Urban Biodiversity: Successes and Challenges: Human perceptions towards peri-urban deer in Central Scotland

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Red deer (*Cervus elaphus)* have been successfully breeding in the Scottish highlands for centuries, and many people have a classic association of herds of deer roaming over the vast expanding Scottish hills. However, today species such as roe deer (*Capreolus capreolus*) are increasingly being seen in and around Scotland's Central Belt, producing a very different human perception of deer than in the Scottish Highlands. Roe deer bring benefits and impacts to peri-urban areas (communities consisting of urban and rural components) within the Central Belt. It is not yet known peoples' perception towards deer in more urbanised communities, and whether they perceive deer to be beneficial to the local environment or a hindrance.

In the UK there is an estimated 316,000 red deer, 300,000 roe deer, 128,000 fallow (*Dama dama*), 128,000 muntjac (*Muntiacus reevesi*) and 26,600 sika (*Cervus nippon*) and 2100 Chinese water deer (*Hydropotes inermis*) (Mammal Society, 2012). Deer abundance for all red, roe, fallow, sika and muntjac deer species has been recorded in the Scottish Highlands for 10 consecutive years, (2000-2010) indicating deer densities to be as high as 30 per km^2 in the Perthshire area, just north of Pitlochry and in the north west area of Drumnadrochit (SNH, 2012). Furthermore the lowest deer density of 1-5 deer per km^2 stretches from Inveruglas in central Scotland to Cape Wrath in the north and from the Outer Hebrides to the west side of Banchory (SNH, 2012). Red deer were recorded throughout the Scottish Highlands, though not recorded in the Central Belt and regions to the South East of Scotland. (NBN, 2012). Roe deer are more widely distributed than red and are found throughout the whole of Scotland, except from the Shetland islands and the Outer Hebrides. (NBN, 2012). Sika deer are more widely distributed than fallow deer in Scotland, but less so than red or roe, found widely distributed in the North West Highlands of Scotland and in Central Southern Scotland (NBN, 2012). Fallow deer were recorded in over 110 10 km^2 in Scotland with a much more sparse distribution compared with red and roe deer with pockets of higher densities in the west and east central Highlands, and in South West Scotland. (NBN, 2012). Muntjac deer were noted in 15 10 km^2 regions in Scotland sparsely distributed throughout Scotland (NBN, 2012). Deer abundance in these peri-urban communities is also not well known. In order to address some of these questions Forest Research on behalf of the Deer Commission for Scotland was asked to undertake a social and ecological study to: A) Examine if deer presence was being felt in peri-urban communities by members of local communities in Central Scotland and to highlight the benefits of possible deer presence, B) Undertake an ecological study on deer density within Central Scotland ascertaining whether deer density figures tied in with peoples' experience of deer presence in their local community.

To complete both studies two case study areas were set up; Ravenscraig in the West of Central Scotland and Linlithgow in the East of Central Scotland. The two areas were chosen for their mosaic of urban and rural areas and were seen as classic peri-urban environments.

For study A, 7 focus groups were conducted in total between each case study area (6 in Ravenscraig and 1 in Linlithgow) to examine what people in the local community thought about deer in their local area, and 3 manager focus groups were conducted (2 in Ravenscraig and 1 in Linlithgow) to examine what professional deer managers thought about deer in Central Scotland. 'Deer manager' in this case refers to people who have a higher level of knowledge about deer management than the general public, and relates to professional deer stalkers, forestry officials and members of conservation groups. At each focus group a series of slides were shown to participants, and a general introduction to each slide was talked about before the group engaged with the subject. Managers and community focus group structures were identical. To further facilitate study A, a questionnaire was sent out to local community groups ranging from allotment groups, to local sports associations. The questionnaire like the focus groups asked about local deer presence in their area and asked participants to rate deer management options in response to hypothetical deer management situations. In total 415 questionnaires were sent out and 154 were returned, giving the study a successful response rate of 37%.

For study B, night time thermal imaging of deer occurred along farm road transects in each case study area using a Pilkington Lite imager. See Dandy *et al.* (2009) for full survey methods. When deer were seen through the camera, the number of deer, the co-ordinates of their position and distance from the car guestimated, and noted down. The results were then placed in a statistical programme to generate density figures.

For the social study A the participants did show that deer were in their area agreeing with the general perception that deer are using peri-urban environments:

"It's made my day when I've seen them. …. It makes all the difference…Fantastic difference..." (Community Group 1)

"..it's nice to know that they are around. It just makes people feel more natural, a more natural environment." (Community Group 7)

The general feeling from the community focus groups was that deer did exist in the community but that they were not very prevalent, perhaps this relates to the roe deer's timid nature and being mainly active very early in the morning when most people are still asleep. In no way did any community focus group think that deer were overabundant in their community.

Study A also highlighted the benefits that deer bring to their community:

"If you catch sight of the deer, it means the environment is on a high because they're in the area. And if you're not getting good ecology and good feeding grounds they just move away, you see less and less of them.. it's letting you know that the environment and the ecology in the area is really good" (Community Group 6)

As well as bringing in a human wellbeing factor, deer in the local community were seen as a sign that the environment they were living in was healthy. Therefore deer presence was an indicator of living in a healthy green community which many residents see as a positive benefit to where they live. From the questionnaire participants were asked to rank statements in accordance to their preference to the question: 'If the number of deer in the area where you lived increased, which of the following would be the most important priorities?' Participants produced the following order of statements starting with the highest priority:

1. Preventing road-traffic accidents involving deer
2. Ensuring the welfare of individual deer
3. Maintaining the cultural value of deer in Scotland
4. (Joint) Preventing deer damaging local woodlands
4. (Joint) Preventing deer damaging gardens and other vulnerable sites
6. Making a living from deer through deer-watching tourism
7. Obtaining economic income from deer through sport shooting 'stalking'

From the ranking exercise the first statement indicated that if the local deer population was to increase, preventing direct physical road traffic accidents with deer would be the highest priority. This statement being first shows that the community would like to prevent the risk of a serious accident with deer as it is the only statement which contains a serious risk to humans of having deer in the local community. No other statements perceive such a high risk to humans in particular. It could be seen that the first statement protects humans and deer from risk. In the second statement, 'ensuring the welfare of individual deer' it shows that people in general have a high regard for deer welfare in their area, and would like to prevent harm being inflicted on local deer populations. The second statement's position correlates with the general findings from the focus groups that people enjoy seeing deer and therefore want to care for them in some way by looking after their welfare. Direct damage by deer seen in the two statements in joint 4th position shows that direct physical impacts by deer were not of a high concern for residents. Least concern was the statement relating to obtaining economic gain from a local deer population via sport shooting. This correlates with results from the focus groups that sport shooting was mainly only done in the Scottish Highlands and wouldn't be an activity by people in Central Scotland. A comment from the focus group was:

"I couldn't see them [tourists] coming here and saying 'while we are in Motherwell and Lanarkshire, we'll go and see deer'. But I would think they might think that way if they were heading for the Glencoe area for instance or above Stirling…" (Community Group 1)

Therefore it is perceived that no economic value would be practically obtained by local people if deer were sport hunted in their local community.

From study B it was found that deer in Linlithgow had a deer density estimate of 0.9km^2 in open areas and 0.8 km^{-2} in forested areas. Ravenscraig had a deer density estimate of 3.3km^{-2} in forested areas and 1.4 km^{-2} in open areas. These density estimates are rough estimates as not all transects could be done due to access issues in 2009, but the vast majority were completed. Furthermore the estimates were taken from driving along farm roads at night and it can be assumed that not every deer can be seen from farm road positions. Roe deer were distinguished from other deer by their small to mid size and by the fact that they were seen in groups of about 2 or 3 individuals. The thermal imaging camera only showed a bright silouhette of deer so it was reliant on the observer to fully determine if the deer seen was roe. However local knowledge and experience of using the thermal imaging camera before helped to reduce identification bias. The results however show that deer densities are relatively low for both case study areas and show that Ravenscraig has a higher deer density than Linlithgow, and could be due to the Ravenscraig site having a higher sampling intensity with 188 km^2 sampled compared to 88 km^2 in Linlithgow. (This was in part due to snowfall preventing more sampling being undertaken in

Linlithgow at time of survey). Overall the densities for each case study are in agreement with focus group findings that deer exist in the community but are not very commonly seen by residents.

The study shows through thermal imaging surveys, questionnaires and via focus groups that roe deer are penetrating into peri-urban environments within Central Scotland and this is the first study of its kind in Scotland. The density of deer is low in comparison to mean deer densities in the Scottish highlands that may be as great as $30km^{-2}$ (SNH, 2012), but the landscape and deer species (red deer) being different are contributing factors for this difference. The study also highlights the respect the general public have for deer, and the benefit deer have to the wellbeing of humans within peri-urban environments, as with most nature species. In relation to the theme of connecting communities and nature discussed at the Glasgow Natural History Society Conference on Urban Biodiversity, there were several plans to develop green corridors in urban environments to improve connectivity of nature. Such ideas were the Integrated Habitat Networks proposed by SNH, Woodlands In And Around Towns by the Forestry Commission, Living Waters project by Froglife and the importance of bings and brownfield sites were highlighted by the University of Edinburgh and Buglife respectively. These schemes would encourage deer and other species to move into and around urban and peri-urban environments. This may help to increase peoples' perceptions that they are living in a healthy environment because their local area is supporting species such as roe deer. Increasing deer populations in peri-urban environments may raise important management issues. If deer numbers were to increase substantially impacts such as deer vehicle collisions and damage to parks and gardens will need to be addressed. However from the focus groups and questionnaire no management was deemed necessary by residents as the deer population was seen as too low to justify any current management plans. Therefore deer in peri-urban environments at this moment in time present a positive factor if seen in local green spaces.

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