, sandstones and river gravel
- organic and biological remains are generally poorly preserved, but charcoal can be common

ANOXIC

- soil lacking in free moving oxygen
- usually found in the bottom of pits and ditches, as well as in lowland wetlands and lakes
- biological remains are usually well preserved e.g. beetles, seeds, wood, and human remains (hair, nails, clothing)

---

[1] Schiffer 1996

[2] Evans & O'Connor 1999. See also French 2003

Most metals corrode over time, as they are chemically unstable and react to the elements present in soils. During the process of corrosion, metals revert to their more stable, natural form of ores, from which they were originally extracted. Artefacts containing more than one metal type (i.e. an alloy, or a bimetallic object such as an iron blade with a copper handle) may be more prone to corrosion, as the reactions within one part of the object can influence the reactions within the other.[1] A basic summary of the most common corrosion products of silver, copper, lead, tin and iron is below.[2]

Silver

- will corrode in most soils in Britain, resulting in a layer of corrosion products over the surface of the object that preserves the internal structure
- these corrosion layers may be silver sulphide (black), silver chloride (grey white) or copper carbonate (green), the latter forming when silver has been alloyed with copper, for example in base silver Roman coins
- in particularly adverse conditions, silver can become completely corroded

Copper

- occurs naturally and develops a brown (copper oxide), green (copper carbonate), white (oxide) or black (copper sulphide) corrosion layer
- copper oxide and carbonate, where developed slowly, can preserve original surface detail well
- copper alloys such as bronze (copper and tin) and brass (copper and zinc) have good corrosion resistance, but all can be severely affected by chlorides and moisture, which cause the rapid deterioration of artefacts called ‘bronze disease’

Lead

- is very quickly oxidised, turning its characteristic blue/grey colour
- as a result, it is a reasonably corrosion-resistant metal, but can become severely corroded in acidic soils where the corrosion products dissolve easily and are leached away leaving almost nothing remaining.

Tin

- is quite resistant to corrosion as it becomes surrounded by a protective layer of tin oxide, preserving the artefact within
- in acid-oxic environments the tin will be attacked and over time the protective film will become more porous and crack.

Iron

- can survive well in dry environments, but iron and iron-alloys corrode swiftly in the presence of moisture, with orange/brown iron hydroxides developing on the outside of the object, aided by chlorides in the water
- in very acid environments, iron can dissolve quickly. It survives better in waterlogged conditions or chalky soils where much surface detail may be preserved.

If metal objects survive the initial corrosion and are contained within an unchanging burial environment then the layers of corrosion may protect them from any further decay. Artefacts may remain preserved within such a ‘soil archive’ in a near stable condition for many hundreds or thousands of years,[3] until something or someone causes a change in the surrounding environment.

[1] Dowman 1970
[2] See also Fischer et al. 1997 and Hobbs et al. 2002
[3] Wagner et al. 1997

STAGE 3: SURVIVAL

The survival of artefacts is primarily affected by natural erosion, building/industrials works, animal burrowing and agriculture. The latter is particularly destructive to archaeological sites and artefacts, as ploughing cuts into sites buried deep beneath the ground, destroying archaeological features and spreading artefacts through the plough-zone. Objects brought into the plough-zone may then be subjected once more to the actions of physical agents such as heat, wind and rain, and many may not survive. This can be seen particularly with some of the more friable pottery sherds, which quickly disintegrate as a result of frost-action once brought into the plough soil.[1]

As well as the mechanical degradation of artefacts, objects can be damaged by chemicals added to the soil as fertiliser, as these alter the pH of the soil environment - e.g. studies have shown that over the last century archaeological copper-alloy objects have corroded more than they did in the previous 1000 years.[2] This accelerated decay can be attributed to the increasing addition of chemical agents such as chlorides, sulphates, and acids into the soil,[3] through the deliberate spreading of chemical fertilisers, salt spreading on roads and through acid rainfall.[4]

STAGE 4: EXPOSURE

For an artefact to be 'exposed' it must be in a position from which it can be perceived by a collector, and perception will depend on the techniques being used and the position of the artefact in the soil.

Artefact Movement

Artefacts can be uncovered or buried by natural erosion processes and agricultural activity.

All natural erosion events will result in the movement of soil downslope, reducing the soil depth on the hill crest and increasing it at the base of the slope (gravity will have the same effect).[5] However, there is a difference in the exposure of artefacts that is dependent on the size of the event.

Small erosion events

generally move the soil and not the artefacts

may result in the artificial concentration and exposure of artefacts and stones upslope, whilst slowly burying artefacts lower down the hill.

Large erosion events

may move artefacts along with the soil

results in a downslope movement of objects away from their original location.

caused by extreme weather conditions such as heavy rainfall, droughts, storms and high winds

e.g. most Palaeo-Indian sites from the Great Plains of North America have been found during periods of drought, in particular during the 'dustbowl' years of the 1930s, when large numbers of Clovis occupation sites were exposed to collectors by erosion.

[1] Reynolds & Schadla-Hall 1980
[2] Fjaestad et al. 1997
[3] Scharff & Huesmann 1997
[4] Gerwin & Baumhauer 2000
[5] Seebach 2006

The extent of tillage or cultivation is considered to be one of the major causes of geographical bias in archaeological distributions, and in England there is a clear partiality in metal detected findspots towards the heavily cultivated farmlands in East Anglia, where artefacts are continually being moved through the plough-zone and exposed to the collectors. However, levels of agriculture cannot always be assumed to be equated with clusters of artefacts, for example American studies of Clovis fluted point distributions have found that increased levels of cultivation are not significantly associated with any increases in find density.[1]

Agricultural activity affects the exposure of artefacts by moving them both horizontally and vertically through the plough-soil:[2]

*Experiments in the 1980s on the **vertical movement** of artefacts through the plough-zone showed that larger objects are initially better represented on the surface in relation to their total population in the plough-zone than smaller objects, as larger objects are moved upwards by the plough whilst smaller objects slip downwards.*

More recent studies have shown that after around ten tillage events, an 'equilibrium' is reached after which objects become more uniformly mixed throughout the plough-zone.

If objects are not removed from the plough-zone, they have a probability of being exposed on the surface after ploughing once every six or seven years.

*The **horizontal displacement** of artefacts is generally thought to be cumulative through time – Lewarch and O'Brian found that movement of artefacts was greatest in the direction of ploughing, and larger artefacts were moved more than smaller ones.*

Other experiments have shown that objects are moved further from their original location as the number of tillage events increases, whilst being limited by the size of the field.

Technique

All artefacts in an excavation have the potential to be exposed as layers of soil are removed, but with less destructive collection methods the percentage of artefacts exposed to the collector can vary considerably.

The nature of fieldwalking means that artefacts are collected from the surface of a field, but these are only a sample of the total number of artefacts in the plough-zone (the volume of soil turned by a plough) and have been shown by experiment to represent about ten percent of the total plough-zone assemblage.[3]

Metal detectorists are not limited to artefacts lying on the surface of a field, but can 'see' objects in the plough-soil up to a certain depth (dependant on soil and weather conditions and the type of detector being used), meaning that for them a higher percentage of the total plough-zone assemblage is 'exposed' than it is for fieldwalkers.

[1] Buchanan 2003
[2] Key references: Boismier 1991, 1997; Lewarch & O'Brien 1981; and Frink 1984
[3] Boismier 1991

STAGE 5: RECOVERY

The biases behind the recovery of an exposed object are more widely discussed in the literature than any other sources of bias – they are discussed here briefly under 5 titles: **site choices, sampling methods**, **techniques**, **individual interests** and **visual apparency**.

Site Choices

It is an irrefutable fact that artefacts will not be recovered unless a collector goes to that location, and site choices can be affected by a variety of factors,[1] for example:

sites that satisfy the interests of specific researchers

sites that can be explored with the available funds

- e.g. in France the distribution of Palaeolithic artefacts is particularly concentrated in the areas around research centres such as Les Eyzies (The National Prehistory Museum), a historical pattern generated by the costs and logistics of moving people and equipment out to sites
- e.g. in Scotland there is demonstrable bias towards the east and south-east of the country, due to both the inaccessibility of other areas of the country and the financial costs of conducting surveys in the more remote areas

sites in danger of destruction through development

- developer funded work post PPG16 (1990) or the Rescue movement (1970s onwards)
- focused on the routes of pipelines and roads, or on housing or industrial estates
- the site distributions generated by these excavations are biased towards the needs of the developer, rather than having a basis in archaeology – the study of Clovis point distributions in America for example has shown that where more people live, more Clovis sites have been found, a result of increasing urban development and the associated archaeological excavations as well as the increased number of potential collectors in those areas. It is not surprising therefore that rural sites are often underrepresented within developer-funded excavations.

sites that are easily accessible

- in biological sampling (which shows similar patterns to amateur collecting) it has been shown that the location and intensity of specimen collection is heavily influenced by site accessibility, and there is significant clustering of data around urban areas and research centres and along rivers and roads
- other surveys in Spain and Portugal have shown that the geographic distributions of organisms actually reflect the geographic distributions of entomologists rather than the true distributions of the organisms themselves, as collectors stay near to their homes

sites that have proved productive before i.e. 'hotspots'

- such targeted searching is visible in amateur archaeological surveys, for example in America where some collectors were prepared to travel up to 160km to particular hotspot sites to collect fluted points
- amateur collectors in Britain may focus on areas of known activity such as Roman roads and Bronze Age barrows

[1] Key references: Hodder & Orton 1976; Hosfield 1999; Bever & Meltzer 2007; Buchanan 2003; Ferrier 2002; Lobo & Martin-Piera 2002; and Seeman & Prufer 1982

Sampling Methods

There is rarely the time to survey the entirety of an area so in professional archaeology some form of 'formal' sampling strategy is usually employed.

This is a methodological choice that affects the geographical areas investigated and therefore the chances an object has of being recovered.

Sampling can be undertaken by surveying discrete blocks of land (grid squares) or by walking lines (transects), which can be placed randomly or systematically across the landscape.[1]

Fieldwalkers generally collect objects from about two metres either side of the transect line, so on different surveys different spacings between transects will be appropriate. In general a spacing of fifteen to twenty-five metres is thought to be optimal for an experienced field walker aiming to cover a large area each day, but if a large number of relatively inexperienced field walkers are being used, then it might be more appropriate to reduce the spacing to ten metres, as in general they will be less efficient at spotting and collecting objects than more experienced walkers.

Unlike professional archaeologists, amateur collectors are not obliged to sample in any particular way, nor do they have to have a strategy that ensures they cover an area systematically so that they produce an unbiased sample.

they can search wherever they wish, however often they wish and in whatever form they wish, focusing on a particular area if it is productive, or moving quickly on if not

However, whilst there may be no explicit survey strategies within amateur collection, collectors will often employ some form of survey method, and that is likely to affect the distribution of the resulting findspots. For example, amateur collectors are prone to concentrate on the most productive land – arable – at the expensive of non-agricultural land such as mountainous regions, woodland, moorland and urban areas. Other survey methods may include 'zig-zagging' across a field, the 'union jack' approach (around the edge and a diagonal cross through the middle), or searching a field in blocks.

Techniques

As with *exposure*, the *recovery* of artefacts can be biased by technique, as certain objects are more likely to be recovered with one technique than with another,[2] for example:

Excavation

- simply recognising and recovering finds by hand during the process of excavation could result in the loss of up to eighty five percent of certain types of find.
- alternative methods range from sieving all spoil to using floatation techniques to recover much smaller items such as snail shells and fish bones

Geophysical techniques

- the underlying geology of the site, the depth of soil to the underlying rock, the nature of the soil, the nature of the archaeological feature, the conditions of the ground at the time of the survey and the presence of man-made features such as fences or underground services, will determine the effectiveness of each technique
- e.g. experiments have shown that landscapes such as the Jurassic Ridge in southern England, which has iron rich topsoil contrasting strongly with the underlying limestone, are ideal for magnetometry, whereas areas such as East Anglia, which are covered by weakly magnetic deposits, are relatively unresponsive.

[1] Key references: Roskams 2001; Hales et al.2006; and Clark 1996
[2] Key references: Clarke 1978; Green 1981; Haselgrove 1985; Bradley et al. 1994; Mattingly 2000; Boismier 1991

The impact of the individual in the recovery of artefacts should not be underestimated. Every individual brings different experiences, knowledge and interests to the field, affecting what information they collect.

Excavation

- e.g. at the excavations of Skara Brae a high percentage of flint and chert finds were recovered by one individual - Clarke (1978) concluded that this digger's greater recovery rate was a result of (1) their slower speed of excavation and (2) their specific interest in flint objects, making these items more apparent to them than to the other excavators.
- Many other excavations have been affected by this type of collection bias, for example at Pontnewydd, Wales, it is thought that finds were 'artificially enriched' with hand axes due to a bias towards collecting these artefacts by individual diggers.

Fieldwalking

- this, more so than most other archaeological methods, is reliant on the work of few individuals so any differences in patterns of recovery will prejudice the results
- within a team working on the East Hampshire Survey, members tended to focus on either lithics or pottery, but neither recovered either artefact in their true proportions.
- walkers may recover artefacts from one period in preference to others - perhaps partially due to the visual apparency of artefacts e.g. red pottery is often easier to see and collect than earth-coloured or black pottery, so Roman wares may be more visible than prehistoric sherds.
- Individuals may become attuned to particular types of artefact and unintentionally collect them at the expense of other objects.

Amateur fieldwalking

- can be very unsystematic and focus on particular classes of artefacts.
- e.g. Broom Hill (Hampshire) had 12 years of amatuer flint collection. From studying this collection Boismier (1991) identified three key effects of collector bias on artefact class frequencies (1) that temporally diagnostic and retouched artefacts will occur in higher proportions than other artefacts in unsystematic collections; (2) that these artefacts therefore occur in lower frequencies in the remaining plough zone assemblage; and (3) that as these diagnostic artefacts become rarer, more common artefacts will be increasingly collected by the amateur.

The 'visual apparency' or 'obtrusiveness' of an object affects its 'detection probability', i.e. the likelihood of the object being seen by the observer. Apparency is dependent on an object's size, colour, surface morphology, material and a variety of other physical, chemical and biological properties as well as the properties of the surrounding environment, and the techniques used.

Excavation

In the perfect scenario 100% of objects should be recovered (Orton 2000) but the method of excavation, the individual excavator and the conditions at the time of excavation will all affect an object's apparency. For example, more red pottery sherds are recovered with a trowel than black or grey sherds, and more of both colours are missed in wet weather than in the dry (Barker 1993). Visual apparency may also be dependent on the extent of the excavation, as features may be less visible in small test pits than in larger trenches (Orton 2000).

Fieldwalking

The weather has a big impact on visual apparency of artefacts, introducing 'massive biases' into fieldwalking data. Rain will affect the collection of artefacts, either by making them more visible (washing them clean) or less so (covering them in mud), but it is generally true that more pottery is recovered in dry weather than wet (Barker 1993).

Experiments in Calabria in the 1970s looked at the effect of the weather on collection patterns and showed that larger objects had a greater chance of being recovered even when conditions were not ideal, whereas the collection of smaller artefacts depended much more on the collection conditions. Other research has shown that an overcast day offers better light conditions for collecting obsidian (Ammerman & Feldman 1978).

Finally, the density and type of natural vegetation cover will have a serious impact on fieldwalkers' ability to see artefacts (Cherry 1983).

Metal detecting

Many of the factors discussed in the fieldwalking literature are important to metal detectorists, as they can influence the strength of the electromagnetic signal, altering the depth to which the current can penetrate, and subsequently the percentage of the plough-zone which is 'exposed' to the collector. Certainly, aerated or dry soils will reduce the signal strength and the penetration depth, whilst a high mineral content can disturb the signal and make artefacts more difficult to distinguish (Denison & Dobinson 1995).

STAGE 6: REPORTING

The reporting of artefacts to professional databases by amateur collectors can be highly variable, as it is reliant on the wishes and knowledge of the finder i.e. the finder must want to report the object, and then must know how to do this. Finders in England and Wales can report objects to the PAS, to a museum or to the county SMR/HER, but the only objects that must be reported are those classified as treasure by the *1996 Treasure Act*. The reporting of non-treasure finds is at the discretion of the finder, so whilst the PAS and county HER/SMRs hold records on several hundred thousand amateur collected artefacts, there are potentially thousands more held by members of the public.

There are a variety of potential causes for the non-reporting of finds: the type of collector, the time available to both them and the recorder, the potential for loss of artefacts or land, the knowledge of both the finder and recorder, potential recording issues due to the relationships between finders and recorders, and the accessibility and reliability of the recorder (Figure 1).

The reporting of artefacts is highly affected by the characters of the individuals involved, by their relationships with one another, and their experiences with the PAS in the past.

Figure 1: Reasons for the non-reporting of finds

Type of collector

- Specifically their aims and intentions – those collecting for profit rather than pleasure are generally less likely to report their finds

Time

- Finders may not have the time to travel to an FLO
- Finders may be discouraged from further finds reporting by delays in processing/returning objects
- Finders can believe that archaeologists are not interested in seeing the same objects time and time again, and so may refrain from reporting object types they have previously reported
- They may believe the FLOs do not have the time to record all their artefacts

Potential for loss

- Finders may be concerned about the perceived potential for loss of land through scheduling or the withdrawal of access rights by landowners
- Finders may be concerned that their artefacts will be lost during processing

Knowledge

- Reporting can be dependent on the individual object and the perceived value of that object, as an object thought to have less worth may be less likely to be reported. This is clear in the case of 'eye's only' finds of flint or pottery, which are often recovered but not reported
- If a finder feels they know more than the recorder about the artefact, they may not wish to report it

Relationships

- The sometimes fragile relationship between archaeologists and metal detector users means that some finders are as yet unwilling to report artefacts to archaeologists. Finders might instead prefer to record their artefacts on independent databases such as the UK Detector Finds Database (UKDFD), which is run by amateur collectors

Accessibilty and reliability

- Finders may be discouraged by constant changes in personnel or inconsistent attendance at club meetings or rallies
- Finders may be unwilling to travel the distances required to report artefacts to an FLO

STAGE 7: RECORDING

Bias can be introduced during the recording of data, both through the decisions of what, and what not, to record, and through the recording process itself. PAS policy is to record all finds that are over 300 years old, but it is up to the individual recorders to decide which objects younger than this should be recorded, and whether to record objects that they cannot identify or that cannot be dated specifically. If recorders have a heavy workload, they may have to be selective about which artefacts to document. It is therefore potential for higher proportions of more recent objects to be recorded in areas where the density of finds is lower.

The identification and classification of artefacts is reliant on human perceptions, and there is therefore an element of variability that is dependent on the individuals involved.[1] Although all recorders will be trained to identify a wide variety of objects, the research interests and expertise of the individuals will affect the quality of recording. For example, researchers may record different information about an artefact, for what one person sees as important, another may not,[2] and the level of detail recorded for each artefact will depend on the individual recorders expertise. The definitions being applied to the artefacts must be explicit to avoid arbitrary decisions by recorders - differences may arise in the database because different recorders perceive and interpret the classifications in different ways.[3]

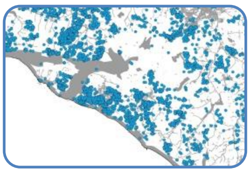
[1] Beck & Jones 1989
[2] Meltzer 1986
[3] Blackmar 2001

METHODS FOR EXPLORING BIAS IN THE PASD

Whilst it is never possible to remove the bias inherent in the PAS data, a variety of methods can be used to identify and display this bias, to enable researchers to consider its effects, particularly on the spatial distribution of artefacts.

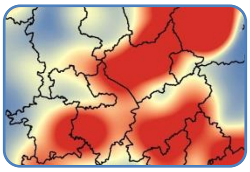
These methods combine both qualitative and quantitative techniques, and encompass macro- and micro-scale analyses. Divided into five key sections (see below), these methods have been developed with reference to a range of other projects that have used the PAS data, particularly 4 recent works that have made understanding the spatial distribution of finds a central component of their work:

(1) Brindle, T. (2014) 'The Portable Antiquities Scheme and Roman Britain', British Museum Research Publication No. 196
(2) Walton, P. (2012) 'Rethinking Roman Britain: Coinage and Archaeology', Moneta Monograph No. 137
(3) Chester-Kadwell, M. (2009) 'Early Anglo-Saxon Communities in the Landscape of Norfolk', BAR British Series No. 481
(4) Richards, J.D., Naylor, J. & Holas-Clark, C. (2009) 'Anglo-Saxon Landscape and Economy: Using Portable Antiquities to study Anglo-Saxon and Viking Age England', Internet Archaeology Vol. 25



Mapping constraints

- A macro- and micro- scale method of identify areas where amatuer collection, specifically metal detecting, is illegal or unlikely to occur

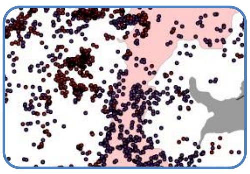


Density and Distributions

- Exploring different methods for displaying the PAS data to enable analysis of the distribution of finds

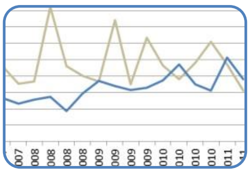
Landscape analysis

- Comparisons between the distribution of PAS findspots and a variety of man-made and physcial landscape features to explore the relationship between amatuer collection and the British landscape



The PASD and other archaeological datasets

- Comparisons between the distributions of PAS findspots and a variety of archaeological datasets, to explore the relationship between amateur collection and known archaeology



People and the PAS

- Methods for exploring the impact of both amatuer collectors and PAS recorders on the spatial distribution of the PAS dataset

MAPPING CONSTRAINTS

It is now well accepted that there are definable limits on the land that can be searched by amateur collectors. Metal detecting is not a public right, meaning that large areas of the English and Welsh landscape are 'constrained', defined here as

> "*something that limits, inhibits or restricts the recovery of finds from a particular location*"

These constrained areas can be drawn together into a 'constraints map' that offers a template of sorts for exploring the distribution of amateur collected finds. Such a map allows researchers to assess the extent to which gaps in the distributions of such finds are likely to be real, or the product of modern recovery factors.

History

Constraints mapping has been in use for some years, but the first project to use this concept at a national scale was the 'Viking and Anglo-Saxon Landscape of England' (VASLE)[1]. This project created a specially designed constraints base map (Figure 2) to show those landscape attributes that were most likely to limit the search areas available to metal detector users and therefore spatially bias the distribution of finds recovered by them. Their map used **urban areas**, **forests**, **lakes**, **danger zones**, and Ordnance Survey (OS) relief data showing the **300m contour line**, which represented the limits of ploughzone farming. The results showed that when considered at a regional scale, the perceived constraints on data recovery did correspond with areas with relatively few finds.

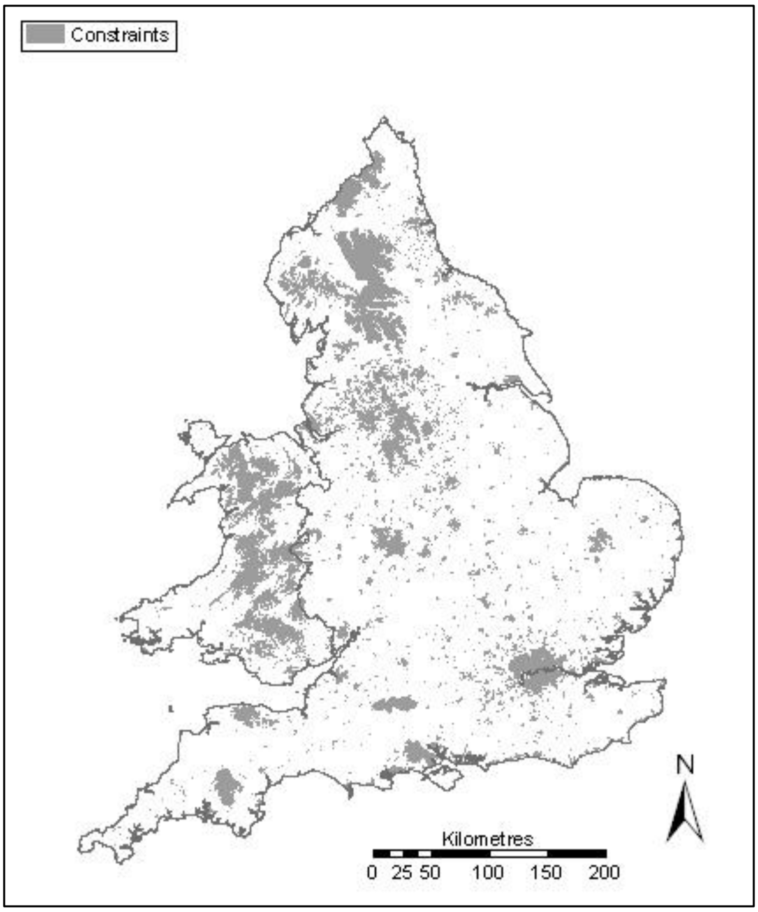


Figure 2: The VASLE constraints base map (2009)

This idea of exploring the constraints limiting the practice of detecting has been taken up by other researchers since the VASLE report. Chester-Kadwell acknowledged the importance of understanding the issue of permissions, identifying **urban areas**, military '**danger zones'**, **National Trust** properties, **Royal estates**, dense **woodland**, **waterlogged** areas and other **reserves** and **parks** as 'off-limits' to detectorists.[2]

More recently, Brindle explored the issue of search constraints in his analysis of Roman finds, plotting the PAS data against **topography**, **urban areas**, **woodland** and **non-agricultural**

[1] Richards et al. 2009

[2] Chester-Kadwell 2009

land.[1] He interpreted the distribution of PAS finds with respect to these constraints and found that the distribution of PAS finds in some counties 'substantially' reflected these modern constraints.

Types of Constraints

There are many different land types/designations that could act as constraints against amateur searching – just looking at the three examples above gives over 10 different land types/designations:

However:

(1) there are many potential constraints not included in this list, e.g. Sites of Special Scientific Interest (SSSIs) and Forestry Commission (FC) land, on both of which metal detecting is restricted.
(2) there is a clear distinction between land on which metal detecting is legally banned (barring special permission) such as Scheduled Ancient Monuments (SAMs), and that on which it is just unlikely to occur, for example within urban areas or dense woodland. These are defined here as 'hard' and 'soft' constraints.

The following table provides a comprehensive list of the range of land types/designations that could be constraining the PAS data.

It gives a brief description of each potential constraint, states the type of constraint (hard/soft/both/none) and where possible provides details of available datasets and further information.[2]

Where one designation is contained within another, it is the 'type' of the overall designation that will be listed. For example, a number of SAMs fall within World Heritage Sites (WHSs) – whilst SAMs are constrained, in this instance they are contained within the WHSs which are not, therefore the constraint type would be listed as 'none'.

[1] Brindle 2014
[2] Whilst the best effort has been made to ensure all the information contained within this table is accurate, any corrections and additions are welcomed.

	Description	Type	Data Holder(s)	Boundary datasets / Further information
Access land **(aka open access land)**	Areas of land in England on which the public can freely walk without having to stick to paths. Access land is covered by the '*Countryside and Rights of way Act 2000'* which states that access to 'open country' is not permitted if the person uses, or has with them, a metal detector.	Hard	Natural England	http://www.naturalengland.org.uk/ourwork/access/openaccess/default.aspx http://www.gis.naturalengland.org.uk/
Area of Outstanding Natural Beauty	Some of the finest and most valuable landscapes of England and Wales - they have certain statutory protections to conserve and enhance the landscape. Where AONB land is open access, it is protected by the Countryside and Rights of Way (CROW) Act 2000 making the use or possession of a metal detector generally prohibited. Where public rights of way exist, metal detecting will require the permission of the landowner.	None	Natural England CCW	http://www.gis.naturalengland.org.uk/ http://www.aonb.org.uk/ Countryside Council for Wales
Beaches	Land above the high water mark requires permission from the landowner as normal. Land falling between the high and low water marks could be (1) Crown Estate therefore covered by a free permit (2) Council owned, so dependent on local byelaws (3) privately owned. Land below the low water mark is covered by the 'Receiver of the Wreck', and a register of protected wrecks is held by English Heritage.	Soft	Crown Estate Local Authorities Government English Heritage	https://www.gov.uk/government/groups/receiver-of-wreck http://services.english-heritage.org.uk/NMRDataDownload/
Biosphere Reserves	Areas where conservation of ecosystems is combined with sustainable use of natural resources. Designated by UNESCO, there are currently two in England. No known universal restrictions on metal detecting are associated with this designation.	None	Natural England	http://www.gis.naturalengland.org.uk/

	Description	Type	Data Holder(s)	Boundary datasets / Further information
Council land	Including local parks and country parks. Permission is always required from the local authority for metal detecting on council owned land. This is often protected by byelaws, and permission can be difficult to obtain.	Soft	Local authorities	Various. GIS data difficult to obtain.
Countryside Stewardship Schemes **(being replaced by Environmental Stewardship Schemes)**	Metal detecting on known sites of 'archaeological interest' on land being managed under the Countryside Stewardship Scheme (CSS) (also known as Farm Environment Plans (FEPs)) is only permitted with written consent from DEFRA/English Heritage. On other areas of CSS land, permission may be difficult to obtain as landholders are required to consult their Stewardship advisor before giving consent.	Both	Natural England	http://www.gis.naturalengland.org.uk/
Crown Estate	Metal detecting on Crown Estate is generally allowed with a permit, however individual local authorities have the power to ban metal detecting on crown estate using byelaws, so access is not universal.	Soft	Crown Estate	http://www.thecrownestate.co.uk/coastal/metal-detecting/permissions,-restrictions,-finds/ but there is no easily accessible GIS dataset.
Danger Zones and MoD land	The NCMD code of conduct states that MoD property has the same designation as SAMs or SSSIs, i.e. you need permission from the appropriate authority. This is supported by information on the MoD websites, which states that metal detecting is prohibited on ranges and training areas.	Hard	Ministry of Defence	https://www.gov.uk/government/organisations/ministry-of-defence but no easily accessible GIS dataset. MoD land is marked on OS maps.
Elevation	The 300m contour line can be used as the limit of ploughzone farming (Richards et al 2009). This project has corroborated the suitability of this boundary line, showing that only 0.3% of the dataset (April 2013) is recovered from above 300m elevation. The 200m elevation line could also be an effective constraint boundary, as only 1.95% of finds recovered by April 2013 were from higher elevations.	Soft	Ordnance Survey	Open-access Terrain 50 dataset available from: http://www.ordnancesurvey.co.uk/business-and-government/products/terrain-50.html More detailed data is available through the subscription only service, Edina Digimap: http://digimap.edina.ac.uk/digimap/home

	Description	Type	Data Holder(s)	Boundary datasets / Further information
Environmental Stewardship Schemes **(replacing Countryside Stewardship schemes)**	Permissions on environmental stewardship land (also known as Farm Environment Plans or FEPs) depend in part on the level of designation. On entry-level stewardship (ELS) land (1) detecting on known archaeological sites under grassland is prohibited without permission from Natural England (2) metal detector users must follow the 'Code of Practice on Responsible Metal Detecting in England and Wales' and report all finds to the PAS (3) notice of large scale detecting events must be given to Natural England at least 12 weeks in advance. On higher-level stewardship (HLS) land metal detecting is not permitted on any archaeological sites within the designated area unless agree with the Natural England advisor in writing.	Both	Natural England	http://www.gis.naturalengland.org.uk/
Foreshore	Land falling between high- and low- water marks. All foreshores in the UK are owned, and permission must be sought before detecting. Many foreshores will be covered by the restrictions governing detecting on Crown estate or special designation (e.g. SPA, SSSIs, LNR, NNR).	None	Ordnance Survey	Mapping data available from the subscription only service, Edina Digimap: http://digimap.edina.ac.uk/digimap/home
Forestry Commission	Forestry Commission byelaws (1982) prevent the use of metal detectors on their land.	Hard	Forestry Commission	http://www.forestry.gov.uk/datadownload
Heritage Coasts	Stretches of coastline which are managed to conserve their natural beauty. These are 'defined' rather than 'designated'. Metal detecting is not universally banned, but most fall within the boundaries of National Parks and AONB and are affected by the restrictions on detecting in these areas.	None	Natural England	http://www.gis.naturalengland.org.uk/

	Description	Type	Data Holder(s)	Boundary datasets / Further information
Military aircraft crash sites	The *'Protection of Military Remains Act 1986'* forbids any disturbance to a military aircraft crash site on land or at sea without a license from the MoD.	Hard	Ministry of Defence English Heritage	Where known these will be included within local Historic Environment Records.
National Parks	Extensive tracts of land protected by law for future generations due to their natural beauty. There are currently nine National Parks in England, plus the Norfolk/Suffolk Broads which have the same status. There are three National Parks in Wales. Whilst metal detecting on a National Park is not universally prohibited, much of the land covered by this designation is either SSSI land, National Trust land, or covered by byelaws preventing metal detecting.	None	Natural England Natural Resources Wales CCW	http://www.gis.naturalengland.org.uk/ http://www.nationalparks.gov.uk/ http://naturalresourceswales.gov.uk/maps-and-data/?lang=en Countryside Council for Wales
National Trails	Long distance footpaths with public rights of way access. Permission to detect is required from the landowner.	None	Natural England	http://www.gis.naturalengland.org.uk/
National Trust	Metal detecting is not permitted on land owned by the National Trust except under exceptional circumstances and only ever with a license agreement. Such licenses will only be granted where metal detecting will further the archaeological knowledge of an area, or protect archaeological remains	Hard	National Trust	GIS datasets available on request.
Nature Reserves	Including both National Nature Reserves (NNRs) and Local Nature Reserves (LNRs), designated to protect wildlife habitats and geological formations and as places of scientific research. Nature Reserves that are not SSSIs have no law against metal detecting, but permission may be more difficult to come by on these land types.	Soft	Natural England CCW	http://www.gis.naturalengland.org.uk/ Countryside Council for Wales

	Description	Type	Data Holder(s)	Boundary datasets / Further information
Permissive access land	Land where the landowner has granted access for walking, cycling or horse riding. Metal detecting is only permitted with permission from the landowner.	None	Ordnance Survey	Natural England details some farms providing permissive access.
Public rights of way	Public rights of way (ROW) are open to everyone – they can be roads, paths or tracks, and run through towns, countryside and private property. Metal detecting is only permitted with permission from the landowner.	None	Ordnance Survey	Visible on all OS maps (printed and digital) http://www.ordnancesurvey.co.uk/ http://www.openstreetmap.org/
Ramsar sites	Wetlands of international importance including marsh, fen, peatland and water. These incorporate banks of streams, rivers and ponds, coastal areas adjacent to wetlands, and islands of marine water lying within wetlands. Whilst metal detecting is not universally prohibited on Ramsar sites, all terrestrial Ramsar sites in England are also notified as Sites of Special Scientific Interest (SSSIs).	None	Natural England CCW	http://jncc.defra.gov.uk/page-161 http://www.gis.naturalengland.org.uk/ Countryside Council for Wales
Registered Battlefields, Parks and Gardens	Parks, gardens and battlefield sites that are deemed by English Heritage to be of special historic interest. No special permissions or consents are required for metal detecting, beyond the permission of the landowner.	None	English Heritage	http://services.english-heritage.org.uk/NMRDataDownload/

	Description	Type	Data Holder(s)	Boundary datasets / Further information
Scheduled Ancient Monuments	Nationally important sites and monuments. Scheduled Ancient Monuments (SAMs) are protected by the '*Ancient Monuments and Archaeological Areas Act 1979*'. It is illegal to use a metal detector or remove an archaeological object found with a metal detector on the site of a SAM or a designated Area of Archaeological Importance without the written permission of the Secretary of State. There is sometimes an 'exclusion zone' around the SAM to prevent metal detecting in the near vicinity.	Hard	English Heritage	http://services.english-heritage.org.uk/NMRDataDownload/
Sites of Special Scientific Interest	Sites of Special Scientific Interest (SSSIs) incorporate the country's best wildlife and/or geological sites. Many SSSIs are also National or Local Nature Reserves, and may also be designated as Special Areas of Conservation (SACs), Special Protection Areas (SPAs) or Ramsar sites. SSSIs are legally protected under the '*Wildlife and Countryside Act 1981*' and metal detecting is usually prohibited without written permission from Natural England as it is deemed an 'operation likely to damage the special interest' of the SSSI.	Hard	Natural England CCW	http://www.gis.naturalengland.org.uk/ Countryside Council for Wales
Special Areas of Conservation	Special Areas of Conservation (SACs) are areas with special protection granted from April 2005 under the European Union's Habitats Directive to protect the world's diversity. Whilst there is no special protection for SACs, as all terrestrial SCAs in England are also SSSIs, metal detecting will generally be prohibited without written permission from Natural England.	None	Natural England CCW	http://www.gis.naturalengland.org.uk/ Countryside Council for Wales

	Description	Type	Data Holder(s)	Boundary datasets / Further information
Special Protection Areas	Special Protection Areas (SPAs) are designated under the '*Wildlife and Countryside Act 1981*' by the European Wild Birds Directive to protect birds and their nests. Whilst there is no special protection for SACs, as all terrestrial SPAs in England are also SSSIs, metal detecting will generally be prohibited without written permission from Natural England.	None	Natural England CCW	http://www.gis.naturalengland.org.uk/ Countryside Council for Wales
Thames foreshore	The foreshore of the River Thames. Metal detecting is permitted with a permit from the Port of London Authority. However, detecting is not generally permitted to the east of the Thames barrier.	None	Port of London	No GIS easily available, but information on detecting on the foreshore provided at: http://www.pla.co.uk/Environment/Metal-Detecting-and-Digging-on-the-Thames-Foreshore
Urban areas	There is no legal restriction against detecting in urban areas, provided you have permission from the landowner. However, the extensive development within these areas makes metal detecting largely impossible.	Soft	Government	2001 Settlement data: http://www.magic.gov.uk/ Agricultural land classification (Natural England) includes an urban layer: http://www.gis.naturalengland.org.uk/ OS datasets available through Edina Digimap: http://digimap.edina.ac.uk/digimap/home
Woodland	There are no universal restrictions on detecting in woodland, although much is owned by the Forestry Commission. Permission must be sought from the relevant landowner.	None	Forestry Commission	http://www.magic.gov.uk/
World Heritage Sites	Deemed places of 'outstanding universal value' and selected by the UNESCO. There are currently 17 WHS in England. Whilst metal detecting is not universally prohibited within WHSs, it may be more difficult to gain permission. However, areas of archaeological importance within WHSs are generally designated as SAMs therefore metal detecting is prohibited.	Soft	English Heritage	http://services.english-heritage.org.uk/NMRDataDownload/

Clearly not all of the potential constraints listed here will be pertinent to each piece of research using the PAS data. This section explores a range of different groupings which might be suitable for different types of analyses.

Group by type of constraint

When creating your constraints map, you may wish to focus on a particular <u>type</u> of constrained land. It has already been established that some constraints have more of an impact on the distribution of metal detecting than others:

- Areas with **hard** constraints are generally unavailable for searching due to legislation preventing metal detecting.
- Lands covered by **soft** constraints have no legal prevention against detecting, but permission is likely to be difficult to obtain, or land is in some way inaccessible.

Hard	Soft
Access land	Beaches
Danger Zones / MoD land	Council land
HLS land	Crown Estate
Forestry Commission land	Elevation
Military Aircraft Crash sites	ELS land
National Trust land	Nature Reserves
SAMs	Urban areas
SSSIs	WHS

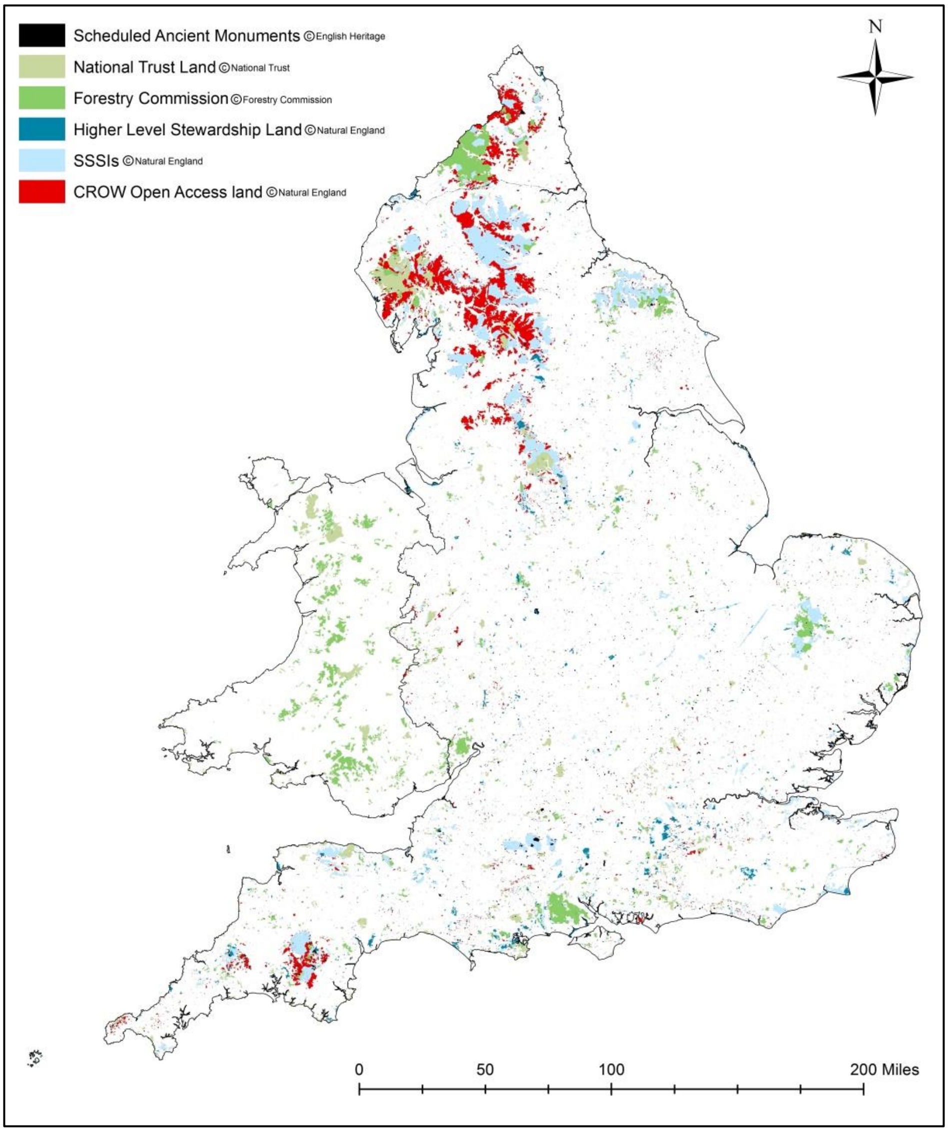


Figure 3: A selection of potential 'hard' constraints

Group by size of constraint

The size of each constraint, i.e. the area of land covered by that constraint, can affect its suitability for different scales of analysis.

This is particularly noticeable in nationwide analyses, where the inclusion of every potential constraint might both unnecessarily complicate the final map, and make any processing much more time-consuming.

In such an instance it might be more appropriate to focus on the more extensive constraints (e.g. Figure 4 and Figure 5).

Nationwide	Regional	Local
Access land	AONB	AONB
Elevation	Elevation	Beaches
FC land	FC land	Council land
NT land	HLS land	Crown Estate
SSSIs	NT land	Danger Zones MoD land
	SSSIs	Elevation
	SAMs	ELS Land
		FC land
		HLS land
		Military Aircraft Crash sites
		NT land
		Nature Reserves
		SAMs
		SSSIs
		Urban areas
		WHS

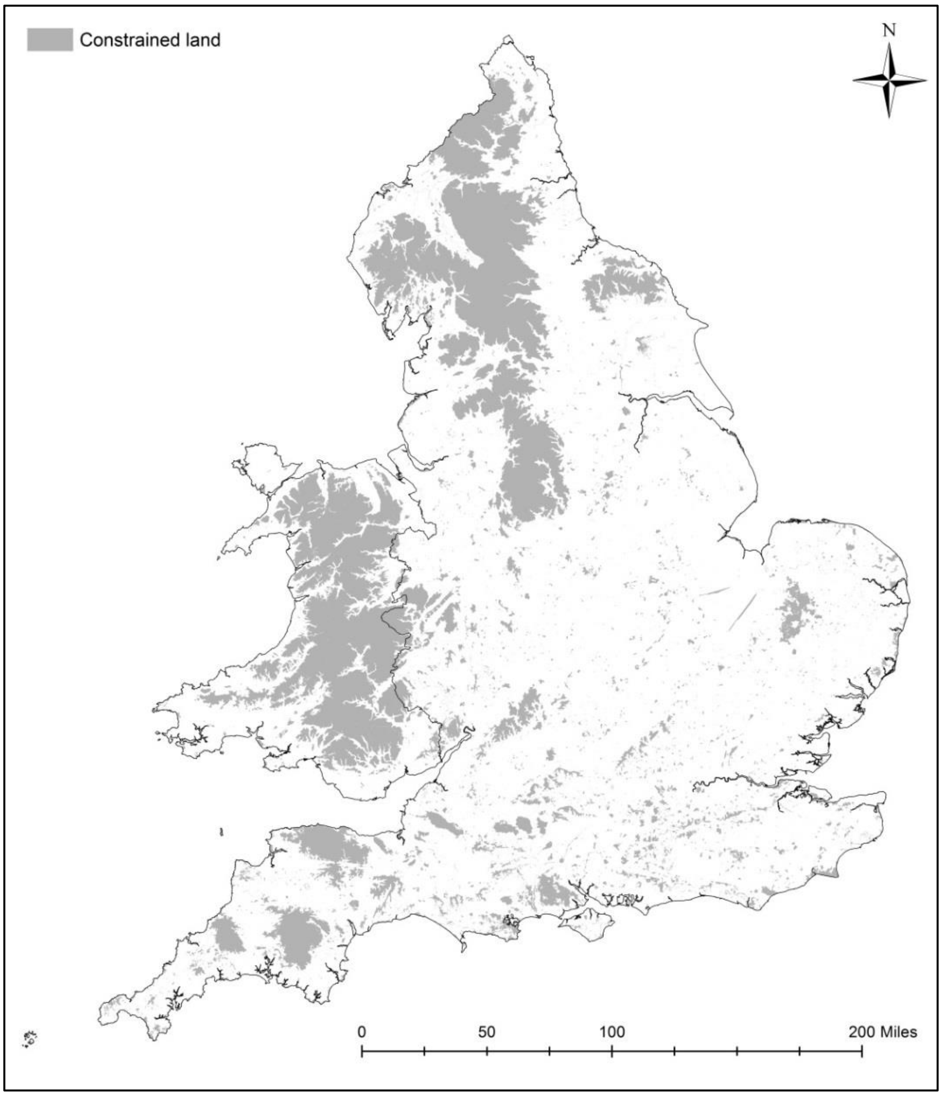


Figure 4: Constrained land at a nationwide scale
(using access land and SSSIs boundaries © Natural England, Forestry Commission and National Trust boundaries, and elevation data derived from OS Terrain 50)

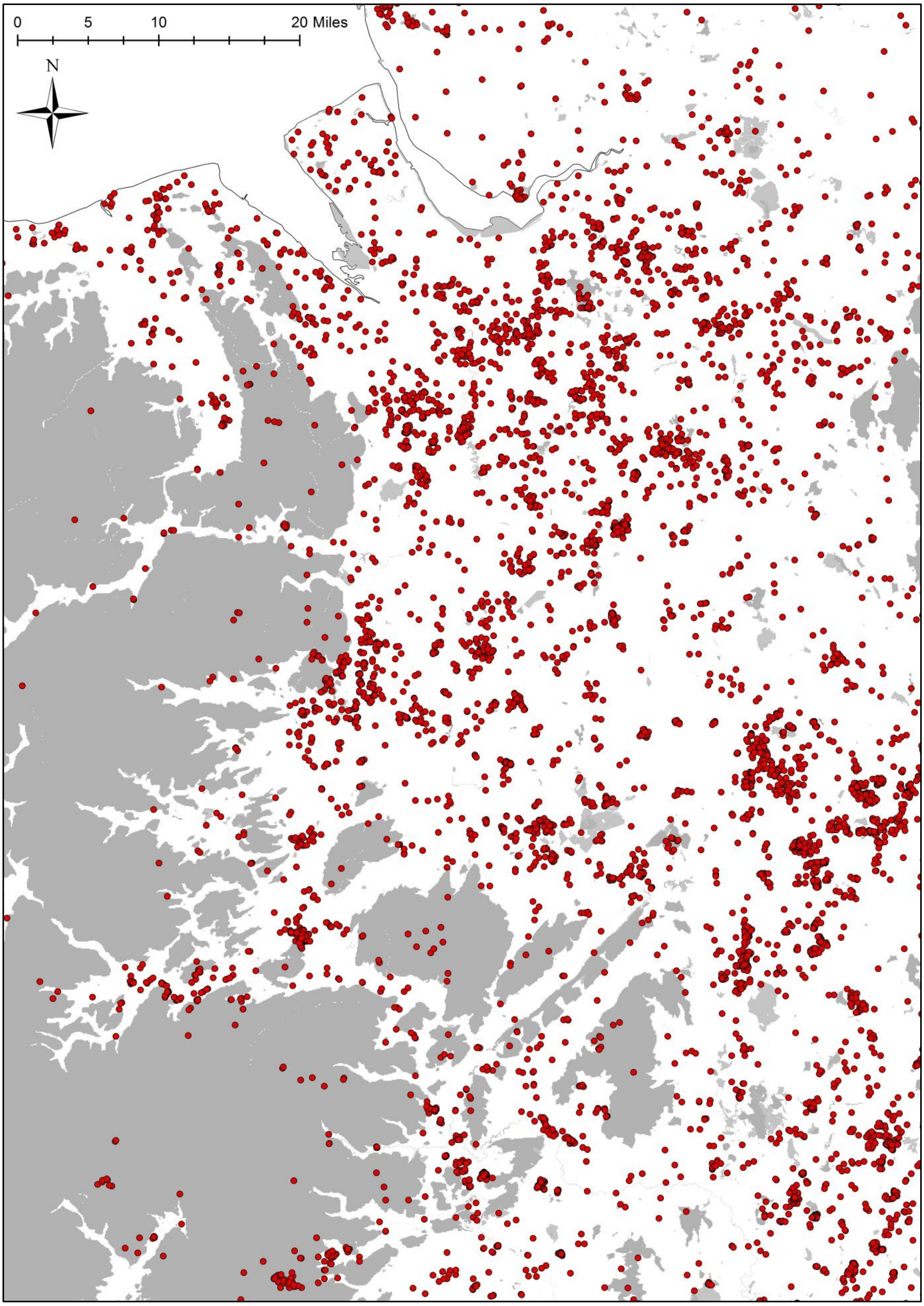


Figure 5: Section of the nationwide constraints map plotted against all PAS finds (correct to April 2013), illustrating the general accuracy of the constraints map

Group by importance of constraint

Whilst the strength of the constraint can be defined as 'hard' or 'soft', this does not equate to importance. Importance is controlled by the effect of that constraint on the overall distribution of findspots.

For example, elevation is a 'soft' constraint, but is intimately related to the distribution of PAS finds, particularly in Wales and the north of England:

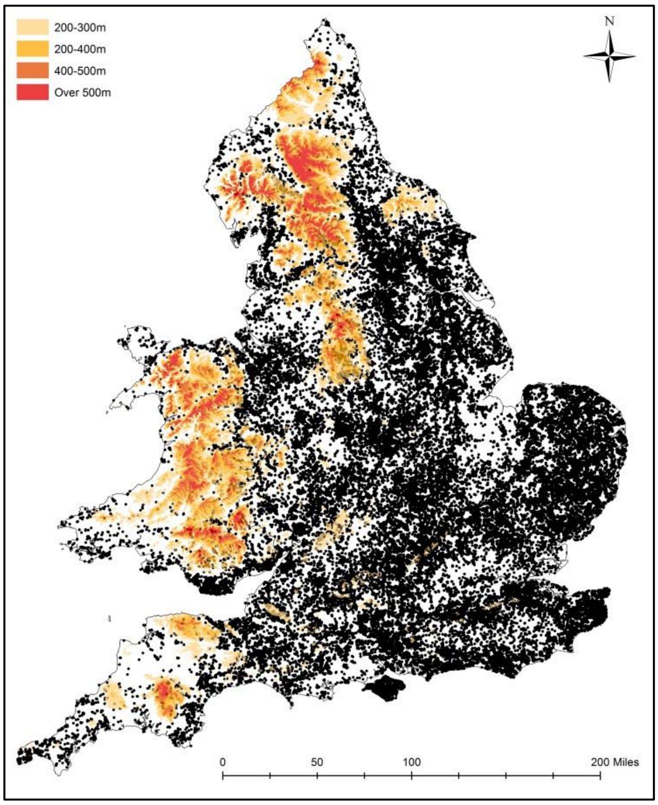


Figure 6: PAS finds (correct to April 2013) plotted against elevation (derived from OS Terrain 50 © Crown copyright 2013)

Whilst in the south of England, Forestry Commission and National Trust land has a significant effect on the distribution of finds:

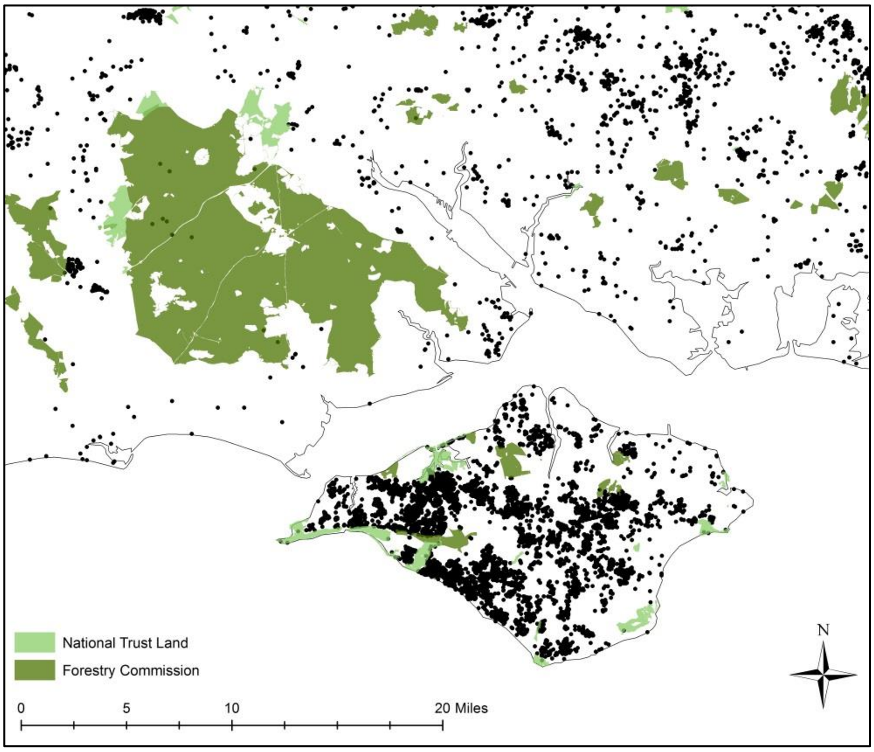


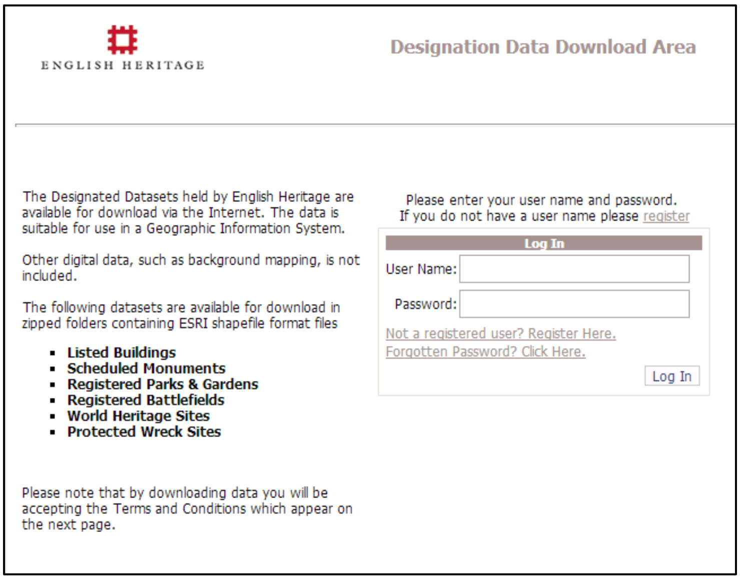
Figure 7: PAS finds (correct to April 2013) plotted against Forestry Commission and National Trust land

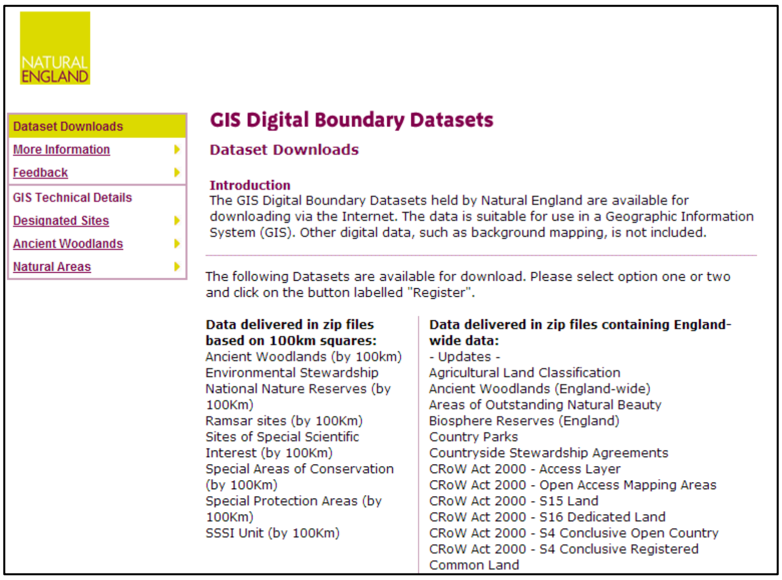
It is important to assess the effect of each constraint on your dataset, so that you can identify those most suitable for use in your constraints map.

Group by ease of data access

A final potential grouping is by the accessibility of the dataset. As shown throughout the potential constraints table, GIS data for some of the constraints is much more easily accessible than others. For example the Natural England data is readily available for download through their website, whereas MoD boundaries are much more difficult to obtain, and some constraints may still need to be digitised.

For a quick analysis of the effect of constraints on your dataset, it is therefore more feasible to use large datasets such as *SSSIs* (© Natural England), or the smaller sized *Register of Scheduled Ancient Monuments* (© English Heritage), both of which are easily downloadable, and instantly useable within a GIS.





Using Constraints Mapping

This section has sought to provide an introduction to the use of constraints mapping within PAS analyses. It has outlined a wide variety of potential constraints that might be used, and highlighted a number of ways to group them depending on the type of analysis being conducted.

However, it is important to remember that these potential constraints are not prescriptive - you will find findspots that fall within each area (e.g. Figure 5), irrespective of the strength of the constraint against searching in that area. This could be for a number of reasons:

(1) because constrained areas can be searched by amateur collectors if the correct permissions have been granted;
(2) because the data accuracy is not perfect for either the constraints boundaries or the PAS findspots;
(3) because of changing land status/designations over time;
(4) because of changing rules about amateur collection within constrained areas over time.

Constraints mapping has the potential to illustrate clearly where amateur collection, particularly metal detecting is unlikely to occur. However, it is important to understand the effect of the constraint on search areas, how long it has been active, and its boundaries.

Finally, one must remember that constraints maps are not intended to reflect historic patterns of activity; rather they facilitate the identification of modern factors affecting the distribution of PAS findspots.

DENSITY AND DISTRIBUTION ANALYSES

It is not always necessary to use additional datasets to explore distribution patterns within the PAS data – several researchers have effectively compared the PAS data with itself, to assess the extent to which the distribution of one group of artefacts (select by type or period for example) differs from that of a broader control dataset, e.g.

- Biddle's work on finds from around Winchester, Hampshire, compared the distribution of Early Medieval finds with plots of all the Hampshire PAS finds from the Roman, Medieval and Post-Medieval periods - by finding patterns in the dataset common to each period, Biddle was able to identify those unique to his Early Medieval dataset.[1]
- In her article on later Iron Age objects from Hampshire, Worrell plotted the distribution of her dataset against all metal-detected artefacts from Hampshire, and found that concentrations of Iron Age finds coincided with concentrations of finds across all periods.[2]

This method (illustrated in Figure 8) is both a simple and efficient means of assessing the extent to which each distribution is unique. It is comparatively easy to implement and, through identifying differences in the patterns of finds between groups of artefacts, it effectively detects areas of interest for further investigation, as well as highlighting areas where modern collection factors might be at play.

There are other tools for analysing point-pattern distributions, for example those that assess the extent to which findspots cluster together in different areas e.g. nearest neighbour analyses. The '*what*' and '*how*' of these are covered extensively elsewhere[3] and will not be discussed further here, suffice to say that such methods can be useful techniques for exploring how the artefacts recovered by amateur collectors are distributed across the landscape.

Data fuzziness

Another consideration when looking at point pattern distributions is that the PAS data, like many other datasets, contains varying levels of spatial precision within it, which can lead to misrepresentative results if this is not taken into consideration.

Whilst a findspot is generally represented as a single point, the national grid reference (NGR) of that findspot is actually representing a grid square, the size of which is dependant of the accuracy of the NGR.

It is possible to represent this 'fuzziness' in a GIS by converting findspot points into findspot polygons, giving a more accurate representation of the distribution of artefacts (Figure 9). Alternatively, you can groups findspots by their NGR accuracy and analyse each group separately.

Either way, the key point to remember is not to assume that the findspot points are a perfectly accurate representation of the distribution of finds recovered.

NGRs are formed of two letters followed by a string of numbers (the easting and northing), together equating to the SW corner of a grid square.

The exact number of digits within the string will vary depending on the accuracy of the NGR, with more accurate NGRs equating to a smaller grid squares e.g.

4 numbers = 1km x 1km square
6 numbers = 100m x 100m square
8 numbers = 10m x 10m square
10 numbers = 1m x 1m square
12 numbers = 10cm x 10cm square

[1] Egan 2010
[2] Worrell 2007
[3] e.g. Lloyd (2010, 2011); Conolly & Lake (2006); Wheatley & Gillings (2002)

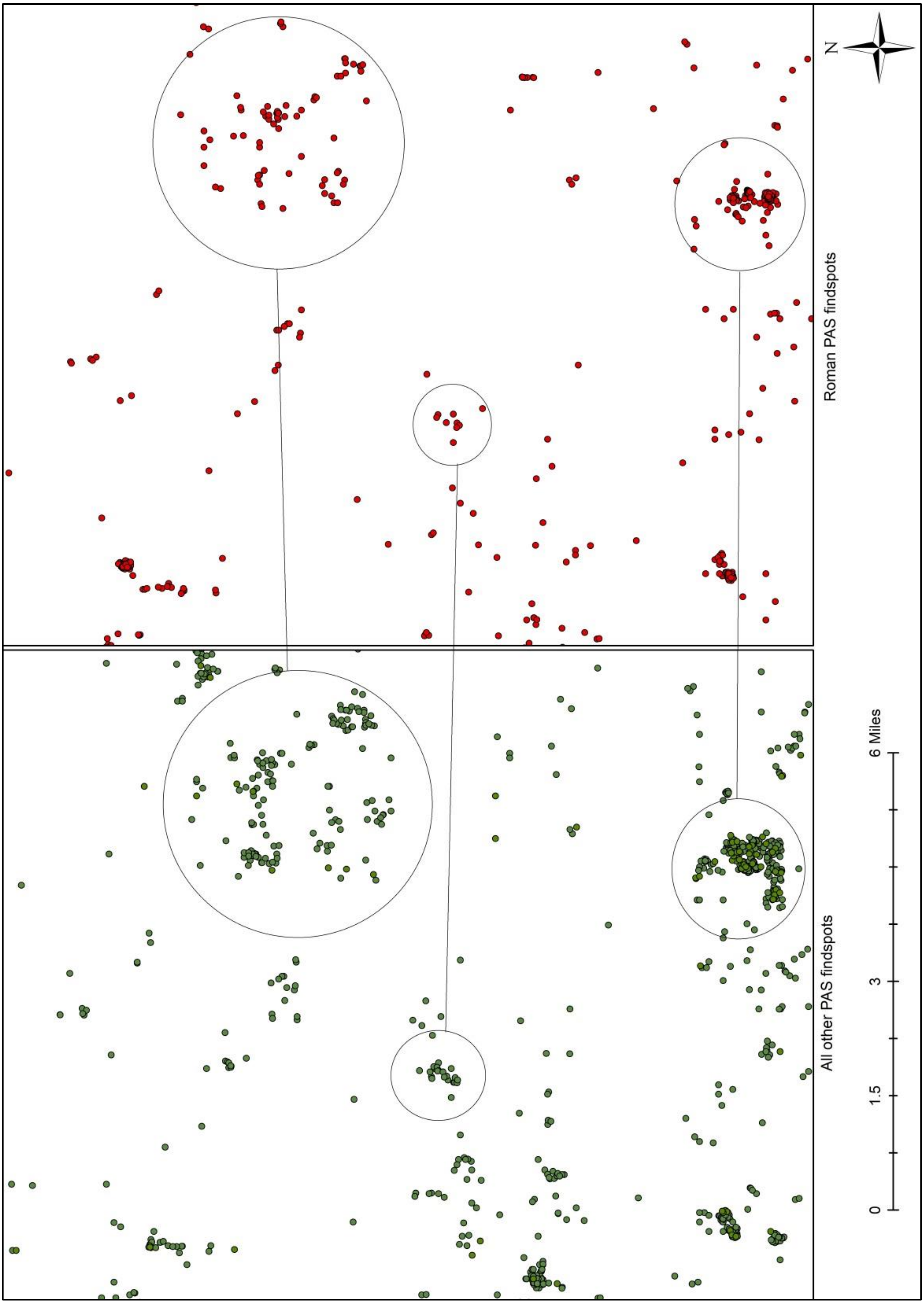


Figure 8: Comparing Roman PAS data to all other findspots (correct to April 2013) illustrating the links between clusters of finds from different periods

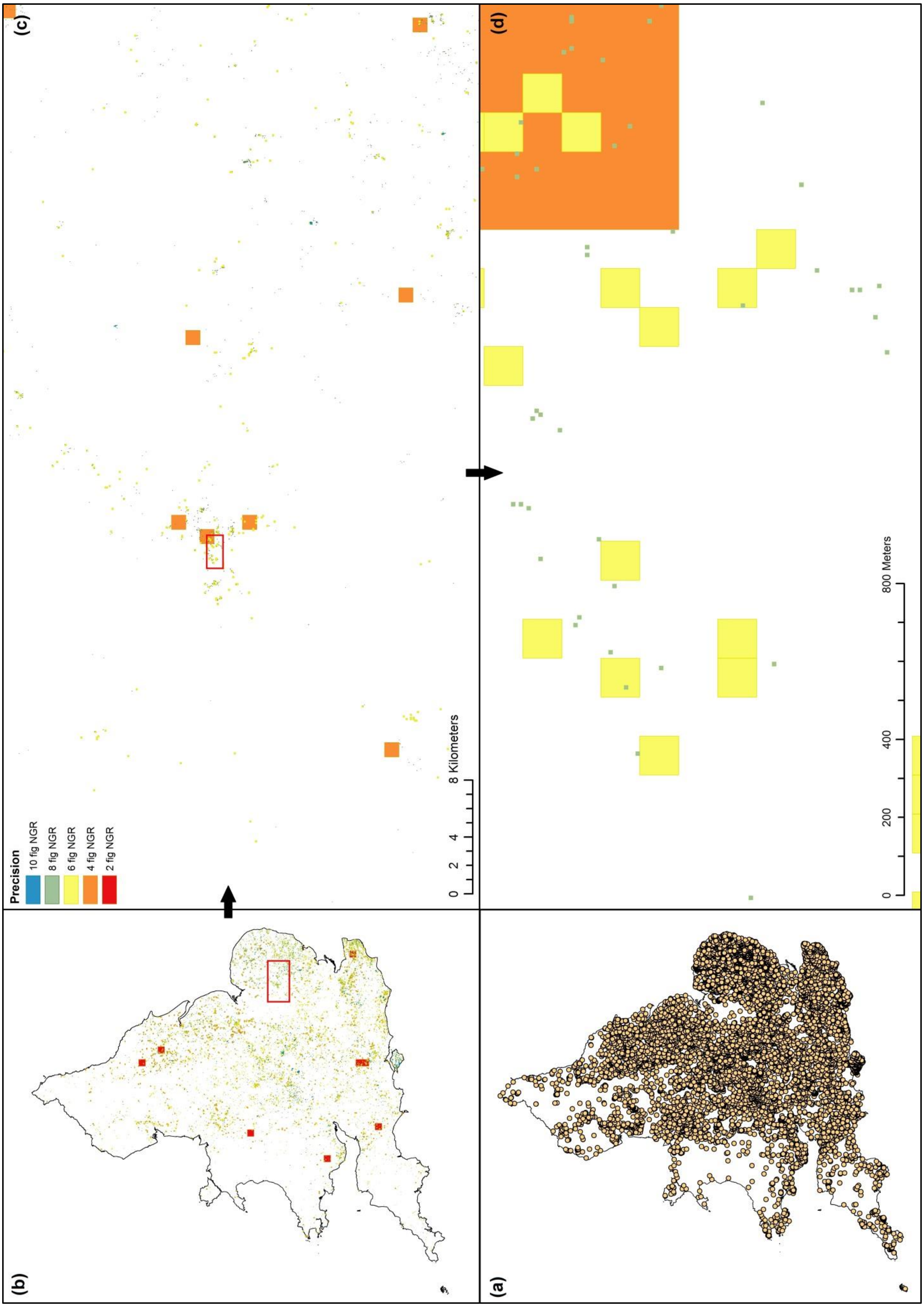


Figure 9: (a) Random selection of ~100,000 PAS artefacts
(b) (c) (d) findspots represented as NGR squares

Going beyond point-pattern analyses to look at density distributions allows more detailed examination of the spread of finds across the landscape.

Density maps can be used to:

(1) display PAS distributions;
(2) identify unusual concentrations or absences of finds;
(3) explore differences in the distributions of different groups of artefacts.

There are several methods for creating density maps – below are two which have been effectively used in the past to explore the distributions of PAS data.

Kernel Density Estimation (KDE)

KDE creates a smooth continuous surface from a number of known points.[1] The points are analysed with a user-defined circular area (the 'kernel') which produces an average density for each cell.

The size of the 'kernel' can have a marked impact on the resulting surface – a smaller kernel (i.e. smaller radius) will include less findspots and create a noisier surface, whilst a larger kernel will include more points and therefore create a smoother surface. It is often necessary therefore to use a variety of kernel sizes and to compare the results, before selecting the appropriate kernel for the analysis.[2]

Trend Surface Analysis

This is a 'global interpolation method' and as such is more valuable for assessing general trends than local variations. It works by fitting a mathematical surface to the points, with the height of the surface defined by a quantitative attribute of the points. The surface can be varied from the 'first-order' (the simplest fit with least variation) to 'twelfth-order' (the most complex variation).[3]

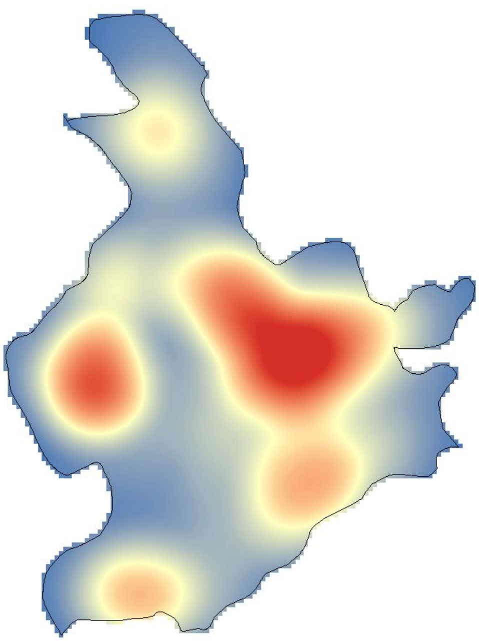


Figure 10: KDE map with kernel size = 20km

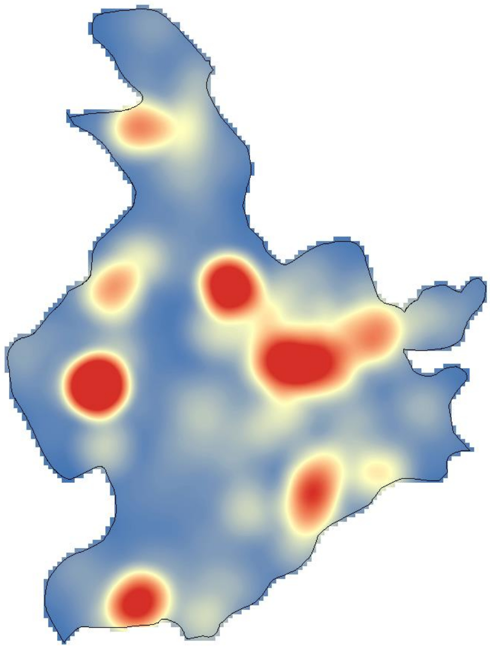


Figure 11: KDE map with kernel size = 10km

[1] Bailey & Gatrell 1995 page 84
[2] Lloyd 2010
[3] Conolly & Lake 2006 pages 91-93

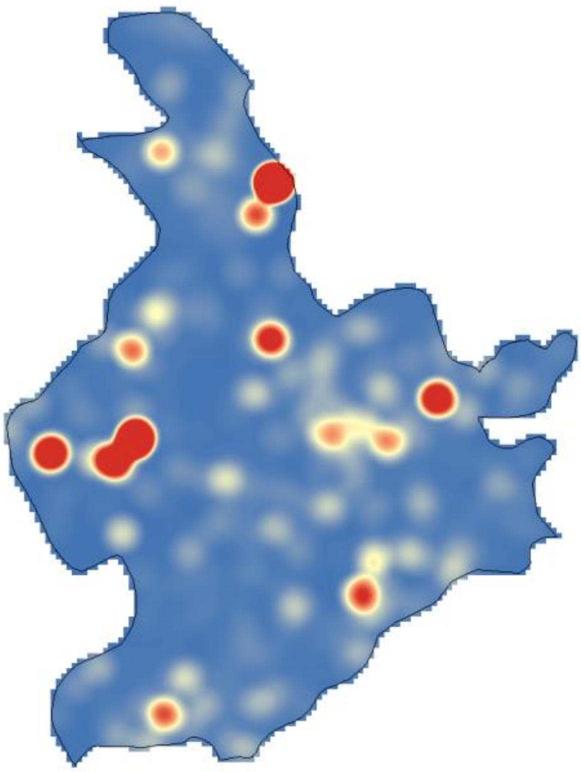


Figure 12: KDE map with kernel size = 5km

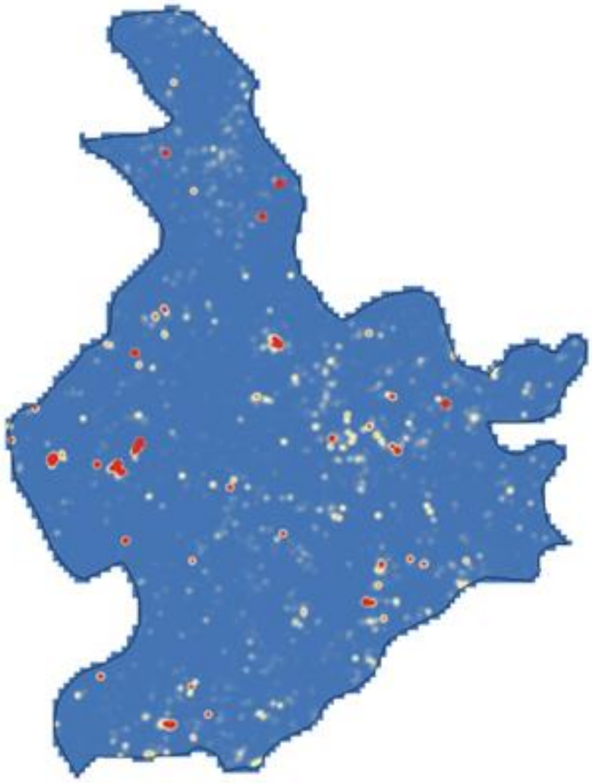


Figure 14: KDE map with kernel size = 1km

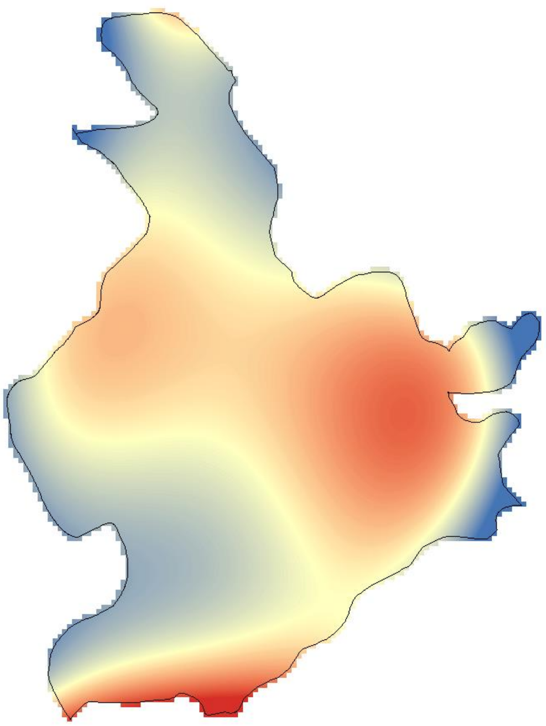


Figure 13: Trend surface, polynomial 4

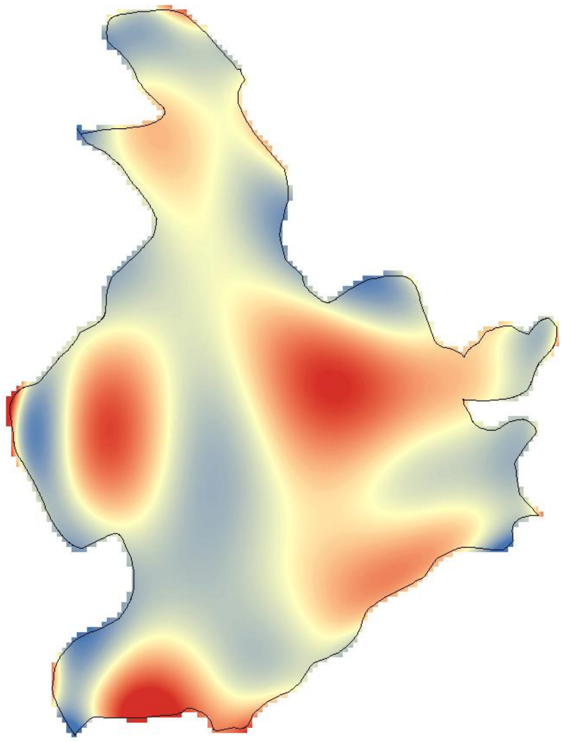


Figure 15: Trend surface, polynomial 12

Whilst many use density maps simply to display the spread of data, they can also be used to understand the distribution of finds in relation to modern collection factors.

This can either be as an aid to further exploration through a visual examination of the data (Example 1) or through map calculations (Example 2).

Example 1: Understanding PAS coin records

There are over 330,000 coins records in the PAS data (September 2014).

Figure 16 shows the distribution of these across England and Wales (colour grades from red [higher density] to blue [lower density]), from which it should be clear that there are both historic and non-historic concentrations visible in the distribution e.g.

- the general concentration of finds towards the south and east of England and away from the north, south west and Wales
- the representation of a finds concentration around the Bristol Channel suggests a large number of finds from a single location

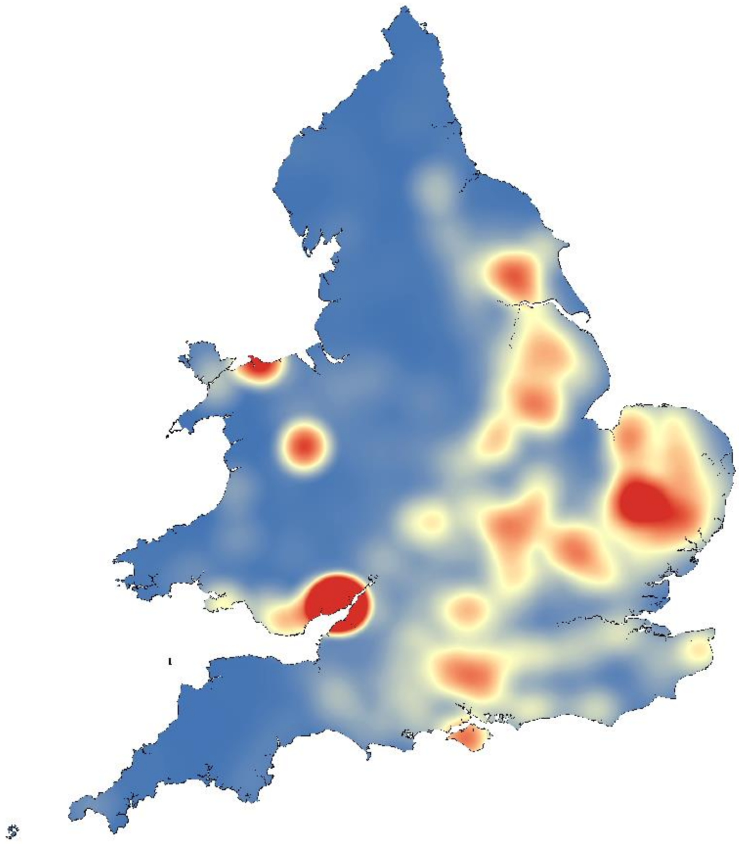


Figure 16: KDE map showing all PAS coin records (max density 24 records/sq km)
kernel size = 30km

By breaking the dataset down into different groups of coins, and creating density maps for each of them (Figure 18 -Figure 20), it is possible to identify a number of those factors, for example:

(1) both the *Iron Age and Roman Coins from Wales* (IARCW) dataset and the *Celtic Coin Index* (CCI) are heavily clustered – the clear red circle surrounded by a yellow halo shows that the finds creating the high density all fall in one area, which in turn suggests that these are lower resolution datasets, making them less suited to this type of mapping.

(2) different datasets are available for different areas of the country e.g. the IARCW is a solely Welsh dataset, so has the potential to skew the distribution map.
(3) some higher concentrations of finds may relate to more intense activity by amateur collectors in those areas, such as in East Anglia or on the Isle of Wight, and need to be investigated further.

Other factors to consider are that density maps of non-metal finds might be heavily influenced by the locations of amateur fieldwalking activity, and that maps of specific archaeological periods will be affected by period specific datasets such as the IARCW and CCI.

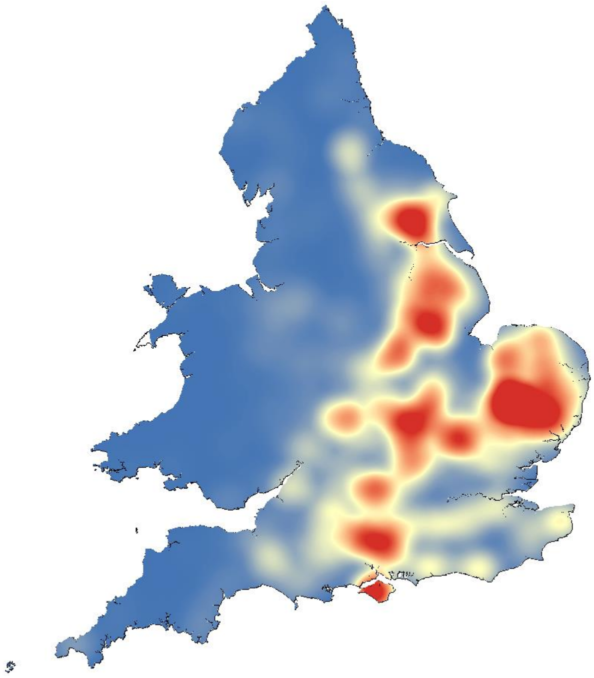


Figure 18: All other coin records (max density 8 records/sq km)

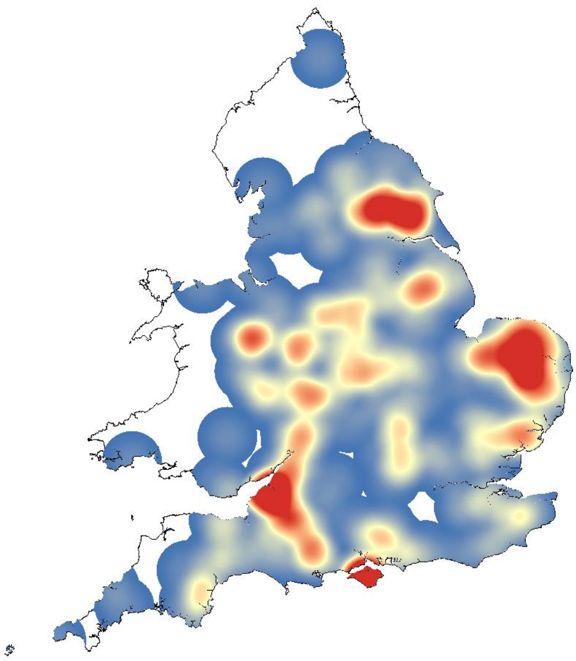


Figure 17: Coin hoard records (max density 0.02 records/sq km)

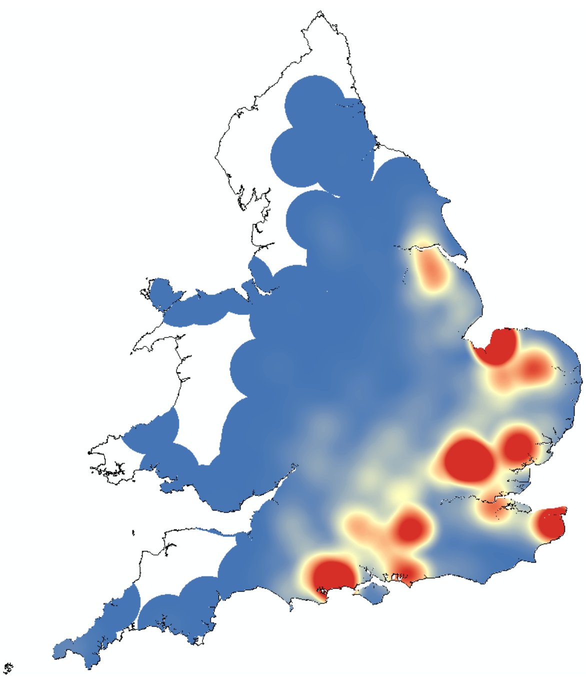


Figure 19: CCI records (max density 2 records/sq km)

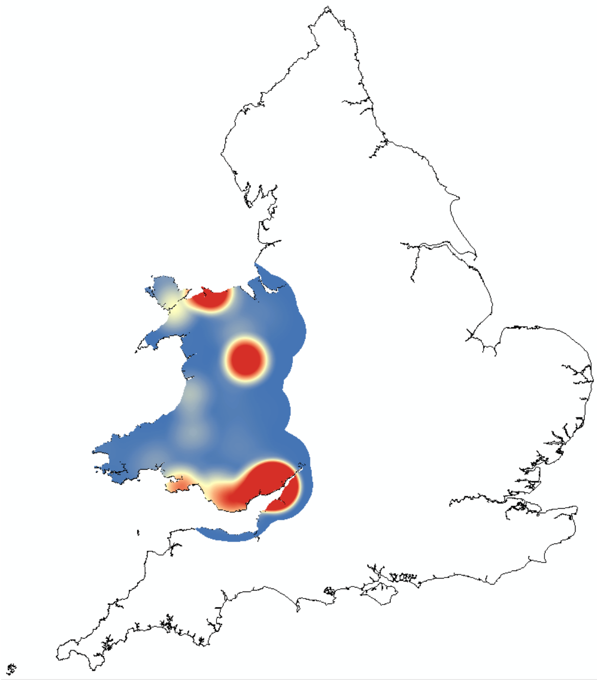


Figure 20: IARCW records (max density 23 records/sq km)

Example 2: Using map calculations to explore PAS data

Taking the use of density mapping further through map calculations allows the creation of complex surfaces that can then be used to explore the PAS data. In essence this is done by 'normalising' a range of KDE maps (making all the density's range between 0-1) and subtracting/adding them to one another.

One example of this is in the work of Dr Chris Green (EngLaId project, University of Oxford), who has used a range of KDE maps to create a constraints map (here called an 'affordance' surface) that has then been overlaid by another KDE map of PAS data - see the EngLaId blog for more details.[1]

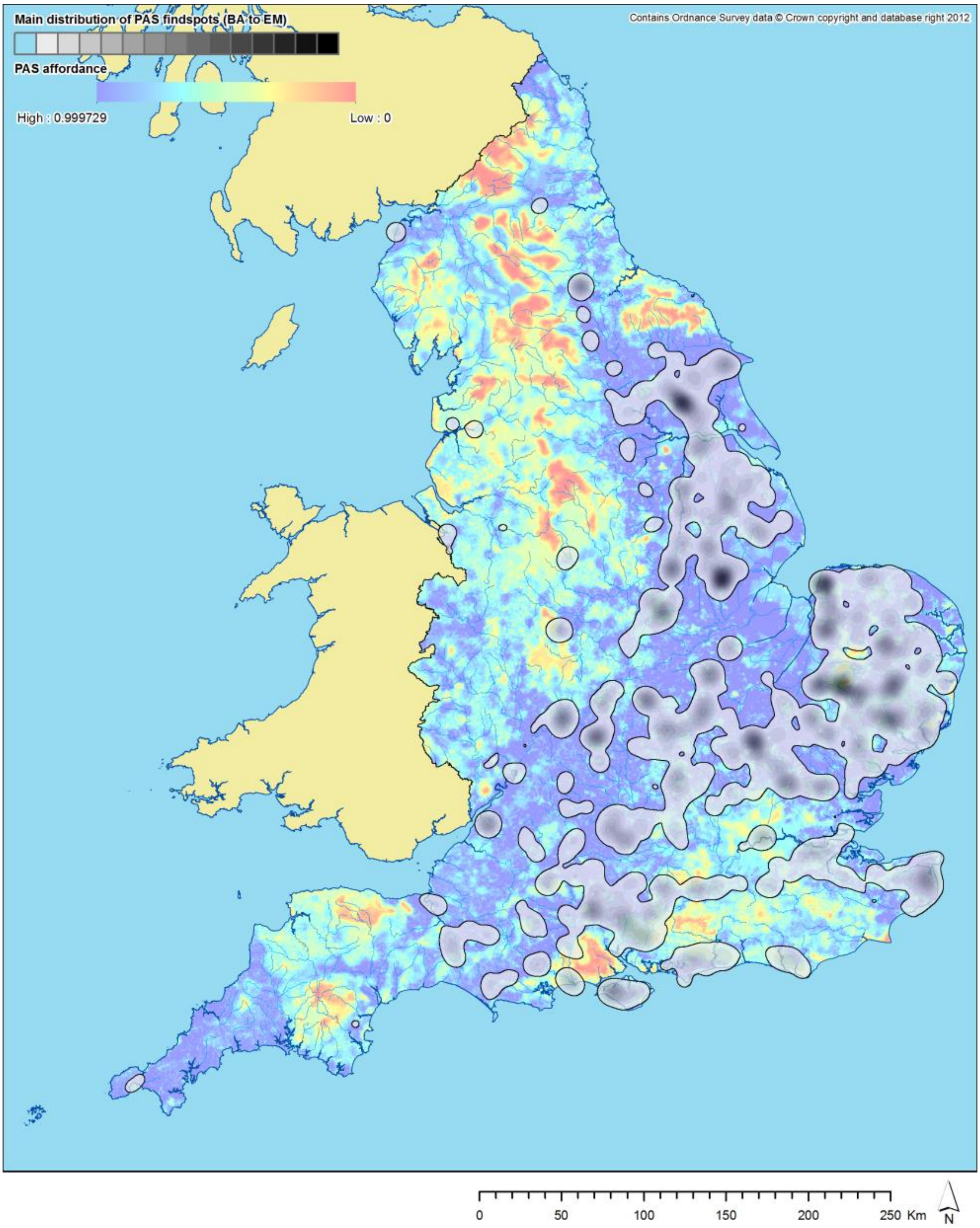


Figure 21: Bronze Age to Early Medieval PAS finds, plotted against a KDE affordance surface (EngLaId 2014)

---

[1] http://englaid.com/2014/03/17/pas-affordances/

LANDSCAPE ANALYSIS

Over the course of human history, the reasons for choosing certain locations for activity have varied considerably, but are often related to factors such as the elevation, slope and aspect of the land, the bedrock geology, the distance to other activity areas and the distance to routeways or fresh water. In the present day, amateur collectors also make decisions about where to site their activity, based on ease of access, ease of finds recovery, quality of finds and knowledge of what might have been there in the past.

It is well established therefore that certain landscape features can influence (1) the distribution of activity in the past (2) the preservation and survival of artefacts to the present and (3) the recovery of artefacts by collectors, and comparisons between finds and the physical landscape are commonplace in archaeological research, and in studies of the PAS data:

- Egan found that soils in the northern and western (highland) zone are less suitable for the preservation of flimsy lead/tin objects than lowland soils.[1]
- Chester-Kadwell found that detectorists in Norfolk searching for early Anglo-Saxon artefacts focussed on river valleys with light soils.[2]
- Yates and Bradley studied the locations of Bronze Age metalwork hoards in south-east England, finding that there was an association between various topographical features and the positions of known hoards.[3]
- Haldenby and Richards looked at the location and topography of sites and soil types in their analysis of plough damage, which sought to understand the levels of artefact damage seen in different locations.[4]
- The VASLE report plotted all PAS finds against a basic topographic map and interpreted the distribution of finds with respect to elevation and major waterways.[5]
- Ulmschneider plotted finds against topographic and geological mapping to explore the middle Saxon histories of Hampshire, Lincolnshire and the Isle of Wight.[6]

It is possible to test the relationship between the PAS data and landscape features, by assessing whether the former is randomly distributed with respect to the latter. However, there is a danger that the results of such quantitative analyses can be perceived as more accurate than they actually are. Such tests do not in themselves prove or disprove any relationship between the PAS findspots and other datasets - rather they give a judgement of significance, which can then be used to interpret the relationship.

Landscape features

A wide range of landscape features can be tested against the PAS data, their significance dependant on the period of the artefacts under investigation, the size of area being studied and the choices of the amateur collectors. The following table highlights some key datasets.

[1] Egan 2010
[2] Chester-Kadwell 2009
[3] Yates & Bradley 2010
[4] Haldenby & Richards 2010
[5] Richards et al. 2009
[6] Ulmschneider 2000

	Description	Data Holder(s)	Further information / Datasets
Aspect	Nationally, aspect is evenly distributed between the eight directions (N, NE, E, SE, S, SW, W, NW), whilst PAS finds show a slight preference for South-East and South facing land, supporting the historic preference for these warmer slopes. There are no discernible modern factors that should influence the distribution of PAS finds with respect to aspect, but this landscape feature could be significant within more local scale analyses.	*derived from elevation*	OS Opendata: OS Terrain 50 Also available through Edina Digimap: http://digimap.edina.ac.uk/digimap/home
Elevation	Consistently shown to be important, elevation affects both the past occupation of the landscape, and the present searching of it. Nationally, PAS finds cluster below 200m, with the majority recovered from 0-100m elevations. Distributions of PAS finds with respect to elevation are often influenced by both the clustering of settlements at lower elevations, and the inaccessibility of higher elevations to amateur collectors.	OS	OS Opendata: OS Terrain 50 Also available through Edina Digimap: http://digimap.edina.ac.uk/digimap/home
Geology	The wide variety of geologies across England and Wales makes a national summary difficult. Very generally, modern collection factors do seem to influence the PAS distribution with respect to geology – the clustering of artefacts on chalk landscapes for example may in part be due to the ease of detecting chalk fields, whilst the higher elevations of some geologies makes them less accessible to amateur collectors.	BGS	The British Geological Survey holds a variety of datasets at various scales, which includes bedrock geology.
Routeways	Ranging from ancient footpaths through the landscape, to disused railway lines and modern metalled roads, routeways can have a significant impact on this distribution of finds. PAS finds cluster near to both modern and historic routes, the latter for obvious reasons, the former due mostly to accessibility, making this a key landscape feature when exploring the distribution of PAS finds	OS	OS Opendata: VectorMap, OS Streetview, Strategi or Meridian 2 ITN data available through Edina Digimap: http://digimap.edina.ac.uk/digimap/home

	Description	Data Holder(s)	Further information / Datasets
Settlements	Three key factors may affect the distribution of PAS finds with respect to modern settlements: (1) the constraints on metal detecting within settlements should result in fewer than anticipated PAS finds; (2) the targeting of known occupied sites could result in concentrations of PAS finds close to settlements; (3) the continuous occupation of many settlements could result in larger numbers of finds in the vicinity.	various	2001 Settlement data: http://www.magic.gov.uk/ Agricultural land classification (Natural England) includes an urban layer: http://www.gis.naturalengland.org.uk/ OS datasets available through Edina Digimap: http://digimap.edina.ac.uk/digimap/home
Slope	With nearly 70% of land at below a 3° slope, much of England/Wales is relatively flat. Not unexpectedly, PAS finds cluster on the flattest land, with nearly 50% of findspots from land with a less than 1° slope. Local variations in slope will be more significant, influencing both where activity happened in the past, and where amateur collectors search in the present. The prevalence for locating settlements on flatter land may bias the recovery of artefacts by amateur collectors.	*derived from elevation*	OS Opendata: OS Terrain 50 Also available through Edina Digimap: http://digimap.edina.ac.uk/digimap/home
Soil	As with geology, the soil type/drainage/fertility/habitat could have a significant impact on the recovery of artefacts by amateurs, affecting both the ease of searching, and the preservation of artefacts. Historically, soil type could also influence the locations of different activities.	Cranfield University	A free online Soilscapes map: http://www.landis.org.uk/soilscapes/ LandIS soil datasets available for a price: http://www.landis.org.uk/data/index.cfm
Water	Distance to water would have been a key consideration in the past. Indeed many modern settlements are located on or close to modern waterways, and this has a roll-on effect on the distribution of amateur collected finds.	Ordnance Survey	OS Opendata: VectorMap and Meridian 2 Also available through Edina Digimap: http://digimap.edina.ac.uk/digimap/home

This table lists the primary landscape features that might be affecting the distribution of PAS data, but there are many combined datasets that could also be used, some of which are listed below.

	Description
Natural Areas	Created by Natural England Based on geological maps, landscape accounts, agricultural treatises and data on the distribution of habitats and species Comprises of 97 terrestrial and 23 maritime Natural Areas across England
National Character Areas	Also called the Character of England map Created by Natural England Defined by landscape, biodiversity, geo-diversity and cultural and economic activity. Boundaries follow natural lines in the landscape. Comprises of 159 areas across England
National Landscape Typology	Defined by Natural England as part of the Landscape Character Assessment Dataset hosted by MAGIC and available on request Subdivisions of the National Character Areas, based on similarities in the physical, biological and cultural character of each area
Terrain Zones	Created by Roberts and Wrathmell for their ‘Atlas of Rural Settlement in England’ (Roberts & Wrathmell 2000) Digitised by English Heritage (Loweere 2012) Comprises of 27 terrain types based on geology and landscape
Historic Landscape Characterisation	Programme run by English Heritage in partnership with local County Councils and SMRs/HERs Landscape divided into zones defined by its history and time-depth.
LANDMAP	Hosted by the Countryside Council for Wales (CCW) Combines landscape characteristics, qualities and influences on the landscape into a nationally consistent dataset 5 key maps summarising the ‘Cultural Landscape’, ‘Geological Landscape’, ‘Historic Landscape’, ‘Landscape Habitats’ and ‘Visual Sensory’ landscapes of Wales

There is a strong link between the landscape features presented here and the constraints mapping discussed earlier, with settlements and elevation for example appearing on both lists. However, generally the relationships between amateur collected finds and the landscape datasets detailed here are too complex to incorporate into a constraints map. Rather this method lends itself to more localised analyses, using suitable statistical methods to test the relationships between select groups of finds and landscapes.

Perhaps the most comprehensive use of such a methodology with amateur collected data is Chester-Kadwell's work on metal detected finds from Norfolk, which used two quantitative techniques (see below) to analyse the relationship between findspots and a range of geographical landscape features[1] to explore traditional assumptions about the locations of Anglo-Saxon sites. The associations between finds and the physical features were statistically tested to assess the likelihood that the distribution of finds was related to each of the geographical features. The findings were then interpreted with reference to the method of data collection, and showed for example that there were comparatively few Anglo-Saxon metal detected finds from lower elevations, and that excavation data was biased towards sandy soils.[2]

Analysing PAS data with respect to the surrounding landscape can potentially be a very powerful tool for exploring the effects on modern collection factors on the distribution of amateur collected finds. With multiple factors potentially in play, the key is in using the correct techniques and in the interpretation of the results.

Pearson's X^2 *test is designed to see whether there is a relationship between two categorical variables, i.e. variables such as geology or aspect which are made up of categories rather than continuous numbers. This test allows you to compare the frequency of PAS finds observed in each geological area or aspect category with the frequencies that you would anticipate if the distribution of finds was random.*

H_0 states that finds will be evenly distributed across each of the categories, and will be rejected if the difference between the observed and expected distributions is statistically significant.

The ***Kolmogorov-Smirnov (K-S) test*** *is used to compare the distributions of two sets of continuous variables i.e. variables such as elevation or slope, to identify whether the observed distribution differs significantly from the expected distribution.*

The null hypothesis (H_0) is that the distribution of PAS finds is not related to the continuous variable – this hypothesis can be rejected if the difference in the observed and expected values exceeds a specified critical value.

[1] Waterways, elevation, slope, aspect, soil type, soil drainage, soil fertility, soil habitats and soil boundaries
[2] Chester-Kadwell 2009 pages 94-127

THE PAS AND OTHER ARCHAEOLOGICAL DATASETS

By comparing the distributions of known archaeological sites identified through professional archaeological surveys, with new findspot information being recorded by amateurs, the factors affecting the latter dataset can be explored in more detail.

There are a number of key repositories for archaeological information in England and Wales:

	Description
Historic Environment Records (England)	Sometimes called Sites and Monuments Records (SMRs) Comprehensive resource containing information on the historic environment of a defined geographic area, often a county, but sometimes a unitary authority or other small area. Many are accessible through the Heritage Gateway: http://www.heritagegateway.org.uk/
Historic Environment Records (Wales)	www.archwilio.org.uk Regional resources containing information on the archaeology of each area of Wales Held by the four Welsh Archaeological Trusts
National Monuments Record of England	English Heritage's public archive http://www.english-heritage.org.uk/professional/archives-and-collections/nmr/ Contains photographs, drawings, reports and publications from across England, covering archaeology, historic buildings and social history
National Monuments Record of Wales	www.coflein.gov.uk A national collection of information about the historic environment of Wales
Archaeological Data Service (ADS)	http://archaeologydataservice.ac.uk/ A digital archive service, containing journals, grey literature, complete projects, bibliographies and theses
Historic Wales Portal	www.historicwales.gov.uk An overview of records held by: - The Royal Commission of the Ancient & Historical Monuments of Wales - Amgueddfa Cymru (the National Museum Wales) - The four Welsh Archaeological Trusts

Whilst there are similarities between HER and PAS data, there are also distinct differences, both in the quantity of data held, but also the spatial distribution of data. For example, professionally collected data is often focussed along areas of development such as settlements or roads, whilst PAS finds are more generally distributed across the landscape, whilst also clustering around the edges of settlements (e.g. Figure 22).

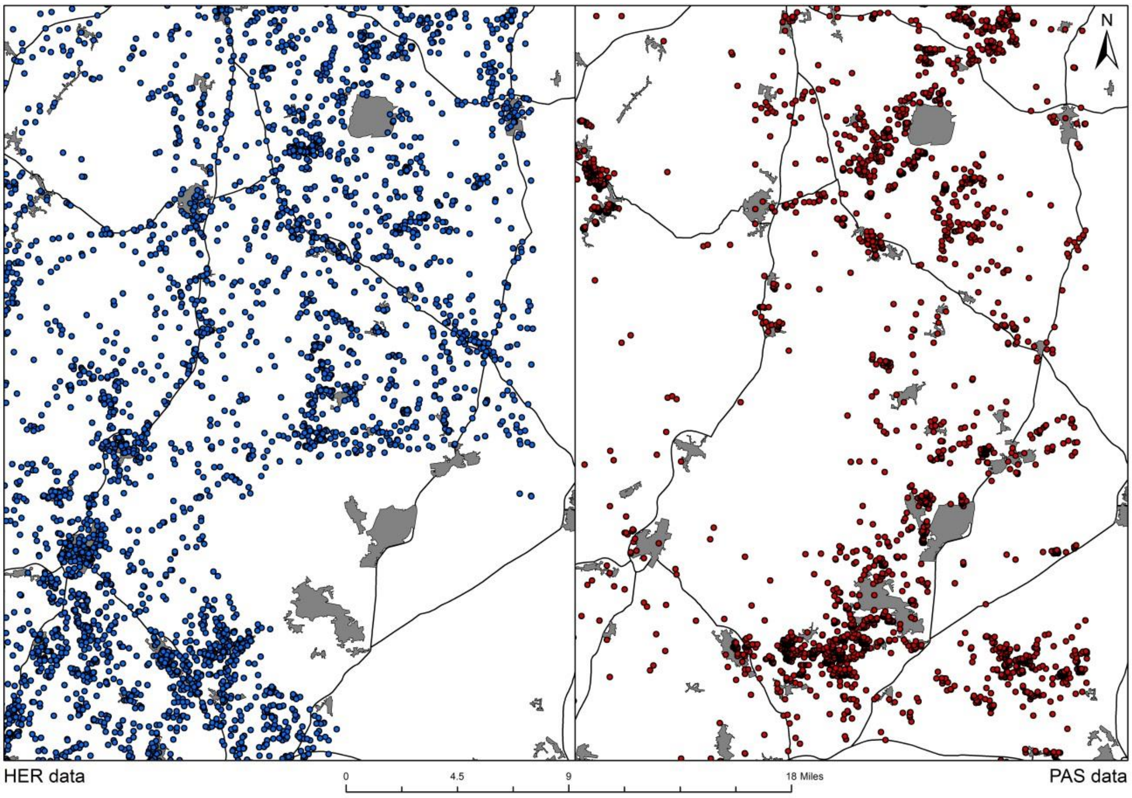


Figure 22: Comparing distributions of HER and PAS data, plotted against modern settlements

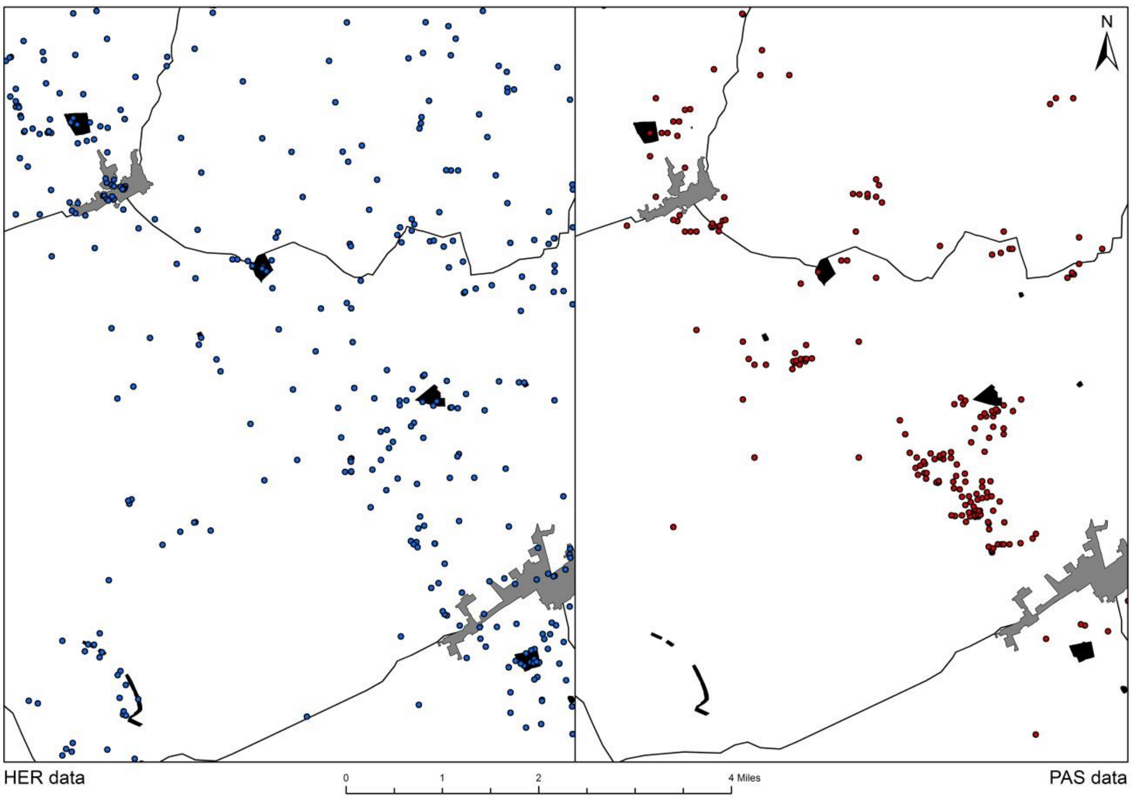


Figure 23: Comparing distributions of HER and PAS data, plotted against SAMs

As well as illuminating the differences in the distributions of HER and PAS data, Figure 23 also illustrates clearly the clustering of PAS finds, highlighting a key question associated with the relationship between HER and PAS data – that of site targeting.

Site targeting

When amateur collectors are asked what most influences their decisions on where to search, the resounding respond is 'wherever they can get permission'. However, the ability to get permission is not the only factor controlling the selection of sites by amateurs - the proximity of a site to areas of known archaeology can also be important.

The metal detecting literature, for example work by Villanueva[1] or Abbeyville[2], understandably encourage new metal detector users to target specific sites types or periods of archaeological sites to improve their chances of recovering finds. Whilst many amateur collectors do not intentionally target known archaeological sites, analysis of the data suggests that there is an apparent preference towards searching areas within the vicinity of known sites (e.g. Figure 23).

PAS finds and SAMs

Perhaps the simplest illustration of the link between PAS finds and known archaeology is that seen in some areas with SAMs. Discussed in more detail under the section on mapping constraints, SAMs are legally off limits to amateur collectors, but their locations are well known making the areas around them potentially interesting to amateur collectors.

Figure 24 and Figure 25 show how statistical tests combined with distance analyses can be used at a high level to explore the relationship between groups of PAS finds and known archaeology sites. The graphs shown in Figure 24 (d) and Figure 25 (d) show that in both cases the percentage of PAS finds (red line) falling within ½km of the SAMs is higher than expected based on the distribution of the surrounding land (blue line). Whilst this of course does not prove that such sites are being targeted in these counties, it makes it clear that the relationship between these finds and the known archaeology needs to be explored in more detail.

Other archaeological datasets

Of course HERs hold much more archaeological data than just details of SAMs, and it is worth in your own research considering the potential effect on findspot distributions of the targeting of different periods of archaeological site or different types of sites by amateur collectors, for example sites of important findspots or hoards, upstanding monuments or earthworks, cropmark sites or known historic routeways.

It is also worth considering the potential biasing effect of other sources of historic data used by amateur collectors, such as online satellite maps like Google Earth; old Ordnance Survey maps; modern road maps; river, canal, railway and road construction maps; enclosure and tithe maps; estate maps and sea charts; as well as more local knowledge from landowners, from local/county historic books, and from other metal detector users.

PAS data is both explained by other archaeological datasets, and it in turn supports them by creating a much broader picture of the historic environment. Through analysing the distributions of PAS data compared to other archaeological datasets, it is possible to understand the biases affecting both in much more detail.

---

[1] Villanueva 2007
[2] Abbeyville 2002a, 2002b

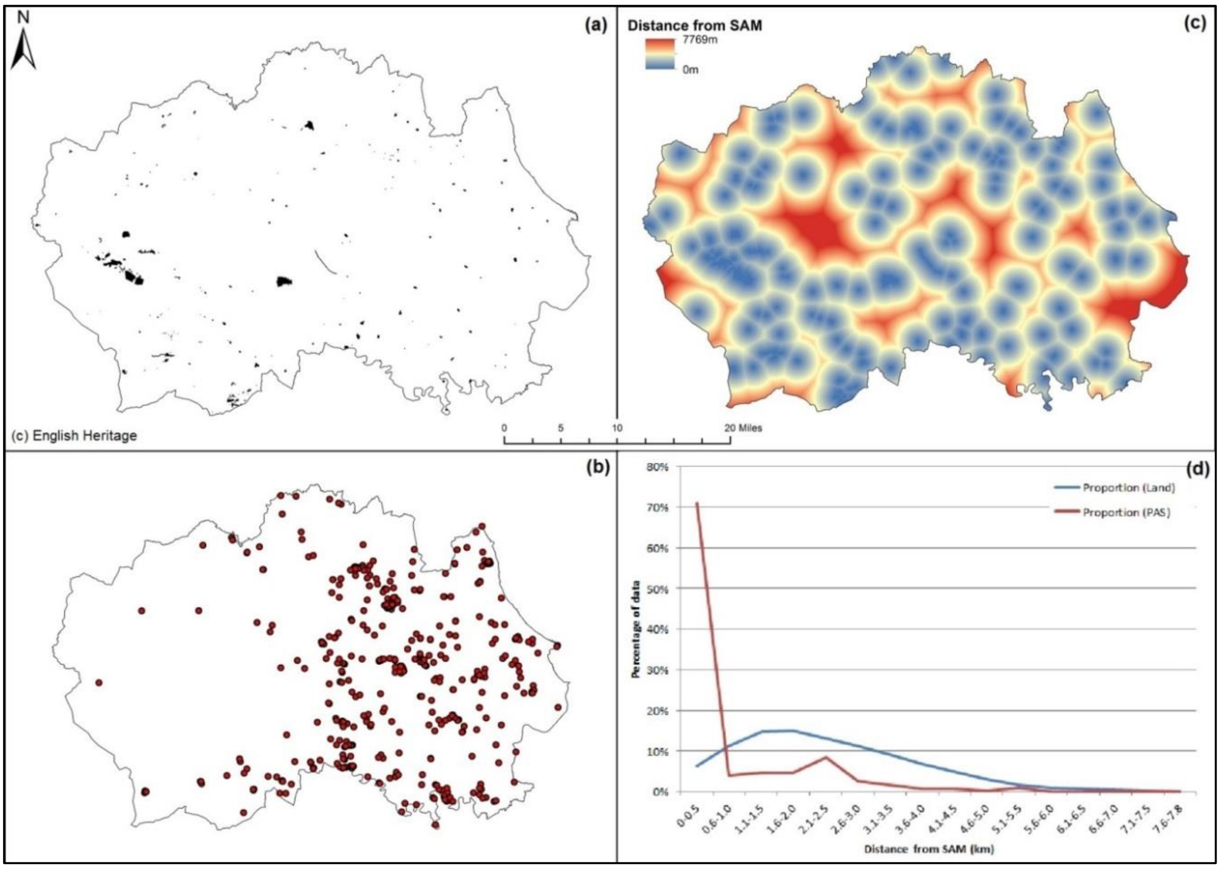


Figure 24: County Durham
(a) SAMs (b) PAS (c) distance of finds from SAMs (d) proportion PAS finds/land within distance bands

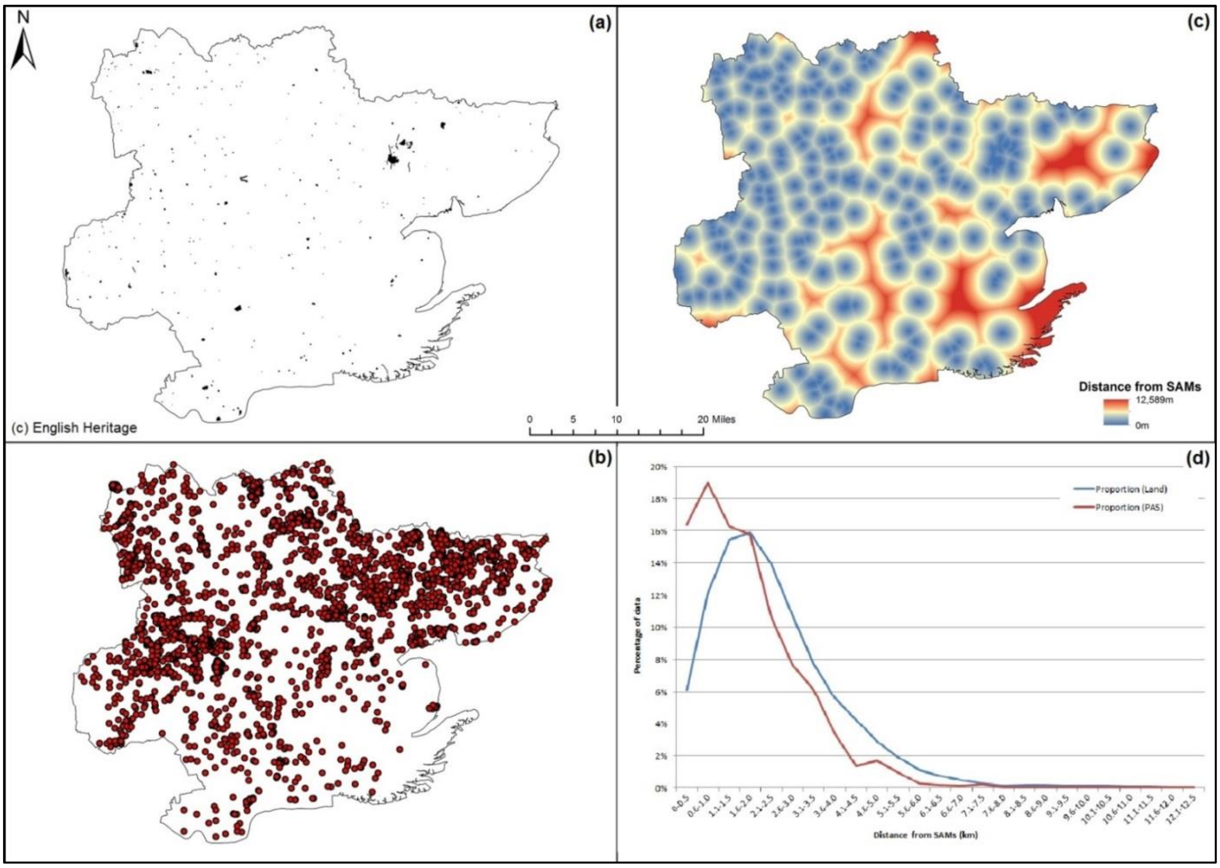


Figure 25: Essex
(a) SAMs (b) PAS (c) distance of finds from SAM (d) proportion of PAS finds/land within distance band

PEOPLE AND THE PAS

The key factors in the distribution of finds have been shown to be the choices made by individuals at every stage of the recovery and recording process – choices about the designation of land by policy makers, choice on granting permissions to search by landowners, choices on where to search by the amateur collectors, and choices about what to record on the PAS by the Finds Liaison Officers. It is possible to explore the influence of some of these choices on the PAS data, in particular those made by the finders and the FLOs. A number of examples are given below.

Exploring finder behaviour

There are many facets of finder behaviour that can influence the distribution of finds recorded on the PASD, several of which are outlined in the pilot study.[1] As shown in the examples below, it is possible to explore some of these, e.g. site choices and search behaviour, using the PAS data.

Exploring 'range'

This first example looks at the effect on distribution of one of the larger scale site choices made by collectors – how far to travel from their homes (start locations)

Finds will only be recovered where an amateur collector goes to search, and amateur collectors are understandably biased in where they go. For example, it is generally thought that landowners are more likely to give permission to locals,[2] and collectors are often more interested in the archaeology of their local area, making the *start location* of searchers a crucial factor in the distribution of PAS finds. By analysing the distance between searchers' *start locations* and their recorded finds, it is possible to identify the 'range' of collectors, and subsequently to identify any areas in a study area that fall outside of the normal searching areas of collectors.

In the example below, the ranges of the 25 most prolific finders in Hampshire were calculated:

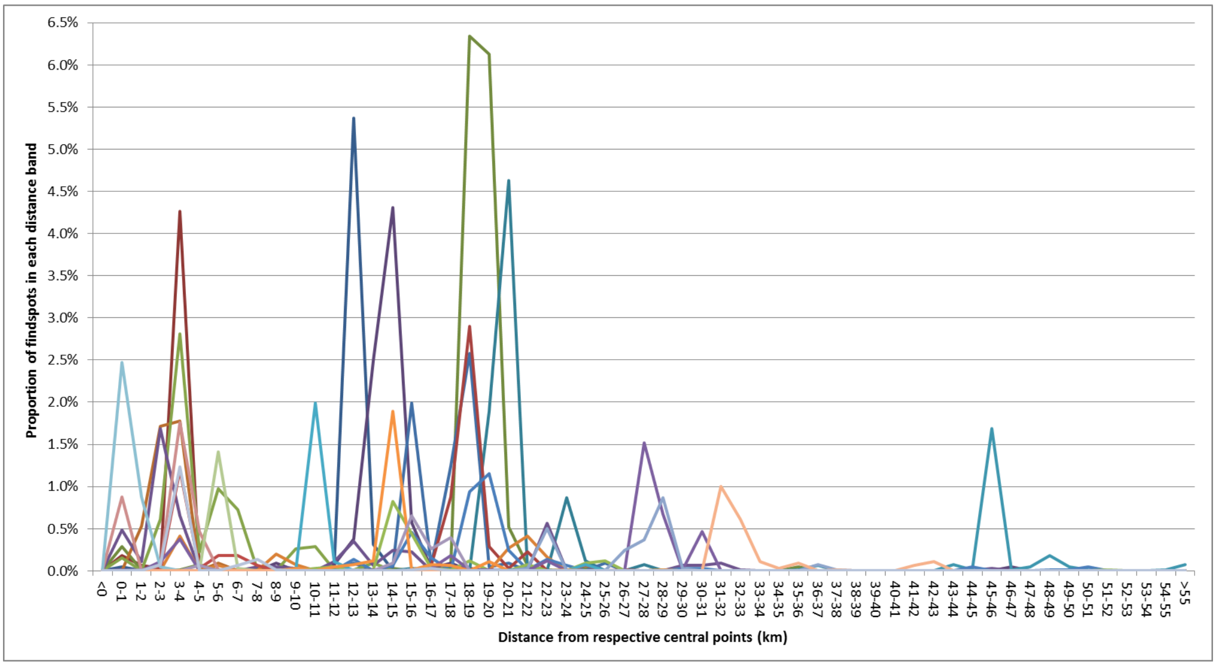


Figure 26: Distance between start locations and recorded findspots for 25 individuals, at 1km intervals

[1] Robbins 2012 Chapter 6

[2] Arnie 2002; Croft 1996; Villanueva 2006

It was found that there were two principal distance bands from which finds were recovered: 0-5km and 10-20km from each collector's home location. Plotting these distance bands, as shown in Figure 27 for four finders, allows the identification of areas which fall outside of normal range of collectors.

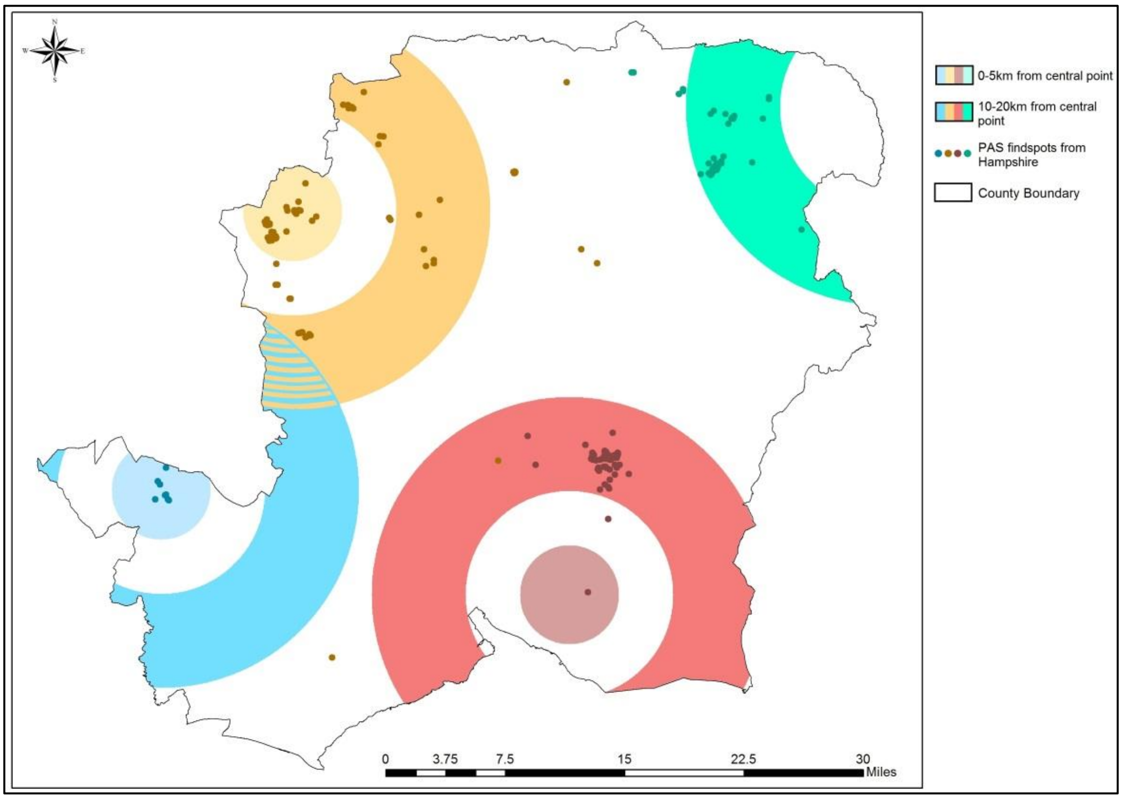


Figure 27: Home ranges in Hampshire
Distance bands of four key finders, 0-5km and 10-20km from their start location

Whilst well-populated areas such as Hampshire are unlikely to have much land which is not within the range of at least one collector, this method could be effective in areas with lower population densities. Combined with cost-surface data such as speed of roads or elevation, this method offers the potential for a detailed exploration of finders' ranges.

Understanding the impact of rallying

This second example highlights the effect of larger scale metal detecting events (rallies) on both the recording of, and spatial distribution of, finds.

Rallies are a particular type of metal detecting event that can produce large numbers of finds, and have the potential to have great impact on the distribution of objects at both a large scale (e.g. Figure 28) and at a more local level (e.g. Figure 29). They can draw in hundreds of searchers, and may result in the recovery of hundreds of artefacts.

The largest events are usually attended by FLOs from a number of counties, but smaller rallies may not have a PAS presence at all. Even when the FLOs are in attendance, it is thought that the percentage of finds reported to them is relatively small.

An analysis of the finds recorded by the Weekend Wanderers rally group in Hampshire[1] showed that there is a clear discrepancy between the numbers of finds recorded when the FLO is able to attend a rally, and the number recorded when they are not. Of the 48 rally days held over the 2 years under analysis, the 5 where FLOs are known to have attended resulted in 103 records on the PASD (20.6 records per day) compared to 145 records from those without a PAS presence (3.4 records per day).

[1] Robbins (2012) Chapter 6

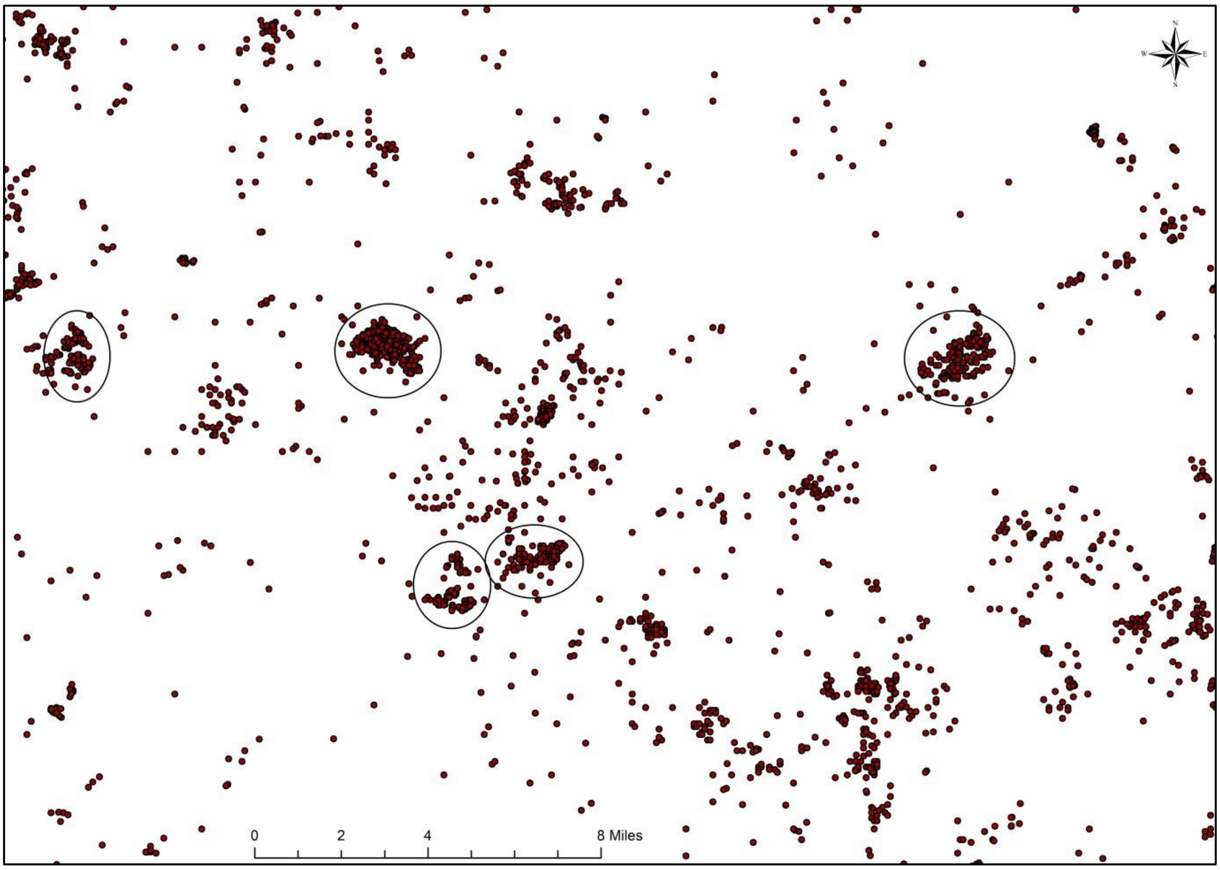


Figure 28: Distribution of PAS finds (correct to April 2013) highlighting the clustering of finds associated with large-scale metal detecting rallies

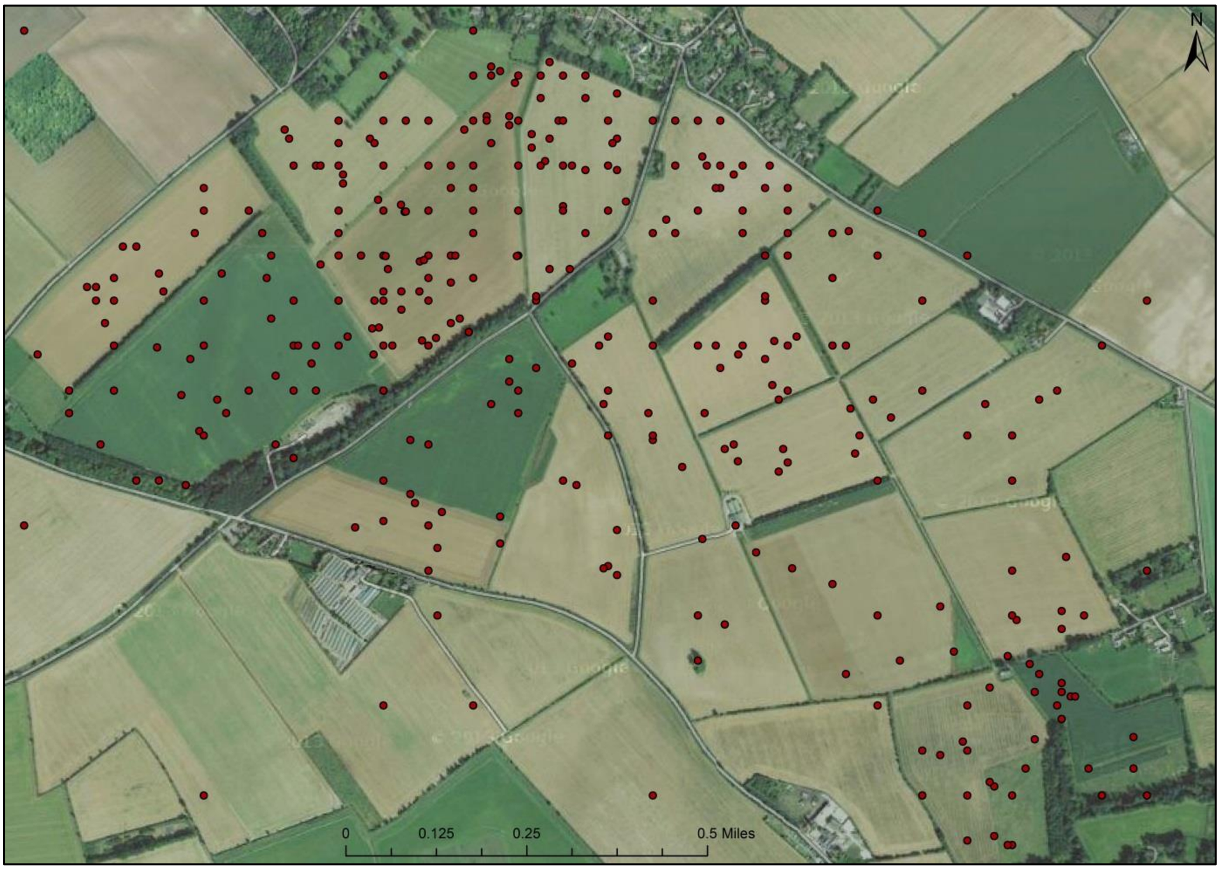


Figure 29: Distribution of over 600 finds across a large rally site (aerial photography © Google Imagery)

The conditions for recording finds at rallies are not ideal and if the rally is particularly well attended, or the site very rich in artefacts, it can be difficult to record objects to an appropriate level of detail.[1] Rally events can also be hard to follow up, as the metal detector users attending the event may not be members of other clubs, and may therefore be unknown to the PAS.

For many projects understanding the phenomenon of rallying will be essential, as rally finds can make up a significant proportion of a dataset. Rally sites are repeatedly visited by large numbers of people, and may cause artificial clustering of artefacts, particularly at a county and parish scale. Within a rally site, the presence or absence of the PAS can affect the extent of finds recording, and therefore the overall body of data available for analysis.

Illustrating collection patterns

At a smaller scale, different collectors will have different patterns of activity within a site, which will affect the resulting distribution of finds.

Different detectorists will approach a field in different ways. Many metal detector users will adopt an explorative search technique (e.g. a union jack search – around the edges and then twice diagonally across the middle) to identify hot spot areas. Once they have decided where to begin, some metal detector users will adopt a very intensive approach (searching by transects or grids for example), whilst others will search much more randomly.

Often the approach adopted will depend on the circumstances – at rallies for example many metal detectorists will wander more randomly, as there is not the time to search the whole site intensively. On fields where they have individual or club access, the search patterns are likely to be more systematic and/or focussed.

Where different groups of collectors have searched the same field, it is possible to explore the differences in search patterns and their effect on the overall distribution of finds. A field on the Isle of Wight, where an individual and a club have both searched the same field for many years, is a classic example of such differences – as shown by the finds distributions in Figure 30.[2] Dividing the field into arbitrary sections (Figure 31) allows one to infer the general pattern of detecting across the field, by identifying the number of times the individual and club returned to each section of the field based on the number of records on the PASD.

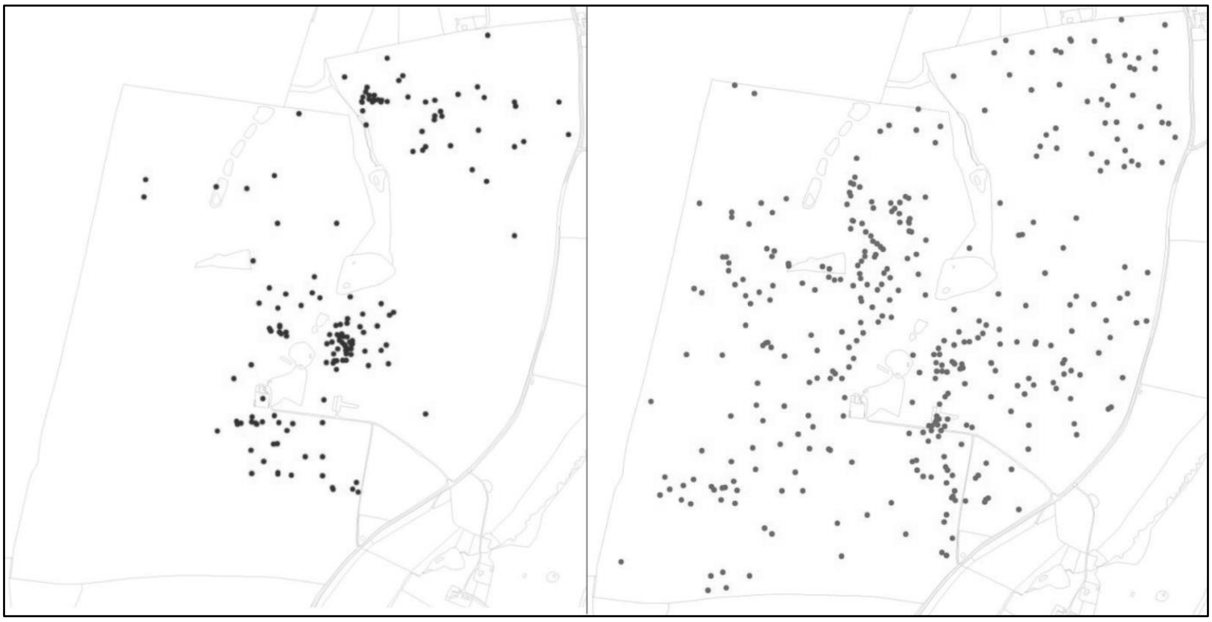


Figure 30: Distribution of finds from (left) an independent detectorist and (right) a metal detecting club

[1] Bland 2008

[2] See Robbins 2012 Chapter 5 for more details

As Figure 32 shows, certain areas of the field have resulted in high numbers of finds by both the club and the independent detectorist (areas 2, 6), and vice versa (areas 1, 7).

However, it is the contrast between the two types of collector that is more important in this example, as it suggests that the limited number of finds recorded by one party results from less intensive searching in that area rather than a genuine historic pattern (areas 3, 4, 8).

Figure 31: Field areas (aerial photograph © Google Imagery)

What this shows is that, when considered on its own, the distribution of findspots reported by the independent metal detector user (for example) may well not be representative of the general distribution of finds across a field. Without the comparative dataset, it might be incorrectly assumed that if a field has been searched over a long period of time, then all areas that are going to produce recordable finds will have done so already.

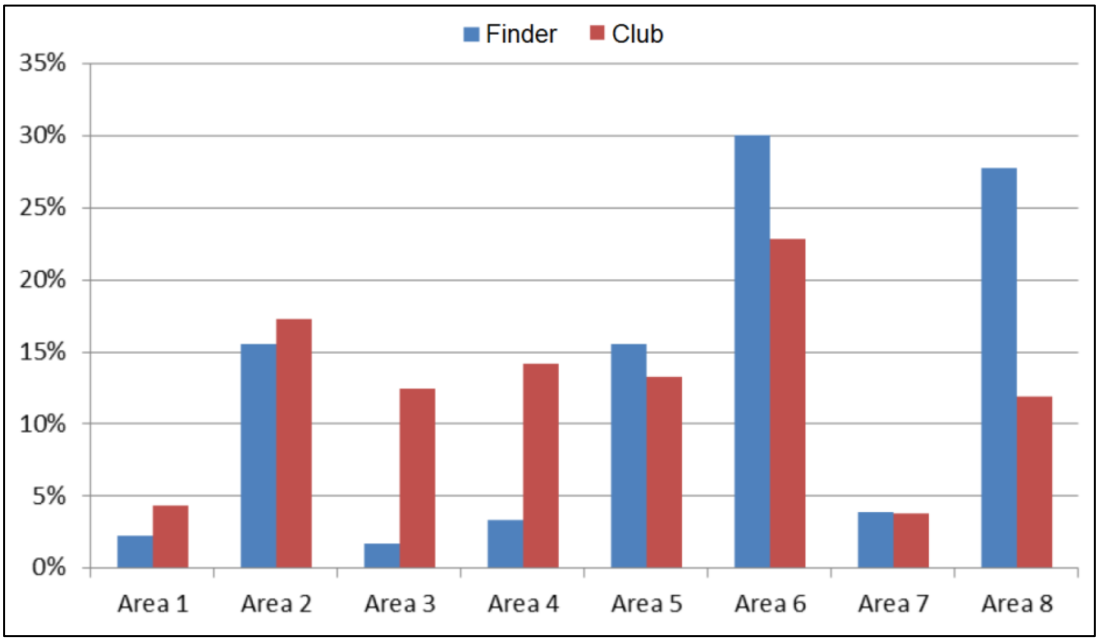


Figure 32: Percentage of visits to each areas of the field by the independent finder and the club members, based on the number of records on the PASD

Without knowledge of the spatial extent and intensity of searching within a field, it cannot therefore be assumed that the entire area has been evenly explored. Subsequently, it cannot be assumed that the distribution of the recorded findspots is truly representative.[1]

[1] The spatial distribution of finds within a field will also be affected by the agricultural history of the field, as discussed in 'Stage 4: Exposure' page 31

The actions of the recorders – in this case primarily that of the Finds Liaison Officers (FLOs) but also a growing number of self-recorders, volunteers and interns – will also influence the spatial distribution of finds on the database at different scales. Various factors can affect recorders, but of particular interest are their reasons for recording, their levels of experience, their personal interests, and the amount of time they dedicate to recording finds.

Finds Liaison Officers

FLOs play a pivotal role in the recording of amateur collected finds on the PASD. They liaise with amateur collectors through finds days, meetings with individual collectors and metal detecting clubs. They collect finds, identify them, record them, and return them to finders.

Over the past 6 years, the numbers of metal detecting clubs and independent detectorists across England and Wales have both risen by over 20%[1], and the work of FLOs has increased alongside. They now record an average of over 85,000 finds each year[2], but their rate of recording finds (and the subsequent density of finds across their area) is dependent on several factors:

(1) the length of time the PAS has been operational in the area;
(2) the length of time the FLO has been in post;
(3) the relationship between the individual FLO and their finders;
(4) and the recording process used by the FLO.

This can be illustrated by comparing the recording rates[3] of FLOs (Figure 33- Figure 35), which shows that each change in FLO can have an impact on the rate of finds recording. Areas like the Isle of Wight, which have had a single FLO since 2003, have a stability that allows both the development of a more efficient reporting and recording process, and an improved relationship between recorder and finders. Such stability results in a greater number of finds being recorded when compared to counties like Northamptonshire, which have had a number of FLOs since the PAS began.

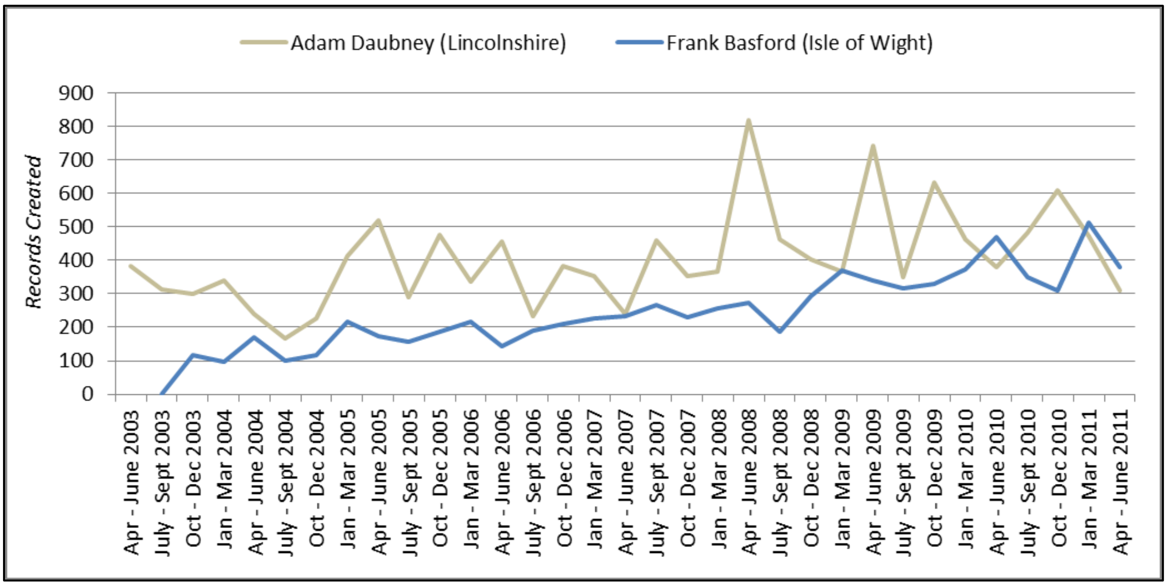


Figure 33: Finds rates of FLOs for Lincolnshire and the Isle of Wight – 2003 to 2011

[1] 153 clubs (survey by Vomvyla 2008) to 185 clubs (survey by Robbins 2014)
1320 independent detectorists (Vomvyla 2008) to 1590 independent detectorists (2014)

[2] 1998 – 2001: average 11,800 finds per year
2002 – 2005: average 32,000 finds per year
2006 – 2009: average 66,500 finds per year
2010 – 2013: average 87,000 finds per year

[3] In this instance the number of new records created per quarter

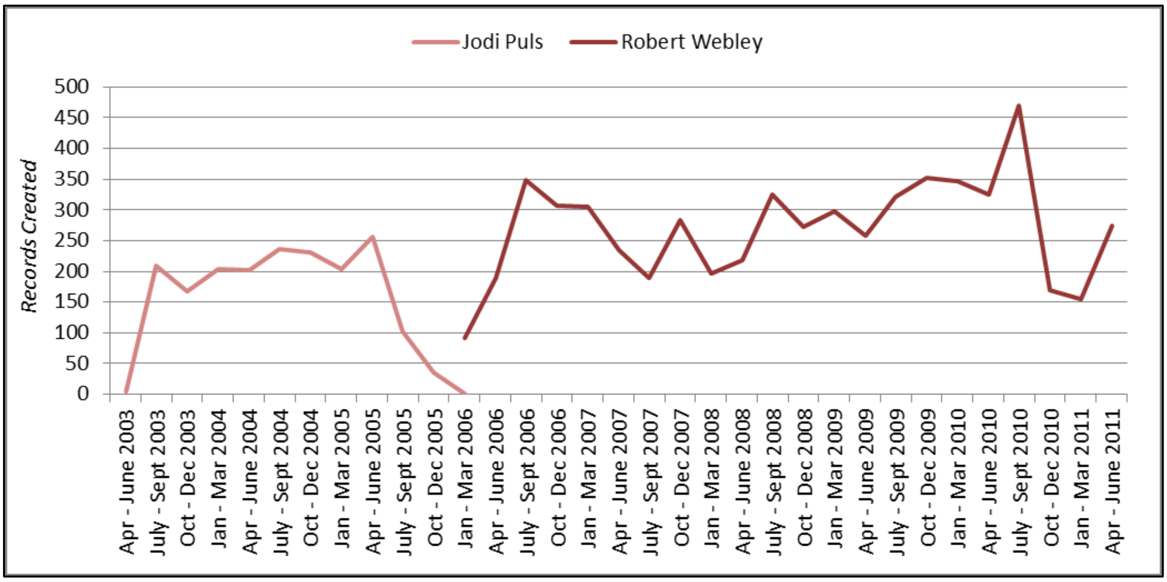


Figure 34: Finds rates of FLOs for Hampshire – 2003 to 2011

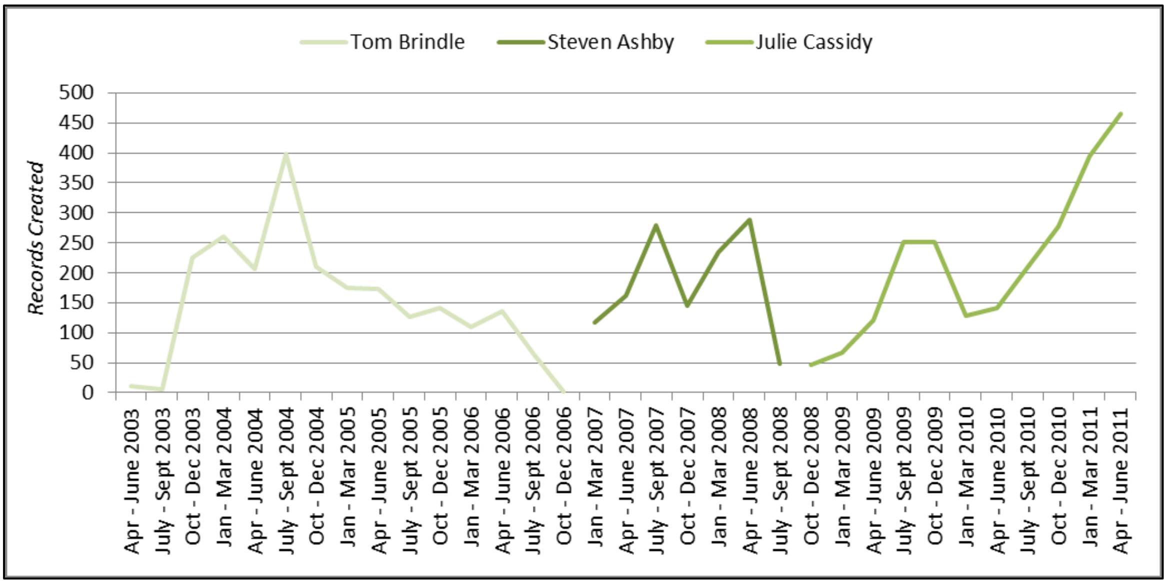


Figure 35: Finds rates of FLOs for Northamptonshire – 2003 to 2011

Whilst the experience of, and time available to, FLOs influences the density of finds by affecting the numbers of finds recorded, the nationwide distribution of finds is also fundamentally linked to the total size of the area covered by the FLO – a single FLO is limited in the number of finds they can record each year, no matter what area they monitor.

For example 100 records per month recorded by the above FLOs would equate to 4.4 records/km^2 per year in Northamptonshire, 2.7 records/km^2 per year in Hampshire, but 26.3 records/km^2 per year on the Isle of Wight, just because of the variations in the size of the area covered by each FLO. Whilst new FLOs will eventually match the recording rate of established FLOs, without greater numbers of recorders it is unlikely that larger counties will ever be able to match the density of finds of smaller counties like the Isle of Wight.

Volunteers, interns and self-recorders

FLOs may be assisted by a range of people, who get involved with the PAS for a number of different reasons. Some FLOs have had work experience students, or those in higher education doing work placements. Others have recently had a number of interns (made possible by the Headley Trust), but most are volunteers, either amateur collectors themselves, or just interested in archaeology. The volunteers and interns may help with all stages of the recording process – making skeleton records, identifying finds, editing findspots, photographing artefacts, editing photos etc. The PAS is about to embark on a programme of training such volunteers,[1] and it will be interesting to see whether this will have any effect on the distribution of PAS finds.

Of most interest when assessing the distribution of artefacts are those volunteers who are self-recorders. These are dedicated finders who are trained to record their own finds onto the PASD, under the supervision of their local FLO. As the distribution of finds attributed to them will undoubtedly reflect the search area of each recorder, they can have a significant impact on the density and distribution of finds at a local scale.

[1] http://finds.org.uk/news/stories/article/id/256

APPROACHING AN ANALYSIS OF THE PASD

What this document has sought to do is identify a number of key ideas and factors that should be explored when using the PAS data. Whilst research has shown that understanding the distribution of amateur collected finds is directly related to the choices made by those involved, it is of course unrealistic to expect every researcher to explore all of these choices in depth. This final section identifies three key questions that are within the scope of the majority of researchers.

WHAT IS THE SURVEY AREA?

Understanding the area that has been searched by amateur collectors is the first stage of understanding the distribution of PAS finds. This means understanding both the area in which amateur collectors can search, and the area that has actually been searched. Whilst defining exactly which areas have been searched is not yet possible, the methodologies suggested within this document provide two complementary approaches for defining the minimum and maximum extent of the search area:

(1) the use of constraints mapping is an effective technique for identifying areas where finds are unlikely to have been recovered (the maximum extent)

(2) mapping those fields from which PAS findspots have been recorded shows which fields have been searched by collectors (the minimum extent).

Despite the effectiveness of such approaches, it must be remembered that (1) the presence of finds in a field do not prove that the entire field has been searched, and (2) constraints mapping is not infallible.

HOW ARE THE CHOICES OF COLLECTORS AFFECTING YOUR DATA?

It is important to remember how the choices made by amateur collectors will affect the density of finds across your study area:

- at a larger scale, there may be heavily searched sites such as rally sites affecting the distribution
- the accessibility of your study area will affect the levels of searching, particularly if it falls outside the range of many collectors
- within sites the search patterns used by collectors will vary depending on the event. Search patterns on rally sites are likely to be more random and more focussed on hot spot areas than those used by independents or metal detecting clubs on land they return to more regularly

Another factor to consider that has not been particularly touched on in this guide is the level of discrimination being used by collectors, in particular the amount of sorting of artefacts happening prior to the reporting of finds to the PAS e.g. many metal detectorists do not collect non-metal objects or iron objects, and some will target particular types of periods of artefact.

WHAT ‘REPORTING’ AND ‘RECORDING’ ISSUES ARE THERE?

Whilst it can be difficult to assess the levels of reporting in each study area, the importance of understanding any reporting and recording issues should not be underestimated.

A range of factors can affect the reporting of artefacts, in particular the historic relationship between archaeologists and metal detector users, the PAS presence at rally sites within the area, and the length of time an FLO has been in post. The latter has also been shown to affect the recording process

BIBLIOGRAPHY

Abbeyville, C., 2002a. A Beginner's Guide to Successful Detecting. Part 4a: Finding Sites to Search. *Treasure Hunting*, June, pp.17–21.

Abbeyville, C., 2002b. A Beginner's Guide to Successful Detecting. Part 4b: Finding Sites to Search. *Treasure Hunting*, July, pp.38–40.

Addyman, P.V., 2001. Antiquities without Archaeology in the United Kingdom. In N. Brodie, J. Doole, & C. Renfrew, eds. *Trade in illicit antiquities: the destruction of the world's archaeological heritage*. Cambridge: McDonald Institute for Archaeological Research, pp. 141–144.

Ammerman, A.J. & Feldman, M.W., 1978. Replicated Collection of Site Surfaces. *American Antiquity*, 43(4), pp.734–740.

Arnie, 2002. Big Farms - Big Problems? *The Searcher*, December p, pp.41–43.

Ascher, R., 1968. Times arrow and the archaeology of a contemporary community. In K. C. Chang, ed. *Settlement Archaeology*. Palo Alto: Nation Press Books, pp. 43–52.

Bailey, T.C. & Gatrell, A.C., 1995. *Interactive Spatial Data Analysis*, London: Longman Scientific and Technical.

Barford, P.M., 2011. How many active detectorists are there in Austria? *Portable Antiquity Collecting and Heritage Issues Blog*. Available at: http://paul-barford.blogspot.com/2011/12/how-many-active-metal-detectorists-are.html [Accessed January 31, 2012].

Barford, P.M., 2008. The Heritage Action Erosion Counter. *Portable Antiquity Collecting and Heritage Issues Blog*. Available at: http://paul-barford.blogspot.com/2008/11/heritage-action-erosion-counter.html [Accessed April 20, 2011].

Barker, P., 1993. *Techniques of Archaeological Excavation* 3rd ed., London: Routledge.

Beck, C. & Jones, G.T., 1989. Bias and Archaeological Classification. *American Antiquity*, 54(2), pp.244–262.

Bever, M.R. & Meltzer, D.J., 2007. Exploring Variation in Paleoindian Life Ways: The Third Revised Edition of the Texas Clovis Fluted Point Survey. *Bulletin of the Texas Archaeological Society*, 78, pp.65–99.

Blackmar, J.M., 2001. Regional Variability in Clovis, Folsom, and Cody Land Use. *Plains Anthropologist*, 46(175), pp.65–94.

Bland, R., 2005a. A pragmatic approach to the problem of portable antiquities: the experience of England and Wales. *Antiquity*, 79, pp.440–447.

Bland, R., 1999. Commentary on Treasure and Finds. *Institute of Art and Law Foundation Certificate in Art Law. Module 2: Treasure and Finds*.

Bland, R., 2005b. Rescuing Our Neglected Heritage: The Evolution of the Government's Policy on Portable Antiquities in England and Wales. *Cultural Trends*, 14(4), pp.257–297.

Bland, R., 2008. The Development and Future of the Treasure Act and Portable Antiquities Scheme. In S. Thomas & P. G. Stone, eds. *Metal Detecting and Archaeology*. Woodbridge: The Boydell Press, pp. 63–85.

Bland, R., 1996. Treasure Trove and the case for reform. *Art, Antiquity and Law*, 1(1), pp.11–26.

Bland, R. & Lewis, M., 2009. *Coroners and Justice Bill: issues relating to Treasure. A brief from the British Museum*,

Bland, R. & Loriot, X., 2010. *Roman and Early Byzantine Gold Coins found in Britain and Ireland*, Royal Numismatic Society.

Boismier, W.A., 1991. The Role of Research Design in Surface Collection: an Example from Broom Hill, Braishfield, Hampshire. In A. J. Schofield, ed. *Interpreting Artefact Scatters: Contributions to Ploughzone Archaeology*. Oxford: Oxbow Books, pp. 11–25.

Booth, A., 2010. The Frome Hoard. Available at: www.finds.org.uk/blogs/fromehoard [Accessed April 12, 2011].

Bradley, R., Durden, T. & Spencer, N., 1994. The creative use of bias in field survey. *Antiquity*, 68, pp.343–346.

Brindle, T., 2014. *The Portable Antiquities Scheme and Roman Britain*, British Museum Research Publication 196.

Brindle, T., 2011. *The Portable Antiquities Scheme and Roman Britain: An Evaluation of the Potential for Using Amateur Metal Detector Data as an Archaeological Resource*. King's College London: Unpublished PhD Thesis.

Buchanan, B., 2003. The Effects of Sample Bias on Paleoindian Fluted Point Recovery in the United States. *North American Archaeologist*, 24(4), pp.311–338.

Cassely, V., 1998. *A Database for Recording Archaeological Finds. MSc Dissertation.* Birkbeck College, University of London.

Cherry, J., 1983. Frogs round the pond: Perspectives on current archaeological survey projects in the Mediterranean region. In D. R. Keller & D. W. Rupp, eds. *Archaeological Survey in the Mediterranean Area*. British Archaeological Reports, International Series 155, pp. 375–416.

Chester-Kadwell, M., 2009. *Early Anglo-Saxon Communities in the Landscape of Norfolk*, British Archaeological Reports, British Series 481.

Chitty, G., 2001. *A review of Portable Antiquities Pilot Scheme*, Hawkshead Archaeology and Conservation.

Chitty, G. & Edwards, R., 2004. *Review of Portable Antiquities Scheme 2004*, Available at: http://finds.org.uk/documents/2004.pdf.

Clark, A., 1996. *Seeing beneath the soil: prospecting methods in archaeology (revised edition)*, London: Routledge.

Clark, K., 2008. *A review of the Portable Antiquities Scheme. Report for "The Museums, Libraries and Archives Council,"* Available at: http://finds.org.uk.

Clarke, D.V., 1978. Excavation and Volunteers: A Cautionary Tale. *World Archaeology*, 10(1: Field Techniques and Research Design), pp.63–70.

Collins, M.B., 1975. Sources of bias in Processual data: An Appraisal. In J. W. Mueller, ed. *Sampling in Archaeology*. Tucson: The University of Arizona Press, pp. 26–32.

Conolly, J. & Lake, M., 2006. *Geographical Information Systems in Archaeology*, Cambridge: Manuals in Archaeology.

Croft, W.A., 1996. Detecting for the Disheartened. *The Searcher*, October pp, pp.10–13.

Denison, S. & Dobinson, C., 1995. *Metal Detecting and Archaeology in England*, Available at: http://old.britarch.ac.uk/detecting/cont.html.

Department for Culture Media and Sport, 2002. *The Treasure Act 1996 Code of Practice (2nd Revision) England and Wales*, Available at: http://finds.org.uk/documents/treasure_act.pdf.

Department of National Heritage, 1996. Portable Antiquities: A Discussion Document. Available at: http://old.britarch.ac.uk/cba/portant1.html [Accessed April 18, 2011].

Dowman, E.A., 1970. *Conservation in Field Archaeology*, London: Methuen and Co. Ltd.

Drewitt, P.L., 1999. *Field Archaeology: An Introduction*, London: UCL Press.

Edwards, R., 2006. *Portable Antiquities Scheme User Survey 2006*, Available at: http://www.finds.org.uk/documents/User Survey 2006.pdf.

Egan, G., 2010. Widespread Devotion: new insights from the Portable Antiquities Scheme into medieval pilgrim trinkets. In S. Worrell et al., eds. *A Decade of Discovery: Proceedings of the Portable Antiquities Scheme Conference 2007*. British Archaeological Reports, British Series 520, pp. 200–214.

Evans, J. & O'Connor, T., 1999. *Environmental Archaeology: Principles and Methods*, Stroud: Sutton Publishing Ltd.

Ferrier, S., 2002. Mapping Spatial Pattern in Biodiversity for Regional Conservation Planning: Where to from here? *Systematic Biology*, 51(2), pp.331–363.

FID, 1996. FID Code of Conduct. Available at: http://fid.newbury.net/html/code.htm [Accessed April 12, 2011].

Fischer, W.. et al., 1997. The Influence of Chloride Ions and Light on the Corrosion Behaviour of Copper Alloys in Aqueous Environments with Special Regard to Bronze Disease. In I. D. MacLeod, S. L. Pennec, & L. Robbiola, eds. *Metal 95: Proceedings of the International conference on Metals Conservation*. pp. 89–94.

Fjaestad, M., Nord, A.G. & Tronner, K., 1997. The Decay of Archaeological Copper-Alloy Artefacts in Soil. In I. D. MacLeod, S. L. Pennec, & L. Robbiola, eds. *Metal 95: Proceedings of the International conference on Metals Conservation*. pp. 32–35.

French, C., 2003. *Geoarchaeology in Action: Studies in soil micromorphology and landscape evolution*, London: Routledge.

Frink, D.S., 1984. Artifact Behaviour within the Plow Zone. *Journal of Field Archaeology*, 11(3), pp.356–363.

Gerwin, W. & Baumhauer, R., 2000. Effect of soil parameters on the corrosion of archaeological metal finds. *Geoderma*, 96, pp.63–80.

Gray, L., 2011. English Heritage launch campaign against "night hawkers" 11th February 2011. *The Telegraph*. Available at: http://www.telegraph.co.uk/earth/earthnews/8316620/English-Heritage-launch-campaign-against-night-hawkers.html [Accessed March 1, 2012].

Green, B. & Gregory, T., 1978. An initiative on the use of metal-detectors in Norfolk. *Museums Journal*, 4, pp.161–162.

Green, H.S., 1981. The first Welshman: excavations at Pontynewydd. *Antiquity*, 55, pp.184–196.

Gregory, T., 1986. Whose fault is treasure hunting? In C. Dobinson & R. Gilchrist, eds. *Archaeology, Politics and the Public*. York: York University Archaeological Publications, pp. 25–27.

Grove, B., 2005. *The Treasure Hunter's Handbook*, London: Piatkus.

Guest, P. & Wells, N., 2007. Iron Age and Roman Coins from Wales. Available at: http://ads.ahds.ac.uk/catalogue/archive/iarcw_bcs_2007/index.cfm?CFID=5098996&CFTOKEN=37196877 [Accessed April 20, 2011].

Haldenby, D. & Richards, J.D., 2010. Charting the effects of plough damage using metal detected assemblages. *Antiquity*, 84(4), pp.1151–1162.

Hales, D., Haselgrove, C. & Fitts, L., 2006. Geomagnetic surveys over cropmarks in the environs of Traprain Law, East Lothian. In R. E. Jones & L. Sharpe, eds. *Going over Old Ground: Perspectives on archaeological geophysical and geochemical survey in Scotland. Proceedings of a conference held at the Department of Archaeology, University of Glasgow, Scotland, August 2003*. British Archaeological Reports, British Series 416, pp. 67–79.

Hammond, A., 1998. The Detector Information Group. Available at: http://wood.newbury.net/dig2.html [Accessed April 12, 2011].

Haselgrove, C., 1985. Inference from Ploughsoil Artefact Samples. In C. Haselgrove, M. Millett, & I. Smith, eds. *Archaeology from the Ploughsoil: Studies in the Collection and Interpretation of Field Survey Data*. Sheffield: John R. Collis, pp. 7–29.

Hinton, D., 2010. Deserted medieval villages and the objects from them. In C. Dyer & R. Jones, eds. *Deserted Villages Revisited*. Hatfield: University of Hertfordshire Press, pp. 85–108.

Hobbs, R., 2003. *Treasure: Finding our past*, London: The British Museum Press.

Hobbs, R., Honeycombe, C. & Watkins, S., 2002. *Guide to Conservation for Metal Detectorists*, Stroud: Tempus Publishing Ltd.

Hodder, I. & Orton, C., 1976. *Spatial Analysis in Archaeology*, Cambridge: Cambridge University Press.

Hosfield, R., 1999. *The Palaeolithic of the Hampshire Basin: A regional model of hominid behaviour during the Middle Pleistocene*, British Archaeological Reports, British Series 286.

House of Lords, 1989. Museums and Galleries: Current Problems. Available at: http://hansard.millbanksystems.com/lords.

Jones, R., 2009. Manure and the Medieval Social Order. In M. J. Allen, N. Sharples, & T. O'Connor, eds. *Land and People: Papers in memory of John Evans*. Oxford: Oxbow Books, pp. 215–225.

Lewarch, D. & O'Brien, M., 1981. The Expanding Role of Surface Assemblages in Archaeological Research M. Schiffer, ed. *Advances in Archaeological Method and Theory*, 4, pp.297–342.

Lloyd, C.D., 2011. *Local Models for Spatial Analysis* 2nd ed., Florida: Taylor and Francis Group, LLC.

Lloyd, C.D., 2010. *Spatial Data Analysis: An Introduction for GIS users*, Oxford: Oxford University Press.

Lobo, J.M. & Martin-Piera, F., 2002. Searching for a Predictive Model for Species Richness of Iberian Dung Beetle Based on Spatial and Environmental Variables. *Conservation Biology*, 16(1), pp.158–173.

Loweere, A., 2012. Some GIS Analysis of Roberts and Wrathmell's Atlas of Rural Settlement in England. In *GISRUK 2012*. Available at: http://www.geos.ed.ac.uk/~gisteac/proceedingsonline/GISRUK2012/Papers/presentation-54.pdf.

Mattingly, D., 2000. Methods of collection, recording and quantification. In R. Francovich & H. Patterson, eds. *Extracting Meaning from Ploughsoil Assemblages (The Archaeology of Mediterranean Landscapes 5)*. Oxford: Oxbow Books, pp. 5–15.

Meltzer, D.J., 1986. The Clovis Paleoindian Occupation of Texas: Results of the Texas Clovis Fluted Point Survey. *Bulletin of the Texas Archaeological Society*, 57, pp.27–68.

NCMD, 2007a. Code of Conduct. Available at: http://www.ncmd.co.uk/code of conduct.htm [Accessed April 12, 2011].

NCMD, 2007b. NCMD Constitution. Available at: http://www.ncmd.co.uk/docs/constitution.pdf [Accessed April 12, 2011].

Orton, C., 2000. Book review of: Sampling in Archaeology by Clive Orton. *American Antiquity*, pp.982–982.

Oxford Archaeology, 2009. *Nighthawks and Nighthawking: Damage to Archaeological Sites in the United Kingdom and Crown Dependencies Caused by the Illegal Search for and Removal of Antiquities: Strategic Study Final Report*, Available at: http://nighthawking.thehumanjourney.net.

Palmer, N.E., 1993. Treasure Trove and Title to Discovered Antiquities. *International Journal of Cultural Property*, 2, pp.276–318.

Pett, D., 2010a. Another milestone reached. *PAS Blog*. Available at: http://finds.org.uk/blogs/centralunit/2010/07/26/another-milestone-reached/ [Accessed April 20, 2011].

Pett, D., 2011. Scheme's website wins a "Best of the Web" award. *PAS Blog*. Available at: http://finds.org.uk/news/stories/article/id/210 [Accessed April 20, 2011].

Pett, D., 2007. The Celtic Coin Index. Available at: http://www.finds.org.uk/CCI/ [Accessed April 20, 2011].

Pett, D., 2010b. The Portable Antiquities Scheme's Database: its development for research since 1998. In S. Worrell et al., eds. *A Decade of Discovery: Proceedings of the Portable Antiquities Scheme Conference 2007*. British Archaeological Reports, British Series 520, pp. 1–18.

Portable Antiquities Scheme, 2009. *Portable Antiquities and Treasure Annual Report 2007*, Department of Culture, Media and Sport.

Portable Antiquities Scheme, 2011. *Portable Antiquities and Treasure Annual Report 2008*, Department of Culture, Media and Sport.

Portable Antiquities Scheme, 1999. *Portable Antiquities Annual Report 1997-98*, Department of Culture, Media and Sport.

Portable Antiquities Scheme, 2000. *Portable Antiquities Annual Report 1998-99*, Department of Culture, Media and Sport.

Portable Antiquities Scheme, 2001. *Portable Antiquities Annual Report 1999-2000*, Department of Culture, Media and Sport.

Portable Antiquities Scheme, 2002. *Portable Antiquities Annual Report 2000-2001*, Department of Culture, Media and Sport.

Portable Antiquities Scheme, 2004. *Portable Antiquities Scheme Annual Report 2001/2 - 2002/3*, Department of Culture, Media and Sport.

Portable Antiquities Scheme, 2005. *Portable Antiquities Scheme Annual Report 2003/04*, Department of Culture, Media and Sport.

Portable Antiquities Scheme, 2006. *Portable Antiquities Scheme Annual Report 2004/05*, Department of Culture, Media and Sport.

Portable Antiquities Scheme, 2007. *Portable Antiquities Scheme Annual Report 2005/06*, Department of Culture, Media and Sport.

Portable Antiquities Scheme, 2008. *Portable Antiquities Scheme Annual Report 2006*, Department of Culture, Media and Sport.

Portable Antiquities Scheme Database, 2011. www.finds.org.uk/database.

Reynolds, P. & Schadla-Hall, R.T., 1980. Measurement of Plough Damage and the Effects of Ploughing on archaeological material. In J. Hinchcliffe & R. T. Schadla-Hall, eds. *The Past Under the Plough (Occasional Papers No. 3)*. Department of the Environment: Directorate of Ancient Monuments and Historic Buildings, pp. 114–119.

Richards, J.D., Naylor, J. & Holas-Clark, C., 2009. Anglo-Saxon Landscape and Economy: Using Portable Antiquities to study Anglo-Saxon and Viking Age England. *Internet Archaeology*, 25.

Robbins, K.J., 2012. *From Past to Present: Understanding the impact of sampling bias on the distribution of finds recorded by the Portable Antiquities Scheme*. Unpublished Thesis. University of Southampton. Available at: http://eprints.soton.ac.uk/360475/.

Roberts, B.K. & Wrathmell, S., 2000. *An Atlas of Rural Settlement in England* 2003rd ed., English Heritage, London.

Roskams, S., 2001. *Cambridge Manuals in Archaeology: Excavation*, Cambridge: Cambridge University Press.

Scharff, W. & Huesmann, I.A., 1997. Accelerated Decay of Metal Soil Finds due to Soil Pollution: First Report. In I. D. MacLeod, S. L. Pennec, & L. Robbiola, eds. *Metal 95: Proceedings of the International conference on Metals Conservation*. pp. 17–20.

Schiffer, M.B., 1987. *Formation Processes of the Archaeological Record*, Albuquerque, New Mexico: University of New Mexico Press.

Schiffer, M.B., 1996. *Formation Processes of the Archaeological Record* Press Edit., Salt Lake City: University of Utah Press.

Searcher Publications, The Searcher Magazine. *The Searcher*. Available at: http://www.thesearcher.co.uk/ [Accessed April 20, 2011].

Seebach, J., 2006. Drought or Development? Patterns of Paleoindian Site Discovery on the Great Plains of North America. *Plains Anthropologist*, 51(197), pp.71–88.

Seeman, M.F. & Prufer, O.H., 1982. An Updated Distribution of Ohio Fluted Points. *Midcontinental Journal of Archaeology*, 7, pp.155–169.

Thomas, S., 2006. Building Bridges on Tyneside. *Public Archaeology*, 5, pp.253–256.

Thomas, S., 2009. *The Relationship between Archaeologists and Metal-Detector Users in England and Wales: Impact of the Past and Implication for the Future*. University of Newcastle: Unpublished PhD Thesis. Available at: http://traffickingculture.org/publications/thomas-s-2009-the-relationships-between-archaeologists-and-metal-detector-users-in-england-and-wales-impact-of-the-past-and-implications-for-the-future-ph-d-thesis-newcastle-university/

Treasure Hunting, Treasure Hunting Website. *Treasure Hunting*. Available at: http://www.treasurehunting.co.uk/ [Accessed April 20, 2011].

UK Government, 1979. *Ancient Monuments and Archaeological Areas Act*, Available at: http://www.legislation.gov.uk/ukpga/1979/46/contents.

UK Government, 2002. *The Treasure (Designation) Order 2002*, Available at: http://www.legislation.gov.uk/uksi/2002/2666/contents/made.

UK Government, 1996. *Treasure Act 1996*, Available at: http://www.legislation.gov.uk/ukpga/1996/24/contents.

UKDFD, UK Detector Finds Database. Available at: http://www.ukdfd.co.uk/ [Accessed April 11, 2011].

Ulmschneider, K., 2000. *Markets, Minsters and Metal-Detectors: The archaeology of Middle Saxon Lincolnshire and Hampshire compared*, British Archaeological Reports, British Series 307.

Villanueva, D., 2006. *Site Research for Detectorists, Fieldwalkers and Archaeologists*, Essex: Greenlight Publishing.

Villanueva, D., 2007. *Successful Detecting Sites*, Essex: Greenlight Publishing.

Vomvyla, E., 2008. *How do metal detecting clubs (MDC) operating in England and Wales facilitate the recording work of the Portable Antiquities Scheme (PAS)?*,

Wagner, D. et al., 1997. “Soil Archive” Classification in Terms of Impacts of Conservability of Archaeological Heritage. In I. D. MacLeod, S. L. Pennec, & L. Robbiola, eds. *Metal 95: Proceedings of the International conference on Metals Conservation*. pp. 21–26.

Walton, P., 2012. *Rethinking Roman Britain: Coinage and Archaeology*, Moneta Monograph No. 137.

Webb, J., 1996. The Forgotten Art of Coin Shooting. *Treasure Hunting*, August pp, pp.38–43.

Wheatley, D. & Gillings, M., 2002. *Spatial Technology and Archaeology: The Archaeological Applications of GIS*, London: Taylor & Francis.

Wheeler, H.J., 1914. *Manures and fertilizers: a text book for college students and a work of reference*,

Whitehead, R., 1997. Distant Fields. *Treasure Hunting*, April pp, pp.31–35.

Worrell, S., 2007. Detecting the later Iron Age: A view from the Portable Antiquities Scheme. In C. Haselgrove & T. Moore, eds. *The Later Iron Age in Britain and Beyond*. Oxford: Oxbow Books, pp. 371–388.

Worrell, S. et al., 2011. The Crosby Garrett Roman Helmet. *British Archaeology*.

Yates, D. & Bradley, R., 2010. The siting of metalwork hoards in the Bronze Age of South-East England. *The Antiquaries Journal*, 90, pp.41–72.

CODE OF PRACTICE FOR RESPONSIBLE METAL-DETECTING IN ENGLAND & WALES

Endorsed by:

- *National Council of Metal Detecting*
- *Federation of Independent Detectorists*
- *Country Land and Business Association*
- *National Farmers Union*
- *Council for British Archaeology*
- *English Heritage*
- *National Museums and Galleries of Wales*
- *Museums, Libraries and Archives Council*
- *The British Museum*
- *Portable Antiquities Scheme*
- *Society of Museum Archaeologists*
- *Royal Commission for the Ancient and Historical Monuments of Wales.*

Being responsible means:

BEFORE YOU GO METAL-DETECTING:

1. Not trespassing; before you start detecting obtain permission to search from the landowner/occupier, regardless of the status, or perceived status, of the land. Remember that all land has an owner. To avoid subsequent disputes it is always advisable to get permission and agreement in writing first regarding the ownership of any finds subsequently discovered (see www.cla.org.uk or www.nfuonline.com).
2. Adhering to the laws concerning protected sites (e.g., those defined as Scheduled Monuments or Sites of Special Scientific Interest: you can obtain details of these from the landowner/occupier, Finds Liaison Officer, Historic Environment Record or at www.magic.gov.uk). Take extra care when detecting near protected sites: for example, it is not always clear where the boundaries lie on the ground.
3. You are strongly recommended to join a metal detecting club or association that encourages co-operation and responsive exchanges with other responsible heritage groups. Details of metal detecting organisations can be found at www.ncmd.co.uk or www.fid.newbury.net
4. Familiarising yourself with and following current conservation advice on the handling, care and storage of archaeological objects (see www.finds.org.uk).

WHILE YOU ARE METAL-DETECTING:

5. Wherever possible working on ground that has already been disturbed (such as ploughed land or that which has formerly been ploughed), and only within the depth of ploughing. If detecting takes place on undisturbed pasture, be careful to ensure that no damage is done to the archaeological value of the land, including earthworks.
6. Minimising any ground disturbance through the use of suitable tools and by reinstating any excavated material as neatly as possible. Endeavour not to damage stratified archaeological deposits.
7. Recording findspots as accurately as possible for all finds (i.e. to at least a one hundred square metre, using an Ordnance Survey map or hand-held Global Positioning Systems (GPS) device) whilst in the field. Bag finds individually and record the National Grid Reference (NGR) on the bag. Findspot information should not be passed on to other parties without the agreement of the landowner/occupier (see also clause 9).
8. Respecting the Country Code (leave gates and property as you find them and do not damage crops, frighten animals, or disturb ground nesting birds, and dispose properly of litter: see www.countrysideaccess.gov.uk).

AFTER YOU HAVE BEEN METAL-DETECTING:

9. Reporting any finds to the relevant landowner/occupier; and (with the agreement of the landowner/occupier) to the Portable Antiquities Scheme, so the information can pass into the local Historic Environment Record. Both the Country Land and Business Association (www.cla.org.uk) and the National Farmers Union (www.nfuonline.com) support the reporting of finds. Details of your local Finds Liaison Officer can be found at www.finds.org.uk, e-mail info@finds.org.uk or phone 020 7323 8611.
10. Abiding by the provisions of the Treasure Act and Treasure Act Code of Practice (www.finds.org.uk), wreck law (www.mcga.gov.uk) and export licensing (www.mla.gov.uk). If you need advice your local Finds Liaison Officer will be able to help you.
11. Seeking expert help if you discover something large below the ploughsoil, or a concentration of finds or unusual material, or wreck remains, and ensuring that the landowner/occupier's permission is obtained to do so. Your local Finds Liaison Officer may be able to help or will be able to advise of an appropriate person. Reporting the find does not change your rights of discovery, but will result in far more archaeological evidence being discovered.
12. Calling the police, and notifying the landowner/occupier, if you find any traces of human remains.
13. Calling the police or HM Coastguard, and notifying the landowner/occupier, if you find anything that may be a live explosive: do not use a metal-detector or mobile phone nearby as this might trigger an explosion. Do not attempt to move or interfere with any such explosives.