



Biotope Distribution of The Common Fox in The Steppe Zone of Ukraine

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Abstract:

In the steppe zone, foxes use fields, meadows and steppe areas characterised by good visibility during daytime rest. A total of 37.8% of individuals were recorded in these areas, with the highest numbers on the coasts of the Dnipro (48.9%), Azov (43.3%) and Black (29.9%) Seas. In forested areas, foxes rested most often in deciduous (12.5%) and pine plantations (2.8%), while in field areas - in forest belts (6.7%), uncultivated fields (16.2%), and in orchards and vineyards (7.6%). However, the largest number of individuals (32.6%) was found in thickets of southern reeds (*Phragmites australis*) and other aquatic plants. In the Black Sea region, more than 45% of foxes spent the day in reed beds. This resulted in a high population density (26.6 ± 1.37 individuals/10 ha or 4.4 ± 0.18 per reed bed). The probability of encountering predators in such areas, which usually do not exceed 1-2 ha (49.4%), is very high - out of 231 surveyed sites, animals were absent only in 2. The location of foxes' dwellings, which they create to breed their young, is peculiar: the main number of dens (about 23%) was located on the forest margins, somewhat less - in the treeless valleys of small rivers, as well as on the banks of estuaries. In the Black Sea region, many burrows (18.5%) were found in floodplains of large rivers (Danube, Dniester, Southern Bug and Dnieper), and in the Azov region - on sea spits and islands (14.3%), as well as in numerous forest belts (11.5%). After the dust storms of 1969, many of these sites were covered with high earthen berms made of wind-blown black soil. This improved conditions for dens of all predatory animals, but especially for foxes. Already in the early 20th century in Ukraine, they began to avoid open steppes and fields, although they made holes in haystacks that had been stored for many years and used to feed sheep.

Keywords: fox, steppe zone, Ukraine, population, dynamics, structure, biotopes.

INTRODUCTION

The most numerous predators of the steppe zone are undoubtedly the common fox. Since it is less picky than other animals in choosing places to rest and feed, the geographical variability of its biotope distribution is quite high. In Germany, most foxes rest in dense shrubs and meadows (Pielowski, 1976), in Denmark - in swamps (Jensen, 1968), in the mountainous regions of Azerbaijan - in rock crevices or small grottoes (Gidayatov, 1965), in Spain - in blackberry bushes (Blanco, 1986), etc. The fox can be found anywhere: in fields, meadows, forests, gardens, and even in settlements. There are cases of repeated visits of this predator to Odesa, Zaporizhzhia, Dnipro, Lviv and other large cities, and there is nothing to say about villages. In Western Europe, urban populations of foxes have formed, which are typical for Copenhagen (Jensen, 1968), Bristol, London (Harris and Smith, 1987), Berlin (Börner u. a., 2009) and other cities. Therefore, the purpose of our research was to study the biotopic distribution of the common fox in the steppe regions of Ukraine, which are characterised by regular intensive agricultural development.

MATERIALS AND METHODS

In 1978-2014, during hunting (12.X - 22.I) in the southern districts of Zaporizhzhia and Kherson (Azov Sea), Mykolaiv and Odesa (Black Sea), northern districts of Zaporizhzhia, Dnipro, Donetsk (Dnipro) regions, more than 3000 individuals of the common fox were recorded. In most cases, the animals were taken by hunters using different hunting dogs. In the Black Sea region, these were hunting hounds, in the Azov Sea region - Foxterriers and Jagdterriers, in the Dnipro River region - Siberian huskies. In those years, the fur of 1 common fox was worth 100-150 USD, and therefore its extraction was economically very profitable for a hunter. This contributed to keeping the number and density of the predator population at a low and stable level (1-2 individuals/ 1 thousand hectares), as defined by the World Health Organisation. In addition, several tens of thousands of foxes were counted in the hunting grounds of the steppe regions of Ukraine during special surveys during the time prohibited for hunting. The collected scientific material was processed, if necessary, by regression and correlation analyses using the CSS software package (Microsoft-Corpiring). In most cases, the 95% confidence level ($P = 0.05$) was used when comparing fox population densities.

DISCUSSION

In the steppe zone, the first category includes fields, meadows and steppe areas characterised by very good visibility. In such places, foxes build their dens both on flat surfaces and on small elevations, which can be piles of stalks of various crops, earthen blocks, mounds, straw piles, etc. These animals often rest on the ground in open areas during the rut. At the time of high prices for fox fur, there was even a specialisation of hunters who used binoculars to track down animals resting in the open, carefully approach them within shooting distance and often kill them. The location of daytime fox dens in open areas is very typical for steppe reserves (Askania Nova, Chornomorskyi, Ukrainian Steppe). It is also typical for other regions, including the forest-steppe (Polushina, 1967) and forest zones, taiga and even tundra (Geptner et al., 1967). In Prydniprovya, 37.8% of foxes were recorded in fields, meadows and steppe areas (Table 1).

Table 1: Biotopic distribution of foxes in 1978-2014

Bi o t o p s	Dnieper region*		Black Sea region		Azov Sea region		Total:	
	Abs.	%	Abs.	%	Abs.	%	Abs.	%
Meadows	76	9.4	275	17.5	150	22.7	501	16.5
Reed thickets	98	12.1	737	46.9	155	23.6	990	32.6
Deciduous forests	93	11.5	221	14.0	64	9.7	378	12.5
Coniferous forests	10	1.2	58	3.7	18	2.7	86	2.8
Gardens, vineyards	109	13.5	45	2.9	77	11.7	231	7.6
Fields	194	24.1	195	12.4	103	15.7	492	16.2
Forest belts	103	12.8	41	2.6	59	9.0	203	6.7
Steppe areas	124	15.4	—	—	32	4.9	156	5.1
Total:	807	100.0	1572	100.0	658	100.0	3037	100.0

Data from: *N. Lebedeva, V. Domnich (1998)

The reason for this is the high density of their population in this region, which led to the frequent appearance of predators in field areas where animals hunt and rest. The second group of habitats chosen by foxes for daytime rest includes dense thickets of grass, woody shrubs and hygrophytes. In forest areas, foxes often rest in unspars pine saplings and bushes, in field areas - in forest belts, uncleared or abandoned fields and in gullies. However, most often the fox spends the night in reed beds (Figure 1), and then in cattails and other aquatic plants that line the banks of all steppe

rivers. According to our data, when hounds were used in studies, more than 45% of foxes in the Black Sea region rested during the day mainly in reed beds (Rozenko, 2007).



Figure 1: Reedbeds near Zaporizhzhia (A); a hunter with foxes harvested near Odesa (B)

Moreover, several animals rested in these places side by side, having come here independently of each other (Gursky, 1979). This creates a very high density of foxes in reed beds (26.6 ± 1.37 individuals/10 ha or 4.4 ± 0.18 per 1 bed with a maximum number of 17 individuals). The probability of encountering predators in such places is very high, as out of 231 surveyed plots, animals were absent in only 2! The area of such plots usually does not exceed 1-2 ha (49.4%), although, of course, foxes use larger reed beds for rest (Rozenko, 2006). It is interesting to note that in areas of frequent hunting with hunting dogs, which used to be very popular in the Ukrainian Black Sea region, foxes rarely stayed for a day in dense reed beds of less than 0.5 ha.

This selectivity is not well understood, but it is possible that it is the result of learning from the experience of animals that have survived hunting. In other regions, where animals are not disturbed much, their resting places can be not only small reed beds, but also small islands of grass in meadows and fields. The reason for the significant dynamics in the use of habitats by foxes is the large area of individual plots, which is generally characteristic of predatory animals, and the significant dispersion of individuals. For example, in Denmark, based on the tagging of almost 500 animals, it was found that during the first year of life, 85% of young females and 75% of males travelled within ~15 km of their birthplace, and 5 individuals (3 males and 2 females) were captured at a distance of 55-140 km (Jensen, 1968). Similar results were obtained in the Kyiv region, where within 1-2 years most of the tagged foxes dispersed within a radius of 15-30 km, a few within a radius of 2-5 km, and only one travelled over 120 km (Heptner et al., 1967).

In the Voronezh Reserve, out of 123 foxes, most travelled to different habitats within 1-6 km, although one young male travelled 50 km in one year (Sapelnikov 1999). In Norway, several animals migrated up to 30 km in 9 years (Lund and Munthe-Kaas, 1967). At the same time, in the United States, cases were recorded when one female moved 16 km away from the tagging site in more than 8 years (Tular, 1983), and another young female travelled 395 km in one year (Ables, 1965). However, when there is a high concentration of animal prey, the area of an individual fox's territory may be small. For example, in Central Spain, in an area with many wild rabbits and a household waste dump, the home range of an adult male fox over 7 months of observations was only 113 ha, and the length of a daily walk was ~5 km. The predator used only ~35% of the occupied territory per day (Blanco, 1986).

The territorial distribution of foxes' dens, which they create for breeding, is quite peculiar and differs significantly from the biotopic distribution of adult animals, as the majority of dens (about 23%) were located on the edges of natural forests, somewhat less in the treeless valleys of small rivers, as well as on the banks of estuaries (Table 2).

Table 2: Territorial distribution of fox burrows in 1978-2013

Bi o t o p s	Black Sea region		Azov Sea region		Total:	
	Abs.	%	Abs.	%	Abs.	%
Sea coast	31	6.4	64	14.3	95	10.2
Shores of estuaries	111	23.0	68	15.1	179	19.2
Valleys of small rivers	46	9.6	136	30.3	182	19.6
Valleys of large rivers	89	18.5	–	–	89	9.6
Deciduous forests	133	27.6	76	16.9	209	22.5
Coniferous forests	32	6.6	12	2.7	44	4.7
Gardens, vineyards	11	2,3	6	1.3	17	1.8
Fields	6	1.2	3	0.7	9	0.9
Forest belts	23	4.8	84	18.7	107	11.5
Total:	482	100.0	449	100.0	931	100.0

In the Black Sea region, many burrows (18.5%) were found in floodplains of large rivers (Danube, Dniester, Southern Bug and Dnieper), whereas in the Azov region – on sea spits and islands (14.3%), as well as in numerous forest belts (11.5%). In many of them, after the dust storms of 1969, high earth ramparts of wind–borne black soil were formed. This improved the conditions for burrowing by all species of predatory animals, but especially for foxes.

Regular use of dens as resting shelters was observed only in adult females during the breeding season and also in their pups. The latter visit their birthplaces for some time after brood separation and often hide in dens. As it is more comfortable and safe underground, this is observed both during inclement weather and very hot summer days. In winter, foxes very rarely rest in their burrows - usually in rainy or snowy weather. They are mostly avoided by predators when not needed. Fox dens can vary greatly in their structure due to the landscape features of the area and their purpose.

Both simple and complex burrows are very common, but are used in different ways. For example, in the steppe zone of Ukraine, 24.2% of the 219 burrows detected were classified as brood burrows. Of these, 1.8 % were simple straight or slightly branched tunnels, while 22.4 % were complex multi-storey structures (Table 3), covering an area of up to 130 sq m.

Table 3: Characteristics of common fox burrows (%) * 1 – brood, 2 – visited, 3 – unvisited

Study areas	n	Simple burrows			Complex burrows		
		1	2	3	1	2	3
Biryuchiy Peninsula (Sea of Azov)	101	–	25.8	24.7	18.8	19.8	10.9
Khortitsa Island (Dnieper River)	46	4.4	15.2	13.0	21.7	26.1	19.6
Deciduous forests (Zaporizhzhya region)	45	–	11.1	8.9	33.3	28.9	17.8
Kinburn Spit (Black Sea)	27	7.4	25.9	14.8	18.5	18.6	14.8
Total:	219	1.8	20.6	17.8	22.4	22.8	14.6

*Data from V. Domnich, N. Lebedeva (2000)

Complex burrows, although very common, were found with almost equal frequency in different study areas, while simple burrows were more typical of sea spits and sandy islands (Domnich and Lebedeva 2000). In the south of Ukraine, where agrocenoses dominate, quite a few adult and juvenile animals settle in straw haystacks, regardless of their location. And, of course, in the flat terrain, predators use all the ancient mounds, which are called "graves" in the south. In Odesa and Mykolaiv regions, foxes often dig burrows in gully forests, on the slopes of beams, in forest belts, in thorns, and in dams of former ponds (Gursky, 1979). In western Ukraine, they typically use ravines, gullies, valleys, hollows, gullies, karst hollows and shrubs (Polushyna, 1967). In the Mordovian Reserve, which is located in the taiga zone, foxes prefer burrows in pine forests (70%), less often in mixed forests (15%), old clearings (10%) and deciduous stands (5%) (Borodin, 1976).

The swarming activity of large rodents has a great influence on the location of fox dens. In 1975, we even found a fox litter in a burrow occupied by a family of beavers (Volokh, 1979). On the territory of Askania Nova Reserve, 62.5 % of fox dens ($n = 49$) were located in steppe marmot colonies (Dumenko, 2001). We observed many such cases in many northern districts of the Luhansk region (Fig. 2), where this rodent is quite numerous. Naturally, on the eve of birth and during the rearing of young foxes, they try not to stray far from their dwellings. Usually, during this period of life, the size of their individual territory decreases to 0.31-2.33 sq. km (Kolb, 1986), although the number of habitats visited by adult animals can be quite large. At this time, the fox population is characterised by an uneven distribution of individuals, which is associated with its sedentary lifestyle.



Figure 2: Fox cubs at the steppe marmot hole (Lugansk region, «Streltsovskaya Steppe nature reserve», 2009). Photo by A. Volokh

The distance between brood burrows in the Ukrainian steppe can reach 2.7 ± 0.14 km (Dumenko, 2001), whereas, for example, in the south of Western Siberia – 7.0 ± 0.8 km (Poleshchuk & Sidorov, 2007). Interestingly, in the latter case, the distance between dens with single animals was significantly greater (11.1 ± 2.0 km) than between brood dwellings. Occupancy of the same den by foxes occurs irregularly. It is known that in Siberia one burrow was used by these predators 1–2 and only once – 4 years in a row. Even during one reproductive period in Askania Nova Reserve,

these animals moved broods to a distance of 52.6 ± 10.3 m in 94.7% of cases, using 2.6 ± 0.22 dens (Dumenko, 2001).

In general, red foxes prefer frequent changes of dwellings, regardless of their biotopic habitat. For example, in the Azov region, burrows located on sea spits are rarely used again – within 2-3 months they crumble and become small holes. Even such very comfortable places in the steppe zone as ancient burial mounds and forest tracts are not used by foxes for burrowing every year. As early as the early 20th century, it was noted that as the steppe biota in Ukraine was transforming, the red fox began to change the places used for breeding (Brauner, 1914).

It began to avoid open steppes and fields, although it had previously willingly burrowed in haystacks that had been stored for many years and used to feed sheep. In the 1960s, this predator began to make frequent burrows in the precipices of ravines, among rocks, as well as in dense bushes and forest tracts (Formozov, 1962). Very few fox dens are now also found in fields, as all agroecosystems undergo regular structural changes. Usually, animals create dwellings in such places only in case of very high intraspecific competition, using even insignificant elevations or depressions of the ground surface for this purpose.

CONCLUSIONS

1. In the steppe zone of Ukraine the common fox most often uses reed thickets for daytime rest, and then - meadows and fields.
2. This predator prefers forested areas for making dens, although it often makes them in steppe and meadow areas located on the slopes of river valleys.
3. Despite the scarcity of dwelling sites, old burrows are rarely reused.

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