

Institution: University of Brighton		
Unit of Assessment: C14 Geography and Environmental Studies		
Title of case study: Enabling coexistence between humans and wild carnivores		
Period when the underpinning research was undertaken: 2006 – 2020		
Details of staff conducting the underpinning research from the submitting unit:		
Name(s):	Role(s) (e.g. job title):	Period(s) employed by submitting HEI:
Dawn Scott	Principal Lecturer (2006 – 2018), Professor of Mammal Ecology and Conservation (2018 – 2019)	2001 – 2019
Andrew Overall	Senior Lecturer (2005 – to date)	2004 – to date
Bryony Tolhurst	Senior Lecturer (2014 – to date)	2013 – to date
Maureen Berg	Senior Lecturer (2013 – 2017), Principal Lecturer (2017 – to date)	2008 – to date
Period when the claimed impact occurred: 2013 – 2020		
Is this case study continued from a case study submitted in 2014? N		
1. Summary of the impact		
<p>University of Brighton (UoB) research has developed an empirically informed understanding of human-carnivore relationships and promoted coexistence between humans and wild carnivores in Africa and the UK. This has led to changes in the management of human-wildlife interactions by individual landowners (South Africa, UK), wildlife reserves (South Africa), conservation agencies (RSPCA) and government bodies (DEFRA). Interpretation of wildlife distribution and density data has driven global (IUCN) and national (South Africa, UK) reassessments of species conservation and management policies, and underpinned UK-wide rabies contingency planning. Through the co-design and delivery of research-led content for the BBC's longest-running television natural history series, UoB researchers have changed broadcast media practices, popularised the concept of urban ecology and transformed how the public engage with citizen science, reaching 3,000,000 viewers per episode.</p>		
2. Underpinning research		
<p>Research by UoB has tackled both biogeographical and methodological questions in the context of human-carnivore conflict; these include the factors influencing the distribution and abundance of mammalian carnivore populations over time, the causes of changes in populations, and the outcomes of management practices. New protocols developed at UoB have determined carnivore relative abundance, density and distribution, at regional and national scales, in rural and urban areas, and within protected and unprotected sites. These protocols have combined traditional mapping and survey methods with citizen science via media engagement to provide a holistic solution to human-wildlife conflict.</p>		
2.1 Determining the distribution and abundance of carnivores		
<p>UoB researchers have been working in human-modified landscapes in South Africa since 2006 and in the UK since 2012. In South Africa, opposing agendas of livestock and game farming versus wildlife tourism present major challenges for both conservation and human-wildlife coexistence. The UoB team collaborated with private- and government-owned nature reserves, national and international NGOs, and c.500 individuals to fill regional knowledge gaps on carnivore distribution and abundance. The research considered priorities for human-carnivore conflict mitigation, including international conservation assessments. Researchers combined landscape-scale sign surveys and remote camera 'trapping' to assess carnivore abundance, used subsequently to populate new distribution maps for the 104,882 km² North West Province. Surveys and interviews with c.100 landowners identified causes of conflict and solutions for conflict mitigation. Results showed that brown hyaena (<i>Parahyaena brunnea</i>) occurred 57% more frequently in protected areas than on ranch land and that a partner organisation (the Pilanesberg National Park) harbours one of the world's highest densities of this species. The findings identified unprotected areas as target sites for conservation programmes and allowed species-specific conservation priorities to be established [reference 3.1].</p>		

UK-based research has focused on determining the distribution and abundance of wild carnivores in urban environments. Urbanisation is detrimental to many wild mammal carnivores, yet some thrive in towns and cities. This can result in conflict with humans arising from nuisance factors and zoonotic/veterinary disease transmission, with negative impacts on wild carnivore welfare and human wellbeing. Prior to UoB research, up-to-date information on UK urban carnivore distributions was limited. Further, there were few data on how humans affect wild animal welfare in cities, and urban ecology in mainstream media focused on nuisance or disease risk factors. The main cause of this data gap was the challenge of collecting field data at regional or national scales in the fragmented matrix of privately- and publicly-owned land present in towns and cities. UoB researchers confronted this challenge by developing a citizen science project linked to broadcasts on a major terrestrial television channel (Channel 4) in 2012. Four 1-hour programmes entitled *Foxes Live: Wild in the City* were aired, each including a call for the public to submit sightings of urban foxes to a website ([Foxes Live: Wild in the City | Channel 4](#)). This generated 17,500 records in a 3-week period, with the data used to determine urban red fox distribution on a national scale [3.2]. From 2013 to 2015, further urban fox data were collected through a combination of citizen science observations (again via media engagement; see section 4.3) and field surveys. These data were mapped digitally to determine fox abundance in eight UK cities, with the method also adapted to other species (eg Eurasian badgers) [3.3].

2.2 Identifying human-carnivore conflict and enabling coexistence

In South Africa, human persecution of wild carnivores is widespread, including through both lethal and non-lethal control. Prior to UoB research, however, little information existed on the drivers of persecution or its impacts on carnivore populations. The UoB team conducted semi-structured interviews with farmers and landowners in North West Province, identifying cultural group as the most important determinant of negative attitudes towards carnivores. Results showed that socio-economic factors interact with cultural belief systems to affect persecution, and that the success of conflict resolution programmes is greater where positive attitudes towards carnivores are fostered [3.4]. Between 2013 and 2016, investigations of specific carnivore populations found that management interventions affected behaviour, abundance and consequent genetic structuring of those populations, such that lethal control is likely to be an ineffective practice for reducing carnivore depredation of livestock or game species of economic interest [3.5].

In the UK, sick or injured wildlife are often taken into rehabilitation centres before being released. However, the effect of captivity on animal behaviour and long-term survival is disputed. Working with the RSPCA, the UoB team researched the impact of rehabilitation on urban foxes (2012 – 14) and on hedgehogs during winter (2010 – 14). Findings showed that temporary captivity of urban foxes can cause behavioural disruption and territory displacement and, in turn, affect survival [3.6], and that over-winter survival of hedgehogs is not improved by rehabilitation [3.7].

3. References to the research

- [3.1] Thorn, M., Green, M., Keith, M., Marnewick, K., Bateman, P. W., Cameron, E. Z., Scott, D. M., (2011). Large-scale distribution patterns of carnivore populations in northern South Africa: implications for conservation and management. *Oryx* 4, 579-586 <https://doi.org/10.1017/S0030605311000123>. [Quality validation: peer-reviewed publication in international conservation journal].
- [3.2] Scott, D. M., Berg, M., Tolhurst, B., Chauvenet, A., Smith, G., Neaves, K., Lochhead, J., Baker, P., (2014). Changes in the distribution of red foxes (*Vulpes vulpes*) in urban areas in Great Britain: Findings and limitations of a media-driven nationwide survey. *PLoS ONE* 9, article e99059 <https://doi.org/10.1371/journal.pone.0099059>. [Quality validation: peer-reviewed publication in international multidisciplinary journal].
- [3.3] Scott, D. M., Baker, R., Charman, N., Karlsson, H., Yarnell, R., Mill, A., Smith, G., Tolhurst, B., (2018). A citizen science-based survey method for estimating the density of urban carnivores. *PLoS ONE* 13, article e0197445 <https://doi.org/10.1371/journal.pone.0197445>. [Quality validation: peer-reviewed publication in international multidisciplinary journal].
- [3.4] Thorn, M., Green, M., Dalerum, F., Bateman, P. W., Scott, D. M. (2012). What drives human-carnivore conflict in the North West Province of South Africa. *Biological Conservation*

150, 23-32 <https://doi.org/10.1016/j.biocon.2012.02.017>. [Quality validation: peer-reviewed publication in international conservation journal].

[3.5] James, R., Scott, D. M., Yarnell, R., Overall, A., (2017). Food availability and population structure: How do clumped and abundant sources of carrion affect the genetic diversity of the black-backed jackal? *Journal of Zoology* 301, 184-192 <https://doi.org/10.1111/jzo.12407>. [Quality validation: peer-reviewed publication in international zoology journal].

[3.6] Tolhurst, B., Grogan, A., Hughes, H., Scott, D. M., (2016). Effects of temporary captivity on ranging behaviour in urban red foxes (*Vulpes vulpes*). *Applied Animal Behaviour Science* 181,182-190 <https://doi.org/10.1016/j.applanim.2016.05.004>. [Quality validation: peer-reviewed publication in international zoology journal].

[3.7] Yarnell, R., Surgey, J., Grogan, A., Thompson, R., Davies, K., Kimborough, C., Scott, D. M., (2019). Should rehabilitated hedgehogs be released in winter? A comparison of survival, nest use and weight changes in wild and rescued animals. *European Journal of Wildlife Research* 65, 6 <https://doi.org/10.1007/s10344-018-1244-4>. [Quality validation: peer-reviewed publication in international conservation journal].

Key research grants

Dawn Scott [PI], Earthwatch Institute funding (2006 – 2015): 'South Africa's Brown Hyenas' (2006 –2015; GBP416,981) and 'Urban Mammals' (2013 – 2014; GBP8,819).

Total funding: GBP425,800.

4. Details of the impact

Working in collaboration with landowners, government agencies and NGOs, UoB researchers have enabled decision-makers to prescribe key conservation, land and species management actions, and enabled co-existence between wild carnivores and people at local, regional and national scales. UoB research has boosted skills, opportunities and economic development in South Africa. Dissemination of new knowledge to the UK public through high-profile television broadcasts that include active citizen science engagement methods has both changed media practices and increased public understanding of (and coexistence with) urban wild carnivores.

4.1 Driving conservation assessments and national wildlife management plans

UoB data on the distribution and abundance of six species of carnivore in North West Province (South Africa) have contributed to conservation assessments for the International Union for Conservation of Nature (IUCN) global Red List, the most comprehensive information source on the conservation status of animals and plant species. The Red List is used to inform decisions taken under Multilateral Environmental Agreements and to calculate the Red List Index, one of the biodiversity indicators used by the Convention on Biological Diversity to monitor progress towards biodiversity targets. The data used to highlight the brown hyaena (2014), cheetah (*Acinonyx jubatus*, 2014) and leopard (*Panthera pardus*, 2015) as either vulnerable to, or near-threatened with, extinction on the Red List relies on multiple citations from UoB-led projects as evidence. These species are now recognised as a global conservation concern [source 5.1].

In addition to underpinning IUCN assessments, UoB research has informed regional Red Lists – critical in identifying extinction threats at a regional level before they become a global issue. The *Red List of Mammals of South Africa, Lesotho and Swaziland 2016*, funded by the South African government and the Endangered Wildlife Trust, cites UoB research in the conservation assessments for cheetah and leopard (classed as vulnerable), and black-backed jackal (*Canis mesomelas*), caracal (*Caracal caracal*) and brown hyaena (all classed as near-threatened) [5.2]. Data on brown hyaena have also been shared with the IUCN Hyaena Working Group to develop their conservation recommendations for reserves in South Africa, Botswana and Namibia [5.3].

UoB data on red foxes have been used by DEFRA (the UK Department for Environment, Food and Rural Affairs) to update contingency plans for the emergence of serious zoonotic diseases. Red foxes are considered the primary wildlife host for rabies in the UK, making fox abundance and distribution data critical components of response plans. In urban planning, foxes were largely regarded as a southern English phenomenon. However, as a result of sharing UoB red fox distribution and density data with DEFRA's Animal and Plant Health Agency, contingency plans will be implemented in eight additional urban areas in northern England and Scotland in

the event of a rabies outbreak [5.4]. The same data are included in the 2018 *Review of the Population and Conservation Status of British Mammals* [5.5], a key resource used by UK policy- and decision-makers in mammal conservation and management.

4.2 Shaping carnivore management practices and boosting regional development

In North West Province (South Africa), UoB data were collected in collaboration with the Chief Ecologist at Pilanesberg National Park (PNP) and the owners of Mankwe Wildlife Reserve (MWR), who manage land containing approximately 2,000 animals across 53 individual species. Regular dialogue with these stakeholders helped prioritise responses to UoB data via modification of their site management plans. For example, in response to UoB findings on the territorial behaviour of black-backed jackal, MWR ceased their practice of culling the animal, thereby enabling jackal numbers to increase with no negative effects on the Reserve. Other private landowners have also ceased culling activities [5.3]. In response to UoB data highlighting the presence and importance of brown hyaena on their land, MWR have added hyaena den searches into their regular anti-poaching patrols, with any active dens now subject to intensive anti-poaching monitoring (eg snare removal) [5.3].

Earthwatch-funded projects led by UoB in collaboration with MWR and PNP (2006 – 16) have yielded significant revenue, legacy and research capacity in North West Province. The projects involved 48 teams of volunteers (>500 in total) from >20 countries, contributing 76,000 hours of voluntary assistance. Financial inputs from the projects were GBP420,000, providing income for PNP, MWR, local suppliers and craftspeople. At MWR alone, income from researcher, volunteer and student visits comprised approximately 25% of annual revenue, enabling the recruitment of 5 new staff members and purchase of 4 vehicles and scientific equipment to aid conservation efforts [5.3]. The sustained UoB-MWR partnership led to the award of a UBS African Scientist Programme fellowship to the Reserve, which has helped build research capacity. Findings on human attitudes to carnivores, causes of conflict and threats to carnivore populations have been used by MWR to direct their educational outreach programmes (2006-16), including over 30 conservation days, talks and safari tours involving >2,000 local school children aged 8-18 [5.3].

In the UK, UoB research has shifted practice on the use of temporary captivity in rehabilitation centres as the default management action for sick or injured wildlife. The RSPCA, for example, have used UoB evidence to confirm that their protocol of treating and releasing the hundreds of hedgehogs admitted each winter had no detrimental effect on animal survival. This approach had been criticised by hedgehog charities who believed that the animals should be kept indoors all winter before release. RSPCA guidance, shared with national hedgehog conservation groups, now states that any hedgehog brought in over winter should be released once treated [5.6]. The co-benefits of this approach are that the overall costs of rehabilitation (GBP150 per animal for over-winter care; British Hedgehog Preservation Society, 2020) are reduced, whilst the increased capacity to treat other sick or injured wildlife promotes greater survival rates. The RSPCA has also used UoB evidence of post-release fox movement behaviour, including recommendations on monitoring, as a key step forward in science-informed practice for rehabilitation [5.6].

4.3 Changing public discourse on urban ecology and media engagement with the public

Since 2012, Professor Dawn Scott's regular television, radio and magazine content on urban mammals has brought the concept of urban ecology into public discourse, with her sustained input into the content and delivery of wildlife-related programming benefitting researchers, broadcasters and the public [5.7-5.9]. Since *Foxes Live: Wild in the City* in 2012, she has worked in partnership with the BBC on eight series of the BAFTA award-winning *Autumnwatch* (2013, 2014, 2017), *Springwatch* (2014, 2017, 2018) and *Winterwatch* (2014, 2018) plus their sister programmes *Unsprung* and *Extra* [5.7]. These broadcasts combined UoB research findings and new citizen science data with wildlife footage (including viewer-generated content in later series) to provide unique insights into the behaviour of urban foxes, badgers, hedgehogs and other species. Scott's contributions to *Springwatch*, *Autumnwatch* and *Winterwatch* were seen by, on average, 3,000,000 viewers per show and, according to the series' producer, were "unprecedented in their depth". In his view, her inputs have "...helped lift the series beyond entertainment and [...] led to urban ecology being taken more seriously by the viewing public" [5.7].

The scale of Scott's work with broadcasters has shaped public perceptions of, and promoted co-existence with, urban wild carnivores, particularly those with negative stereotypes such as foxes [5.7]. This has been achieved through her co-development with the BBC of distinctive and accessible research-driven content that has enabled the public to develop informed views about individual species. UoB-led research conducted as part of *Winterwatch* and *Springwatch* in 2014, for example, showed that approximately 50% of urban fox food was anthropogenic and the rest came from wild sources. According to naturalist Chris Packham, presenter of the series, this finding "*helped to change particular beliefs about these animals as we came to realise that urban foxes are not entirely dependent on people.*" As Packham states further: "*Dawn's visible research methods on the show helped to deliver a toolkit for viewers to make their own decisions*" [5.8].

Mobilising the media in this way has altered the relationship between broadcasters and the UK public, such that citizens are no longer passive viewers but active participants in knowledge generation. Evidence of the scale of public engagement can be seen from 2017 when, as part of UoB-led research into the impact of providing food for urban wildlife, a recruitment drive on *Springwatch* resulted in 700 video submissions of interactions between mammals in private gardens. The viewer-generated footage provided content for subsequent shows [5.7]. According to Packham, the combination of ecological research expertise and citizen science-generated data provided by Scott has helped realise his aims for the series – to engage and inform audiences through research-led content: "*Involving the audience [...] in data collection, tracking, and reporting sightings in their own areas made the research representative of the audience itself*". As his testimonial confirms, Scott's sustained contributions to *Springwatch*, *Autumnwatch* and *Winterwatch*, including content design, delivery and research-led public engagement, have changed the way that the series' developers and presenters engage with their audiences [5.8].

5. Sources to corroborate the impact

[5.1] Citation of research in the Bibliography of the IUCN Red List of threatened species for Cheetah, Leopard, Serval, Caracal, and Brown Hyaena [all URLs accessed 18 January 2021].

[5.2] Citation of research in the Bibliography of 2016 Mammal Red List of South Africa, Lesotho and Swaziland for Cheetah, Black-Backed Jackal, Brown Hyaena, Leopard, Serval and Caracal. [all URLs accessed 18 January 2021].

[5.3] Testimonial from Mankwe Wildlife Reserve, covering changes to management plans, landowner behaviour and carnivore populations, plus economic and educational benefits.

[5.4] Testimonial from the Animal and Plant Health Agency, covering input into UK-wide rabies contingency planning and citing research published as 3.2 and 3.3.

[5.5] Mathews F, Kubasiewicz LM, Gurnell J, Harrower CA, McDonald RA, Shore RF (2018) *A review of the population and conservation status of British mammals. A report by the Mammal Society*. Natural England, Peterborough. ISBN 978-1-78354-494-3.

<http://publications.naturalengland.org.uk/publication/5636785878597632> [Accessed 18 January 2021] Scott et al cited pp. 233, 238 and in the acknowledgements (D. Scott, expert consultation).

[5.6] Testimonial from the RSPCA, covering UoB input into UK rehabilitation practice for red foxes and hedgehogs.

[5.7] Testimonial from the producer of *Springwatch*, *Autumnwatch* and *Winterwatch* for the BBC, confirming the role UoB played in the changing approach to and reception of urban ecology.

[5.8] Testimonial from Chris Packham CBE (presenter of the BBC *Springwatch*, *Autumnwatch* and *Winterwatch* series since 2009), describing the significant contribution made by UoB researchers to programme content and public engagement through citizen science.

[5.9] A report on public engagement events with webpages, stories, posters and feedback including event evaluation.