Mammalian Biology 82 (2017) 8–16

Contents lists available at ScienceDirect

Mammalian Biology

journal homepage: www.elsevier.com/locate/mambio

Original Investigation

Spatial organisation of European wildcats (*Felis silvestris silvestris*) in an agriculturally dominated landscape in Central Europe

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ARTICLE INFO

Article history:
Received 16 March 2016
Accepted 25 October 2016
Handled by Luca Corlatti
Available online 27 October 2016

Keywords:
Suboptimal habitat
Ecology
Resident
Annual home-range
Seasonal home-range

ABSTRACT

For the first time, a telemetry study of European wildcats was conducted outside heavily forested habitats, in an agriculturally-dominated landscape, which is assumed to be a suboptimal habitat in Central Europe. According to the current knowledge of morphological and genetic diagnoses all captured wildcats were purebred, without any hint of recent interbreeding. Our results confirmed the regular use of open landscape habitats also by resident individuals. Sex and age ratios of wildcats, using the open landscapes, were balanced, and one successful reproduction event was recorded. Female annual home-ranges were smaller compared to those recorded in forested habitats. Male annual home-ranges were similar in size, whereas the core areas were smaller than those recorded in adjacent forested habitats. Males had the largest home-ranges during spring and the smallest in summer, whereas females had the largest home-ranges during summer and the smallest during winter/spring. The structure of the apparently purebred population with resident individuals and a reproduction event in an open cultivated landscape may be related to the close proximity (3.5–5 km) of a wildcat core distribution area. As a consequence of our results, the potential range of the European wildcat is increased, because it may occur in agricultural landscapes where sufficient shelter is available. This should be considered in environmental impact analyses and species monitoring.

Introduction

The European wildcat (*Felis silvestris silvestris*, Schreber, 1777) was once common throughout Europe (Sunquist and Sunquist, 2002). Habitat loss and intensive hunting up to the 20th century were the main causes of a radical decline in the species. Thus, from mid till the end of the 20th century, wildcat distribution in Germany was limited to some widespread forests in low montane regions, such as Harz, Eifel, Hunsrueck and Palatinate Forest (Piechocki, 1990). In the last two decades, however, the German population has slowly recovered, and an expansion of the species' range has been observed (Birlenbach and Klar, 2009; Götz, 2015; Pott-Dörfer and Dörfer, 2007; Steyer et al., 2016). Wildcats have been reported in former habitats, such as Westerwald, Kellerwald and Kaiserstuhl (Herdtfelder et al., 2007; Schiefenhövel and Klar, 2009; Simon and Hupe, 2008). However, wildcats currently inhabit only a small part of their original area. Thus, their national and international protection remains necessary (FFH-Directive Appendix IV, Convention on the Conservation of European Wildlife and Natural Habitats [Anhang II], Red List Germany).

To date, research projects have primarily investigated genetic issues (Beaumont et al., 2001; Daniels et al., 2001; Hille et al., 2000; Kitchener et al., 2005; Pierpaoli et al., 2003; Randi et al., 2001), basic ecology (Germain et al., 2009; Götz, 2009, 2015; Hötzel et al., 2007; Jerosch et al., 2010; Klar et al., 2008; Lozano et al., 2006; Monterroso et al., 2009; Sarmento et al., 2006) or monitoring (Anile et al., 2012; Götz, 2015; Lozano et al., 2013; Steyer et al., 2013; Velli et al., 2015). However, almost nothing is known about the role of open landscapes in the space-use patterns of wildcats, including their dispersal. The wildcat is considered, in Central Europe, to be a forest species that also uses adjacent meadows but will never exceed a distance of approximately one kilometre from a forest edge (Hötzel et al., 2007; Klar et al., 2008; Mölich and Klaus, 2003; Sarmento et al., 2006; Wittmer, 2001). Nevertheless, wildcat deaths on roads in Saxony-Anhalt, located up to 7.5 km away from forested habitats (Götz and Roth, 2007), indicate the use of open landscapes. Thus, the question of how wildcats use an open cultivated landscape has to be addressed also with respect to dispersal.

Our investigation focused on wildcats living in an open cultivated landscape between two forested habitats. Our primary goal

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http://dx.doi.org/10.1016/j.mambio.2016.10.003
1616-5047/

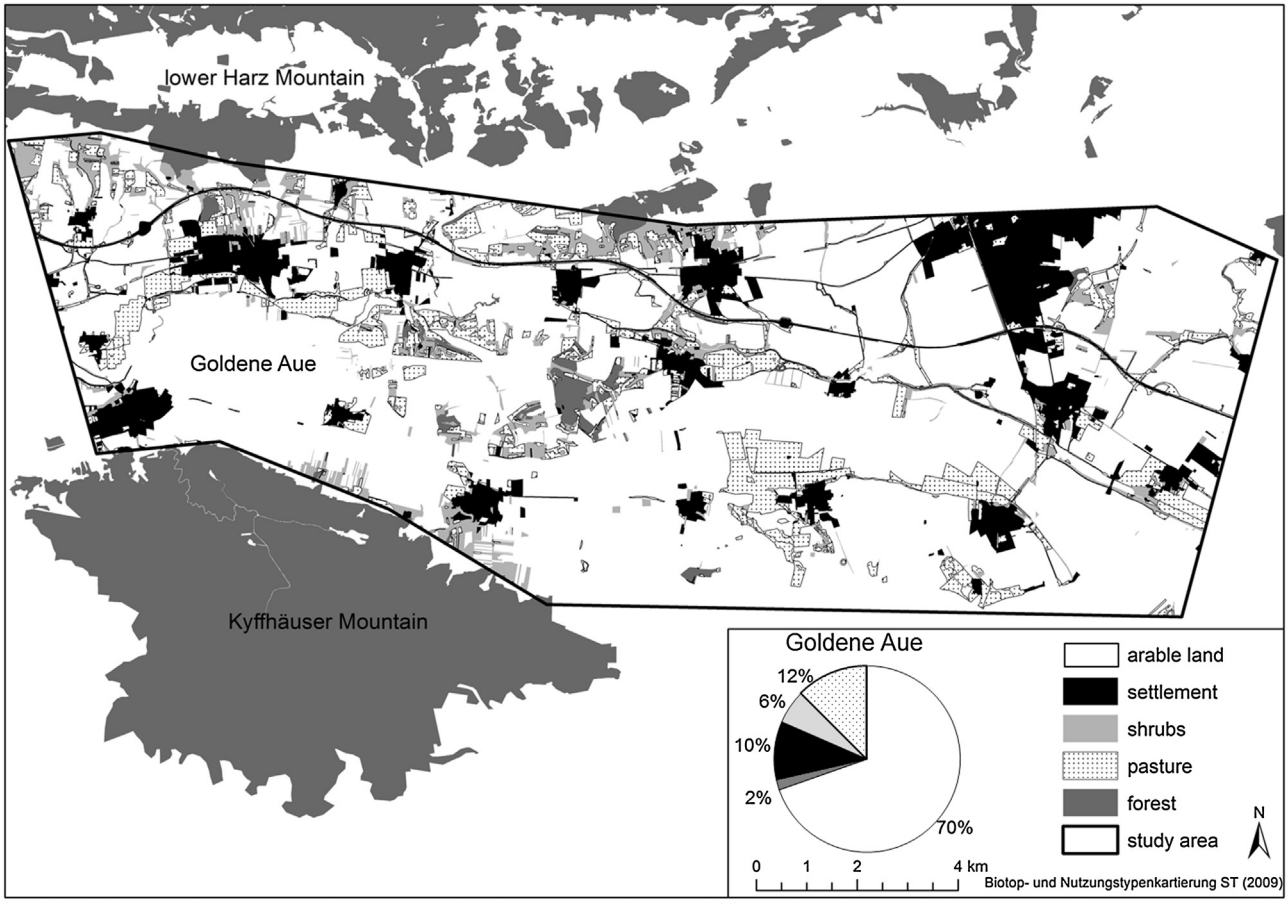

Fig. 1. Study area.

was to determine if an agricultural landscape provides a habitat for resident wildcats or if it is used only for dispersal. We collected ecological data concerning sex, age, relatedness, land tenure system and social structure.

Study area

The study area in central Germany was located in a landscape unit called "Goldene Aue", which is situated between the woodlands of the Lower Harz Mountains (Saxony-Anhalt) to the north and Kyffhäuser Mountain (Thuringia) to the south. The linear distance between these forests is 7–10 km (Fig. 1). Both woodlands have stable wildcat populations with a supposed regular exchange of individuals (Piechocki, 1990). Utilisation of the study area by wildcats was underpinned by two road kills (Jerosch et al., 2009).

The "Goldene Aue" is located at 150 m a.s.l. and is thought to be a suboptimal habitat for the European wildcat due to its intensive agricultural utilisation, which involves the cultivation of rapeseed and different cereal crops. The countryside is marked by high structural diversity, including hedges, copses and old orchards. A patch of 122 ha in the centre of the study area represents the largest forest. Overall, the proportion of forest in the study area is only 2% whereas farmland with 70% represents the dominant habitat type. The mean annual temperature is 8 °C, and the average annual precipitation is 490 mm.

Material and methods

Between 2010 and 2013, we captured wildcats in timber box traps using valerian tincture (*Valeriana officinalis*) as olfactory bait. The main trapping period was from October till March. Animals were immobilised with intramuscular injections of Domitor®, (Orion Corporation, Espoo, Finland) and Ketavet® (Parke-Davis, Berlin, Germany). As an antidote, we used Antisedan® (Orion Corporation, Espoo, Finland). While anaesthetised, a photo was taken and each wildcat was sexed, weighed, measured and genotyped using hair samples in cooperation with the Senckenberg Institute (Gelnhausen, Germany). Age classifications were based on indicators such as tooth wear, body size, pre- or post-reproductive teats of females and hind foot length. Individuals were grouped according to the age classes described by Piechocki (1990). Wildcats were fitted with individual VHF radio-collars (Wagner, Cologne, Germany, 65 g). Since 2011, we have fitted females with VHF-collars and males with GPS-collars (e-obs, Munich, Germany, 70 g). Immatures were fitted with expanding VHF-collars (Wagner, Cologne, Germany, 35 g). According to Kenward (2001), radio-collar weights were below the level of 3–5% of the body weight of collared animals.

We estimated wildcat locations by car and on foot using triangulation, as described by Kenward (2001) and White and Garrott (1990). For monitoring, we used a portable TRX-1000S receiver (Wildlife Materials, Murphysboro, IL, USA) connected to a H-antenna (HB9CV). All wildcats were localised at least once a day approximately five times per week and one to six times a night at least twice per week. The average tracking distance was 100 m. We calibrated our radio tracking every three months according to Zimmerman and Powell (1995). We used an AR8200 (AOR Ltd., Tokyo, Japan) receiver with an 8-element Yagi antenna to search for the VHF signals of the GPS-collared individuals. The GPS-collars were programmed to acquire two locations during the day and six locations at night. To download the GPS-data, we used a BaseSta-