

Original investigation

Variations in the diet and population density of the red fox *Vulpes vulpes* in the mixed woodlands of northern Belarus

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Abstract

The dietary structure and distribution patterns of red foxes *Vulpes vulpes* in situations of different food supply in the coniferous–deciduous (mostly small-leaved) woodlands of northern Belarus were investigated. A total of 1526 scats of red foxes was analysed, and snowtracking of the species was performed each winter. Abundance of the main prey (small rodents, perching birds and hares) and wild ungulates supplying carrion for red foxes in the cold season were monitored. The results suggest that in northern Belarus red foxes had a diversified diet, consisting basically of different combinations of bank voles, *Microtus* voles, and wild ungulate carrion. The importance of carrion much increased in winter, while the proportions of birds and fruits grew during the warm season. In the ecologically rich woodland harbouring on clay soil, red foxes relied more on small rodents, while carrion and fruits appeared to be more important food item of the predator in the barren forested terrain dwelling on poor sandy deposits. During *Microtus* population outbreaks, red foxes more frequently fed on this prey. One-sixth lower density of red foxes was attributable to the forested terrain on sandy deposits compared to the woodland on clay soil, and a pronounced landscape-related difference in the habitat selection by the predator was found.

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Key words: *Vulpes vulpes*, feeding ecology, population dynamics, Belarus

Introduction

Feeding habits of red foxes have been investigated in many regions of Europe including boreal coniferous forest and broad-leaved woodlands in southern parts of Europe (e.g., Englund 1965; Geptner et al. 1967; Macdonald 1977; Nasimovich and Isakov 1985; Jensen and Sequeira 1978; Goszczyński 1986; Serafini and Lovari 1993; Ferrari and Weber 1995; Jędrzejewska and Jędrzejewski 1998; O'Mahony et al. 1999). Only three studies (Sidorovich et al. 2000;

Baltrūnaitė 2001, 2002) have reported on the diet of red foxes in the extended transitional coniferous–deciduous (mostly small-leaved) forest. Food composition of red foxes in relation to prey diversity and supply was investigated in several regions of Europe (Ferrari and Weber 1995; Jędrzejewska and Jędrzejewski 1998; O'Mahony et al. 1999). Population density and distribution pattern of the red fox have also been numerically studied in Europe (e.g., Geptner et al. 1967;

Nasimovich and Isakov 1985; Weber and Meia 1996; Jędrzejewska and Jędrzejewski 1998; Heydon et al. 2000), but none relate to the transitional woodlands.

The main goal of the present study on the red fox in northern Belarus was to analyse the species diet in connection with the landscape-related, seasonal, and between-year differences in food supply as well as to reveal how these affect the predator distribution and density dynamics. The second aim was to produce data concerning the ecological niche of the red fox under the conditions of a transitional mixed forest in northern Belarus.

Material and methods

The woodlands in northern Belarus belong to the extended region of transitional forest located between the more southern deciduous (mostly broad-leaved) and the boreal coniferous forest zones of Europe. In the transitional forest, the spruce *Picea abies* and the pine *Pinus sylvestris* are only present amongst coniferous trees, and small-leaved species such as the black alder *Alnus glutinosa*, the grey alder *A. incana*, and birches *Betula pendula*, *B. pubescens* are the most common deciduous trees.

The studies were conducted in natural landscape of northern Belarus. There are rather dense river network, numerous glacial lakes, large forests and bog ecosystems on rough glacial terrain, whereas a man-made part (villages and fields) constituted only 8–14% of the landscape. The data were collected in two areas substantially differing in landscape structure. Composition of the surface ground deposits of the last glaciation resulted in considerably different carrying capacities of the habitats (Solovej et al. 2001, 2003).

The first study area, Gorodok, is situated on the upper reaches of the Lovat river (Gorodok district, Vitebsk region, NE Belarus, 55°N, 31°E) and had an area of approximately 300 km². There is much clay in the surface ground deposits, resulting in a good water supply and abundant trace elements, producing a rich soil (hereafter “clay” area). Plant communities in the “clay” area have high species diversity and productivity, and habi-

tats with high carrying capacity for herbivores dominate. Forest types, characterised by abundant and diverse vegetation (mature forests dominated by spruce, medium-aged deciduous forest consisting of grey alders, birches and aspens, and black alder swamps) made up about 51% in the landscape structure. Also, ecologically rich grassy openings, i.e. marshes and dry meadows, comprise a substantial part of the landscape (about 24%). Consequently, in the “clay” area red foxes can forage for both main groups of small rodents such as the forest rodents (the bank vole *Clethrionomys glareolus* and *Apodemus* mice) densely inhabiting the ecologically rich woodland and *Microtus* voles mostly living in open grasslands and having rather frequent (about each fourth year) population outbreaks (Sidorovich et al. 2003).

The second study area, Polotsk (Polotsk district, Vitebsk region, central north of Belarus, 55°N, 29°E), was approximately 250 km². The surface ground deposits consist of sand only (hereafter “sandy” area), with clay only in the valleys of glacial lakes and rivers. The soils of the area are very barren with poor water supply. Therefore, the woodland is dominated by pine stands with a very poor ground vegetation, comprising about 60% of the forest on dry land and 19% in raised bogs. Consequently, the species-poor micromammalian community with very low biomass attributes to the “sandy” area (Sidorovich et al. 2003).

The present studies were conducted in 1995–2003. By comparing the results obtained in both study areas, we did not use the data collected in the “sandy” area after 1999, because in the period after September 1999 a large-scale logging had started there.

A total of 1526 red fox scats was analysed from which 6694 prey individuals and other food objects (presence of fruits, seeds and herbs) were recorded. The scats were collected over a period of 8 years (1995–2002) in the “clay” area and during 5 years (1995–1999) in the “sandy” area. The gained data were divided into the cold season (November–March) and the warm season (April–October) as well as periods of *Microtus* population outbreak and crash. The scats were found on red fox tracks. Mammal identification was

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