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Den Habitat Characteristics of the Red Fox (*Vulpes vulpes*) in the Czech Republic

Stanoviště a charakteristika nor lišky obecné (*Vulpes vulpes*) v České republice

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Abstract

This master thesis deals with the red fox (*Vulpes vulpes*) dens in the Czech Republic. Detailed data about den localisation, den habitat characteristics and den characteristics were gathered and analysed. In April 2010 altogether 60 dens of the red fox were localised and described, data about their use were also recorded. Registered descriptions included: shortest den distance to water source, to communication and to residential realty; slope orientation and gradient; determinant vegetation cover; soil texture class and skeleton content; ground water influence; rooting; artificiality of the substratum; den use by the red fox and other burrowing carnivores in years 2009 and 2010; den area size and finally entrance use, function, size, aspect and mouth. Determined shortest den distances to water source, to communication and to residential realty of all dens counted 165 ± 173 m, 488 ± 495 m, 877 ± 1,567 m respectively with no statistically significant differences between breeding and non-breeding dens. Most (20.0%) den areas faced southwest and least (3.3%) northwest; significant orientation preference was not detected. Mean den area reached 73 ± 84 m^2 (range 5-300 m^2). Average number of all and used entrances was 6.27 ± 5.69 (range 1-24) and 4.17 ± 3.80 respectively. Resulted characteristics of the dens can be discussed as indicator of the environment. Den distance to human caused disturbance was argued as a potential measure of habitat fragmentation. Slope orientation contradiction with other studies; wind influence on burrowing mammals could be taken as minor in czech conditions. Further it was concluded that human itself provided not purposefully the red fox indispensable amount of artificial burrowing opportunities. Analyses of the den area size and the number of used entrances found no differences between breeding and non-breeding dens contrary to other authors.

Key Words: Red Fox, *Vulpes vulpes*, den, habitat, localisation, breeding

Souhrn

Tato diplomová práce se zabývá norami lišky obecné (*Vulpes vulpes*) v České republice. Podrobná data o lokalizaci nor, o jejich chrarakteristice a popisu jejich prostředí byla shromážděna a vyhodnocena. Celkem 60 nor bylo lokalizováno a popsáno v dubnu 2010, včetně zaznamenání dat o jejich využívání. Sbírané popisy zahrnovaly: nejkratší vzdálenost nory k vodnímu zdroji, ke komunikaci a k obývané nemovitosti; orientaci a sklon svahu; určující vrstvu vegetace; půdní druh a obsah skeletu; vliv spodní vody; prokořenění; antropogennost substrátu; využití nory liškou a ostatními živočichy v letech 2009 a 2010; plocha nory a konečně charakteristiky jednotlivých vsuků – používání, funkce, velikost, orientace a vyústění. Zjištěná nejkratší vzdálenost k vodnímu zdroji, ke komunikaci a k obydlené nemovitosti činila 165 ± 173 m, 488 ± 495 m respektive 877 ± 1,567 m, ani v jednom případě nebyl zjištěn statisticky významný rozdíl ve vzdálenosti rozmnožovacích a nerozmnožovacích nor. Nejvíce (20,0 %) nor bylo exponovaných k jihozápadu a nejméně (3,3 %) k severozápadu; nebyla zjištěna preference určité orientace. Průměrná velikost nory dosahovala 73 ± 84 m^2 (rozpětí 5-300 m^2). Průměrný počet všech vsuků a používaných vsuků činil 6,27 ± 5,69 (rozpětí 1-24) respektive 4,17 ± 3,80. Výsledné charakteristiky mohou být diskutovány jako indikátory životního prostředí. Vzdálenost nory k rušivému vlivu člověka může také svědčit jako potencionální měřítko fragmentace biotopu. Výsledná orientace nory byla v rozporu s jinými studiemi; vliv větru na savce žijící v norách by v českých podmínkách mohl být považován za minoritní. Dále bylo dospěno k závěru, že člověk pro lišku sám necíleně vytvořil nezanedbatelné množství možností vytvoření nory. Analýzy velikosti nory a počtu používaných vsuků nenašly žádné významné rozdíly mezi rozmnožovacími a nerozmnožovacími norami v rozporu s jinými autory.

Klíčová slova: liška obecná, *Vulpes vulpes*, nora, biotop, lokalizace, rozmnožování

Contents

1. Introduction

The red fox (*Vulpes vulpes*) is the most common and the most known carnivore at all (ANDĚRA 1999). Out of mammals it has got second largest areal of distribution after human, it is widespread nearly all over the holarctic ecozone and Australia (WANDELER & LÜPS 1993; NOWAK 1999). Fox ranges on a vast variety of habitats; from dense forests to arctic tundra, from open steppe to farmland (ABLES 1975 in NOWAK 1999). In the Czech Republic the fox can be met almost everywhere, it got used to live even in the cities (ANDĚRA 1999).

Pivotal literature concerning den and den habiat characteristics cited in this thesis comes from the foreign authors, where the denning habits were researched in detail in past. These are especially the works of KRIM *et al.* (1990) from Maryland (USA), MEIA & WEBER (1992) from Switzerland, URAGUCHI & TAKAHASHI (1998) from Japan, MICKEVIČIUS (2002) from Lithuania, DELL´ARTE & LEONARDI (2007) from Tunisia.

Until the beginning of 21st century, most research activities of this species in the Czech Republic concentrated mainly on the rabies problems. Rabies constitues for mammals, including man, lethal virus disease, to which is the fox heavily susceptible and whose was fox the greatest carrier (MATOUCH 1987). After the disappearance of rabies in the Czech Republic with the help of oral vaccination application, arised need to closely understand population characteristics and dynamics and habitat characteristics of this carnivore in the game management context. The complex research of this species should also acknowledge the rapid increase of the population density in the Czech Republic in the past few decades.

This master thesis aims to concern on the research demand described above particularly by exploring den characteristics and localisation and den habitat characteristics of the red fox in the Czech Republic. The objectives of this thesis are particularly: determination of nearest den distance to water source, to communication and to residential realty; characteristics about den area – its size, exposure, inclination, vegetation cover, soil texture and skeleton content, ground water and rooting influence, artificiality of a den substratum; information about den use by the red fox and by other carnivorous species in the year of description and yesteryear; data concerning number of entrances, their use,

function, size and orientation and finaly discuss differences in these characteristics between breeding and non-breeding dens.

2. Literature Review

The aim of this chapter is to generally characterize the red fox. The focus is particularly on informations concerning den habitat characteristics.

2.1 Taxonomic Classification

According to present scientific nomenclature (WOZENCRAFT 2005) the red fox (*Vulpes vulpes*) is classified as follows:
Kingdom: *Animalia*
Phylum: *Chordata*
Subphylum: *Vertebrata*
Class: *Mammalia*
Subclass: *Theria*
Superorder: *Placentalia*
Order: *Carnivora* (Bowdich 1821)
Suborder: *Caniformia* (Kretzoi 1938)
Family: *Canidae* (Fischer 1817)
Genus: *Vulpes* (Frisch 1775)
Species: *Vulpes vulpes* – Red Fox (Linnaeus 1758)

The red fox is the most common and the most known species among the genus *Vulpes* (LARIVIÈRE & PASITSCHNIAK-ARTS 1996; NOWAK 1999) and even probably among the family *Canidae* at all (ANDĚRA 1999). *Vulpes vulpes* together with *V. bengalensis*, *V. cana*, *V. chama*, *V. corsac*, *V. ferrilata*, *V. lagopus*, *V. macrotis*, *V. pallida*, *V. rueppellii*, *V. velox* and *V. zerda* belongs to overall 12 species of the genus *Vulpes* (WOZENCRAFT 2005). North American fox (*Vulpes fulva*) formerly classified separately, is nowadays described only as one of more subspecies of holarctic species *V. vulpes* (VOIGT 1987 in FORSBERG 1990; NOWAK 1999). Compared to european red foxes the North American´s are smaller and more diverse in coat colouring, the standard shade is usually lighter (ANDĚRA 1999). The list of all 44 subspecies *V. vulpes* made e.g. LARIVIÈRE & PASITSCHNIAK-ARTS (1996). European red fox (*Vulpes vulpes crucigera*), the subspecies of the red fox (*V. vulpes*) ranges on the extensive part of European continent and its natural

range includes also the territory of the Czech Republic (ANDĚRA 1999). Consequently this thesis describes living features of this subspecies.

2.2 Description

2.2.1 General Characteristics

The red fox (*Vulpes vulpes*) is a relatively small slender canid with an elongated muzzle and round bushy tail (STROGANOV 1969 in LARIVIÈRE & PASITSCHNIAK-ARTS 1996; HALL 1981 in LARIVIÈRE & PASITSCHNIAK-ARTS 1996). The skeletal structure and the skull resemble that of a small slender dog (LARIVIÈRE & PASITSCHNIAK-ARTS 1996; HERZ 2003). Very voluble ears have triangular shape (HERZ 2003). Red foxes have long slender legs, relatively small feet, eyes moderate in size and eliptical pupils (JACKSON 1961 in LARIVIÈRE & PASITSCHNIAK-ARTS 1996; BANFIELD 1987 in LARIVIÈRE & PASITSCHNIAK-ARTS 1996). The forefoot and hindfoot have five and four toes respectively, each with long nonretractile claws (SAMUEL & NELSON 1982 in LARIVIÈRE & PASITSCHNIAK-ARTS 1996). The red fox belongs among the plantigrades, the ratio between the lenght of the forefoot and hindfoot is 1.0:0.8. There is no distinct sexual dimorphism at first sight not even in fur coloration, so the sex identification of free ranging animals in open landscape is difficult (HERZ 2003).

The animals are agile and can occasionally reach the speed up to 48 km/h, jump even two meters high and are good swimmers (JACKSON 1961 in LARIVIÈRE & PASITSCHNIAK-ARTS 1996; HALTENORTH & ROTH 1968 in NOWAK 1999; ANDĚRA 1999; HERZ 2003), and even able to climb a tree (SKLEPKOVYCH 1994 in LARIVIÈRE & PASITSCHNIAK-ARTS 1996). The sight, hearing and smell are very well developed out of the sense organs (NOWAK 1999).

2.2.2 Morphometric Characteristics

The red fox shows wide individual, seasonal and geographical variation in size (WANDELER & LÜPS 1993; LARIVIÈRE & PASITSCHNIAK-ARTS 1996) among approximately three to fourteen kilograms (NOWAK 1999), males are in average larger than females (LARIVIÈRE & PASITSCHNIAK-ARTS 1996). The heaviest male from Norway weighing 14.9 kg cite HAVRÁNEK & BUKOVJAN (2000). Measured weights from Germany state

WANDELER & LÜPS (1993): adult males weighed in average 5.5-7.5 kg (interval 4.0-9.5 kg) and adult females 5.0-6.5 kg (interval 4.5-8.0 kg).

Lenght of head and body in adults can range from 455 to 900 mm (NOWAK 1999); average values for adult animals from Germany ranges in interval 650-750 mm over the males and 620-680 mm over the females (WANDELER & LÜPS 1993). Relatively long tail is as long as about 70% of head and body lenght (VOIGT 1987 in LARIVIÈRE & PASITSCHNIAK-ARTS 1996), ie. 300-555 mm (NOWAK 1999). The lenght of the tail by the adult animals from Germany reached 350-450 mm over the males and 300-420 mm over the females, lenght of the hindfoot ranged among 150-170 mm and 140-160 mm and lenght of the ear among 90-105 mm and 85-100 mm respectively (WANDELER & LÜPS 1993). Height at withers is approximately 400 mm (ANDĚRA 1999); LABHARDT (1990 in HERZ 2003) cites 381 ± 45 mm in average for males and 349 ± 43 mm for females older than nine months. Skull measurements of adult males and females respectively shows e.g. WANDELER & LÜPS (1993): total lenght ♂ 135-160 mm, ♀ 115-150 mm; zygomatic breadth ♂ 64-90 mm, ♀ 61-86 mm.

2.2.3 Anatomical Characteristics

The red fox have 7 cervical, 13 thoracic, 7 lumbar, 3 sacral and 20-23 caudal vertebrae and 9 pairs of true and 4 pairs of false ribs (HERZ 2003). The weight of skeleton does 7-8% of the total body weight (HAVRÁNEK & BUKOVJAN 2000). Males have penis bone (baculum, os penis), that hardens the free end of penis – glans (ČERVENÝ & PIKULA 2008). It attains the lenght to 50 mm by the young males (up to one year) and 51-57 mm by the older ones (HAVRÁNEK & BUKOVJAN 2000). It has got the „v“ letter shape turned upside down on the cross-section, the urethra leads through the stria. The lenght and weight of the penis bone can help as an auxiliary indicator while determining the age of the individual (ČERVENÝ & PIKULA 2008).

The skull of the red fox is relatively long and slender, flattened with narrow neurocranium. It is generally difficult to differentiate skull of the fox and of the dog (*Canis familiaris*) of the same body size; the skull of the fox is only characterized by the „finer“ frontal and temporal bones (HERZ 2003). The set of teeth is concerning number and shape best similar to the set of teeth of dog and wolf. Complete permanent set of teeth numbers 42 teeth – both in right and left half of upper jaw grow three incisors, one canine, four

premolars and two molars; in lower jaw there is the same number of teeth as in the upper except for molars – there are on both sides three. Permanent dental formula is: I 3/3, C 1/1, P 4/4, M 2/3. Deciduous set teeth misses first premolars and all molars – that is why it has got only 28 teeth; dental formula of the deciduous teeth looks like: i 3/3, c 1/1, p 3/3 (ČERVENÝ & PIKULA 2007). Teeth of fox are often used to determine the age of the individual (e.g. ČERVENÝ & PIKULA 2007; ROULICHOVÁ & ANDĚRA 2007).

LESSMAN (1971 in WANDELER & LÜPS 1993) concerned in detail with the weight of single organs of foxes in Denmark, according to his results, male weighing 6.5 kg and female weighing 5.5 kg have average weight of lungs 0.766 and 0.688 kg, heart 0.687 and 0.552 kg, kidneys 0.422 and 0.374 kg, liver 1.356 and 1.352 kg respectively and spleen 0.181 kg. Weight of fresh skin after stripping amounts in average 12-13% of the total body weight (LÜPS unpublished in WANDELER & LÜPS 1993).

Red foxes have a 2 cm long subcaudal gland on the upper portion of the tail that gives off a „foxy" odour (LARIVIÈRE & PASITSCHNIAK-ARTS 1996; HERZ 2003). This gland is located approximately in position of seventh caudal vertebra and has got violet colour (WANDELER & LÜPS 1993; HERZ 2003). The function of this gland is not known, but it may be used in individual recognition (SAMUEL & NELSON 1982 in LARIVIÈRE & PASITSCHNIAK-ARTS 1996). It probably plays important role during the mating season (ZIMA 1953). The red fox use also the urine and excrements for marking beyond the scent glands (MACDONALD & BARRETT 1993; HERZ 2003).

The outer fur of the red fox is long and silky. The underfur is long and thick, gray at the base and buff towards the tips (BANFIELD 1987 in LARIVIÈRE & PASITSCHNIAK-ARTS 1996). HAVRÁNEK & BUKOVJAN (2000) indicates that winter hair has on 1 cm^2 of skin 67 guard hairs and 100 hair of underfur. The pelt is at its prime (i.e. long and dense guard hairs and dense underfur) in the beginning of December (VOIGT 1987 in LARIVIÈRE & PASITSCHNIAK-ARTS 1996). Moulting runs through only once a year, in April and May the underfur is released and long witer hair is replaced by short summer fur. Winter fur then starts to grow at the end of summer when denser and longer hair grow (HAVRÁNEK & BUKOVJAN 2000), because of that the animals in winter fur looks more massive (HERZ 2003). There is no seasonal variation in colour (LARIVIÈRE & PASITSCHNIAK-ARTS 1996).

Three color morphs of the red fox have been identified: red, silver or black and cross (VOIGT 1987 in FORSBERG 1990; JOHNSON & HERSTEINSSON 1993

in LARIVIÈRE & PASITSCHNIAK-ARTS 1996). Cross and silver (black) morphs are rare, but in some regions can represent up to 25 respectively 10% of the population (NOWAK 1999). There can be found individuals with albinism in the red fox population and even abnormal individuals missing guard hair those have inter alia also other morphological and ethological distinctions (so called Samson foxes; VOIPIO 1990 in NOWAK 1999; MACDONALD & BARRETT 1993).

In the typical red fox, yellow to reddish-brown tones predominate in the upper body; cheeks, chin, throat and abdomen are white; face and rump are rusty; legs and ear tips are black and the tail with distinctive white tip is mixed profusely with black (JACKSON 1961 in LARIVIÈRE & PASITSCHNIAK-ARTS 1996). The cross morph is coloured reddish-brown; its name got after the cross which is created by one black line going through the middle of the back and one black line that goes across the first one through the shoulder. The colour of the silver (black) morph, which fur most valuable, ranges from strong silver to even black. Overall colour effect depends on the proportion of white hair or white-tipped black hair (NOWAK 1999). By the particular understanding of inheritance many other colour morphs were bred (NES *et al*. 1987 in FORSBERG 1990).

2.3 Distribution

2.3.1 Natural Range

Vulpes vulpes is the second most spread mammal after *Homo sapiens*, concerning the size of the distribution areal (see Fig. 1, WANDELER & LÜPS 1993; NOWAK 1999). The red fox is wide-spread nearly over the whole Old World, from the coast of Arctic Ocean to North Africa (to northern border of Sahara desert), southern part of Arabian Peninsula, central India, northern Indo-china, China, Corea, Japan and Kamchatka, it is missing in the northern Siberia (WANDELER & LÜPS 1993; LARIVIÈRE & PASITSCHNIAK-ARTS 1996; HAVRÁNEK & BUKOVJAN 2000). Concerning Europe, it is missing in Iceland, Crete, Malta and other smaller islands. The fox is also distributed in North America, where southern most edge of its areal reaches north coast of Gulf of Mexico (WANDELER & LÜPS 1993). Red foxes were brought to Australia in 1868 and have spread over much of the continent (ELLERMAN & MORRISON-SCOTT 1966 in LARIVIÈRE & PASITSCHNIAK-ARTS 1996; CORBET & HILL 1980 in LARIVIÈRE & PASITSCHNIAK-ARTS 1996; VOIGT 1987 in

LARIVIÈRE & PASITSCHNIAK-ARTS 1996; WOZENCRAFT 1993 in LARIVIÈRE & PASITSCHNIAK-ARTS 1996), on the contrary not introduced to the New Zealand (LLOYD 1980b in WANDELER & LÜPS 1993).

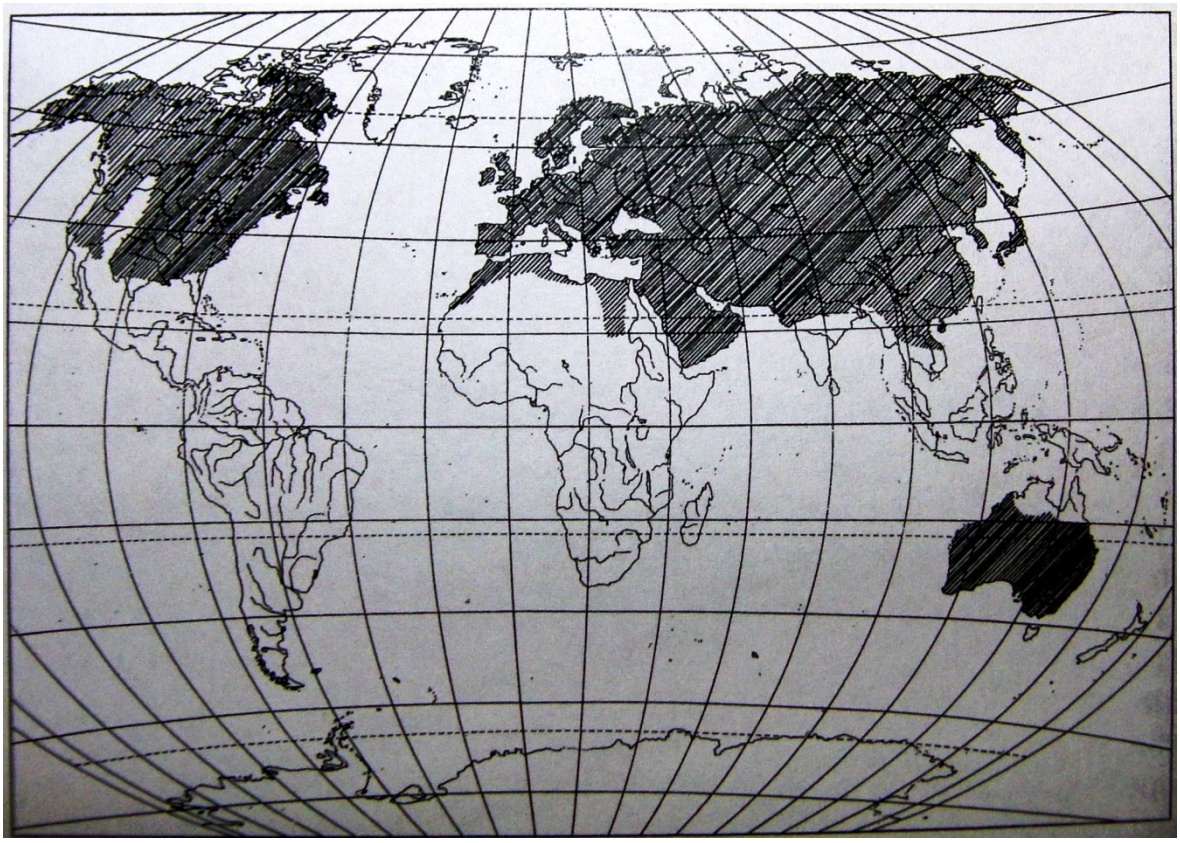


Fig. 1. Range of the red fox in the world (WANDELER & LÜPS 1993).

2.3.2 Environmental Conditions

The red fox is extremely adaptable species (GOSZCZYNSKI 1995 in TRYJANOWSKI *et al.* 2002) and it ranges on wide variety of biotopes, from continuous forests to arctic tundra, open steppe and agricultural land, however it evidently preffers regions with diverse vegetation and avoids vast monotonous areas (ABLES 1975 in NOWAK 1999). As a rule, foxes are most abundant in mixed, heterogeneous, fragmented or discontinuous habitats (ABLES 1975 in CAVALLINI & LOVARI 1994; LLOYD 1975 in CAVALLINI & LOVARI 1994), and select mosaic or shrub areas over homogeneous forests or open areas (JONES & THEBERGE 1982 in CAVALLINI & LOVARI 1994; NAKAZANO 1989 in CAVALLINI & LOVARI 1994). However interference competition by other canids may change this pattern (THEBERGE & WEDELES 1989 in CAVALLINI & LOVARI 1994). The red fox in its areal

always avoids central tundra, in mountains, fox can be seen up to the line of permanent snow (HAVRÁNEK & BUKOVJAN 2000), it can be in some areas up to 4,500 m a.s.l. (HALTENORTH & ROTH 1968 in NOWAK 1999).

The red fox can be seen almost everywhere in the Czech Republic, it is so adaptable that it got used to live even in cities (ANDĚRA 1999). In urban areas, red foxes are more abundant in residential suburbs and less abundant in industrial and commercial areas (HARRIS & RAYNER 1986 in LARIVIÈRE & PASITSCHNIAK-ARTS 1996). Prey availability seems to be the most important factor affecting habitat use (JONES & THEBERGE 1982 in LARIVIÈRE & PASITSCHNIAK-ARTS 1996; HALPIN & BISSONETTE 1988 in LARIVIÈRE & PASITSCHNIAK-ARTS 1996; PHILLIPS & CATLING 1991 in LARIVIÈRE & PASITSCHNIAK-ARTS 1996).

2.3.3 Den and Den Habitat Characteristics

Dens are used by the red fox (*Vulpes vulpes*) for two different activities – as resting sites during the non-active period (non-breeding dens) and as sites for giving birth and rearing cubs (breeding dens) (TEMBROCK 1957 in JEPPESEN *et al.* 2000; HENRY 1986 & 1996 in JEPPESEN *et al.* 2000; MEIA & WEBER 1992). Foxes are central-place foragers using den site as the place where they bring up their prey during both breeding and non-breeding periods (TRYJANOWSKI *et al.* 2002; LINDSTROM 1994 in DELL´ARTE & LEONARDI 2007; CARTER & FINN 1999 in DELL´ARTE & LEONARDI 2007). Fox dens often have several entrances, according to NOWAK (1999) 1-19 entrances, and one or more chambers (WANDELER & LÜPS 1993). If the number of entrances is taken as an evidence of the den size, than it was found a predominance of small dens with up to 5 entrances (70.7% in Bernese uplands, Switzerland, FUCHS 1973 in WANDELER & LÜPS 1993; 73% in Hakel region, Germany, STUBBE 1965 in WANDELER & LÜPS 1993). Dens with more than 30 entrances are rare (WANDELER & LÜPS 1993). Both small (BEHRENDT 1955 in WANDELER & LÜPS 1993; HARRIS 1977a in WANDELER & LÜPS 1993) and also bigger (STUBBE 1974 in WANDELER & LÜPS 1993) burrows can be used as breeding dens. Some dens are used in many years sequence by several fox generations (NOWAK 1999; HERZ 2003).

The main entrance is usually 40 cm high and the tunnel can be up to 22.5 m long (SHELDON 1950 in LARIVIÈRE & PASITSCHNIAK-ARTS 1996) and the main chamber lies usually 1 to 3 m under ground (NOWAK 1999). Inside the main chamber, the temperature

never drops below zero and air humidity edges 100 % (HERZ 2003). Fox often takes advantage of inaccessible rock fissures, gullies, root balls of windfalls and tree roots, but it is able to skillfully utilize even man made environments such as straw piles, causeways, culverts of the non functional sewage, drainage and irrigation system, ruins and waste dumps (WANDELER 1968 in WANDELER & LÜPS 1993; HARRIS 1977a in WANDELER & LÜPS 1993; HERZ 2003; SÝKORA 2004). Most red fox dens are found in sandy soils – soils of very high permeability (SHELDON 1950 in LARIVIÈRE & PASITSCHNIAK-ARTS 1996; BORODIN 1976 in MICKEVIČIUS 2002; MICKEVIČIUS 2002). Concerning den habitat cover some authors state that the red fox prefer habitats providing cover (NIELSEN 1989 in MICKEVIČIUS 2002; MICKEVIČIUS 2002), while others cite that most dens are found in open landscape such as pastures or open farmland (SARGEANT 1972 in LARIVIÈRE & PASITSCHNIAK-ARTS 1996; HEWSON 1986; TRYJANOWSKI *et al.* 2002). TRYJANOWSKI (2000 in TRYJANOWSKI *et al.* 2002) reports a change in den localization during 1990s in Poland from mid-field afforested areas to open arable fields.

European badger dens are frequently used, possibly extended and sometimes dwelled together with badger (BEHRENDT 1955 in WANDELER & LÜPS 1993; GOETHE 1955 in WANDELER & LÜPS 1993; BURROWS 1968 in WANDELER & LÜPS 1993; WANDELER 1968 in WANDELER & LÜPS 1993; STUBBE 1974 in WANDELER & LÜPS 1993; MEIA & WEBER 1992; ANDĚRA 1999; HERZ 2003). Co-inhabitation with raccoon dog was also reported (KOWALCZYK *et al.* 2008). Also burrows dug by other animals can be used and extended by fox (e.g. wild rabbit holes, BEHRENDT 1955 in WANDELER & LÜPS 1993; BURROWS 1968 in WANDELER & LÜPS 1993; or marmot, *Marmota baibacina*, holes in Kazakhstan, STRAUTMAN & BEKENOV 1982 in WANDELER & LÜPS 1993). In areas with favourable soil conditions (deep soil; STUBBE 1965 in WANDELER & LÜPS 1993), and if not enough other shelters are available, the fox digs its own burrows by digging with the front legs (WANDELER & LÜPS 1993).

MEIA & WEBER (1992) found density of regularly used dens of the red fox in Switzerland to be 1.88 per km^2, for breeding dens 0.33 per km^2. The den density certainly depends on fox density but also on the possibility for digging (MEIA & WEBER 1992). The question of breeding dens is important because it could provide useful information about a fox population, i.e. absolute number of foxes, recruitment and level of urbanization (HEWSON 1986; MEIA & WEBER 1992; VOS 1995). However, the estimation of fox density

is difficult because the number of foxes in an area also depends on the social organization of the fox population (MEIA & WEBER 1992).

2.4 Nutriment

NOWAK (1999) cites the daily fox consumption in interval 0.5-1.0 kg, MACDONALD & BARRETT (1993) 0.5 kg (120 kcal), HERZ (2003) 0.35-0.5 kg and up to 0.7 kg of feed per lactating female. From the point of view of fox nutrition in the Czech Republic, one fox consumes approximately 240 kg of feed per year and out of it is at least 180 kg of animal origin . Acoording to conditions where the fox lives, the amount of small game reaches up to 50 kg per year, in smaller amout is also represented the ungulate game (BABIČKA & DIVIŠ 2000). Captive adults require 2.3 kg of prey per week, while pups aged 5-8 weeks, 9-12 weeks and pups in the post-denning period (> 12 weeks old) require 1.4, 1.9, 2.5 kg of prey per week respectively (SARGEANT 1978 in LARIVIÈRE & PASITSCHNIAK-ARTS 1996).

The red fox has a varied diet (SCOTT 1943 in LARIVIÈRE & PASITSCHNIAK-ARTS 1996), it depends on the prey species availability, on natural conditions, population density of foxes and season of the year (HAVRÁNEK & BUKOVJAN 2000). It can be generaly stated, that the red fox is omnivorous animal (NOWAK 1999) and that feed of animal origin usually prevails (HERZ 2003).

Basic and essential part of the nutriment, both in volume and numbers, is represented by rodents, predominantly by voles and mice (ENGLUND 1965a,b in WANDELER & LÜPS 1993; FORBES & LANCE 1976 in WANDELER & LÜPS 1993; HRUŠKA 1998; PINTÍŘ *et al.* 2000; HERZ 2003). Hares and rabbits are also important prey animals (ENGLUND 1970). Fox is also significant predator of roe deer – it chases young roe kids and attenuate individuals in hardship periods (BABIČKA & DIVIŠ 2000), but contrary to it HOLZKNECHT (1999 in PINTÍŘ *et al.* 2000) cites, that fox does not have grand influence on the roe deer abundance. Out of other ungulate game species, red fox can only occasionally kill chamois and mouflon kid or the piglet of wild boar, namely only in a short time after thier birth (BABIČKA & DIVIŠ 2000).

Carrion may be seasonally or locally important (HEWSON 1983 in LARIVIÈRE & PASITSCHNIAK-ARTS 1996; PINTÍŘ *et al.* 2000). Galliformes are the most important group of birds consumed (SEQUERIA 1980 in LARIVIÈRE & PASITSCHNIAK-ARTS 1996), whereas

individuals of passeriformes, columbiformes, anseriformes are only occasionally eaten (KOLB & HEWSON 1979 in LARIVIÈRE & PASITSCHNIAK-ARTS 1996; SARGEANT *et al.* 1984 in LARIVIÈRE & PASITSCHNIAK-ARTS 1996; HENRY 1986 in LARIVIÈRE & PASITSCHNIAK-ARTS 1996). In certain areas, the red fox is an important predator of nesting birds and their eggs (SARGEANT *et al*. 1984 in LARIVIÈRE & PASITSCHNIAK-ARTS 1996; SOUTHERN *et al*. 1985 in LARIVIÈRE & PASITSCHNIAK-ARTS 1996).

Other nutriment sources that can be locally or seasonally important are: fish, amphibians, reptiles, insects, slugs (GREEN & OSBORNE 1981 in LARIVIÈRE & PASITSCHNIAK-ARTS 1996; LUCHERINI & CREMA 1994 in LARIVIÈRE & PASITSCHNIAK-ARTS 1996; ANDĚRA 1999; BABIČKA & DIVIŠ 2000; PINTÍŘ *et al.* 2000; HERZ 2003), hedgehogs (MACDONALD & BARRETT 1993), earthworms (*Lumbricus terrestris*) (MACDONALD 1980b in LARIVIÈRE & PASITSCHNIAK-ARTS 1996; HERZ 2003), forest fruits (SERAFINI, & LOVARI 1993 in LARIVIÈRE & PASITSCHNIAK-ARTS 1996; LOVARI *et al*. 1994 in LARIVIÈRE & PASITSCHNIAK-ARTS 1996; BABIČKA & DIVIŠ 2000; HERZ 2003), even sunflower (*Helianthus* sp.) seeds (SARGEANT *et al*. 1986 in LARIVIÈRE & PASITSCHNIAK-ARTS 1996), maize and oats (HERZ 2003), Juniper (*Juniperus oxycedras*) berries (CAVALLINI & LOVARI 1991) and Balsam fir (*Abies balsamea*) cones (SKLEPKOVYCH 1994 in LARIVIÈRE & PASITSCHNIAK-ARTS 1996), furthermore domestic rabbits and poultry (HERZ 2003), lambs (MCILROY *et al.* 2001) and garbage (DONCASTER *et al*. 1990 in LARIVIÈRE & PASITSCHNIAK-ARTS 1996; HERZ 2003). The red fox also chases shrews and moles but usually does not eat them (MACDONALD & BARRETT 1993).

When consuming bigger prey, fox consumes entrails at first, then trunk and other parts. The rest of the prey, which the fox is not able to consume, is earthed. The lenght of the digestive system is very short (ratio between lenght of body to lenght of digestive system only 1:6), that is why the feed passes through very quickly (excretion after 6-8 hours after consuming) and there is no bacterial digestion (HERZ 2003). Red fox is able to cause considerable damages in intensive small game breeding, on the other hand it is very helpful when selecting weak individuals of prey population and by decreasing numbers of mice and voles (ZABLOUDIL *et al.* 2000). In many cases the red fox is the most important predator in farmland areas (GOSZCZYNSKI 1985 in TRYJANOWSKI *et al.* 2002; NEWTON 1998 in TRYJANOWSKI *et al.* 2002; TRYJANOWSKI 2000 in TRYJANOWSKI *et al.* 2002).

2.5 Reproduction

Red fox is monestrous animal ie. female has oestrus once a year (KOSTROŇ 1955; MCINTOSH 1963 in LARIVIÈRE & PASITSCHNIAK-ARTS 1996; SKŘIVAN 1976; RYAN 1976 in LARIVIÈRE & PASITSCHNIAK-ARTS 1996; BOUE *et al.* 2000; HAVRÁNEK & BUKOVJAN 2000). In temperate environments, red foxes breed from December through April, although most matings occur in January and February (SKŘIVAN 1976; STORM *et al*. 1976 in LARIVIÈRE & PASITSCHNIAK-ARTS 1996; MACDONALD 1980a in LARIVIÈRE & PASITSCHNIAK-ARTS 1996; ALLEN 1984 in LARIVIÈRE & PASITSCHNIAK-ARTS 1996; MATĚJŮ 2009), namely in the Old World and North America (ABLES 1975 in NOWAK 1999; STORM *et al*. 1976 in NOWAK 1999). In Australia, breeding occurs between June and October (RYAN 1976 in LARIVIÈRE & PASITSCHNIAK-ARTS 1996).

Males have active sperm already during their first year of life (ZAPATA *et al.* 1998). Ejaculate compose of three fractions, sperm form 1-2 ml, that amounted 200-500 million sperms by foxes in captivity. Sperm density is lower and morphological defects are more frequent in males during their first mating season (JALKANEN 1992c in FARSTAD 1998). Testicles undergo seasonal changes in size (JOFFRE J. & JOFFRE M. 1973; MATĚJŮ 2009), they reach volume peak right before the mating season (FARSTAD 1998). Testicle size of yearlings is lower in average then of older males (CAVALLINI & SANTINI 1996).

Females enter reproduction usually during their first year of life (ALLEN 1984 in LARIVIÈRE & PASITSCHNIAK-ARTS 1996), however a part of them do not mature enough to breed successfully. Females are fertile up to 6-10 years of age (SKŘIVAN 1976). The ratio of reproducing females is yearly and locally various (LLOYD 1968 in WANDELER & LÜPS 1993; ENGLUND 1970; LLOYD *et al*. 1976 in WANDELER & LÜPS 1993; HARRIS 1979 in WANDELER & LÜPS 1993). Factors like prey availability and presence of more females in the social unit may inhibit pregnancy (HARRIS 1979 in LARIVIÈRE & PASITSCHNIAK-ARTS 1996; MACDONALD & BARRETT 1993).

Duration of copulation averages 26 minutes, but ranges from 1 to 67 minutes (PEARSON & BASSETT 1946 in LARIVIÈRE & PASITSCHNIAK-ARTS 1996). Litter size ranges from one to 14 (SKŘIVAN 1976; VOIGT 1987 in LARIVIÈRE & PASITSCHNIAK-ARTS 1996; WANDELER & LÜPS 1993; HAVRÁNEK & BUKOVJAN 2000; HERZ 2003). The average litter size documented in the Czech Republic was 5.48 ± 1.73 cub per female (span 2-11; n =

174) (MATĚJŮ 2009). Mean litter size in red foxes can be determined using counts of corpora lutea (LAYNE & MCKEON 1956 in LARIVIÈRE & PASITSCHNIAK-ARTS 1996), placental scars (ENGLUND 1970; HARRIS 1979 in LARIVIÈRE & PASITSCHNIAK-ARTS 1996; ALLEN 1983 in LARIVIÈRE & PASITSCHNIAK-ARTS 1996) and embryos (ENGLUND 1970; ALLEN 1983 in LARIVIÈRE & PASITSCHNIAK-ARTS 1996) by dissection of dead foxes or by instant cubs observation in the den vicinity (ZAPATA *et al.* 1998; BERGHOUT 2000). Communal denning (TULLAR *et al*. 1976 in LARIVIÈRE & PASITSCHNIAK-ARTS 1996; TULLAR & BERCHIELLI 1980 in LARIVIÈRE & PASITSCHNIAK-ARTS 1996) may explain the abnormally high number of pups observed ocasionally (HOLCOMB 1965 in LARIVIÈRE & PASITSCHNIAK-ARTS 1996; PILS & MARTIN 1978 in NOWAK 1999).

Litter size correlates positively with prey availability (ZABEL & TAGGART 1989; GOSZCZYNSKI 1989a in LARIVIÈRE & PASITSCHNIAK-ARTS 1996; MACDONALD & BARRETT 1993) and with age of females – yearlings produce lesser litters than older ones (SKŘIVAN 1976; HARRIS 1979 in LARIVIÈRE & PASITSCHNIAK-ARTS 1996; ALLEN 1984 in LARIVIÈRE & PASITSCHNIAK-ARTS 1996; VOS 1994 in LARIVIÈRE & PASITSCHNIAK-ARTS 1996; MCILROY *et al.* 2001). CAVALLINI & SANTINI (1996) proved that litter size is higher at heavier females.

2.6 Ontogeny

2.6.1. Prenatal Period

Ova are fertilized with sperm in the oviducts, from where the fertilized ova descend down to the bicornuate uterus (HERZ 2003), which they enter at the 14-16 cell stage, 4-6 days after mating (JALKANEN 1992a in FARSTAD 1998; BOUE *et al.* 2000). Morulae are found on days 6-7, expanded blastocysts on days 9-10 and hatching blastocysts on days 11-12. Implantation (embryo adhesion to the wall of uterus) occurs 16-18 days after mating (JALKANEN 1992a in FARSTAD 1998; BOUE *et al.* 2000). BOUE *et al.* (2000) documented amniotic sac 6 mm in diameter 18th day, the embryonic mass appeared at 20th day and the fetus was visible at 22nd day after mating. Fetuses are usually randomly placed in both uterine horns (FAIRLEY 1970 in WANDELER & LÜPS 1993; ANSORGE 1990 in WANDELER & LÜPS 1993). Parturition occurs generally after a gestation period of 51-53 days, with possible range 48-56 days – extreme cases are very occasional (KOSTROŇ 1955; SKŘIVAN

1976; VOIGT 1987 in LARIVIÈRE & PASITSCHNIAK-ARTS 1996; WANDELER & LÜPS 1993; NOWAK 1999; ZABLOUDIL *et al.* 2000; HERZ 2003).

2.6.2 Postnatal Period

Fox cubs are born blind and with closed auditory canals in the den, they are fully dependent on the parent female – so called altricial cubs (WANDELER & LÜPS 1993; SKŘIVAN 1976). The weight of newborn pups vary between 50-180 g (NAAKTGEBOREN 1965 in WANDELER & LÜPS 1993; STORM & ABLES 1966 in WANDELER & LÜPS 1993; KOLB & HEWSON 1980b in WANDELER & LÜPS 1993; SKŘIVAN 1976; NOWAK 1999; HAVRÁNEK & BUKOVJAN 2000). Mean body mass of four newborn females and three males from Illinois, USA, was 105.2 g and 117.8 g, respectively. Average total lenght, lenght of tail, lenght of hindfoot and lenght of ear of the same litter were 211, 67, 32 and 13 mm, respectively (STORM & ABLES 1966 in LARIVIÈRE & PASITSCHNIAK-ARTS 1996). Coat color of newborn foxes is dark grey and the inner and distal portions of legs are lighter. The feet are whittish-brown with creamy-white footpads and toenails (STORM & ABLES 1966 in LARIVIÈRE & PASITSCHNIAK-ARTS 1996; SARGEANT *et al*. 1981 in LARIVIÈRE & PASITSCHNIAK-ARTS 1996).

The female helps intestinal peristalsis of cubs by licking their tummies during the first days after the birth (SKŘIVAN 1976). The diet of the cubs compose only of milk for the first three weeks (HAVRÁNEK & BUKOVJAN 2000), females have usually 4-5 pairs of mammary glands (milk contnet: 8-9% proteins, 8-12% fats, 3-4% sugars a 1% mineral substances) (SKŘIVAN 1976). Cubs are fed additionally with meat firstly in 20-24 days (WANDELER & LÜPS 1993; HAVRÁNEK & BUKOVJAN 2000), initially it has the form of digested pellets (HERZ 2003). Lactation lasts c. 5 weeks and weaning occurs gradually (HENRY 1986 in LARIVIÈRE & PASITSCHNIAK-ARTS 1996). If the fox family is disturbed (by human, cattle etc.), the cubs can be removed by its parents to another den (according to e.g. MEIA & WEBER 1992 or TAKEUCHI & KOGANEZAWA 1992).

Pelage of young foxes changes from grayish-brown at birth to pale buff at 8-14 days of age and to red at 9-14 weeks of age (LINHART 1968 in LARIVIÈRE & PASITSCHNIAK-ARTS 1996; SARGEANT *et al*. 1981 in LARIVIÈRE & PASITSCHNIAK-ARTS 1996). Cubs are able to see and hear in 9-21 days of age (STORM & ABLES 1966 in LARIVIÈRE & PASITSCHNIAK-ARTS 1996; LINHART 1968 in LARIVIÈRE & PASITSCHNIAK-

ARTS 1996; SKŘIVAN 1976; NOWAK 1999). Pups are able to walk after three weeks (LINHART 1968 in LARIVIÈRE & PASITSCHNIAK-ARTS 1996; WANDELER & LÜPS 1993) and in 4-5 weeks they first appear outside the den (NOWAK 1999).

Deciduous teeth eruption appears at the age of 14-18 days, incisors erupt at first, then canines and finally premolars, theirs growth usually finishes at the age of one month. Permanent teeth eruption starts at 3 ½ month of age, first grow incisors and premolars, molars appear 1-2 weeks later. Permanent canines erupt at the end of 4th and in the half of 5th month of cubs age. Permanent teeth eruption finishes with the growth of third molars in the lower jaw, they appear at the age of 5½-6½ month and the growth ends at the age of 6-7 months (ČERVENÝ & PIKULA 2007).

Young foxes are almost indistinguishable from adults in open landscape at the age of 6 months (MACDONALD & BARRETT 1993). Red foxes become sexually mature between 9th and 12th month of life (SKŘIVAN 1976; WANDELER & LÜPS 1993). However, sperm can appear in epididymides at already 6 months of age (LLOYD & ENGLUND 1973 in WANDELER & LÜPS 1993). First ovulation comes approximately at the age of 10½ month during the first mating season, between the half of January to the end of February (WANDELER & LÜPS 1993).

2.7 Behaviour

Red foxes are mostly nocturnal (ABLES 1969 in LARIVIÈRE & PASITSCHNIAK-ARTS 1996; TRAVAINI *et al*. 1993 in LARIVIÈRE & PASITSCHNIAK-ARTS 1996; WEBER *et al*. 1994 in LARIVIÈRE & PASITSCHNIAK-ARTS 1996; NOWAK 1999). When undisturbed, they are more active also during the day (MACDONALD & BARRETT 1993). Their activity pattern overlaps with that of their principal prey (ABLES 1969 in LARIVIÈRE & PASITSCHNIAK-ARTS 1996; LOVARI *et al*. 1994 in LARIVIÈRE & PASITSCHNIAK-ARTS 1996). The activity itself is influenced by seasonality, foxes are more active during the day in winter unlike in summer (HAVRÁNEK & BUKOVJAN 2000). Females may exhibit increased activity during the day while rearing young (PHILLIPS & CATLING 1991 in LARIVIÈRE, PASITSCHNIAK-ARTS 1996).

Red foxes are highly mobile, often covering daily distances longer than 10 km (VOIGT 1987 in LARIVIÈRE & PASITSCHNIAK-ARTS 1996; GOSZCZYNSKI 1989b in LARIVIÈRE & PASITSCHNIAK-ARTS 1996). MATOUCH (1987) cites that with clinical phase

of rabies the frequency of fox movements increases and that kinetic activity often overlap home range. Daytime is spent in regular rest areas (STORM 1965 in LARIVIÈRE & PASITSCHNIAK-ARTS 1996), for this purpose foxes select above-ground rest sites (particularly out mating season; MACDONALD & BARRETT 1993) or may use underground burrows (MEIA & WEBER 1992).

During the mating season foxes often resound with barking or with the sound similar to voice of peacock (HERZ 2003). Before mating season, it is possible to see increased activity of male, that runs around the female smell it and tries to mate, but the female still resist and escape. Sometimes the animals jump against each other, stand on the hindfeet and so called „dance foxtrot", this phase lasts 3-8 days, sometimes even longer (SKŘIVAN 1976). Own mating season is characterized with female readiness to mate – it slightly crouch forefeet, raise back up, slide the tail off, to make mating easier, and mate willingly (SKŘIVAN 1976; HERZ 2003). The female accept the male only during two to three days, when oestrum takes time (BOUE *et al.* 2000). Red foxes mate in dens early in the morning (HAVRÁNEK & BUKOVJAN 2000; ZABLOUDIL *et al.* 2000). After mating, male usually remains in the near of female and share care of youngs (HAVRÁNEK & BUKOVJAN 2000). Female can mate with more males (red foxes have multiple mating) (HALTENORTH & ROTH 1968 in NOWAK 1999; ABLES 1975 in CAVALLINI & SANTINI 1996; NIEWOLD 1980 in CAVALLINI & SANTINI 1996; LLOYD & HEWSON 1986 in CAVALLINI & SANTINI 1996).

Female drag up fur around mammary glands, few days before parturition, and prepare lair for youngs (SKŘIVAN 1976; HERZ 2003). During parturition female helps itself by taking suitable position – hunching and pulling cubs out and releasing them from amniotic sac (SKŘIVAN 1976; HERZ 2003). Parturition itself lasts 1-6 hours, placenta is then eaten by vixen (KOSTROŇ 1955; SKŘIVAN 1976; HAVRÁNEK & BUKOVJAN 2000; HERZ 2003). Lactation starts immediately after or eventually during the parturition (HERZ 2003). Female remains in the very near of the den in the period short before and few weeks after parturition. Male brings it the feed but never enters the den (NOWAK 1999).

The basic social unit of the red fox is monogamous pair. The dog-fox provides parental care and the male-female association lasts until cubs are reared (MACDONALD 1979 in LARIVIÈRE & PASITSCHNIAK-ARTS 1996). Consequently the season of separate life takes time in autumn and winter (HAVRÁNEK & BUKOVJAN 2000). Occasionally, females

without young may be present within a group and assist in rearing of young of another female (STORM & MONTGOMERY 1975 in NOWAK 1999; MACDONALD 1979 in LARIVIÈRE & PASITSCHNIAK-ARTS 1996; NIEWOLD 1980 in LINDSTRÖM 1989; VON SCHANTZ 1981 in LINDSTRÖM 1989; MULDER 1985 in LINDSTRÖM 1989; MACDONALD & BARRETT 1993). Thus one male can live even with five females (MACDONALD & BARRETT 1993; HERZ 2003). Younger females staying with dominant pair are usually daughters from lasts year (HERZ 2003). SCHANTZ (1981 & 1984 in LARIVIÈRE & PASITSCHNIAK-ARTS 1996) cites, that groups with helpers are most commonly reproted in European countries. When alpha female dies the subordinate one may adopt the cubs (MACDONALD & BARRETT 1993). Occasionally, two females can have their litters in one den (PILS & MARTIN 1978 in NOWAK 1999), then the youngs can be nursed together (MACDONALD & BARRETT 1993).

ZABEL & TAGGART (1989) reproted 15 reproductive units during five years of observation on the Round Island, Alaska, USA. Nine of them were monogamous (60%), five composed of one male and two reproducing and lactating females (polygynous groups; 33%) and in one case single female raised the litter unassisted. Futhermore the same authors documented that in years 1980 and 1981 majority of the social units was polygynous (5 out of 7) and 3 out of 7 (two polygynous and one monogamous) had additional non-reproducing female (so called helper), social units mostly number 3 adult foxes (span 2-5). During further observation in years 1982-1984, after occurence of El Niño in the Bering sea and sequential failure of sea birds nesting (primary prey of foxes on the island), were all eight social units monogamous and only one of them had a helper, so social units mostly number two adult foxes (span 1-3).

Theory, that social group size depends on the prey availability was formerly proved by MACDONALD (1977 & 1981 in LINDSTRÖM 1989). In prey poorer environments are the territories larger and social groups smaller, vice versa in conditions with high prey availability, but there only one or occasionally two females in the social unit have youngs every year (MACDONALD 1977 & 1981 in LINDSTRÖM 1989).

2.8 Population Dynamics

2.8.1 Mortality Causes

Among the natural predators of the red fox belongs e.g.: wolf (*Canis lupus*) (MECH 1970 in LARIVIÈRE & PASITSCHNIAK-ARTS 1996), lynx (*Lynx lynx*) (STEPHENSON *et al*. 1991 in LARIVIÈRE & PASITSCHNIAK-ARTS 1996), eagles and optionally eagle-owl (*Bubo bubo*), but these are often missing in the ecosystems of the central Europe (HAVRÁNEK & BUKOVJAN 2000; HERZ 2003). Domestic dogs (*Canis familiaris*) may also occasionally kill adult red fox (STORM *et al*. 1976 in LARIVIÈRE & PASITSCHNIAK-ARTS 1996; TULLAR & BERCHIELLI 1982 in LARIVIÈRE & PASITSCHNIAK-ARTS 1996). Reduction preassure of natural enemies is in the central Europe substitued with losses on the roads and railways and in particular with targeted human intervention – game management (BABIČKA & DIVIŠ 2000; HAVRÁNEK & BUKOVJAN 2000). Fox mortality increases at feed shortage, at very cold period or at very high snow cover (HERZ 2003). Last but not least the density of fox population is influenced by diseases and parasitoses. Rabies counted as an important fox population reduction factor in the Czech Republic in the past (BABIČKA & DIVIŠ 2000).

Red fox harbors many internal parasites such as protozoans *Eimeria* sp., *Isospora* sp., *Sarcocystis* sp., *Toxoplasma gondii* (QUINN *et al*. 1976 in LARIVIÈRE & PASITSCHNIAK-ARTS 1996; REED & TUREK 1985 in LARIVIÈRE & PASITSCHNIAK-ARTS 1996; DAVIDSON *et al*. 1992 in LARIVIÈRE & PASITSCHNIAK-ARTS 1996; HAVRÁNEK & BUKOVJAN 2000), heart-worms *Angiostrongylosis vasorum* (BOLT *et al*. 1992 in LARIVIÈRE & PASITSCHNIAK-ARTS 1996) and *Dirofilaria immitis* (GORTAZAR *et al*. 1994 in LARIVIÈRE & PASITSCHNIAK-ARTS 1996), cestodes *Amoebotaenia paradoxa*, *Diphyllobothrium latum*, *Dipylidium caninum*, *Echinococcus multilocularis*, *Hydatigena taeniaeformis*, *Mesocestoides litteratus*, *Taenia crassiceps*, *T. hydatigena*, *T. pisiformis*, *T. polyacantha*, *T. serialis*, *T. taeniaformis* (DIBBLE *et al*. 1983 in LARIVIÈRE & PASITSCHNIAK-ARTS 1996; BROCHIER *et al*. 1992 in LARIVIÈRE & PASITSCHNIAK-ARTS 1996; DAGMAR & ECKERT 1993 in LARIVIÈRE & PASITSCHNIAK-ARTS 1996; WESSBECHER *et al*. 1994a in LARIVIÈRE & PASITSCHNIAK-ARTS 1996), trematodes *Alaria alata*, *A. arisaemoides*, *A. americana*, *Apophallus donicus*, *Istmiophora melis*, *Metorchis albidus*, *Opisthorchis felineus*, *Paragonimus kellicotti*, *Pseudamphistomum truncatum* (CARVALHO-VARELA & COSTA DURAO 1977 in LARIVIÈRE & PASITSCHNIAK-ARTS 1996; DIBBLE *et al*. 1983 in LARIVIÈRE

& PASITSCHNIAK-ARTS 1996; DAVIDSON *et al*. 1992 in LARIVIÈRE & PASITSCHNIAK-ARTS 1996; STEINBACH *et al*. 1994 in LARIVIÈRE & PASITSCHNIAK-ARTS 1996) and nematodes *Aelurostrongylus falciformis*, *Ancylostoma caninum*, *Capillaria aeophila*, *C. plica*, *Crenosoma vulpis*, *Phylasoptera rara*, *Pterygodermatites affinis*, *Spirocerca lupi*, *Thominx aerophillus*, *Toxascaris leonina*, *Toxocara canis*, *Trichinella spiralis*, *Trichocephalus vulpis*, *Trichuris vulpis*, *Uncinaria stenocephala* (DIBBLE *et al*. 1983 in LARIVIÈRE & PASITSCHNIAK-ARTS 1996; BALLEK *et al*. 1992 in LARIVIÈRE & PASITSCHNIAK-ARTS 1996; DAVIDSON *et al*. 1992 in LARIVIÈRE & PASITSCHNIAK-ARTS 1996; STEINBACH *et al*. 1994 in LARIVIÈRE & PASITSCHNIAK-ARTS 1996; WESSBECHER *et al*. 1994b in LARIVIÈRE & PASITSCHNIAK-ARTS 1996; HAVRÁNEK & BUKOVJAN 2000).

Ectoparasites include ringworm *Microsporum* sp. (ROSS & FAIRLEY 1969 in LARIVIÈRE & PASITSCHNIAK-ARTS 1996), ticks *Amblyomma americanum*, *Ixodes persulcatus* (SMITH *et al*. 1986 in LARIVIÈRE & PASITSCHNIAK-ARTS 1996; ISOGAI *et al*. 1994 in LARIVIÈRE & PASITSCHNIAK-ARTS 1996), *Ixodes ricinus*, fleas *Ctenocephalides canis*, *Chaetopsylla globiceps*, *Ch. trichosa*, lice *Linognathus setosus*, *Eichlerella vulpis* (HAVRÁNEK & BUKOVJAN 2000) and mites *Sarcoptes scabiei*, *Otodectes cynotis*, whose cause sarcoptic mange (TRAINER & HALE 1969 in LARIVIÈRE & PASITSCHNIAK-ARTS 1996; LINDSTRÖM *et al*. 1994 in LARIVIÈRE & PASITSCHNIAK-ARTS 1996; HAVRÁNEK & BUKOVJAN 2000).

Infections from α and β haemolytic streptococci *Leptospira ictohaemorrhangica* and *L. canicola*, as well as chronic interstitial nephritis were observed in red foxes in France and Ireland (ROSS & FAIRLEY 1969 in LARIVIÈRE & PASITSCHNIAK-ARTS 1996; BARRAT *et al*. 1985 in LARIVIÈRE & PASITSCHNIAK-ARTS 1996). Anthrax may possibly appear in the sites of former knackeries, the disease is caused by bacteria *Bacillus antraxis* (HAVRÁNEK & BUKOVJAN 2000). Canine parvovirus, adenovirus, rotavirus (EVANS 1984 in LARIVIÈRE & PASITSCHNIAK-ARTS 1996), herpesvirus and parainfluenza virus were recorded in foxes from South Carolina, USA (DAVIDSON *et al*. 1992 in LARIVIÈRE & PASITSCHNIAK-ARTS 1996). Canine distemper virus was detected in foxes from Spain (LOPÉZ-PEÑA *et al*. 1994 in LARIVIÈRE & PASITSCHNIAK-ARTS 1996), and Lyme disease spirochetes were found in a fox from Japan (ISOGAI *et al*. 1994 in LARIVIÈRE & PASITSCHNIAK-ARTS 1996).

Red foxes represent the most widespread reservoir of rabies in the wild (MATOUCH *et al.* 1981; CHOMEL 1993 in LARIVIÈRE & PASITSCHNIAK-ARTS 1996), fox infects easy with bite (MATOUCH 2000) and is unique source of the disease for other individuals (MATOUCH 1987). Rabies is caused by rhabdoviruses (HAVRÁNEK & BUKOVJAN 2000). Rabies is acting as a severe source of density dependent mortality. Data from areas in Switzerland indicate that rabies can kill over 50% of a local fox population during the height of an epidemic (WANDELER *et al.* 1974 in VOS 1995). Foxes may be rarely affected by other virus, which may in certain phase imitate rabies by its symptoms, the virus belongs to the group of herpesviruses (HAVRÁNEK & BUKOVJAN 2000).

2.8.2 Population Characteristics

Sex ratio within the red fox litter is often unbalanced (STORM *et al*. 1976 in LARIVIÈRE & PASITSCHNIAK-ARTS 1996) and males or females strongly prevails, but in average the prenatal sex ratio equals 1:1 (MACDONALD & BARRETT 1993; WANDELER & LÜPS 1993; MCILROY *et al.* 2001; MATĚJŮ 2009). Concerning subadult and adult animals, most authors cite that males prevails. Indicated ratio ♂ to ♀ ranges between 1:0.94 and 1:0.56 (SHELDON 1949 in WANDELER & LÜPS 1993; LUND 1959 in WANDELER & LÜPS 1993; WANDELER 1968 in WANDELER & LÜPS 1993; ULBRICH 1973 in WANDELER & LÜPS 1993; STUBBE 1974 in WANDELER & LÜPS 1993; PIELOWSKI 1976 in WANDELER & LÜPS 1993; LLOYD *et al*. 1976 in WANDELER & LÜPS 1993; STUBBE & STUBBE 1977 in WANDELER & LÜPS 1993; HAVRÁNEK & BUKOVJAN 2000; HERZ 2003). It is not absolutely clear if this population structure correspond to reality or if dog-foxes are easier to kill or catch then vixens (WANDELER & LÜPS 1993).

Many authors state that red fox can live up to 12 years, but only a smal proportion of individuals live longer than 3-4 years, mainly in regions where foxes are hunted intensively, thus the vast majority of individuals is one to two years old (ABLES 1975 in NOWAK 1999; AŠMERA 1982; ANDĚRA 1999; HERZ 2003). This indicates the rapid turnover of the population (AŠMERA 1982). CHUBBS & PHILLIPS (1996 in NOWAK 1999) documented in Labrador, Canada, a fox male which age was proved to be 10 years and 8 months. With the help of teeth examination, ROULICHOVÁ & ANDĚRA (2007) detected the age of foxes hunted in the Czech Republic, the average age was 17.9 month (n = 335; ♂ 18.1 month, ♀ 17.7 month). Oldest male was 83 month old (i.e. almost 7 years) and oldest

female 95 month old (i.e. almost 8 years). Furthermore the study shows that approximately half of the population is younger then one year. That corresponds with many authors, whose proved that 49-77% fox population is younger than one year (JENSEN & BRUNBERG NIELSEN 1968 in WANDELER & LÜPS 1993; VAN HAAFTEN 1970 in WANDELER & LÜPS 1993; BÖGEL *et al.* 1974 in WANDELER & LÜPS 1993; ABLES 1975 in WANDELER & LÜPS 1993; LLOYD *et al.* 1976 in WANDELER & LÜPS 1993; WANDELER 1976 in WANDELER & LÜPS 1993; HARRIS 1977a & 1978 in WANDELER & LÜPS 1993). ENGLUND (1970), however, claims that material gained by hunting contains about 20% higher proportion of juveniles than is in population.

If older individuals prevail in some region, the mortality of juveniles is high, on the other hand, if mortality ratio of old foxes is high, probability of juveniles survival increases. This is the way how foxes can compensate the population losses and population size may remain on the same level (AŠMERA 1982). Hunting foxes itself is not sufficient to keep fox population size on a low level, every reduction tends to be compensated (MATOUCH 1987).

Densities of red fox population vary locally; 0.43 fox/km^2 in Poland (GOSZCZYNSKI 1980a in LARIVIÈRE & PASITSCHNIAK-ARTS 1996), 1.0-1.7 fox/km^2 in Spain and Ontario, Canada (RAU *et al*. 1985 in LARIVIÈRE & PASITSCHNIAK-ARTS 1996; VOIGT 1987 in LARIVIÈRE & PASITSCHNIAK-ARTS 1996) and 2.1-3.0 fox/km^2 in the United Kingdom (INSLEY 1977 in LARIVIÈRE & PASITSCHNIAK-ARTS 1996; PAGE 1981 in LARIVIÈRE & PASITSCHNIAK-ARTS 1996; HARRIS & RAYNER 1986 in LARIVIÈRE & PASITSCHNIAK-ARTS 1996). MATOUCH (2000) cites that foxes reach high population densities in central Europe, namely 1.33 fox/km^2. This value is far-off to so called optimal state which more authors consider to be 0.2 fox/km^2 (e.g. MATOUCH *et al.* 1981; BABIČKA & DIVIŠ 2000; SÝKORA 2004). Red fox population density generally fluctuates depending on the population health status and on the small rodents availability (ZABLOUDIL *et al.* 2000).

Size of home ranges is different according to the environment conditions and prey accessibility (ABLES 1975 in NOWAK 1999; MACDONALD 1977b & 1980b in WANDELER & LÜPS 1993), distribution patterns of prey species largely affect the patterns of range utilisation of foxes (TAKEUCHI & KOGANEZAWA 1992). Home ranges are generally exclusive with non-overlapping borders (VOIGT & MACDONALD 1984 in LARIVIÈRE & PASITSCHNIAK-ARTS 1996; VOIGT 1987 in LARIVIÈRE & PASITSCHNIAK-ARTS 1996). In

some areas, home ranges may overlap, although this may be explained by groups of genetically related individuals. The home range size decreases with higher fox population density (TREWHELLA *et al*. 1988 in WANDELER & LÜPS 1993). Most evidence suggest that home ranges are actively defended and thus should be considered territories (VOIGT 1987 in LARIVIÈRE & PASITSCHNIAK-ARTS 1996; NOWAK 1999).

Territory is typically inhabited by an adult male, one or two adult females and their youngs (STORM & MONTGOMERY 1975 in NOWAK 1999). Territories are larger in winter and smallest during the rearing period (ABLES 1975 in NOWAK 1999; KOLB 1986 in LARIVIÈRE & PASITSCHNIAK-ARTS 1996), but are maintained throughout the year (VOIGT 1987 in LARIVIÈRE & PASITSCHNIAK-ARTS 1996). TAKEUCHI & KOGANEZAWA (1992) registered home range of a gravid vixen, her range decreased with the advance of her pregnancy and was smallest within the denning period, during which her out-of-den activities were confined almost exclusively to a small circum-den area. Her range increased again during the post-denning period. Recorded sizes of territories are often significantly different (Table 1).

Table 1. Comparison of red fox territories size in different environments in the world.

Region / environment	Territory size (km^2)	Reference
Australia and Japan	♂ 4.5-6.8 ♀ 0.003-5.3	PHILLIPS & CATLING 1991 in LARIVIÈRE & PASITSCHNIAK-ARTS 1996; TAKEUCHI & KOGANEZAWA 1992
Great Britain / incl. urban areas	♂ 0.42-4.6 ♀ ~ 1.5	KOLB 1986 in LARIVIÈRE & PASITSCHNIAK-ARTS 1996
Maine, USA	14.7-19.9	HARRISON *et al*. 1989 in LARIVIÈRE & PASITSCHNIAK-ARTS 1996; MAJOR & SHEPBURNE 1987 in LARIVIÈRE & PASITSCHNIAK-ARTS 1996
Poland / mating season	5.0-6.5	GOSZCZYNSKI 1989b in LARIVIÈRE & PASITSCHNIAK-ARTS 1996
Tundra / in summer	16.1	JONES & THEBERGE 1982 in LARIVIÈRE & PASITSCHNIAK-ARTS 1996
Bristol, Great Britain / urban areas	0.26-0.78	HARRIS 1980 in WANDELER & LÜPS 1993
Central Europe	0.2-10	MATOUCH 2000

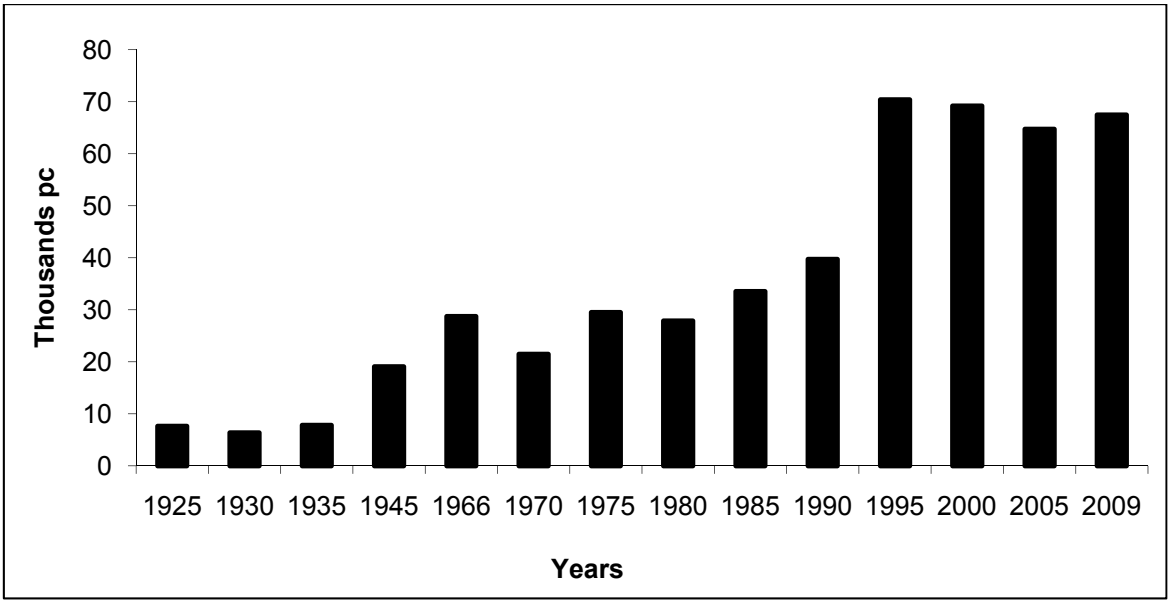
In the northern hemisphere, dispersal of youngs occurs from September to January (ANDREWS *et al*. 1973 in LARIVIÈRE & PASITSCHNIAK-ARTS 1996; STORM *et al*.1976 in LARIVIÈRE & PASITSCHNIAK-ARTS 1996; TULLAR & BERCHIELLI 1980 in LARIVIÈRE & PASITSCHNIAK-ARTS 1996). Cubs leave off native territories at the age of 6 months and quest out own hunting-grounds (AŠMERA 1982; MACDONALD & BARRETT 1993; MATOUCH 2000). Males usually disperse further than females (STORM *et al*. 1976 in LARIVIÈRE & PASITSCHNIAK-ARTS 1996; SCHANTZ 1981 in LARIVIÈRE & PASITSCHNIAK-ARTS 1996; ALLEN & SARGEANT 1993 in LARIVIÈRE & PASITSCHNIAK-ARTS 1996). In the case of females, there is a relatively high probability that they will remain in the native territory (MULDER 1985 in LINDSTRÖM 1989; LINDSTRÖM 1989).

Cities, highways, lakes, rivers and railway lines may influence dispersal directions (STORM *et al*. 1976 in LARIVIÈRE & PASITSCHNIAK-ARTS 1996; KOLB 1984 in LARIVIÈRE & PASITSCHNIAK-ARTS 1996; TREWHELLA & HARRIS 1990 in LARIVIÈRE & PASITSCHNIAK-ARTS 1996; ALLEN & SARGEANT 1993 in LARIVIÈRE & PASITSCHNIAK-ARTS 1996). Dispersal distance was negatively correlated with population density in the United Kingdom (TREWHELLA *et al*. 1988 in LARIVIÈRE & PASITSCHNIAK-ARTS 1996), but not in the USA (ALLEN & SARGEANT 1993 in LARIVIÈRE & PASITSCHNIAK-ARTS 1996). MATOUCH (2000) indicates, that majority (about ¾) of the individuals remains in area of 5 km, 15% of new population migrate up to 25 km and 10% even longer. ABLES (1975 in NOWAK 1999) and STORM *et al.* (1976 in NOWAK 1999) cite longest recorded dispersal that was 394 km long, in this case average dispersal distance was 40 km concerning males and 10 km by females. The longer the dipersal is, the lower is the survival rate of young foxes (MACDONALD & BARRETT 1993). Once the young animals already enforce in a new area, then they generally remain there for the whole life (NOWAK 1999).

2.8.3 Population Size Development in the Czech Republic

It is possible to deduce red fox population size development in the Czech Republic according to development of annual bags (PINTÍŘ *et al.* 2000; SÝKORA 2004) – see Graph 1. BABIČKA & DIVIŠ (2000) cites that fox population growth in the first half of 1990s was directly linked with the rabies oral vaccination, also other authors tend to this explanation (e.g. HRUŠKA 1998; PINTÍŘ *et al.* 2000). On contrary, JIRÁSEK (1998) and SÝKORA (2004) assume that rabies oral vaccination was not the principal factor influencing the red fox

population growth. Other causes of very high fox numbers may be high prey availability and sufficiency of safe shelters enabling young rearing – e.g. in amelioration network (HRUŠKA 1998; PINTÍŘ *et al.* 2000). JIRÁSEK (1998) publishes that population growth may be linked with the change of game management approach particularly after 1993 (new hunting ground lease-contracts).



Graph 1. Red fox annual bag development from 1925 through 2009 (data from 1925 to 1945 HERZ 2003; data from 1966 to 2000 www.uhul.cz – does not contain annual bag in national parks; data from 2005 to 2009 www.mze.cz).

3. Study Area Description

Study area of this thesis is generalized to the territory of the Czech Republic. Consequent chapter is so dedicated to the brief geographical and zoogeographical characterization of the Czech Republic.

3.1 Geographical Characteristics of the Czech Republic

Area of the Czech Republic counts 78,864 km^2, it ranges between 48°35′ and 51°02′ north latitude and between 12°05′ and 18°50′ east longitude. Highest point – peak of the mountain Sněžka – lies in the altitude 1602 m, and lowest point – river Labe at the state border – lies 115 m a.s.l. 5% of the territory is located under 200 m altitude, 74% within altitude 200–600 m, 19% within altitude 600–1,000 m and 2% lies over 1,000 m above sea level (OPATRNÝ 1999).

The Czech Republic is situated in inland of Europe, approximately in the middle of temperate zone of north hemisphere. Shortest distances from Baltic and from the Adriatic Sea count about 300 km, from Black Sea about 900 km. Oceanic impacts are here compensated with impacts continental, in consequence of west winds prevalence. Altitudinal terrain variance causes generally temperature decrease beyond precipitation increase with ascendent altitude. It is possible to distinct three climatic regions in the Czech Republic territory: warm, temperate and cold. Warm climatic region is determined approximately by the 300 m contour line and comprises Elbe lowland in Bohemia and Moravian lowlands Hornomoravský, Dolnomoravský and Dyjskosvratecký. Temperate climatic region comprises the major part of the Czechia and lies between 300 and 700 m contour lines. Cold climatic region lies above 700 m contour line and comprises in particular border mountains (OPATRNÝ 1999).

3.2 Zoogeographical Characteristics of the Czech Republic

3.2.1 Zoogeographical Regionalization of the Czech Republic

The area of the Czechia lies in the northern half of Palearctic ecozone, in Euro-Siberian region – by its southern border, relatively close to the Atlantic Ocean (BUCHAR in

ROSYPAL 1994; OPATRNÝ 1999). All of this considerably influences the fauna structure of the territory. Broadleaf forests ecoregion prevails in the Czech Republic conditions, to which fauna constitution corresponds. There is not completely integral fauna, according to west-east oblong shape of the czech territory. Natural ranges of species prefering atlantic climate (humid with mild winters) intervene in the territory from west, on the eastern part species adapted to continental climate (arid with greater annual temperature differences) rather predominates (BUCHAR in ROSYPAL 1994). This dissimilarity is expressed by ecoregion partition into two divisions (OPATRNÝ 1999) – Czech and Carpathian (BUCHAR in ROSYPAL 1994). Border between both divisions leads somewhere through eastern part of Czech-Moravian Highlands and through Jeseníky Mountains, such that major area of Moravia is ranged to the Carpathian division. That corresponds with distribution of some Carpathian endemic species. Pannonian division is also partly represented in the Czech Republic territory (south Moravia) by the steppe ecoregion (OPATRNÝ 1999).

3.2.2 Fauna Characteristics of the Czech Republic (Broadleaf forests ecoregion)

Majority of the czech fauna species are distinctive for broadleaf forests ecoregion fauna. These species compose altogether over 75% of fauna. Their proportion is even higher in forested areas from lowlands to uplands – nearly 95%. The fauna can be divided according to its ecological requirements into two components (OPATRNÝ 1999):

a) Species dependent directly on broadleaf and mixed forests habitats. When speaking about mammals, majority of insectivores and bats, dormice, some species of genera *Apodemus* and *Microtus*, Eurasian Red Squirrel, European Polecat, European Badger, the Wildcat, Wild Boar and European Roe Deer belongs to this fauna component. These species could disperse on the area of Czechia (some species of tertiary origin alternatively returned back) only in the Holocene, when the glacial tundra was converted into formations of broadleaved forests – coming from refugiums from southwest and southeast Europe (OPATRNÝ 1999).
b) Species that have their centre of dispersal also in the broadleaf forests ecoregion but they are not ecologically on the forests instantly dependent; species that have wider ecological valence. Natural range of some of these species gain on the north up to the taiga or even tundra region, on the south to steppes. They range from lowlands to alpine altitudes in the territory of the Czech Republic. The presence of

some of them in Czechia was not interrupted by last ice-age; as an eurythermic forms they were present even during the ice-age. Out of mammals they are for example: Eurasian Wolf, **Red Fox**, Eurasian Brown Bear, Red Deer and others (OPATRNÝ 1999).

4. Material and Methods

4.1 Origin of the Data

Data concerning dens of the red fox (*Vulpes vulpes*) were collected in the area of the Czech Republic, namely in nine districts. All the dens were described during a quite short period from 10th to 30th April 2010. Most of the dens were visited and examined by myself; several dens were investigated by instructed assistants. Den location, characteristics concerning past and present den use by the red fox and by other cohabiting carnivorous species were obtained from my evidence or from observation of hunters of hunting grounds in which the dens were localised. All dens included in this thesis are regarded as dens of the red fox; for every den in its history there is evidence of occupation by the red fox. However not all characteristics measured and description collected are evaluated in this thesis; they are available for further research concerning red fox and its dens.

4.2 Den Localisation

Following data were gathered for each red fox den:

1) Locality – czech local name.
2) Cadastral territory – small area entity defined in cadastre.
3) District – administrative entity in the Czech Republic, smaller than region.
4) Date – date of den characteristics description.
5) Altitude – elevation above sea level. Accuracy of determination was 5 m a.s.l.
6) Water source – shortest distance from den to all year round accessible source of water. Accuracy of measurement 10 m.
7) Communication – shortest distance to public road or railway. When the distance to communication would be greater than distance to residential realty then distance to residential realty was taken also as shortest distance to communication (assuming that vicinity of residential realty causes always more disturbation then communication proximity). Accuracy of measurement 10 m.

8) Residential realty – shortest distance to common human activity. Most often to residential realties, furthermore to industry, recreational facilities and possibly others. Accuracy of measurement 10 m.

4.3 Den Habitat Characteristics

Registered habitat characteristics of the red fox dens were:

1) Slope orientation – prevailing exposure of the den area to cardinal or intermediate direction (N; NE; E; SE; S; SW; W; NW).
2) Slope gradient – prevailing inclination of the den area classified into four ranks:
   I. Gentle slope (slope gradient < 15°)
   II. Moderate slope (15°-30°)
   III. Steep slope (30°-45°)
   IV. Ravine (> 45°)
3) Relief – den site description. Relevant habitat features were registered.
4) Determinant vegetation layers – vegetation type with den area cover > 50%. Every den had either one or two determinant vegetation layers. Designated vegetation layers were:
   I. Tree
   II. Shrub
   III. Herb
5) Soil texture class – classified according to NOVÁK (in Ministry of Agriculture of the Czech Republic 1998):
   I. Sandy
   II. Loamy-sandy
   III. Sandy-loamy
   IV. Loamy
   V. Clay-loamy

   Additional two classes were articulated:

   VI. Gravelly – for anthropogenic structures made of gravel
   VII. Concrete – for anthropogenic structures made of concrete

6) Ground water – estimation of possible ground water influence on the red fox den system; acquire values „no“ or „yes“ (for dens in pond, brook, swamp, … vicinity).
7) Soil skeleton – classified according to NĚMEČEK *et al.* (2001), with spans of classes slightly modified:
   I. Without or with skeleton admixture (skeleton content < 10%)
   II. Mildly skeletal soil (10–25%)
   III. Soil with medium skeleton content (25–50%)
   IV. Highly skeletal soil (> 50%)
8) Rooting – sorted according to estimated average volume content of roots with diameter > 2 mm (practically i.e. without fine roots) in the uppermost 25 cm of den substratum:
   I. None (root content < 10%)
   II. Weak (10–25%)
   III. Middle (25–50%)
   IV. Heavy (> 50%)

   Rooting was not evaluated at anthropogenic structures made of concrete.
9) Substratum type – either „anthropogenic“ or „natural“. Sites with terrain evidently modified by human activity in the past were considered to be anthropogenic substratum types (terrain excavation, made-up ground, dump,…).

4.4 Den Characteristics

Recorded red fox den descriptions were:

1) Den use – divided into „occupied“ dens (den was used by the red fox in the year of description) and „abandoned“ dens (den was not used by the red fox in the year of description).
2) Breeding den – acquire values „yes“ (den was used for breeding of the red fox in the year of description) or „no“ (den was not used for breeding of the red fox in the year of description). Distinction between breeding and non-breeding dens was only done for occupied dens; in other words abandoned dens were excluded from analyses done for detections of differences between non-breeding and breeding dens.

3) Yesteryear occupation – dens used by the red red fox in the year previous to the year of description were classed to the value „yes“ other dens classed to the value „no“.
4) Cohabiting carnivores – possibility „European badger“ was marked when the den was used by the european badger (*Meles meles*) in the year of description. Possibility „Raccoon dog“ was highlighted when the den was used by the raccoon dog (*Nyctereutes procyonoides*) in the year of description.
5) Area – range occupied by the den of the red fox. Estimated from land surface among farthermost entrances (both used and abandoned) of a single den; approximately lenght × width – slightly overestimates the size (not rectangular but oval shape usually) so the area was then corrected with respect to the shape. Accuracy of estimation 5 m^2. Area of single entrance dens was considered to be 5 m^2.
6) Entrance use – either „used“ when the entrance was used by the red fox for passing through in the time of description or „abandoned“ old passable entrances and all upcasts. If the den was classified as abandoned (according to den use by the red fox) then all entrances were considered to be abandoned.
7) Entrance function – „passable“ entrances were used by the red fox for passing through in the time of description (used entrances) or evidently during the history of the den (abandoned entrances). „Upcasts“ originated owing to soil slide due to excavating activites below them, they were always connected to den system and were used passively for ventilation. Upcasts not connected to den system were not registered. Upcasts used for passing through were counted as passable entrances.
8) Entrance size – height (h) and width (w) were measured 45 cm deep in the entrance in order to minimize distortion caused by soil slide around the entrance mouth according to KRIM *et al.* (1990). Accuracy of measurement was 1 cm.
9) Entrance aspect – exposure of the entrance to cardinal or intermediate direction (N; NE; E; SE; S; SW; W; NW).
10) Entrance mouth – material that held the entrance mouth vault with the share > 34%. For every entrance mouth were identified either one or two of following four material types:
    I. Roots

II. Earth
III. Stones
IV. Waste – as waste was considered all matter of human origin.

4.5 Statistical Analysis

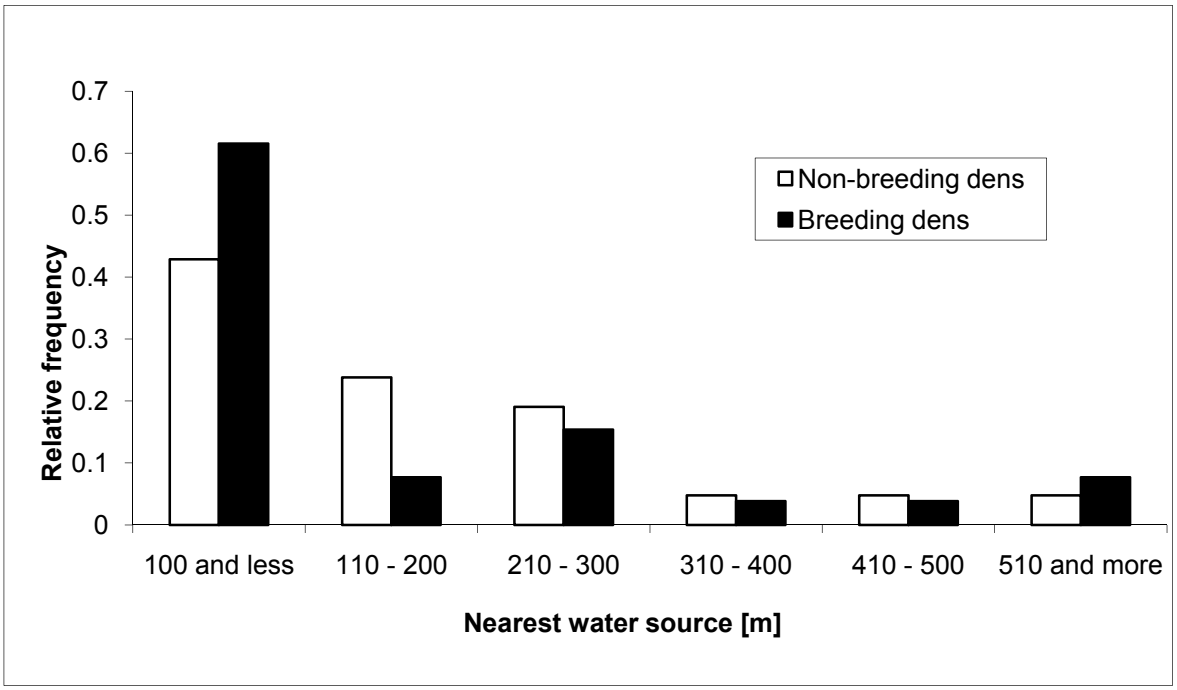
Statistical analyses followed the procedures of ANDĚL (1998) and were performed using R 2.13.0 software (The R Foundation for Statistical Computing 2011). The sample size vary according to the factor studied. Results are indicated as arithmetic means ± one standard deviation. Differences are considered significant when the p-value is less than 0.05. Chi-square test for fit of a discrete uniform distribution was used for determination den slope orientation preferences. For calculation statistical differences between breeding and occupied non-breeding dens was used test of homogeneity of two multinomial distributions – for characteristics den area extent and number of used entrances. Wilcoxon signed-rank test was used for statistical analyses of shortest den distance to water source, to communication and to residential realty – searching significant deviations between breeding and non-breeding dens.

5. Results

Altogether 60 red fox (*Vulpes vulpes*) dens were measured and described in this thesis.

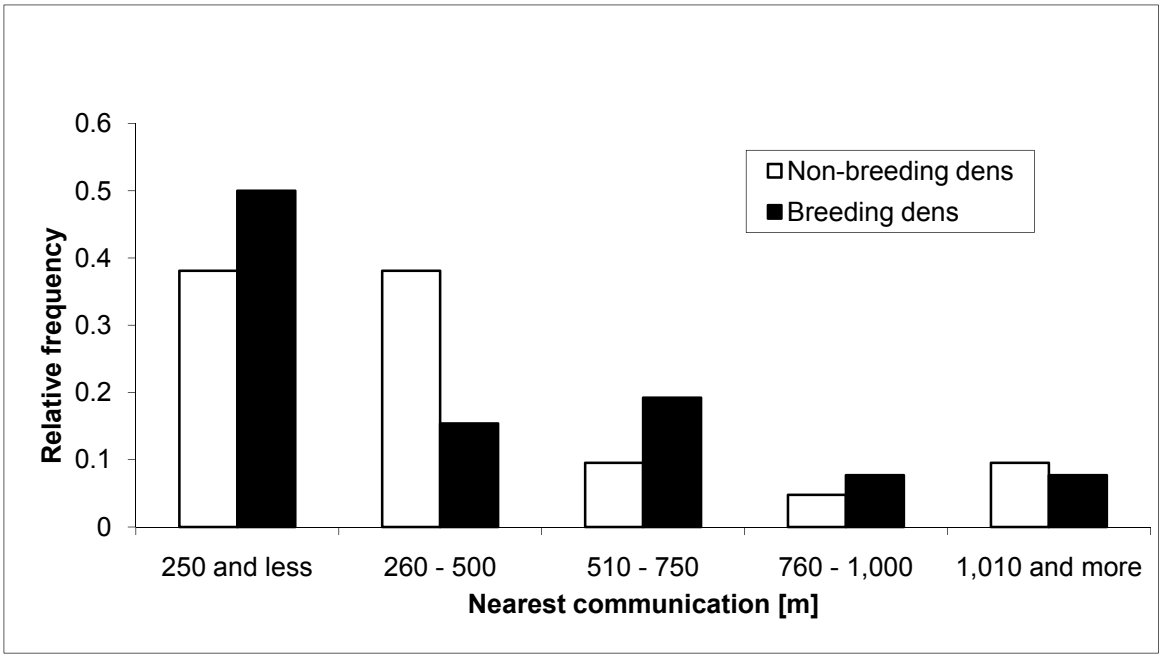
5.1 Den Localisation

The 60 red fox dens described were located between 300 and 685 m a.s.l.; calculated average altitude was 440 ± 65 m a.s.l. Average shortest den distance to water source was 165 ± 173 m (x_{min} = 10 m ; x_{max} = 800 m; Me = 110 m) for all dens. Default null hypothesis that breeding and non-breeding den distances to nearest water source have the same distribution was tested and not rejected (W = 228.5; p = 0.3431; Graph 2).



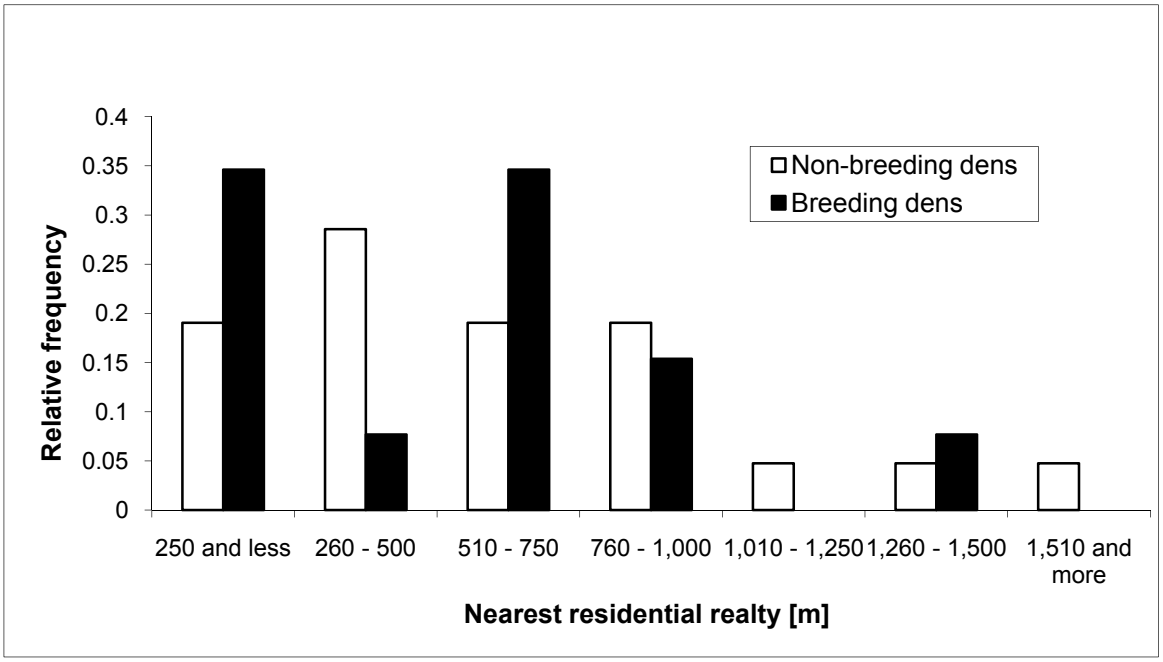
Graph 2. Shortest breeding and non-breeding den distance to water source

Mean nearest den distance to communication did 488 ± 495 m (x_{min} = 10 m ; x_{max} = 3,200 m; Me = 320 m) for both abandoned and occupied dens. Tested null hypothesis that shortest breeding and non-breeding den distances to communication have the same distribution was not rejected (W = 302; 0.5418; Graph 3).



Graph 3. Shortest breeding and non-breeding den distance to communication

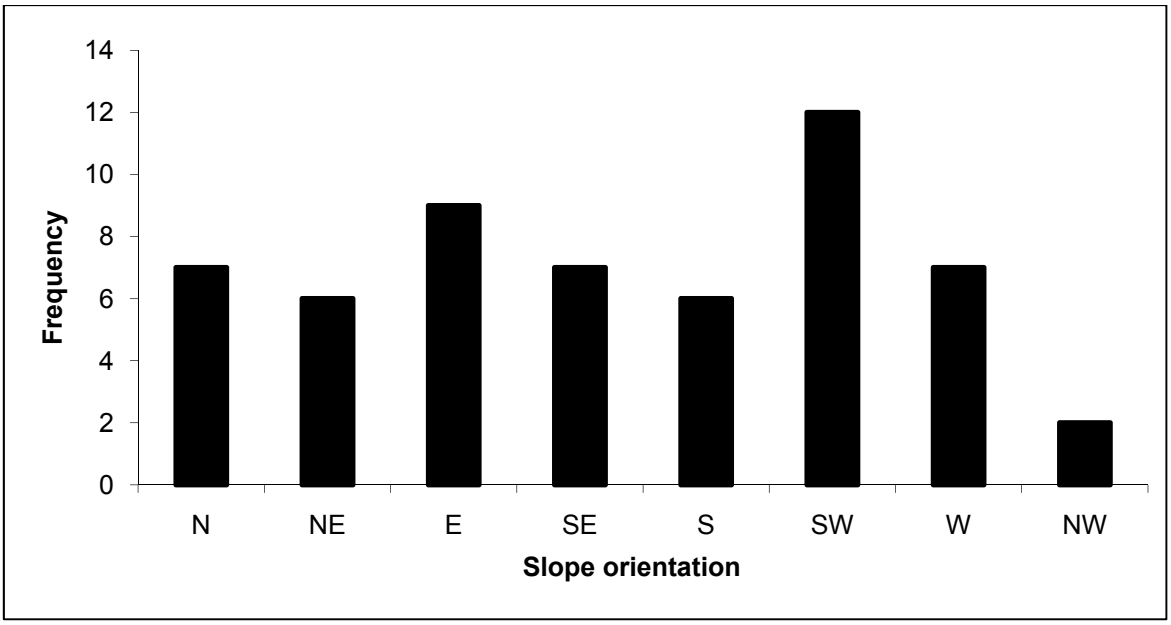
Average shortest den distance to residential realty counted 877 ± 1,567 m (x_{min} = 80 m; x_{max} = 12,000 m; Me = 555 m) for all dens. Null hypothesis that shortest breeding and non-breeding den distances to residential realty have the same distribution was not rejected (W = 279.5; p = 0.8978; Graph 4).



Graph 4. Shortest breeding and non-breeding den distance to residential realty

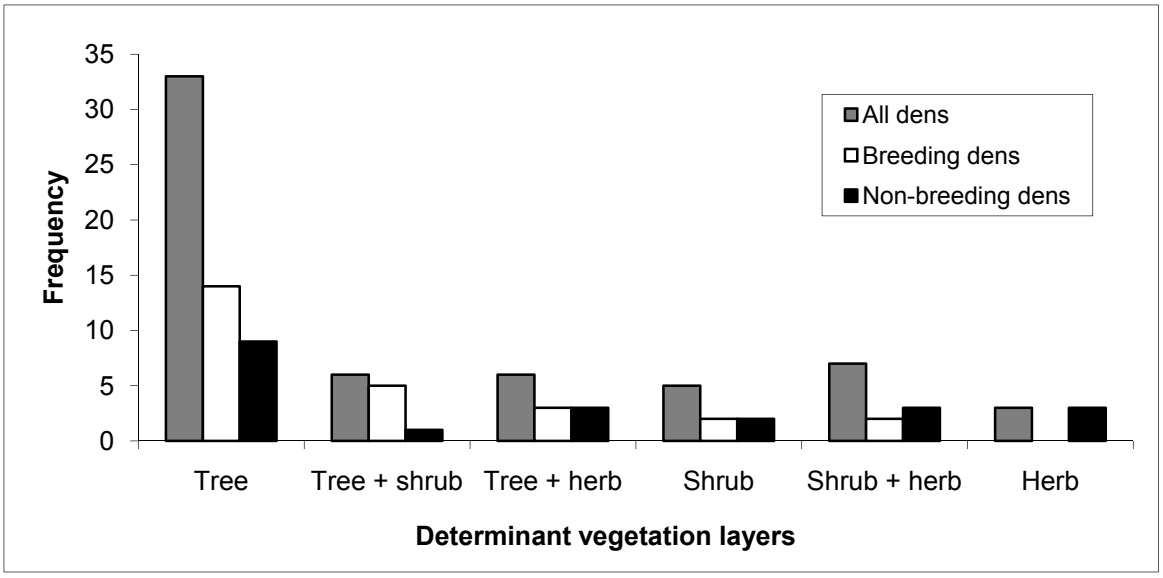
5.2 Den Habitat Characteristics

Den investigation showed that most den areas (n = 12; 20.0%) faced southwest and least to the northwest (n = 2; 3.3%; in detail see Graph 5). There were four den areas with ambiguous slope orientations so were not included in the analyses. In three cases the exposure could not be determined either because the complete extent of two dens was unknown (locality: „Koloměř“ and „Lom Košťálov“) or because the den area had conical shape and thus was oriented to all cardinal directions („Mohyla“). One den area had two slope orientations because it lied on a narrow ridge by half on its each side („Kanice“). Default null hypothesis that any slope orientation of a den area has the same probability was not rejected ($\chi^2 = 8$; df = 7; p = 0.3326).



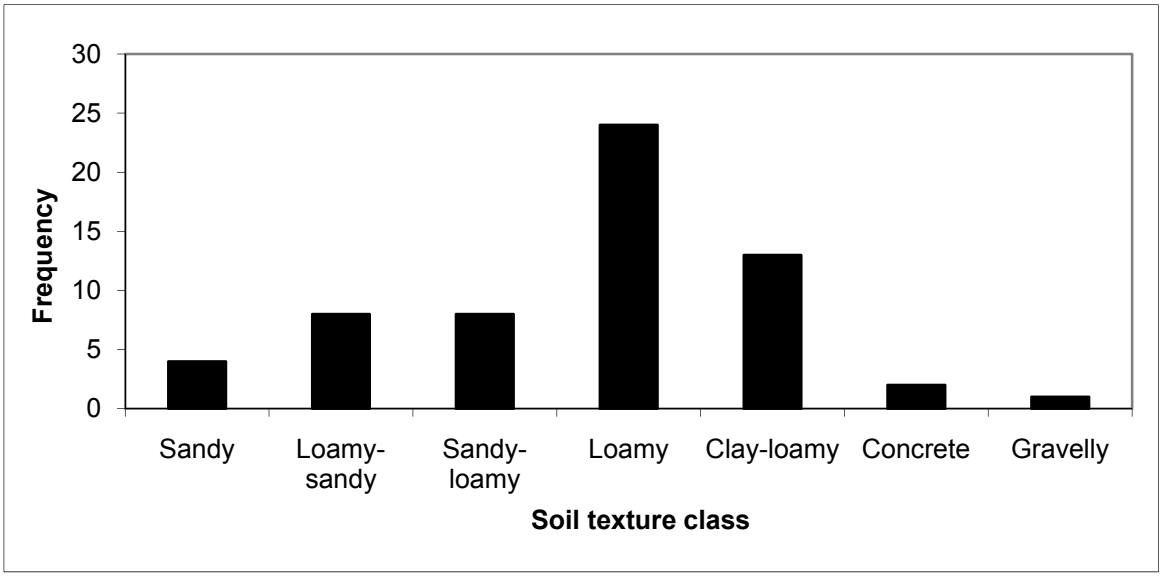
Graph 5. Registered den area exposures (all dens).

Concerning inclination of den areas, most of them were situated on gentle slopes (slope gradient < 15°; n = 21; 35.0%) than on moderate slopes (15°- 30°; n = 19; 31.7%) and least both in steep slopes (30°-45°; n = 10; 16.7%) and in ravines (> 45°; n = 10; 16.7%). Vegetation layer of a den area was mostly determined by trees themselves (n = 33; 55.0%), cover that was dominant at least cases was pure herb type (n = 3, 5.0%; in detail see Graph 6).



Graph 6. Determined vegetation layers of all dens, occupied non-breeding and breeding dens

Most den habitats were found on loamy soils (n = 24; 40.0%; Graph 7) and least on sandy soils (n = 4; 6.7%). Two special soil texture classes discriminated for dens in anthropogenic substrates – „concrete“ and „gravelly“ – were represented by two (3.3%) and one (1.7%) den site respectively.



Graph 7. Identified soil texture classes (all dens)

Furthermore it was found that nine (15.0%) red fox dens had been excavated at sites with possible influence by ground water. Most dens were described in soils without or

with skeleton admixture (skeleton content < 10%; n = 27; 46.6%) and least in highly skeletal soils (> 50%; n = 5; 8.6%). 18 dens (31.0%) were situated in mildly skeletal soils (10–25%) and eight dens (13.8%) in soils with medium skeleton content (25–50%). Two dens were excluded from soil skeleton evaluation for they subsisted in concrete pipes („Koloměř“ and „Lom Košťálov“). The most, 26 dens had been dug in substrates with middle rooting (44.8%) than in soils with heavy (n = 16; 27.6%) and weak (n = 13; 22.4%) rooting. The least dens were found in substrates with none rooting (n = 3; 5.2%). Two dens were expelled from rooting assessment for they subsisted in concrete pipes. 42 dens (70.0%) were found in natural substratum types and the rest 30.0% (n = 18) in anthropogenic substratum types such as stony balks, embankments of earth roads, reclamation pipes systems and others.

5.3 Den Characteristics

Out of the 60 red fox dens described in this thesis were 13 dens classified as abandoned (21.7%) and 47 (78.3%) as occupied; from that 21 as non-breeding dens (35.0%) and 26 as breeding dens (43.3%).

Table 2. Den use in the year of description and yesteryear.

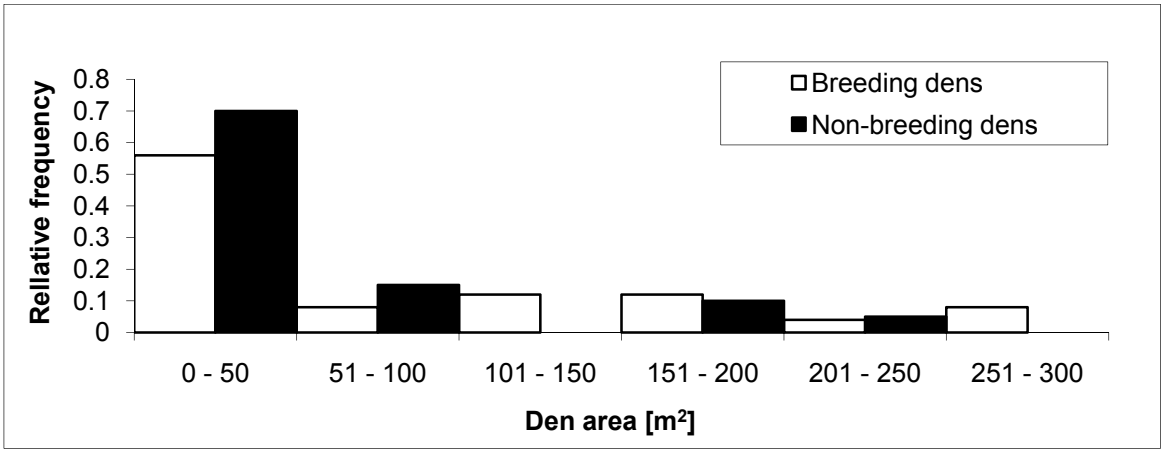
Den use	Occupied in 2010	Abandoned in 2010
Occupied in 2009	58.3% (n = 35)	11.7% (n = 7)
Abandoned in 2009	20.0% (n = 12)	10.0% (n = 6)

In the year previous to the year of description 42 (70.0%) dens were used by the red fox and 18 dens not (30.0%); detailed informations to be found in Table 2.

Table 3. Cohabiting carnivorous species in abandoned, breeding and non-breeding dens.

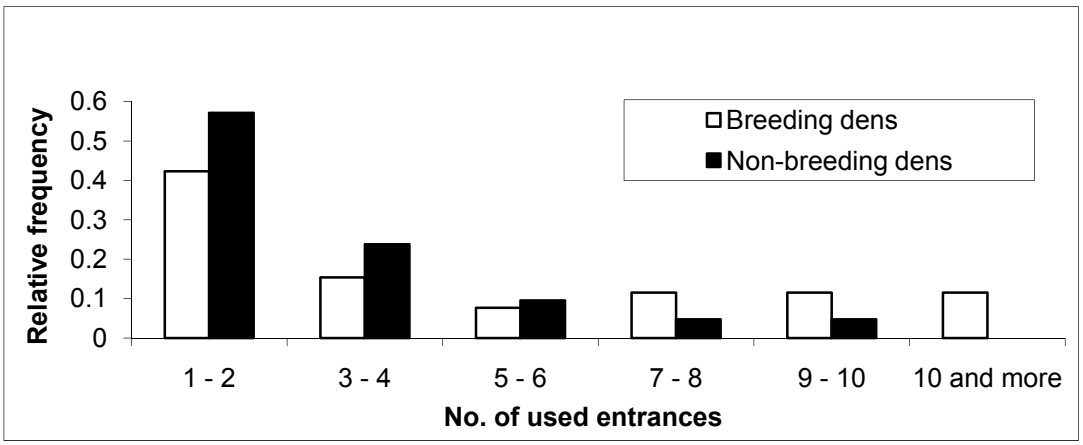
Cohabiting carnivores / den use	Abandoned	Breeding	Non-breeding
None	9	15	16
European badger	4	9	5
Raccoon dog	0	1	0
European badger + Raccoon dog	0	1	0

40 (66.7%) dens were reported without any cohabiting carnivores, 18 (30.0%) were co-inhabited by european badger, 1 by raccoon dog and 1 (1.7%) by european badger and raccoon dog together. 4 (6.7%) dens co-inhabited by only european badger were abandoned by the red fox so it was not true cohabitation literally (Table 3). Red fox den area extents varied considerably among sites from 5 m^2 to 300 m^2.



Graph 8. Den area size of breeding and non-breeding dens

Mean den area reached 73 ± 84 m^2 (n = 58; Me = 27.5 m^2). Two den area extents („Koloměř“ and „Lom Košťálov“) were not determined since their complete dimension was not ascertainable. For the analysis den areas were grouped into small ($\leq$ 50 m^2) and large (> 50 m^2) dens. Tested null hypothesis that den area extents of breeding and non-breeding dens have the same distribution was not rejected (χ^2 = 0.4266; df = 1; p = 0.5137; Graph 8).



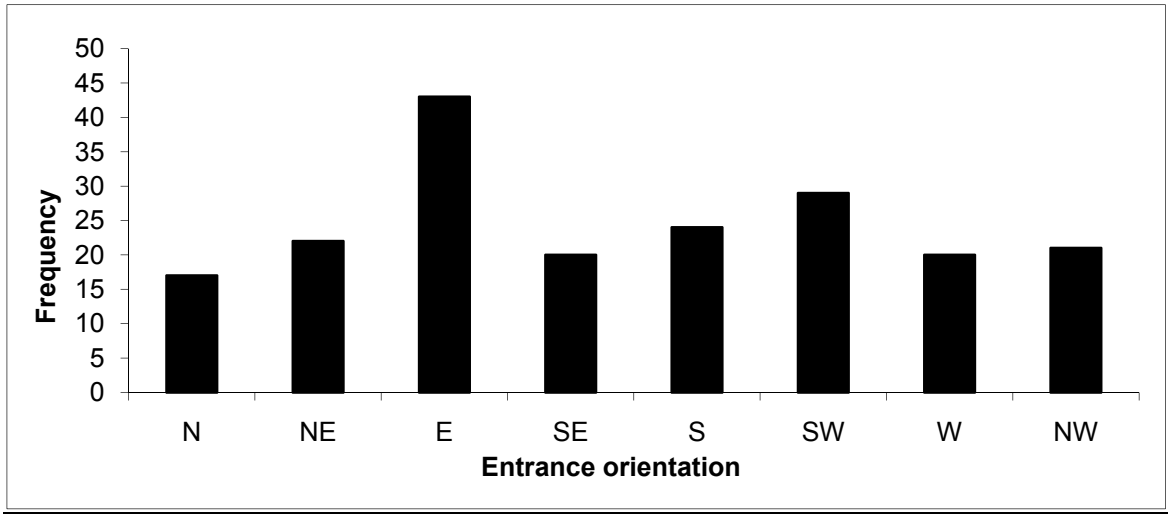
Graph 9. Number of used entrances of breeding and non-breeding dens

Detected mean number of all entrances of all the described red fox dens was 6.27 ± 5.69 (range 1-24; Me = 4; Mo = 2; frequency of mode = 14). Descriptive statistics of used passable (all used entrances were passable according to the methodology vide ante) and abandoned entrances was done for occupied dens only (n = 47; Table 4). For the analysis dens were clustered according to number of **used** entrances into three intervals (1-2; 3-6; > 7 used entrances). Null hypothesis that number of used entrances of breeding and non-breeding dens have the same distribution was not rejected ($\chi^2 = 4.0893$; df = 2; p = 0.1294; Graph 9).

Table 4. Descriptive statistics of number of different types of entrances (rows „all" and „upcasts" refer to all dens; rows „used" and „abandoned" refer to occupied dens).

Entrance type	Mean	Standard deviation	Me	Mo	Frequency of mode	x_{min}	x_{max}
All	6.27	5.69	4.0	2	14	1	24
Used	4.17	3.80	3.0	2	12	1	16
Abandoned	2.55	2.72	2.0	0	15	0	11
Upcasts	1.02	1.36	0.5	0	30	0	6

Discovered mean height of used entrances counted 30.10 ± 8.02 cm (n = 194; x_{min} = 16 cm ; x_{max} = 75 cm; Me = 29 cm) and average width 34.94 ± 10.83 cm (n = 194; x_{min} = 16 cm ; x_{max} = 80 cm; Me = 33 cm). Artificial concrete pipes were excluded from the calculation. It was found that most used entrances (43 out of 196; 21.9%) were oriented towards the east whereas least entrances faced north (n = 17; 8.7%; Graph 10).



Graph 10. Exposures of used entrances

6. Discussion

In this chapter pivotal results of this master thesis will be discussed. Descriptive characteristics which are (most likely) influenced by the **not** random sampling of the recorded dens among the whole study area (the Czech Republic) will be excluded from discussion. These are particularly soil texture class, ground water, soil skeleton and rooting.

In this master thesis was ascertained no statistically significant difference between shortest den distance of breeding and non-breeding dens to water source. That squares with study of URAGUCHI & TAKAHASHI (1998), and also nearest water source in their study was the same in orders as the one determined in this thesis. Previous studies suggested that the area selection was strongly influenced by the water availability that should not be far from dens (ZHANG *et al.* 1999 in DELL´ARTE & LEONARDI 2007). Likewise red fox relative *Vulpes ferrilata* dens are typically located less than 500 m from water (WANG *et al.* 2003 in CLARK *et al.* 2008). URAGUCHI & TAKAHASHI (1998) further found out that red fox dens are located significantly closer to water sources (usually a stream), than random control sites. But they state that although many fox dens are situated near streams it is not for the source of drinking water primarily because adult foxes are able to find water to drink in many situations but the reason of location can be probably the result of the foxes´ preference for well-drained, steeper slopes. In this work one third of all dens was located in steeper slopes (ranks steep slopes and ravines).

Mean nearest den distance to communication and to residential realty correspond in orders with those from Japan (URAGUCHI & TAKAHASHI 1998) and Switzerland (MEIA & WEBER 1992) with no difference between breeding and non-breeding dens as well. FRAFJORD (2002) found in Norway average arctic fox den distance 14,660 ± 7,500 m to road and 10,240 ± 6,600 m to human activity (slightly different methodology of distances determination). Furthermore there were no statistically significant differences between arctic fox dens with or without red fox use. Foxes avoid roads at some scale when selecting den sites but, at the same time, they are attracted to roads for foraging activities (e.g. scavenging opportunities; DELL´ARTE & LEONARDI 2007). Distance to the nearest communication and residential realty can be understood conversely as a degree of human utilisation of the environment. That means in less human disturbed areas the red fox have

more denning opportunities farther from human activities than foxes in more urbanized territories. Thus the resulted mean nearest den distance to communication and residential realty cannot be taken in an absolute numbers – because they are surely influenced by the **not** random sampling of the dens described in this thesis. Disturbance (especially human) is, however, considered an important variable affecting selection and utilization of fox den sites (STORM *et al.* 1976 in URAGUCHI & TAKAHASHI 1998; HARRIS 1977 & 1981 in URAGUCHI & TAKAHASHI 1998). URAGUCHI & TAKAHASHI (1998) discuss that finding no difference between breeding and non-breeding dens might be because of the absence of any measure of „disturbance" factor in their study; the statement is very probably valid also for this thesis.

No statistically significant preference in slope orientation of red fox den was found in this thesis. Likewise *Vulpes ferrilata* dens are not oriented in any particular compass direction (WANG *et al.* 2003 in CLARK *et al.* 2008). Unlike other burrowing carnivorous species – the european badger – which most often selects south exposure or leeward slopes in windy areas (MATYÁŠTÍK *et al.* 2000). On the other hand KRIM *et al.* (1990) found no significant correlation between wind direction and red fox excavation orientation. Foxes are opportunists concerning their dens (MEIA & WEBER 1992), they do not dig their own dens when other possibilities are available (WEBER 1983 in MEIA & WEBER 1992), that can partly explain no exposure preference.

Approximately one third (30.0%) of dens were found in anthropogenic substratum types. MEIA & WEBER (1992) in their research found 6 dens (9.4%; n = 64) in man-made accumulations with no significant difference between breeding and non-breeding dens. URAGUCHI & TAKAHASHI (1998) in Japan located 16 artificial dens out of total 161 (9.9%). So the proportion of dens in artificial substrates is in this thesis about three times higher compared to other studies. One reason for that can be agricultural land drainage system in which considerable number of dens was situated. More than 1.1 million hectares (> 25%) of agricultural land was drained all over the Czech Republic in past (ORSILLO 2008; KULHAVÝ & SOUKUP 2010).

The vast majority of dens was detected in tree-determined habitats (in forest) compared to only several dens in grassy (e.g. meadows) and shrubby ecosystems. The preference for covered areas was already noticed by several studies (e.g. WEBER 1983 in MEIA & WEBER 1992; IOKEM 1985 in MEIA & WEBER 1992; PAQUOT & LIBOIS 1986 in

MEIA & WEBER 1992; MICKEVIČIUS 2002; KEULING *et al.* 2011). GOSZCZYNSKI (1989 in URAGUCHI & TAKAHASHI 1998) described forests as primary shelter for foxes and for raising their young.

This thesis detected that previous year to the year of description about 30% dens was abandoned and in the year of description 22% dens was abandoned 43% were breeding dens. This data can indicate variation of red fox density but that would have to be affirmed by much more extensive research. To derive population densities from active den densities requires estimates of adult sex ratios, the proportion of female non-breeders and ratio of itinerant: resident foxes (HARRIS *et al.* 1995 in HEYDON *et al.* 2000). Proportion of red fox vixen non-breeders in the Czech Republic was recently determined by MATĚJŮ (2009).

Two thirds of all dens in this study were **not** co-inhabited by other carnivorous species. In other one third mainly european badger, raccoon dog or both two were present. The european badger and the red fox show a notable level of tolerance, including communal denning (VAN WIJNGAARDEN & VAN DE PEPPEL 1964 in KOWALCZYK *et al.* 2008; NEAL 1986 in KOWALCZYK *et al.* 2008; KOWALCZYK *et al.* 2000; MATYÁŠTÍK *et al.* 2000) even rearing young of both species in the same sett (KOWALCZYK *et al.* 2008). However, the same author observed killing of red fox (and raccoon dog) cubs by badgers, beyond found not any evidence for the opposite case, i.e. badger cubs being killed by either of the two other carnivores.

Den area size of breeding and non-breeding dens did not differ significantly. It can be expected that the bigger den area size maesured on the land surface the greater subsurface space of the den interior. But however this study indicates that the size of the den interior probably does not play crucial role for fox when selecting den for breeding. This contradicts with arctic fox dens; FRAFJORD (2002) detected significant difference in size of non-breeding and breeding dens, breeding earths were about one third much bigger.

In the number of **used** entrances of breeding and non-breeding dens there was also not statistical distinction. Determined number of **all** entrances corresponds very to the study from Tunisia (DELL´ARTE & LEONARDI 2007). On the contrary MEIA & WEBER (1992) reported that number of entrances of breeding dens was significantly greater than in non-breeding dens, but they did not indicate if all or only used entrances were counted. Statistical difference was again proved in number of entrances between non-breeding and

breeding dens of arctic fox in Norway (FRAFJORD 2002), but the author self discuss that it did not necessarily imply that arctic foxes prefer larger dens (for breeding), but simply the dens that are used increase in size.

Ascertained mean height and width were considerably higher to those counted by KRIM *et al.* (1990) and others (STORM *et al.* 1976 in KRIM *et al.* 1990; PILS & MARTIN 1978 in KRIM *et al.* 1990). Differences can be attributed to different soil conditions – especially soil consistency. No statistical analysis was done with the used entrances exposure (only descrptive data). The analysis could produce misguided data about certain entrance orientation preference while the intensity of use of each entrance surely differs and can be only hardly quantified.

7. Conclusion

This master thesis provides information on 60 dens of the red fox (*Vulpes vulpes*) in the Czech Republic from the year 2010. Detailed data about den localisation, den habitat characteristics and den characteristics were gathered and analysed.

Concerning den localisations – nearest den distances to water source, communication and residential realty were counted. Analyses of these variables resulted into no significant differences between breeding and non-breeding dens. It was discussed that the importance of driking water for foxes is not so considerable in a way that it can influence den location. Den distance to human caused disturbance was argued as a potential measure of habitat fragmentation. If the red fox have even chance of denning further from civilisation in densely inhabited country. To complete knowledge about den localisations more extensive research should be undertaken (comparison of den localities to randomly generated sites).

In other studies significant relation between slope orientation and prevailing wind direction was detected, on the contrary no preference in slope orientation was found in this thesis which may indicate that wind has not so strong impact on burrowing mammals in czech conditions. Another den habitat characteristics (slope gradient, determinant vegetation layer, soil texture class, ground water, soil skeleton content and rooting) have more or less illustrative character because it is highly probable that they were strongly modified by the localisation of dens measured and thus cannot be generalized to the whole study area. In next research the dens would have to be equally represented over the variety of natural conditions of the study area.

When examining type of den substratum it was detected that human itself provided not purposefully the red fox indispensable amount of artificial burrowing opportunities. Data of den use can be very useful in estimating population density of the red fox but they would have to be completed by other population characteristics. Proportion of abandoned, occupied non-breeding and occupied breeding dens served as classes for comparison den habitat characteristics. Other two burrowing carnivores were present in one third of examined fox dens, all three species show a notable level of co-inhabiting tolerance.

Analyses of the den area size and the number of used entrances aimed to describe under surface den extent and its influence on selection of den for breeding. No significant

indication was found contrary to other authors. Further research should be done with the help of direct observation of dens and entrances use – that would help also to the analysis of the entrance exposure. Determined entrance size has descriptive character for it is firstly determined by the size of the dwelling mammal (not only fox but also badger and raccoon dog) and secondly by the soil consistency.

Finaly this master thesis provides red fox den habiat characteristics from the Czech Republic that were mostly up to now missing. It must be stated that the red fox is very adaptive and flexible species and this fact makes any research concerning its behaviour and habitat demands much more difficult.

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9. Appendices

9.1 Completed Forms with the Dens Descriptions

Tables 1-60. Forms with the recorded red fox dens

Locality	**Bilský lesík - Bojenice**						
Cadastral territory	**Bojenice**						
District	**Písek**			Date	**17.04.2010**		
Altitude (m a.s.l.)	**480**	Slope orientation	**N**	Area (m^2)	**15**		
Slope gradient	□ **< 15°**	□ 15°–30°	□ 30°–45°	□ > 45°			
Relief	**Shrubland; mild slope**						
Determinant vegetation layers	□ tree	□ **shrub**	□ herb				
Soil texture class	**loamy**		Ground water	□ yes	□ **no**		
Soil skeleton	□ **< 10%**	□ 10–25%	□ 25–50%	□ > 50%			
Rooting	□ none	□ **weak**	□ middle	□ heavy			
Substratum type	□ anthropogenic	□ **natural**	Water source (m)	**800**			
Den use	□ **occupied**	□ abandoned	Communication (m)	**1,200**			
Breeding den	□ yes	□ **no**	Residential realty (m)	**2,500**			
Yesteryear occupation	□ **yes**	□ no					
Cohabiting carnivores	□ European badger	□ Raccoon dog					
Remark							

Entrance	h/w (cm)	Aspect	Use	Function	Entrance mouth	
1	**24** **23**	**N**	□ **used** □ abandoned	□ **passable** □ upcast	□ roots □ stones	□ **earth** □ waste
2	**27** **29**	**NE**	□ **used** □ abandoned	□ **passable** □ upcast	□ roots □ stones	□ **earth** □ waste

Locality	**Bilský lesík I.**						
Cadastral territory	**Bilina**						
District	**Písek**			Date	**17.04.2010**		
Altitude (m a.s.l.)	**465**	Slope orientation	**N**	Area (m^2)	**5**		
Slope gradient	□ < 15°	□ **15°–30°**	□ 30°–45°	□ > 45°			
Relief	**Field-forest edge**						
Determinant vegetation layers	□ **tree**	□ shrub	□ herb				
Soil texture class	**loamy-sandy**		Ground water	□ yes	□ **no**		
Soil skeleton	□ < 10%	□ **10–25%**	□ 25–50%	□ > 50%			
Rooting	□ none	□ weak	□ **middle**	□ heavy			
Substratum type	□ anthropogenic	□ **natural**	Water source (m)	**300**			
Den use	□ occupied	□ **abandoned**	Communication (m)	**1,000**			
Breeding den	□ yes	□ **no**	Residential realty (m)	**1,800**			
Yesteryear occupation	□ yes	□ **no**					
Cohabiting carnivores	□ European badger	□ Raccoon dog					
Remark							

Entrance	h/w (cm)	Aspect	Use	Function	Entrance mouth	
1	**16** **17**	**N**	□ used □ **abandoned**	□ **passable** □ upcast	□ **roots** □ stones	□ **earth** □ waste

2	**12** **10**	**E**	□ used □ **abandoned**	□ passable □ **upcast**	□ roots □ stones	□ **earth** □ waste

Locality	**Bilský lesík II.**		
Cadastral territory	**Bilina**		
District	**Písek**	Date	**17.04.2010**
Altitude (m a.s.l.)	**465**	Slope orientation	**S**
Area (m^2)	**25**		
Slope gradient	□ < 15°	□ 15°–30°	□ 30°–45°	□ **> 45°**
Relief	**Vertical ground wall in ravine; field-forest edge**		
Determinant vegetation layers	□ **tree**	□ shrub	□ herb
Soil texture class	**loamy-sandy**	Ground water	□ yes	□ **no**
Soil skeleton	□ < 10%	□ **10–25%**	□ 25–50%	□ > 50%
Rooting	□ none	□ weak	□ middle	□ **heavy**
Substratum type	□ anthropogenic	□ **natural**	Water source (m)	**300**
Den use	□ occupied	□ **abandoned**	Communication (m)	**1,000**
Breeding den	□ yes	□ **no**	Residential realty (m)	**1,800**
Yesteryear occupation	□ yes	□ **no**		
Cohabiting carnivores	□ European badger	□ Raccoon dog		
Remark				

Entrance	h/w (cm)	Aspect	Use	Function	Entrance mouth
1	**28** **31**	**E**	□ used □ **abandoned**	□ **passable** □ upcast	□ **roots** □ stones	□ **earth** □ waste
2	**42** **40**	**W**	□ used □ **abandoned**	□ **passable** □ upcast	□ **roots** □ stones	□ **earth** □ waste

Locality	**Bojenice - Na Vrchách**		
Cadastral territory	**Bojenice**		
District	**Písek**	Date	**17.04.2010**
Altitude (m a.s.l.)	**485**	Slope orientation	**E**
Area (m^2)	**5**		
Slope gradient	□ < 15°	□ 15°–30°	□ 30°–45°	□ **> 45°**
Relief	**Balk between field and field road**		
Determinant vegetation layers	□ tree	□ **shrub**	□ **herb**
Soil texture class	**loamy**	Ground water	□ yes	□ **no**
Soil skeleton	□ **< 10%**	□ 10–25%	□ 25–50%	□ > 50%
Rooting	□ none	□ **weak**	□ middle	□ heavy
Substratum type	□ **anthropogenic**	□ natural	Water source (m)	**150**
Den use	□ occupied	□ **abandoned**	Communication (m)	**800**
Breeding den	□ yes	□ **no**	Residential realty (m)	**800**
Yesteryear occupation	□ yes	□ **no**		
Cohabiting carnivores	□ European badger	□ Raccoon dog		
Remark				

Entrance	h/w (cm)	Aspect	Use	Function	Entrance mouth
1	**22** **19**	**W**	□ used □ **abandoned**	□ **passable** □ upcast	□ roots □ stones	□ **earth** □ waste
2	**30** **31**	**E**	□ used □ **abandoned**	□ **passable** □ upcast	□ roots □ stones	□ **earth** □ waste

Locality	**Bojenice - rybník**
Cadastral territory	**Bojenice**

District	**Písek**			Date	**17.04.2010**
Altitude (m a.s.l.)	**465**	Slope orientation	**E**	Area (m^2)	**5**
Slope gradient	□ < 15°	□ 15°–30°	□ 30°–45°	□ **> 45°**	
Relief	**Balk between field and field road**				
Determinant vegetation layers	□ tree	□ **shrub**	□ **herb**		
Soil texture class	**sandy-loamy**		Ground water	□ **yes**	□ no
Soil skeleton	□ **< 10%**	□ 10–25%	□ 25–50%	□ > 50%	
Rooting	□ none	□ **weak**	□ middle	□ heavy	
Substratum type	□ **anthropogenic**	□ natural	Water source (m)		**400**
Den use	□ **occupied**	□ abandoned	Communication (m)		**600**
Breeding den	□ **yes**	□ no	Residential realty (m)		**800**
Yesteryear occupation	□ **yes**		□ no		
Cohabiting carnivores	□ European badger		□ Raccoon dog		
Remark	**Entrance no 2 - mouth alongside drain colliery**				

Entrance	h/w (cm)	Aspect	Use	Function	Entrance mouth	
1	**41** **38**	**E**	□ used □ **abandoned**	□ **passable** □ upcast	□ roots □ **stones**	□ earth □ waste
2	**20** **19**	**E**	□ **used** □ abandoned	□ **passable** □ upcast	□ roots □ **stones**	□ **earth** □ waste

Locality	**Bouská - hraniční strouha**				
Cadastral territory	**Slapy nad Vltavou**				
District	**Praha - západ**			Date	**19.04.2010**
Altitude (m a.s.l.)	**300**	Slope orientation	**NE**	Area (m^2)	**40**
Slope gradient	□ < 15°	□ 15°–30°	□ 30°–45°	□ **> 45°**	
Relief	**Ravine between spruce thicket and beech pole-stage stand**				
Determinant vegetation layers	□ **tree**	□ shrub	□ herb		
Soil texture class	**clay-loamy**		Ground water	□ yes	□ **no**
Soil skeleton	□ **< 10%**	□ 10–25%	□ 25–50%	□ > 50%	
Rooting	□ none	□ weak	□ middle	□ **heavy**	
Substratum type	□ anthropogenic	□ **natural**	Water source (m)		**20**
Den use	□ **occupied**	□ abandoned	Communication (m)		**500**
Breeding den	□ **yes**	□ no	Residential realty (m)		**500**
Yesteryear occupation	□ **yes**		□ no		
Cohabiting carnivores	□ **European badger**		□ Raccoon dog		
Remark					

Entrance	h/w (cm)	Aspect	Use	Function	Entrance mouth	
1	**21** **20**	**E**	□ **used** □ abandoned	□ **passable** □ upcast	□ **roots** □ stones	□ **earth** □ waste
2	**27** **22**	**E**	□ **used** □ abandoned	□ **passable** □ upcast	□ **roots** □ stones	□ **earth** □ waste
3	**34** **39**	**E**	□ used □ **abandoned**	□ passable □ **upcast**	□ **roots** □ stones	□ **earth** □ waste

Locality	**Bysterská mez - pod Skalicí**				
Cadastral territory	**Bystrá nad Jizerou**				
District	**Semily**			Date	**25.04.2010**
Altitude (m a.s.l.)	**500**	Slope orientation	**W**	Area (m^2)	**75**
Slope gradient	□ < 15°	□ 15°–30°	□ **30°–45°**	□ > 45°	

Relief	**Slope above brook**				
Determinant vegetation layers	□ **tree**	□ shrub	□ herb		
Soil texture class	**loamy**		Ground water	□ yes	□ **no**
Soil skeleton	□ **< 10%**	□ 10–25%	□ 25–50%	□ > 50%	
Rooting	□ none	□ weak	□ **middle**	□ heavy	
Substratum type	□ anthropogenic	□ **natural**	Water source (m)		**10**
Den use	□ **occupied**	□ abandoned	Communication (m)		**860**
Breeding den	□ **yes**	□ no	Residential realty (m)		**860**
Yesteryear occupation	□ **yes**	□ no			
Cohabiting carnivores	□ **European badger**	□ **Raccoon dog**			
Remark					

Entrance	h/w (cm)	Aspect	Use	Function	Entrance mouth	
1	**32** **43**	**S**	□ used □ **abandoned**	□ **passable** □ upcast	□ **roots** □ stones	□ **earth** □ waste
2	**20** **32**	**W**	□ used □ **abandoned**	□ passable □ **upcast**	□ **roots** □ stones	□ **earth** □ waste
3	**20** **38**	**W**	□ used □ **abandoned**	□ passable □ **upcast**	□ roots □ stones	□ **earth** □ waste
4	**19** **27**	**SW**	□ **used** □ abandoned	□ **passable** □ upcast	□ **roots** □ stones	□ earth □ waste
5	**30** **14**	**S**	□ used □ **abandoned**	□ passable □ **upcast**	□ roots □ stones	□ **earth** □ waste
6	**27** **36**	**SW**	□ **used** □ abandoned	□ **passable** □ upcast	□ roots □ stones	□ **earth** □ waste
7	**29** **23**	**NW**	□ **used** □ abandoned	□ **passable** □ upcast	□ **roots** □ stones	□ earth □ waste
8	**46** **52**	**W**	□ **used** □ abandoned	□ **passable** □ upcast	□ **roots** □ stones	□ **earth** □ waste
9	**23** **19**	**W**	□ used □ **abandoned**	□ **passable** □ upcast	□ **roots** □ stones	□ earth □ waste
10	**36** **28**	**NW**	□ used □ **abandoned**	□ **passable** □ upcast	□ **roots** □ stones	□ **earth** □ waste
11	**24** **28**	**N**	□ **used** □ abandoned	□ **passable** □ upcast	□ **roots** □ stones	□ earth □ waste
12	**20** **15**	**SW**	□ used □ **abandoned**	□ **passable** □ upcast	□ **roots** □ stones	□ earth □ waste
13	**20** **30**	**NW**	□ **used** □ abandoned	□ **passable** □ upcast	□ **roots** □ stones	□ **earth** □ waste
14	**20** **37**	**W**	□ **used** □ abandoned	□ **passable** □ upcast	□ **roots** □ stones	□ earth □ waste

Locality	**Celiny - panelka**				
Cadastral territory	**Bor u Karlových Var**				
District	**Karlovy Vary**		Date	**24.04.2010**	
Altitude (m a.s.l.)	**480**	Slope orientation **SE**	Area (m^2)		**5**
Slope gradient	□ **< 15°**	□ 15°–30°	□ 30°–45°	□ > 45°	
Relief	**Shrubby balk along the field road**				
Determinant vegetation layers	□ tree	□ **shrub**	□ herb		
Soil texture class	**loamy**		Ground water	□ yes	□ **no**

Soil skeleton	□ < 10%	□ **10–25%**	□ 25–50%	□ > 50%	
Rooting	□ none	□ weak	□ **middle**	□ heavy	
Substratum type	□ anthropogenic	□ **natural**	Water source (m)	**200**	
Den use	□ **occupied**	□ abandoned	Communication (m)	**440**	
Breeding den	□ yes	□ **no**	Residential realty (m)	**840**	
Yesteryear occupation	□ **yes**	□ no			
Cohabiting carnivores	□ European badger	□ Raccoon dog			
Remark	**Excavated and used for breeding in 2009**				

Entrance	h/w (cm)	Aspect	Use	Function	Entrance mouth	
1	**31** **30**	**S**	□ **used** □ abandoned	□ **passable** □ upcast	□ **roots** □ stones	□ **earth** □ waste

Locality	**Čermačka**				
Cadastral territory	**Roztoky u Jilemnice**				
District	**Semily**		Date	**25.04.2010**	
Altitude (m a.s.l.)	**500**	Slope orientation **N**	Area (m^2)	**25**	
Slope gradient	□ **< 15°**	□ 15°–30°	□ 30°–45°	□ > 45°	
Relief	**Edge of plateau above brook; root system of spruces**				
Determinant vegetation layers	□ **tree**	□ shrub	□ herb		
Soil texture class	**clay-loamy**		Ground water	□ yes	□ **no**
Soil skeleton	□ **< 10%**	□ 10–25%	□ 25–50%	□ > 50%	
Rooting	□ none	□ weak	□ middle	□ **heavy**	
Substratum type	□ anthropogenic	□ **natural**	Water source (m)	**10**	
Den use	□ occupied	□ **abandoned**	Communication (m)	**250**	
Breeding den	□ yes	□ **no**	Residential realty (m)	**680**	
Yesteryear occupation	□ **yes**	□ no			
Cohabiting carnivores	□ European badger	□ Raccoon dog			
Remark					

Entrance	h/w (cm)	Aspect	Use	Function	Entrance mouth	
1	**21** **26**	**N**	□ used □ **abandoned**	□ **passable** □ upcast	□ roots □ stones	□ **earth** □ waste
2	**36** **25**	**N**	□ used □ **abandoned**	□ **passable** □ upcast	□ **roots** □ stones	□ **earth** □ waste
3	**37** **29**	**NW**	□ used □ **abandoned**	□ **passable** □ upcast	□ **roots** □ stones	□ earth □ waste
4	**13** **32**	**N**	□ used □ **abandoned**	□ passable □ **upcast**	□ **roots** □ stones	□ **earth** □ waste
5	**26** **25**	**SE**	□ used □ **abandoned**	□ **passable** □ upcast	□ **roots** □ stones	□ **earth** □ waste
6	**21** **37**	**NE**	□ used □ **abandoned**	□ **passable** □ upcast	□ **roots** □ stones	□ **earth** □ waste
7	**24** **24**	**NE**	□ used □ **abandoned**	□ **passable** □ upcast	□ **roots** □ stones	□ earth □ waste
8	**38** **23**	**N**	□ used □ **abandoned**	□ **passable** □ upcast	□ **roots** □ stones	□ **earth** □ waste

Locality	**Doupov - pod hrobkou**		
Cadastral territory	**Bražec u Hradiště**		
District	**Karlovy Vary**	Date	**21.04.2010**

Altitude (m a.s.l.)	**685**	Slope orientation	**W**	Area (m^2)	**25**
Slope gradient	□ < 15°	□ **15°–30°**	□ 30°–45°	□ > 45°	
Relief	**Wooded slope**				
Determinant vegetation layers	□ **tree**	□ shrub	□ herb		
Soil texture class	**loamy**	Ground water	□ yes	□ **no**	
Soil skeleton	□ **< 10%**	□ 10–25%	□ 25–50%	□ > 50%	
Rooting	□ none	□ weak	□ **middle**	□ heavy	
Substratum type	□ anthropogenic	□ **natural**	Water source (m)	**30**	
Den use	□ **occupied**	□ abandoned	Communication (m)	**1,500**	
Breeding den	□ **yes**	□ no	Residential realty (m)	**12,000**	
Yesteryear occupation	□ **yes**	□ no			
Cohabiting carnivores	□ European badger	□ Raccoon dog			
Remark	**Military region**				

Entrance	h/w (cm)	Aspect	Use	Function	Entrance mouth
1	**32** **33**	**W**	□ **used** □ abandoned	□ **passable** □ upcast	□ roots □ stones	□ **earth** □ waste
2	**27** **20**	**W**	□ used □ **abandoned**	□ passable □ **upcast**	□ roots □ **stones**	□ earth □ waste
3	**31** **38**	**W**	□ **used** □ abandoned	□ **passable** □ upcast	□ **roots** □ stones	□ earth □ waste
4	**25** **29**	**W**	□ **used** □ abandoned	□ **passable** □ upcast	□ **roots** □ stones	□ earth □ waste

Locality	**Fabrický**				
Cadastral territory	**Košťálov**				
District	**Semily**			Date	**25.04.2010**
Altitude (m a.s.l.)	**440**	Slope orientation	**SW**	Area (m^2)	**5**
Slope gradient	□ < 15°	□ 15°–30°	□ 30°–45°	□ **> 45°**	
Relief	**Denudated soil profile in steep slope beneath meadow**				
Determinant vegetation layers	□ **tree**	□ shrub	□ herb		
Soil texture class	**clay-loamy**	Ground water	□ yes	□ **no**	
Soil skeleton	□ < 10%	□ 10–25%	□ **25–50%**	□ > 50%	
Rooting	□ none	□ weak	□ middle	□ **heavy**	
Substratum type	□ anthropogenic	□ **natural**	Water source (m)	**50**	
Den use	□ occupied	□ **abandoned**	Communication (m)	**330**	
Breeding den	□ yes	□ **no**	Residential realty (m)	**420**	
Yesteryear occupation	□ **yes**	□ no			
Cohabiting carnivores	□ **European badger**	□ Raccoon dog			
Remark					

Entrance	h/w (cm)	Aspect	Use	Function	Entrance mouth
1	**30** **32**	**S**	□ used □ **abandoned**	□ **passable** □ upcast	□ **roots** □ **stones**	□ earth □ waste
2	**38** **25**	**NW**	□ used □ **abandoned**	□ **passable** □ upcast	□ **roots** □ stones	□ earth □ waste

Locality	**Hvězda - Na Drančírně**				
Cadastral territory	**Hvězda**				
District	**Kladno**			Date	**25.04.2010**
Altitude (m a.s.l.)	**390**	Slope orientation	**N**	Area (m^2)	**150**

Slope gradient	□ < 15°	□ 15°–30°	**□ 30°–45°**	□ > 45°
Relief	**Wooded slope**			
Determinant vegetation layers	**□ tree**	□ shrub	□ herb	
Soil texture class	**loamy**	Ground water	□ yes	**□ no**
Soil skeleton	□ < 10%	**□ 10–25%**	□ 25–50%	□ > 50%
Rooting	□ none	□ weak	**□ middle**	□ heavy
Substratum type	□ anthropogenic	**□ natural**	Water source (m)	**150**
Den use	□ occupied	**□ abandoned**	Communication (m)	**300**
Breeding den	□ yes	**□ no**	Residential realty (m)	**500**
Yesteryear occupation	□ yes		**□ no**	
Cohabiting carnivores	□ European badger		□ Raccoon dog	
Remark				

Entrance	h/w (cm)	Aspect	Use	Function	Entrance mouth	
1	**43** **40**	**N**	□ used **□ abandoned**	**□ passable** □ upcast	**□ roots** □ stones	**□ earth** □ waste
2	**32** **52**	**N**	□ used **□ abandoned**	**□ passable** □ upcast	**□ roots** □ stones	**□ earth** □ waste
3	**21** **30**	**SE**	□ used **□ abandoned**	**□ passable** □ upcast	**□ roots** □ stones	**□ earth** □ waste
4	**28** **49**	**N**	□ used **□ abandoned**	**□ passable** □ upcast	**□ roots** □ stones	**□ earth** □ waste

Locality	**Chlívek - pod Trianglem**			
Cadastral territory	**Pulovice**			
District	**Karlovy Vary**		Date	**11.04.2010**
Altitude (m a.s.l.)	**475**	Slope orientation **W**	Area (m^2)	**50**
Slope gradient	□ < 15°	□ 15°–30°	**□ 30°–45°**	□ > 45°
Relief	**Lower and higher slope gradient boundary**			
Determinant vegetation layers	**□ tree**	**□ shrub**	□ herb	
Soil texture class	**loamy**	Ground water	□ yes	**□ no**
Soil skeleton	□ < 10%	**□ 10–25%**	□ 25–50%	□ > 50%
Rooting	□ none	□ weak	**□ middle**	□ heavy
Substratum type	□ anthropogenic	**□ natural**	Water source (m)	**170**
Den use	**□ occupied**	□ abandoned	Communication (m)	**240**
Breeding den	**□ yes**	□ no	Residential realty (m)	**530**
Yesteryear occupation	□ yes		**□ no**	
Cohabiting carnivores	**□ European badger**		□ Raccoon dog	
Remark	**Old den**			

Entrance	h/w (cm)	Aspect	Use	Function	Entrance mouth	
1	**20** **22**	**W**	**□ used** □ abandoned	**□ passable** □ upcast	**□ roots** □ stones	**□ earth** □ waste
2	**21** **32**	**SW**	□ used **□ abandoned**	□ passable **□ upcast**	**□ roots** □ stones	**□ earth** □ waste
3	**34** **37**	**SW**	**□ used** □ abandoned	**□ passable** □ upcast	**□ roots** □ stones	**□ earth** □ waste
4	**29** **28**	**E**	**□ used** □ abandoned	**□ passable** □ upcast	□ roots **□ stones**	**□ earth** □ waste
5	**14** **16**	**SW**	□ used **□ abandoned**	**□ passable** □ upcast	□ roots □ stones	**□ earth** □ waste

6	**28** **32**	**SW**	□ **used** □ abandoned	□ **passable** □ upcast	□ roots □ stones	□ **earth** □ waste
7	**24** **31**	**SW**	□ used □ **abandoned**	□ **passable** □ upcast	□ **roots** □ stones	□ **earth** □ waste

Locality	**Jedomělice - Ostrov**				
Cadastral territory	**Jedomělice**				
District	**Kladno**			Date	**25.04.2010**
Altitude (m a.s.l.)	**330**	Slope orientation	**S**	Area (m^2)	**50**
Slope gradient	□ < 15°	□ 15°–30°	□ **30°–45°**	□ > 45°	
Relief	**Wooded slope**				
Determinant vegetation layers	□ **tree**	□ shrub	□ herb		
Soil texture class	**clay-loamy**			Ground water	□ yes □ **no**
Soil skeleton	□ **< 10%**	□ 10–25%	□ 25–50%	□ > 50%	
Rooting	□ none	□ weak	□ **middle**	□ heavy	
Substratum type	□ anthropogenic	□ **natural**		Water source (m)	**100**
Den use	□ occupied	□ **abandoned**		Communication (m)	**800**
Breeding den	□ yes	□ **no**		Residential realty (m)	**1,200**
Yesteryear occupation	□ yes		□ **no**		
Cohabiting carnivores	□ European badger		□ Raccoon dog		
Remark					

Entrance	**h/w (cm)**	**Aspect**	**Use**	**Function**	**Entrance mouth**
1	**20** **35**	**S**	□ used □ **abandoned**	□ **passable** □ upcast	□ **roots** □ **earth** □ stones □ waste

Locality	**Kanice**				
Cadastral territory	**Kanice**				
District	**Domažlice**			Date	**14.04.2010**
Altitude (m a.s.l.)	**480**	Slope orientation	**W + E**	Area (m^2)	**90**
Slope gradient	□ < 15°	□ 15°–30°	□ **30°–45°**	□ > 45°	
Relief	**Narrow ridge in greater ravine**				
Determinant vegetation layers	□ **tree**	□ shrub	□ herb		
Soil texture class	**loamy**			Ground water	□ yes □ **no**
Soil skeleton	□ **< 10%**	□ 10–25%	□ 25–50%	□ > 50%	
Rooting	□ none	□ **weak**	□ middle	□ heavy	
Substratum type	□ anthropogenic	□ **natural**		Water source (m)	**50**
Den use	□ **occupied**	□ abandoned		Communication (m)	**500**
Breeding den	□ yes	□ **no**		Residential realty (m)	**500**
Yesteryear occupation	□ **yes**		□ no		
Cohabiting carnivores	□ **European badger**		□ Raccoon dog		
Remark	**Den regularly occupied by both species in past**				

Entrance	**h/w (cm)**	**Aspect**	**Use**	**Function**	**Entrance mouth**
1	**25** **20**	**W**	□ **used** □ abandoned	□ **passable** □ upcast	□ roots □ **earth** □ stones □ waste
2	**39** **40**	**W**	□ **used** □ abandoned	□ **passable** □ upcast	□ roots □ **earth** □ stones □ waste
3	**29** **28**	**W**	□ **used** □ abandoned	□ **passable** □ upcast	□ roots □ **earth** □ stones □ waste

4	**30** **35**	**S**	□ **used** □ abandoned	□ **passable** □ upcast	□ roots □ stones	□ **earth** □ waste
5	**22** **19**	**S**	□ used □ **abandoned**	□ passable □ **upcast**	□ roots □ stones	□ **earth** □ waste
6	**15** **15**	**E**	□ used □ **abandoned**	□ passable □ **upcast**	□ roots □ stones	□ **earth** □ waste

Locality	**Kolišov**				
Cadastral territory	**Kolišov**				
District	**Písek**		Date	**17.04.2010**	
Altitude (m a.s.l.)	**440**	Slope orientation **S**	Area (m^2)	**20**	
Slope gradient	□ **< 15°**	□ 15°–30°	□ 30°–45°	□ > 45°	
Relief	**Old abandoned drain in forest**				
Determinant vegetation layers	□ **tree**	□ shrub	□ herb		
Soil texture class	**loamy**		Ground water	□ yes	□ **no**
Soil skeleton	□ **< 10%**	□ 10–25%	□ 25–50%	□ > 50%	
Rooting	□ none	□ **weak**	□ middle	□ heavy	
Substratum type	□ anthropogenic	□ **natural**	Water source (m)	**200**	
Den use	□ occupied	□ **abandoned**	Communication (m)	**80**	
Breeding den	□ yes	□ **no**	Residential realty (m)	**80**	
Yesteryear occupation	□ **yes**		□ no		
Cohabiting carnivores	□ European badger		□ Raccoon dog		
Remark	**Den damaged by hunters during fox hunting last year**				

Entrance	**h/w (cm)**	**Aspect**	**Use**	**Function**	**Entrance mouth**	
1	**30** **29**	**W**	□ used □ **abandoned**	□ **passable** □ upcast	□ roots □ stones	□ **earth** □ waste
2	**28** **30**	**E**	□ used □ **abandoned**	□ **passable** □ upcast	□ roots □ stones	□ **earth** □ waste

Locality	**Koloměř**				
Cadastral territory	**Borovany u Milevska**				
District	**Písek**		Date	**17.04.2010**	
Altitude (m a.s.l.)	**450**	Slope orientation **no**	Area (m^2)	**?**	
Slope gradient	□ **< 15°**	□ 15°–30°	□ 30°–45°	□ > 45°	
Relief	**Old field drainage**				
Determinant vegetation layers	□ tree	□ **shrub**	□ herb		
Soil texture class	**concrete**		Ground water	□ **yes**	□ no
Soil skeleton	□ < 10%	□ 10–25%	□ 25–50%	□ > 50%	
Rooting	□ none	□ weak	□ middle	□ heavy	
Substratum type	□ **anthropogenic**	□ natural	Water source (m)	**10**	
Den use	□ **occupied**	□ abandoned	Communication (m)	**400**	
Breeding den	□ **yes**	□ no	Residential realty (m)	**1,500**	
Yesteryear occupation	□ **yes**		□ no		
Cohabiting carnivores	□ European badger		□ Raccoon dog		
Remark	**Entrance no 1,2 - feed-pipe; no 3 - control colliery**				

Entrance	**h/w (cm)**	**Aspect**	**Use**	**Function**	**Entrance mouth**	
1	**40** **40**	**E**	□ **used** □ abandoned	□ **passable** □ upcast	□ roots □ stones	□ earth □ **waste**

2	**40** **40**	**S**	□ used □ **abandoned**	□ **passable** □ upcast	□ roots □ stones	□ earth □ **waste**
3	**40** **40**	**up**	□ used □ **abandoned**	□ passable □ **upcast**	□ roots □ stones	□ earth □ **waste**

Locality	**Lešákova mez**		
Cadastral territory	**Mříčná**		
District	**Semily**	Date	**25.04.2010**
Altitude (m a.s.l.) **530**	Slope orientation **SW**	Area (m^2)	**200**
Slope gradient	□ < 15° □ 15°–30° □ **30°–45°** □ > 45°		
Relief	**Shrubby-woody moderate slope**		
Determinant vegetation layers	□ **tree** □ **shrub** □ herb		
Soil texture class	**loamy**	Ground water	□ yes □ **no**
Soil skeleton	□ < 10% □ **10–25%** □ 25–50% □ > 50%		
Rooting	□ none □ weak □ middle □ **heavy**		
Substratum type	□ anthropogenic □ **natural**	Water source (m)	**600**
Den use	□ **occupied** □ abandoned	Communication (m)	**900**
Breeding den	□ **yes** □ no	Residential realty (m)	**900**
Yesteryear occupation	□ **yes** □ no		
Cohabiting carnivores	□ **European badger** □ Raccoon dog		
Remark			

Entrance	h/w (cm)	Aspect	Use	Function	Entrance mouth	
1	**36** **74**	**NW**	□ **used** □ abandoned	□ **passable** □ upcast	□ roots □ **stones**	□ **earth** □ waste
2	**51** **50**	**SW**	□ **used** □ abandoned	□ **passable** □ upcast	□ **roots** □ stones	□ earth □ waste
3	**19** **39**	**N**	□ used □ **abandoned**	□ **passable** □ upcast	□ **roots** □ stones	□ **earth** □ waste
4	**25** **27**	**S**	□ **used** □ abandoned	□ **passable** □ upcast	□ **roots** □ stones	□ **earth** □ waste
5	**21** **70**	**S**	□ used □ **abandoned**	□ passable □ **upcast**	□ **roots** □ stones	□ **earth** □ waste
6	**50** **46**	**E**	□ **used** □ abandoned	□ **passable** □ upcast	□ **roots** □ stones	□ **earth** □ waste
7	**40** **46**	**SW**	□ **used** □ abandoned	□ **passable** □ upcast	□ **roots** □ stones	□ **earth** □ waste
8	**40** **72**	**W**	□ **used** □ abandoned	□ **passable** □ upcast	□ **roots** □ stones	□ earth □ waste
9	**23** **32**	**SW**	□ **used** □ abandoned	□ **passable** □ upcast	□ **roots** □ stones	□ **earth** □ waste
10	**37** **28**	**NE**	□ used □ **abandoned**	□ **passable** □ upcast	□ **roots** □ stones	□ **earth** □ waste
11	**50** **70**	**S**	□ **used** □ abandoned	□ **passable** □ upcast	□ **roots** □ stones	□ **earth** □ waste
12	**26** **42**	**NW**	□ **used** □ abandoned	□ **passable** □ upcast	□ **roots** □ stones	□ earth □ waste
13	**75** **62**	**S**	□ **used** □ abandoned	□ **passable** □ upcast	□ roots □ stones	□ **earth** □ waste

14	**32** **38**	**SW**	□ **used** □ abandoned	□ **passable** □ upcast	□ roots □ stones	□ **earth** □ waste
15	**33** **32**	**S**	□ used □ **abandoned**	□ **passable** □ upcast	□ **roots** □ stones	□ earth □ waste
16	**30** **30**	**SW**	□ **used** □ abandoned	□ **passable** □ upcast	□ **roots** □ stones	□ **earth** □ waste
17	**24** **30**	**SW**	□ used □ **abandoned**	□ **passable** □ upcast	□ **roots** □ stones	□ earth □ waste
18	**27** **50**	**SW**	□ used □ **abandoned**	□ **passable** □ upcast	□ **roots** □ stones	□ earth □ waste
19	**36** **46**	**NW**	□ **used** □ abandoned	□ **passable** □ upcast	□ **roots** □ stones	□ **earth** □ waste
20	**25** **30**	**SW**	□ **used** □ abandoned	□ **passable** □ upcast	□ **roots** □ stones	□ **earth** □ waste
21	**62** **49**	**SW**	□ used □ **abandoned**	□ **passable** □ upcast	□ **roots** □ stones	□ **earth** □ waste
22	**43** **45**	**W**	□ **used** □ abandoned	□ **passable** □ upcast	□ **roots** □ stones	□ earth □ waste
23	**30** **58**	**W**	□ **used** □ abandoned	□ **passable** □ upcast	□ **roots** □ stones	□ **earth** □ waste
24	**24** **52**	**W**	□ used □ **abandoned**	□ passable □ **upcast**	□ **roots** □ stones	□ **earth** □ waste

Locality	**Lom Košťálov**				
Cadastral territory	**Košťálov**				
District	**Semily**			Date	**25.04.2010**
Altitude (m a.s.l.)	**445**	Slope orientation	**no**	Area (m^2)	**?**
Slope gradient	□ < 15°	□ **15°–30°**	□ 30°–45°	□ > 45°	
Relief	**Reclamation pipe entrance in grassy slope**				
Determinant vegetation layers	□ tree	□ shrub	□ **herb**		
Soil texture class	**concrete**			Ground water	□ **yes** □ no
Soil skeleton	□ < 10%	□ 10–25%	□ 25–50%	□ > 50%	
Rooting	□ none	□ weak	□ middle	□ heavy	
Substratum type	□ **anthropogenic**	□ natural		Water source (m)	**100**
Den use	□ **occupied**	□ abandoned		Communication (m)	**400**
Breeding den	□ yes	□ **no**		Residential realty (m)	**400**
Yesteryear occupation	□ **yes**	□ no			
Cohabiting carnivores	□ European badger	□ Raccoon dog			
Remark	**Communication and realty distance - operational quarry; ? more entrances**				

Entrance	**h/w (cm)**	**Aspect**	**Use**	**Function**	**Entrance mouth**	
1	**25** **25**	**NW**	□ **used** □ abandoned	□ **passable** □ upcast	□ roots □ stones	□ earth □ **waste**

Locality	**Lom Košťálov - Janatovy vrcha I.**				
Cadastral territory	**Košťálov**				
District	**Semily**			Date	**25.04.2010**
Altitude (m a.s.l.)	**480**	Slope orientation	**N**	Area (m^2)	**10**
Slope gradient	□ < 15°	□ 15°–30°	□ **30°–45°**	□ > 45°	
Relief	**Slope with mature forest**				

Determinant vegetation layers		□ **tree**	□ shrub	□ herb	
Soil texture class	**sandy-loamy**		Ground water	□ yes	□ **no**
Soil skeleton	□ **< 10%**	□ 10–25%	□ 25–50%	□ > 50%	
Rooting	□ none	□ weak	□ **middle**	□ heavy	
Substratum type	□ anthropogenic	□ **natural**	Water source (m)		**300**
Den use	□ **occupied**	□ abandoned	Communication (m)		**160**
Breeding den	□ **yes**	□ no	Residential realty (m)		**160**
Yesteryear occupation	□ **yes**		□ no		
Cohabiting carnivores	□ European badger		□ Raccoon dog		
Remark	**Communication and realty distance measured to operational quarry**				

Entrance	h/w (cm)	Aspect	Use	Function	Entrance mouth	
1	**38** **80**	**NW**	□ **used** □ abandoned	□ **passable** □ upcast	□ **roots** □ stones	□ **earth** □ waste
2	**24** **20**	**N**	□ **used** □ abandoned	□ **passable** □ upcast	□ **roots** □ stones	□ earth □ waste

Locality	**Lom Košťálov - Janatovy vrcha II.**				
Cadastral territory	**Košťálov**				
District	**Semily**		Date		**25.04.2010**
Altitude (m a.s.l.)	**475**	Slope orientation **W**	Area (m^2)		**5**
Slope gradient	□ < 15°	□ **15°–30°**	□ 30°–45°	□ > 45°	
Relief	**Slope with mature forest**				
Determinant vegetation layers		□ **tree**	□ shrub	□ herb	
Soil texture class	**sandy-loamy**		Ground water	□ yes	□ **no**
Soil skeleton	□ **< 10%**	□ 10–25%	□ 25–50%	□ > 50%	
Rooting	□ none	□ weak	□ middle	□ **heavy**	
Substratum type	□ anthropogenic	□ **natural**	Water source (m)		**200**
Den use	□ **occupied**	□ abandoned	Communication (m)		**340**
Breeding den	□ yes	□ **no**	Residential realty (m)		**340**
Yesteryear occupation	□ **yes**		□ no		
Cohabiting carnivores	□ European badger		□ Raccoon dog		
Remark	**Communication and realty distance measured to operational quarry**				

Entrance	h/w (cm)	Aspect	Use	Function	Entrance mouth	
1	**32** **37**	**SW**	□ **used** □ abandoned	□ **passable** □ upcast	□ **roots** □ stones	□ earth □ waste

Locality	**Lom Košťálov - Jodasovo I.**				
Cadastral territory	**Košťálov**				
District	**Semily**		Date		**25.04.2010**
Altitude (m a.s.l.)	**450**	Slope orientation **W**	Area (m^2)		**15**
Slope gradient	□ < 15°	□ **15°–30°**	□ 30°–45°	□ > 45°	
Relief	**Slope with mature forest**				
Determinant vegetation layers		□ **tree**	□ shrub	□ herb	
Soil texture class	**clay-loamy**		Ground water	□ yes	□ **no**
Soil skeleton	□ < 10%	□ **10–25%**	□ 25–50%	□ > 50%	
Rooting	□ none	□ weak	□ **middle**	□ heavy	
Substratum type	□ anthropogenic	□ **natural**	Water source (m)		**100**
Den use	□ occupied	□ **abandoned**	Communication (m)		**380**
Breeding den	□ yes	□ **no**	Residential realty (m)		**380**

Yesteryear occupation			□ **yes**		□ no	
Cohabiting carnivores			□ **European badger**		□ Raccoon dog	
Remark	**Communication and realty distance measured to operational quarry**					
Entrance	**h/w (cm)**	**Aspect**	**Use**	**Function**	**Entrance mouth**	
1	**30** **28**	**N**	□ used □ **abandoned**	□ **passable** □ upcast	□ **roots** □ stones	□ **earth** □ waste
2	**31** **30**	**NW**	□ used □ **abandoned**	□ **passable** □ upcast	□ **roots** □ stones	□ earth □ waste
3	**39** **28**	**W**	□ used □ **abandoned**	□ **passable** □ upcast	□ **roots** □ **stones**	□ earth □ waste

Locality	**Lom Košťálov - Jodasovo II.**				
Cadastral territory	**Košťálov**				
District	**Semily**			Date	**25.04.2010**
Altitude (m a.s.l.)	**455**	Slope orientation	**W**	Area (m^2)	**200**
Slope gradient	□ < 15°	□ 15°–30°	□ **30°–45°**	□ > 45°	
Relief	**Slope with mature forest**				
Determinant vegetation layers	□ **tree**	□ shrub	□ herb		
Soil texture class	**clay-loamy**			Ground water	□ yes □ **no**
Soil skeleton	□ < 10%	□ **10–25%**	□ 25–50%	□ > 50%	
Rooting	□ none	□ weak	□ middle	□ **heavy**	
Substratum type	□ anthropogenic	□ **natural**		Water source (m)	**150**
Den use	□ occupied	□ **abandoned**		Communication (m)	**400**
Breeding den	□ yes	□ **no**		Residential realty (m)	**400**
Yesteryear occupation	□ **yes**		□ no		
Cohabiting carnivores	□ **European badger**		□ Raccoon dog		
Remark	**Communication and realty distance measured to operational quarry**				

Entrance	**h/w (cm)**	**Aspect**	**Use**	**Function**	**Entrance mouth**	
1	**24** **18**	**SW**	□ used □ **abandoned**	□ **passable** □ upcast	□ **roots** □ **stones**	□ earth □ waste
2	**24** **37**	**SW**	□ used □ **abandoned**	□ **passable** □ upcast	□ **roots** □ stones	□ earth □ waste
3	**27** **33**	**W**	□ used □ **abandoned**	□ **passable** □ upcast	□ **roots** □ stones	□ **earth** □ waste
4	**28** **28**	**SW**	□ used □ **abandoned**	□ **passable** □ upcast	□ roots □ stones	□ **earth** □ waste
5	**32** **40**	**NW**	□ used □ **abandoned**	□ **passable** □ upcast	□ **roots** □ stones	□ earth □ waste
6	**33** **41**	**NE**	□ used □ **abandoned**	□ **passable** □ upcast	□ **roots** □ stones	□ **earth** □ waste
7	**47** **55**	**W**	□ used □ **abandoned**	□ **passable** □ upcast	□ **roots** □ stones	□ earth □ waste
8	**21** **34**	**SW**	□ used □ **abandoned**	□ **passable** □ upcast	□ **roots** □ stones	□ earth □ waste
9	**28** **35**	**W**	□ used □ **abandoned**	□ **passable** □ upcast	□ **roots** □ stones	□ earth □ waste
10	**37** **21**	**W**	□ used □ **abandoned**	□ **passable** □ upcast	□ **roots** □ stones	□ earth □ waste

11	**37** **39**	**S**	□ used □ **abandoned**	□ **passable**	□ **roots**	□ **earth**
				□ upcast	□ stones	□ waste
12	**24** **38**	**SW**	□ used □ **abandoned**	□ **passable**	□ **roots**	□ earth
				□ upcast	□ stones	□ waste
13	**31** **42**	**NW**	□ used □ **abandoned**	□ **passable**	□ **roots**	□ **earth**
				□ upcast	□ stones	□ waste
14	**24** **30**	**SW**	□ used □ **abandoned**	□ **passable**	□ **roots**	□ **earth**
				□ upcast	□ stones	□ waste

Locality	**Martiničák I.**				
Cadastral territory	**Roztoky u Jilemnice**				
District	**Semily**		Date	**25.04.2010**	
Altitude (m a.s.l.)	**485**	Slope orientation **SW**	Area (m^2)	**5**	
Slope gradient	□ < 15°	□ **15°–30°**	□ 30°–45°	□ > 45°	
Relief	**Balk above swamp; root system of spruce**				
Determinant vegetation layers	□ **tree**	□ shrub	□ herb		
Soil texture class	**clay-loamy**		Ground water	□ **yes**	□ no
Soil skeleton	□ **< 10%**	□ 10–25%	□ 25–50%	□ > 50%	
Rooting	□ none	□ weak	□ middle	□ **heavy**	
Substratum type	□ anthropogenic	□ **natural**	Water source (m)	**10**	
Den use	□ **occupied**	□ abandoned	Communication (m)	**320**	
Breeding den	□ yes	□ **no**	Residential realty (m)	**550**	
Yesteryear occupation	□ **yes**		□ no		
Cohabiting carnivores	□ European badger		□ Raccoon dog		
Remark					

Entrance	**h/w (cm)**	**Aspect**	**Use**	**Function**	**Entrance mouth**	
1	**34** **41**	**SW**	□ **used** □ abandoned	□ **passable**	□ **roots**	□ earth
				□ upcast	□ stones	□ waste

Locality	**Martiničák II.**				
Cadastral territory	**Roztoky u Jilemnice**				
District	**Semily**		Date	**25.04.2010**	
Altitude (m a.s.l.)	**485**	Slope orientation **W**	Area (m^2)	**20**	
Slope gradient	□ < 15°	□ **15°–30°**	□ 30°–45°	□ > 45°	
Relief	**Balk above swamp; root system of spruces**				
Determinant vegetation layers	□ **tree**	□ shrub	□ herb		
Soil texture class	**clay-loamy**		Ground water	□ **yes**	□ no
Soil skeleton	□ **< 10%**	□ 10–25%	□ 25–50%	□ > 50%	
Rooting	□ none	□ weak	□ middle	□ **heavy**	
Substratum type	□ anthropogenic	□ **natural**	Water source (m)	**10**	
Den use	□ **occupied**	□ abandoned	Communication (m)	**320**	
Breeding den	□ **yes**	□ no	Residential realty (m)	**550**	
Yesteryear occupation	□ **yes**		□ no		
Cohabiting carnivores	□ European badger		□ Raccoon dog		
Remark					

Entrance	**h/w (cm)**	**Aspect**	**Use**	**Function**	**Entrance mouth**	
1	**31** **20**	**NE**	□ used □ **abandoned**	□ passable □ **upcast**	□ **roots**	□ earth
					□ stones	□ waste

2	**28** **23**	**NW**	□ **used** □ abandoned	□ **passable** □ upcast	□ **roots** □ stones	□ earth □ waste
3	**42** **32**	**W**	□ **used** □ abandoned	□ **passable** □ upcast	□ **roots** □ stones	□ earth □ waste
4	**25** **29**	**NW**	□ used □ **abandoned**	□ **passable** □ upcast	□ **roots** □ stones	□ **earth** □ waste
5	**30** **31**	**NW**	□ used □ **abandoned**	□ **passable** □ upcast	□ **roots** □ stones	□ earth □ waste

Locality	**Meliorační kanál pod Součkovým lesem**				
Cadastral territory	**Šemnice**				
District	**Karlovy Vary**			Date	**11.04.2010**
Altitude (m a.s.l.)	**420**	Slope orientation	**NE**	Area (m^2)	**5**
Slope gradient	□ **< 15°**	□ 15°–30°	□ 30°–45°	□ > 45°	
Relief	**Sedge tuft in reclamation brook floodplain**				
Determinant vegetation layers	□ tree	□ shrub	□ **herb**		
Soil texture class	**loamy**			Ground water	□ **yes** □ no
Soil skeleton	□ < 10%	□ **10–25%**	□ 25–50%	□ > 50%	
Rooting	□ none	□ weak	□ **middle**	□ heavy	
Substratum type	□ **anthropogenic**	□ natural		Water source (m)	**10**
Den use	□ **occupied**	□ abandoned		Communication (m)	**170**
Breeding den	□ yes	□ **no**		Residential realty (m)	**240**
Yesteryear occupation	□ yes	□ **no**			
Cohabiting carnivores	□ European badger	□ Raccoon dog			
Remark	**Spring 2009 - excavating attempt; dug in winter 2009/10; rooting=sedge**				

Entrance	**h/w (cm)**	**Aspect**	**Use**	**Function**	**Entrance mouth**
1	**26** **31**	**SE**	□ **used** □ abandoned	□ **passable** □ upcast	□ **roots** □ stones	□ earth □ waste
2	**17** **15**	**NW**	□ used □ **abandoned**	□ passable □ **upcast**	□ roots □ **stones**	□ earth □ waste

Locality	**Mezi Hrobkou a Šáchovcem**				
Cadastral territory	**Konojedy**				
District	**Praha-východ**			Date	**21.04.2010**
Altitude (m a.s.l.)	**370**	Slope orientation	**NW**	Area (m^2)	**30**
Slope gradient	□ < 15°	□ 15°–30°	□ 30°–45°	□ **> 45°**	
Relief	**Rock blocks protuberant above; tiny plateau in a steep slope**				
Determinant vegetation layers	□ **tree**	□ shrub	□ herb		
Soil texture class	**loamy-sandy**			Ground water	□ yes □ **no**
Soil skeleton	□ < 10%	□ 10–25%	□ 25–50%	□ **> 50%**	
Rooting	□ none	□ weak	□ **middle**	□ heavy	
Substratum type	□ anthropogenic	□ **natural**		Water source (m)	**70**
Den use	□ **occupied**	□ abandoned		Communication (m)	**180**
Breeding den	□ **yes**	□ no		Residential realty (m)	**180**
Yesteryear occupation	□ **yes**	□ no			
Cohabiting carnivores	□ European badger	□ Raccoon dog			
Remark					

Entrance	**h/w (cm)**	**Aspect**	**Use**	**Function**	**Entrance mouth**

1	**24** **37**	**N**	□ used □ **abandoned**	□ passable □ **upcast**	□ **roots** □ stones	□ **earth** □ waste
2	**46** **14**	**W**	□ used □ **abandoned**	□ passable □ **upcast**	□ roots □ **stones**	□ earth □ waste
3	**41** **39**	**SW**	□ **used** □ abandoned	□ **passable** □ upcast	□ roots □ **stones**	□ earth □ waste
4	**16** **55**	**N**	□ used □ **abandoned**	□ passable □ **upcast**	□ roots □ **stones**	□ earth □ waste
5	**42** **42**	**SW**	□ used □ **abandoned**	□ **passable** □ upcast	□ roots □ **stones**	□ earth □ waste

Locality	**Mohyla**				
Cadastral territory	**Srlín**				
District	**Písek**			Date	**17.04.2010**
Altitude (m a.s.l.)	**425**	Slope orientation	**no**	Area (m^2)	**200**
Slope gradient	□ < 15°	□ 15°–30°	□ **30°–45°**	□ > 45°	
Relief	**Old made-up ground in forest**				
Determinant vegetation layers	□ **tree**	□ shrub	□ herb		
Soil texture class	**sandy-loamy**		Ground water	□ yes	□ **no**
Soil skeleton	□ < 10%	□ 10–25%	□ **25–50%**	□ > 50%	
Rooting	□ none	□ weak	□ **middle**	□ heavy	
Substratum type	□ **anthropogenic**	□ natural	Water source (m)		**250**
Den use	□ **occupied**	□ abandoned	Communication (m)		**1,400**
Breeding den	□ yes	□ **no**	Residential realty (m)		**1,400**
Yesteryear occupation	□ **yes**		□ no		
Cohabiting carnivores	□ European badger		□ Raccoon dog		
Remark					

Entrance	h/w (cm)	Aspect	Use	Function	Entrance mouth	
1	**21** **20**	**E**	□ **used** □ abandoned	□ **passable** □ upcast	□ **roots** □ **stones**	□ earth □ waste
2	**17** **19**	**SW**	□ **used** □ abandoned	□ **passable** □ upcast	□ **roots** □ **stones**	□ earth □ waste
3	**16** **14**	**S**	□ used □ **abandoned**	□ passable □ **upcast**	□ **roots** □ stones	□ **earth** □ waste
4	**10** **11**	**S**	□ used □ **abandoned**	□ passable □ **upcast**	□ **roots** □ stones	□ **earth** □ waste
5	**20** **32**	**NE**	□ **used** □ abandoned	□ **passable** □ upcast	□ **roots** □ **stones**	□ earth □ waste
6	**18** **19**	**NE**	□ used □ **abandoned**	□ passable □ **upcast**	□ **roots** □ stones	□ **earth** □ waste
7	**14** **17**	**W**	□ used □ **abandoned**	□ passable □ **upcast**	□ **roots** □ stones	□ **earth** □ waste
8	**10** **12**	**W**	□ used □ **abandoned**	□ passable □ **upcast**	□ **roots** □ **stones**	□ earth □ waste

Locality	**MS Orlické Podhůří**				
Cadastral territory	**Říčky v Orlickém Podhůří**				
District	**Ústí nad Orlicí**			Date	**30.04.2010**
Altitude (m a.s.l.)	**450**	Slope orientation	**SW**	Area (m^2)	**50**

Slope gradient	□ **< 15°**	□ 15°–30°	□ 30°–45°	□ > 45°
Relief	**Slope on the field-forest boundary**			
Determinant vegetation layers	□ **tree**	□ shrub	□ herb	
Soil texture class	**loamy**	Ground water	□ yes	□ **no**
Soil skeleton	□ < 10%	□ **10–25%**	□ 25–50%	□ > 50%
Rooting	□ none	□ weak	□ **middle**	□ heavy
Substratum type	□ anthropogenic	□ **natural**	Water source (m)	**500**
Den use	□ **occupied**	□ abandoned	Communication (m)	**700**
Breeding den	□ yes	□ **no**	Residential realty (m)	**700**
Yesteryear occupation	□ yes		□ **no**	
Cohabiting carnivores	□ European badger		□ Raccoon dog	
Remark				

Entrance	h/w (cm)	Aspect	Use	Function	Entrance mouth	
1	**31** **30**	**S**	□ **used** □ abandoned	□ **passable** □ upcast	□ **roots** □ stones	□ earth □ waste
2	**28** **32**	**S**	□ **used** □ abandoned	□ **passable** □ upcast	□ roots □ stones	□ **earth** □ waste
3	**30** **29**	**N**	□ used □ **abandoned**	□ **passable** □ upcast	□ roots □ stones	□ **earth** □ waste

Locality	**Na Šoupandě**			
Cadastral territory	**Oplany**			
District	**Praha-východ**		Date	**26.04.2010**
Altitude (m a.s.l.)	**360**	Slope orientation **SW**	Area (m^2)	**10**
Slope gradient	□ **< 15°**	□ 15°–30°	□ 30°–45°	□ > 45°
Relief	**Old windthrow spruce stump**			
Determinant vegetation layers	□ **tree**	□ shrub	□ herb	
Soil texture class	**sandy-loamy**	Ground water	□ yes	□ **no**
Soil skeleton	□ **< 10%**	□ 10–25%	□ 25–50%	□ > 50%
Rooting	□ none	□ **weak**	□ middle	□ heavy
Substratum type	□ anthropogenic	□ **natural**	Water source (m)	**70**
Den use	□ **occupied**	□ abandoned	Communication (m)	**510**
Breeding den	□ **yes**	□ no	Residential realty (m)	**960**
Yesteryear occupation	□ **yes**		□ no	
Cohabiting carnivores	□ European badger		□ Raccoon dog	
Remark				

Entrance	h/w (cm)	Aspect	Use	Function	Entrance mouth	
1	**22** **32**	**NW**	□ used □ **abandoned**	□ **passable** □ upcast	□ **roots** □ stones	□ **earth** □ waste
2	**29** **37**	**NW**	□ used □ **abandoned**	□ passable □ **upcast**	□ roots □ stones	□ **earth** □ waste
3	**20** **28**	**SW**	□ **used** □ abandoned	□ **passable** □ upcast	□ roots □ stones	□ **earth** □ waste
4	**25** **36**	**E**	□ **used** □ abandoned	□ **passable** □ upcast	□ roots □ stones	□ **earth** □ waste
5	**18** **42**	**E**	□ used □ **abandoned**	□ passable □ **upcast**	□ roots □ stones	□ **earth** □ waste
6	**18** **27**	**N**	□ used □ **abandoned**	□ **passable** □ upcast	□ roots □ stones	□ **earth** □ waste

Locality	**Na Vodárně**		
Cadastral territory	**Božíčany**		
District	**Karlovy Vary**	Date	**23.01.2010**
Altitude (m a.s.l.)	**385**	Slope orientation **SE**	Area (m^2) **20**
Slope gradient	□ < 15°	**□ 15°–30°**	□ 30°–45° □ > 45°
Relief	**Shrubby-woody slope**		
Determinant vegetation layers	**□ tree**	**□ shrub**	□ herb
Soil texture class	**clay-loamy**	Ground water	□ yes **□ no**
Soil skeleton	**□ < 10%**	□ 10–25%	□ 25–50% □ > 50%
Rooting	□ none	□ weak	**□ middle** □ heavy
Substratum type	□ anthropogenic	**□ natural**	Water source (m) **80**
Den use	**□ occupied**	□ abandoned	Communication (m) **230**
Breeding den	**□ yes**	□ no	Residential realty (m) **230**
Yesteryear occupation	**□ yes**	□ no	
Cohabiting carnivores	**□ European badger**	□ Raccoon dog	
Remark			

Entrance	h/w (cm)	Aspect	Use	Function	Entrance mouth	
1	**30** **45**	**SE**	**□ used** □ abandoned	**□ passable** □ upcast	**□ roots** □ stones	**□ earth** □ waste
2	**33** **35**	**NE**	**□ used** □ abandoned	**□ passable** □ upcast	**□ roots** □ stones	**□ earth** □ waste
3	**40** **38**	**N**	**□ used** □ abandoned	**□ passable** □ upcast	**□ roots** □ stones	**□ earth** □ waste
4	**31** **32**	**S**	**□ used** □ abandoned	**□ passable** □ upcast	**□ roots** □ stones	**□ earth** □ waste
5	**29** **37**	**SW**	□ used **□ abandoned**	**□ passable** □ upcast	□ roots □ stones	**□ earth** □ waste
6	**40** **46**	**S**	□ used **□ abandoned**	□ passable **□ upcast**	**□ roots** □ stones	**□ earth** □ waste
7	**43** **52**	**SE**	**□ used** □ abandoned	**□ passable** □ upcast	□ roots □ stones	**□ earth** □ waste
8	**38** **52**	**SE**	**□ used** □ abandoned	**□ passable** □ upcast	**□ roots** □ stones	**□ earth** □ waste
9	**36** **45**	**E**	□ used **□ abandoned**	**□ passable** □ upcast	**□ roots** □ stones	**□ earth** □ waste
10	**36** **52**	**SE**	□ used **□ abandoned**	□ passable **□ upcast**	**□ roots** □ stones	**□ earth** □ waste
11	**34** **41**	**E**	**□ used** □ abandoned	**□ passable** □ upcast	□ roots □ stones	**□ earth** □ waste
12	**28** **29**	**W**	**□ used** □ abandoned	**□ passable** □ upcast	**□ roots** □ stones	**□ earth** □ waste
13	**41** **38**	**SW**	**□ used** □ abandoned	**□ passable** □ upcast	**□ roots** □ stones	**□ earth** □ waste

Locality	**Nejda - násep**		
Cadastral territory	**Nová Víska u Ostrova**		
District	**Karlovy Vary**	Date	**24.04.2010**
Altitude (m a.s.l.)	**465**	Slope orientation **SW**	Area (m^2) **15**
Slope gradient	□ < 15°	□ 15°–30°	□ 30°–45° **□ > 45°**

Relief	**Embankment of frequently used railway**					
Determinant vegetation layers	□ tree	□ **shrub**	□ **herb**			
Soil texture class	**gravelly**			Ground water	□ yes	□ **no**
Soil skeleton	□ < 10%	□ 10–25%	□ **25–50%**	□ > 50%		
Rooting	□ **none**	□ weak	□ middle	□ heavy		
Substratum type	□ **anthropogenic**	□ natural		Water source (m)		**40**
Den use	□ occupied	□ **abandoned**		Communication (m)		**10**
Breeding den	□ yes	□ **no**		Residential realty (m)		**310**
Yesteryear occupation	□ **yes**	□ no				
Cohabiting carnivores	□ European badger	□ Raccoon dog				
Remark						

Entrance	h/w (cm)	Aspect	Use	Function	Entrance mouth	
1	**18** **30**	**SE**	□ used □ **abandoned**	□ **passable** □ upcast	□ roots □ **stones**	□ earth □ **waste**
2	**16** **32**	**SW**	□ used □ **abandoned**	□ **passable** □ upcast	□ roots □ **stones**	□ earth □ **waste**

Locality	**Nejda - za Lhotákem**					
Cadastral territory	**Ostrov nad Ohří**					
District	**Karlovy Vary**			Date		**24.04.2010**
Altitude (m a.s.l.)	**450**	Slope orientation	**NW**	Area (m^2)		**250**
Slope gradient	□ < 15°	□ **15°–30°**	□ 30°–45°	□ > 45°		
Relief	**Lower and higher slope gradient boundary; spruces root system**					
Determinant vegetation layers	□ **tree**	□ shrub	□ herb			
Soil texture class	**loamy**			Ground water	□ yes	□ **no**
Soil skeleton	□ **< 10%**	□ 10–25%	□ 25–50%	□ > 50%		
Rooting	□ none	□ weak	□ middle	□ **heavy**		
Substratum type	□ anthropogenic	□ **natural**		Water source (m)		**430**
Den use	□ **occupied**	□ abandoned		Communication (m)		**250**
Breeding den	□ **yes**	□ no		Residential realty (m)		**250**
Yesteryear occupation	□ **yes**	□ no				
Cohabiting carnivores	□ European badger	□ Raccoon dog				
Remark						

Entrance	h/w (cm)	Aspect	Use	Function	Entrance mouth	
1	**20** **24**	**N**	□ **used** □ abandoned	□ **passable** □ upcast	□ **roots** □ stones	□ earth □ waste
2	**22** **37**	**NE**	□ **used** □ abandoned	□ **passable** □ upcast	□ **roots** □ stones	□ **earth** □ waste
3	**31** **50**	**NW**	□ used □ **abandoned**	□ **passable** □ upcast	□ **roots** □ stones	□ earth □ waste
4	**54** **42**	**N**	□ used □ **abandoned**	□ passable □ **upcast**	□ **roots** □ stones	□ earth □ waste
5	**40** **15**	**N**	□ used □ **abandoned**	□ passable □ **upcast**	□ **roots** □ stones	□ earth □ waste
6	**24** **23**	**N**	□ used □ **abandoned**	□ passable □ **upcast**	□ **roots** □ stones	□ **earth** □ waste
7	**31** **27**	**NW**	□ **used** □ abandoned	□ **passable** □ upcast	□ **roots** □ stones	□ earth □ waste

8	**32** **34**	**NE**	□ **used** □ abandoned	□ **passable** □ upcast	□ **roots** □ stones	□ earth □ waste
9	**22** **23**	**NW**	□ **used** □ abandoned	□ **passable** □ upcast	□ **roots** □ stones	□ earth □ waste
10	**27** **29**	**NW**	□ **used** □ abandoned	□ **passable** □ upcast	□ **roots** □ stones	□ **earth** □ waste
11	**31** **33**	**NW**	□ **used** □ abandoned	□ **passable** □ upcast	□ roots □ stones	□ **earth** □ waste
12	**17** **15**	**NW**	□ used □ **abandoned**	□ passable □ **upcast**	□ **roots** □ stones	□ **earth** □ waste
13	**25** **30**	**NE**	□ **used** □ abandoned	□ **passable** □ upcast	□ roots □ stones	□ **earth** □ waste

Locality	**Nová Kyselka - pískovna u jezu I.**				
Cadastral territory	**Nová Kyselka**				
District	**Karlovy Vary**			Date	**11.04.2010**
Altitude (m a.s.l.)	**355**	Slope orientation	**E**	Area (m^2)	**150**
Slope gradient	□ < 15°	□ **15°–30°**	□ 30°–45°	□ > 45°	
Relief	**Abandoned sand pit**				
Determinant vegetation layers	□ **tree**	□ shrub	□ **herb**		
Soil texture class	**sandy**			Ground water	□ yes □ **no**
Soil skeleton	□ **< 10%**	□ 10–25%	□ 25–50%	□ > 50%	
Rooting	□ none	□ **weak**	□ middle	□ heavy	
Substratum type	□ **anthropogenic**	□ natural		Water source (m)	**60**
Den use	□ **occupied**	□ abandoned		Communication (m)	**150**
Breeding den	□ **yes**	□ no		Residential realty (m)	**200**
Yesteryear occupation	□ yes	□ **no**			
Cohabiting carnivores	□ European badger	□ Raccoon dog			
Remark	**Old den**				

Entrance	h/w (cm)	Aspect	Use	Function	Entrance mouth
1	**18** **21**	**NE**	□ used □ **abandoned**	□ **passable** □ upcast	□ roots □ stones	□ **earth** □ waste
2	**19** **16**	**NW**	□ used □ **abandoned**	□ **passable** □ upcast	□ roots □ stones	□ **earth** □ waste
3	**26** **21**	**NE**	□ used □ **abandoned**	□ **passable** □ upcast	□ **roots** □ stones	□ **earth** □ waste
4	**14** **14**	**NW**	□ used □ **abandoned**	□ **passable** □ upcast	□ roots □ stones	□ **earth** □ waste
5	**17** **23**	**NE**	□ used □ **abandoned**	□ **passable** □ upcast	□ **roots** □ stones	□ **earth** □ waste
6	**20** **24**	**E**	□ **used** □ abandoned	□ **passable** □ upcast	□ roots □ stones	□ **earth** □ waste
7	**32** **30**	**E**	□ **used** □ abandoned	□ **passable** □ upcast	□ **roots** □ stones	□ earth □ waste
8	**13** **41**	**NE**	□ used □ **abandoned**	□ **passable** □ upcast	□ roots □ stones	□ **earth** □ waste

Locality	**Nová Kyselka - pískovna u jezu II.**
Cadastral territory	**Nová Kyselka**

District	**Karlovy Vary**			Date	**11.04.2010**
Altitude (m a.s.l.)	**355**	Slope orientation	**SE**	Area (m^2)	**5**
Slope gradient	□ < 15°	**□ 15°–30°**	□ 30°–45°	□ > 45°	
Relief	**Abandoned sand pit**				
Determinant vegetation layers	**□ tree**	□ shrub	**□ herb**		
Soil texture class	**sandy**		Ground water	□ yes	**□ no**
Soil skeleton	□ < 10%	**□ 10–25%**	□ 25–50%	□ > 50%	
Rooting	□ none	**□ weak**	□ middle	□ heavy	
Substratum type	**□ anthropogenic**	□ natural	Water source (m)		**60**
Den use	**□ occupied**	□ abandoned	Communication (m)		**150**
Breeding den	□ yes	**□ no**	Residential realty (m)		**200**
Yesteryear occupation	□ yes		**□ no**		
Cohabiting carnivores	□ European badger		□ Raccoon dog		
Remark	**Den excavated in spring 2010 c. 20m far from old den**				

Entrance	h/w (cm)	Aspect	Use	Function	Entrance mouth	
1	**31** **28**	**SE**	**□ used** □ abandoned	**□ passable** □ upcast	**□ roots** □ stones	□ earth □ waste

Locality	**Penčice - Kašparův pomník**				
Cadastral territory	**Černé Voděrady**				
District	**Praha-východ**			Date	**26.04.2010**
Altitude (m a.s.l.)	**400**	Slope orientation	**NE**	Area (m^2)	**300**
Slope gradient	□ < 15°	**□ 15°–30°**	□ 30°–45°	□ > 45°	
Relief	**Parent rock protuberant above; partly plateau in slope**				
Determinant vegetation layers	**□ tree**	□ shrub	□ herb		
Soil texture class	**loamy-sandy**		Ground water	□ yes	**□ no**
Soil skeleton	□ < 10%	□ 10–25%	□ 25–50%	**□ > 50%**	
Rooting	□ none	□ weak	**□ middle**	□ heavy	
Substratum type	□ anthropogenic	**□ natural**	Water source (m)		**200**
Den use	**□ occupied**	□ abandoned	Communication (m)		**220**
Breeding den	**□ yes**	□ no	Residential realty (m)		**560**
Yesteryear occupation	**□ yes**		□ no		
Cohabiting carnivores	□ European badger		□ Raccoon dog		
Remark					

Entrance	h/w (cm)	Aspect	Use	Function	Entrance mouth	
1	**19** **47**	**NE**	□ used **□ abandoned**	**□ passable** □ upcast	□ roots **□ stones**	□ earth □ waste
2	**19** **23**	**E**	□ used **□ abandoned**	**□ passable** □ upcast	**□ roots** □ stones	□ earth □ waste
3	**26** **37**	**SE**	**□ used** □ abandoned	**□ passable** □ upcast	**□ roots** □ stones	**□ earth** □ waste
4	**24** **24**	**NE**	□ used **□ abandoned**	**□ passable** □ upcast	**□ roots** □ stones	**□ earth** □ waste
5	**28** **25**	**NE**	□ used **□ abandoned**	**□ passable** □ upcast	□ roots □ stones	**□ earth** □ waste
6	**20** **37**	**E**	□ used **□ abandoned**	**□ passable** □ upcast	□ roots □ stones	**□ earth** □ waste
7	**29** **27**	**SE**	□ used **□ abandoned**	**□ passable** □ upcast	□ roots **□ stones**	**□ earth** □ waste

8	**24** **26**	**E**	□ **used** □ abandoned	□ **passable** □ upcast	□ **roots** □ stones	□ **earth** □ waste
9	**31** **30**	**E**	□ **used** □ abandoned	□ **passable** □ upcast	□ **roots** □ stones	□ **earth** □ waste
10	**25** **32**	**N**	□ used □ **abandoned**	□ **passable** □ upcast	□ roots □ stones	□ **earth** □ waste
11	**24** **23**	**N**	□ used □ **abandoned**	□ **passable** □ upcast	□ **roots** □ stones	□ **earth** □ waste
12	**29** **36**	**E**	□ **used** □ abandoned	□ **passable** □ upcast	□ **roots** □ stones	□ **earth** □ waste
13	**19** **22**	**NE**	□ used □ **abandoned**	□ **passable** □ upcast	□ roots □ **stones**	□ **earth** □ waste
14	**24** **33**	**N**	□ **used** □ abandoned	□ **passable** □ upcast	□ **roots** □ stones	□ **earth** □ waste
15	**20** **28**	**E**	□ **used** □ abandoned	□ **passable** □ upcast	□ roots □ stones	□ **earth** □ waste
16	**27** **28**	**NE**	□ **used** □ abandoned	□ **passable** □ upcast	□ **roots** □ stones	□ **earth** □ waste
17	**21** **31**	**S**	□ **used** □ abandoned	□ **passable** □ upcast	□ **roots** □ stones	□ **earth** □ waste
18	**29** **62**	**N**	□ used □ **abandoned**	□ passable □ **upcast**	□ **roots** □ stones	□ **earth** □ waste
19	**24** **43**	**SE**	□ **used** □ abandoned	□ **passable** □ upcast	□ roots □ **stones**	□ earth □ waste
20	**20** **28**	**E**	□ used □ **abandoned**	□ passable □ **upcast**	□ **roots** □ stones	□ earth □ waste
21	**32** **30**	**E**	□ **used** □ abandoned	□ **passable** □ upcast	□ **roots** □ stones	□ **earth** □ waste

Locality	**Penčice - nad hájovnou**				
Cadastral territory	**Jevany**				
District	**Praha-východ**			Date	**23.04.2010**
Altitude (m a.s.l.)	**370**	Slope orientation	**SW**	Area (m^2)	**225**
Slope gradient	□ **< 15°**	□ 15°–30°	□ 30°–45°	□ > 45°	
Relief	**Ravine top edge in gradual slope; root system of spruces**				
Determinant vegetation layers	□ **tree**	□ shrub	□ herb		
Soil texture class	**loamy**			Ground water	□ yes □ **no**
Soil skeleton	□ **< 10%**	□ 10–25%	□ 25–50%	□ > 50%	
Rooting	□ none	□ weak	□ middle	□ **heavy**	
Substratum type	□ anthropogenic	□ **natural**		Water source (m)	**210**
Den use	□ **occupied**	□ abandoned		Communication (m)	**140**
Breeding den	□ yes	□ **no**		Residential realty (m)	**140**
Yesteryear occupation	□ **yes**	□ no			
Cohabiting carnivores	□ European badger	□ Raccoon dog			
Remark					

Entrance	**h/w (cm)**	**Aspect**	**Use**	**Function**	**Entrance mouth**
1	**36** **42**	**W**	□ used □ **abandoned**	□ passable □ **upcast**	□ roots □ stones	□ **earth** □ waste

2	**34** **43**	**SW**	□ used □ **abandoned**	□ **passable** □ upcast	□ **roots** □ stones	□ earth □ waste
3	**21** **20**	**SW**	□ used □ **abandoned**	□ **passable** □ upcast	□ **roots** □ stones	□ earth □ waste
4	**28** **34**	**S**	□ used □ **abandoned**	□ **passable** □ upcast	□ **roots** □ stones	□ earth □ waste
5	**27** **18**	**SE**	□ used □ **abandoned**	□ **passable** □ upcast	□ **roots** □ stones	□ earth □ waste
6	**22** **32**	**E**	□ **used** □ abandoned	□ **passable** □ upcast	□ **roots** □ stones	□ earth □ waste
7	**28** **28**	**E**	□ **used** □ abandoned	□ **passable** □ upcast	□ **roots** □ stones	□ earth □ waste
8	**24** **47**	**SE**	□ **used** □ abandoned	□ **passable** □ upcast	□ **roots** □ stones	□ earth □ waste
9	**35** **29**	**S**	□ **used** □ abandoned	□ **passable** □ upcast	□ roots □ **stones**	□ **earth** □ waste
10	**28** **26**	**S**	□ **used** □ abandoned	□ **passable** □ upcast	□ **roots** □ stones	□ **earth** □ waste
11	**18** **44**	**NE**	□ used □ **abandoned**	□ passable □ **upcast**	□ **roots** □ stones	□ **earth** □ waste

Locality	**Plavecká cesta**				
Cadastral territory	**Borovany u Milevska**				
District	**Písek**			Date	**17.04.2010**
Altitude (m a.s.l.)	**430**	Slope orientation	**SE**	Area (m^2)	**20**
Slope gradient	□ < 15°	□ 15°–30°		□ 30°–45°	□ **> 45°**
Relief	**Balk of abandoned ravine road**				
Determinant vegetation layers	□ tree		□ **shrub**		□ **herb**
Soil texture class	**sandy-loamy**			Ground water	□ yes □ **no**
Soil skeleton	□ < 10%	□ **10–25%**		□ 25–50%	□ > 50%
Rooting	□ **none**	□ weak		□ middle	□ heavy
Substratum type	□ **anthropogenic**	□ natural		Water source (m)	**400**
Den use	□ **occupied**	□ abandoned		Communication (m)	**250**
Breeding den	□ yes	□ **no**		Residential realty (m)	**1000**
Yesteryear occupation	□ **yes**			□ no	
Cohabiting carnivores	□ **European badger**			□ Raccoon dog	
Remark	**Badger present also previous year**				

Entrance	**h/w (cm)**	**Aspect**	**Use**	**Function**	**Entrance mouth**	
1	**31** **30**	**S**	□ **used** □ abandoned	□ **passable** □ upcast	□ roots □ stones	□ **earth** □ waste
2	**29** **32**	**E**	□ **used** □ abandoned	□ **passable** □ upcast	□ roots □ stones	□ **earth** □ waste

Locality	**Pod skálou - mez u lesa**				
Cadastral territory	**Šemnice**				
District	**Karlovy Vary**			Date	**10.04.2010**
Altitude (m a.s.l.)	**475**	Slope orientation	**NE**	Area (m^2)	**25**
Slope gradient	□ **< 15°**	□ 15°–30°		□ 30°–45°	□ > 45°
Relief	**Stony balk between forest and meadow**				

Determinant vegetation layers	□ tree	□ shrub	□ **herb**		
Soil texture class	**loamy-sandy**		Ground water	□ yes	□ **no**
Soil skeleton	□ < 10%	□ 10–25%	□ 25–50%	□ **> 50%**	
Rooting	□ none	□ weak	□ **middle**	□ heavy	
Substratum type	□ **anthropogenic**	□ natural	Water source (m)		**150**
Den use	□ **occupied**	□ abandoned	Communication (m)		**300**
Breeding den	□ yes	□ **no**	Residential realty (m)		**780**
Yesteryear occupation	□ yes		□ **no**		
Cohabiting carnivores	□ European badger		□ Raccoon dog		
Remark	**Den occupied last in 2007**				

Entrance	h/w (cm)	Aspect	Use	Function	Entrance mouth	
1	**30** **24**	**N**	□ **used** □ abandoned	□ **passable** □ upcast	□ roots □ **stones**	□ earth □ waste
2	**28** **25**	**S**	□ **used** □ abandoned	□ **passable** □ upcast	□ **roots** □ stones	□ earth □ waste
3	**29** **16**	**NE**	□ **used** □ abandoned	□ **passable** □ upcast	□ roots □ **stones**	□ earth □ waste

Locality	**Pod skálou - u rybníka**				
Cadastral territory	**Šemnice**				
District	**Karlovy Vary**		Date		**11.04.2010**
Altitude (m a.s.l.)	**460**	Slope orientation **N**	Area (m^2)		**300**
Slope gradient	□ **< 15°**	□ 15°–30°	□ 30°–45°	□ > 45°	
Relief	**Tree stand between pond and meadow**				
Determinant vegetation layers	□ **tree**	□ shrub	□ herb		
Soil texture class	**sandy**		Ground water	□ **yes**	□ no
Soil skeleton	□ < 10%	□ **10–25%**	□ 25–50%	□ > 50%	
Rooting	□ none	□ weak	□ **middle**	□ heavy	
Substratum type	□ **anthropogenic**	□ natural	Water source (m)		**10**
Den use	□ **occupied**	□ abandoned	Communication (m)		**190**
Breeding den	□ **yes**	□ no	Residential realty (m)		**690**
Yesteryear occupation	□ **yes**		□ no		
Cohabiting carnivores	□ **European badger**		□ Raccoon dog		
Remark	**Den regularly used for reproduction of fox in past; badger present irregularly**				

Entrance	h/w (cm)	Aspect	Use	Function	Entrance mouth	
1	**27** **25**	**NE**	□ **used** □ abandoned	□ **passable** □ upcast	□ **roots** □ stones	□ **earth** □ waste
2	**30** **34**	**NE**	□ **used** □ abandoned	□ **passable** □ upcast	□ **roots** □ stones	□ **earth** □ waste
3	**11** **19**	**SW**	□ used □ **abandoned**	□ passable □ **upcast**	□ **roots** □ stones	□ **earth** □ waste
4	**23** **28**	**E**	□ **used** □ abandoned	□ **passable** □ upcast	□ **roots** □ stones	□ **earth** □ waste
5	**16** **27**	**W**	□ used □ **abandoned**	□ **passable** □ upcast	□ roots □ stones	□ **earth** □ waste
6	**23** **36**	**NE**	□ **used** □ abandoned	□ **passable** □ upcast	□ **roots** □ stones	□ **earth** □ waste
7	**27** **35**	**NW**	□ **used** □ abandoned	□ **passable** □ upcast	□ roots □ stones	□ **earth** □ waste

8	**15** **44**	**N**	□ used □ **abandoned**	□ passable □ **upcast**	□ roots □ stones	□ **earth** □ waste
9	**27** **30**	**NW**	□ **used** □ abandoned	□ **passable** □ upcast	□ **roots** □ stones	□ **earth** □ waste
10	**13** **34**	**N**	□ used □ **abandoned**	□ **passable** □ upcast	□ **roots** □ stones	□ **earth** □ waste
11	**31** **49**	**W**	□ **used** □ abandoned	□ **passable** □ upcast	□ **roots** □ stones	□ **earth** □ waste
12	**27** **42**	**NW**	□ **used** □ abandoned	□ **passable** □ upcast	□ roots □ stones	□ **earth** □ waste
13	**30** **33**	**NW**	□ **used** □ abandoned	□ **passable** □ upcast	□ roots □ stones	□ **earth** □ waste
14	**20** **22**	**NW**	□ used □ **abandoned**	□ passable □ **upcast**	□ **roots** □ stones	□ **earth** □ waste

Locality	**Pod skálou - u včelína**		
Cadastral territory	**Šemnice**		
District	**Karlovy Vary**	Date	**10.04.2010**
Altitude (m a.s.l.)	**465**	Slope orientation **E**	Area (m^2) **100**
Slope gradient	□ **< 15°** □ 15°–30°	□ 30°–45°	□ > 45°
Relief	**Pile of stones and earth**		
Determinant vegetation layers	□ **tree** □ shrub	□ **herb**	
Soil texture class	**sandy-loamy**	Ground water □ yes	□ **no**
Soil skeleton	□ < 10% □ 10–25%	□ **25–50%**	□ > 50%
Rooting	□ none □ **weak**	□ middle	□ heavy
Substratum type	□ **anthropogenic** □ natural	Water source (m)	**120**
Den use	□ **occupied** □ abandoned	Communication (m)	**140**
Breeding den	□ yes □ **no**	Residential realty (m)	**490**
Yesteryear occupation	□ yes	□ **no**	
Cohabiting carnivores	□ European badger	□ Raccoon dog	
Remark	**Apiaries in the distance of 10 m; old den**		

Entrance	h/w (cm)	Aspect	Use	Function	Entrance mouth	
1	**24** **38**	**NE**	□ **used** □ abandoned	□ **passable** □ upcast	□ **roots** □ **stones**	□ earth □ waste
2	**39** **27**	**S**	□ **used** □ abandoned	□ **passable** □ upcast	□ roots □ **stones**	□ earth □ waste
3	**31** **25**	**SW**	□ used □ **abandoned**	□ **passable** □ upcast	□ roots □ **stones**	□ earth □ waste
4	**22** **30**	**S**	□ **used** □ abandoned	□ **passable** □ upcast	□ roots □ **stones**	□ **earth** □ waste
5	**26** **29**	**E**	□ used □ **abandoned**	□ **passable** □ upcast	□ roots □ **stones**	□ **earth** □ waste
6	**32** **35**	**SW**	□ **used** □ abandoned	□ **passable** □ upcast	□ **roots** □ stones	□ **earth** □ waste
7	**41** **23**	**SE**	□ **used** □ abandoned	□ **passable** □ upcast	□ **roots** □ stones	□ **earth** □ waste

Locality	**Policajtská louka**
Cadastral territory	**Stráň**

District	**Karlovy Vary**			Date	**24.04.2010**
Altitude (m a.s.l.)	**530**	Slope orientation	**NE**	Area (m^2)	**50**
Slope gradient	□ < 15°	**□ 15°–30°**	□ 30°–45°	□ > 45°	
Relief	**Mature forest stand in a stony slope**				
Determinant vegetation layers	**□ tree**	□ shrub	□ herb		
Soil texture class	**loamy**		Ground water	□ yes	**□ no**
Soil skeleton	□ < 10%	□ 10–25%	**□ 25–50%**	□ > 50%	
Rooting	□ none	□ weak	**□ middle**	□ heavy	
Substratum type	□ anthropogenic	**□ natural**	Water source (m)		**280**
Den use	**□ occupied**	□ abandoned	Communication (m)		**720**
Breeding den	**□ yes**	□ no	Residential realty (m)		**720**
Yesteryear occupation	**□ yes**	□ no			
Cohabiting carnivores	**□ European badger**	□ Raccoon dog			
Remark					

Entrance	h/w (cm)	Aspect	Use	Function	Entrance mouth	
1	**33** **38**	**SE**	**□ used** □ abandoned	**□ passable** □ upcast	**□ roots** □ stones	□ earth □ waste
2	**34** **33**	**NE**	□ used **□ abandoned**	□ passable **□ upcast**	**□ roots** □ stones	**□ earth** □ waste
3	**22** **29**	**E**	**□ used** □ abandoned	**□ passable** □ upcast	□ roots **□ stones**	**□ earth** □ waste
4	**34** **42**	**SE**	□ used **□ abandoned**	**□ passable** □ upcast	**□ roots** □ stones	**□ earth** □ waste
5	**12** **13**	**E**	□ used **□ abandoned**	□ passable **□ upcast**	□ roots □ stones	**□ earth** □ waste
6	**28** **55**	**E**	**□ used** □ abandoned	**□ passable** □ upcast	**□ roots** □ stones	**□ earth** □ waste
7	**34** **29**	**NE**	**□ used** □ abandoned	**□ passable** □ upcast	□ roots **□ stones**	**□ earth** □ waste

Locality	**Pozdeň - Velký kus**				
Cadastral territory	**Pozdeň**				
District	**Kladno**			Date	**25.04.2010**
Altitude (m a.s.l.)	**310**	Slope orientation	**SE**	Area (m^2)	**150**
Slope gradient	**□ < 15°**	□ 15°–30°	□ 30°–45°	□ > 45°	
Relief	**Gentle slope in forest near field**				
Determinant vegetation layers	**□ tree**	□ shrub	□ herb		
Soil texture class	**clay-loamy**		Ground water	□ yes	**□ no**
Soil skeleton	**□ < 10%**	□ 10–25%	□ 25–50%	□ > 50%	
Rooting	□ none	□ weak	**□ middle**	□ heavy	
Substratum type	□ anthropogenic	**□ natural**	Water source (m)		**150**
Den use	□ occupied	**□ abandoned**	Communication (m)		**300**
Breeding den	□ yes	**□ no**	Residential realty (m)		**300**
Yesteryear occupation	□ yes	**□ no**			
Cohabiting carnivores	□ European badger	□ Raccoon dog			
Remark					

Entrance	h/w (cm)	Aspect	Use	Function	Entrance mouth	
1	**33** **25**	**SE**	□ used **□ abandoned**	**□ passable** □ upcast	**□ roots** □ stones	**□ earth** □ waste

2	**30** **24**	**SE**	□ used □ **abandoned**	□ **passable** □ upcast	□ **roots** □ stones	□ **earth** □ waste
3	**25** **20**	**E**	□ used □ **abandoned**	□ **passable** □ upcast	□ **roots** □ stones	□ **earth** □ waste
4	**29** **48**	**E**	□ used □ **abandoned**	□ **passable** □ upcast	□ **roots** □ stones	□ **earth** □ waste
5	**33** **45**	**E**	□ used □ **abandoned**	□ **passable** □ upcast	□ **roots** □ stones	□ **earth** □ waste
6	**25** **60**	**E**	□ used □ **abandoned**	□ **passable** □ upcast	□ **roots** □ stones	□ **earth** □ waste

Locality	**Pulovice - borovičky**				
Cadastral territory	**Pulovice**				
District	**Karlovy Vary**			Date	**24.04.2010**
Altitude (m a.s.l.)	**480**	Slope orientation	**S**	Area (m^2)	**200**
Slope gradient	□ **< 15°**	□ 15°–30°	□ 30°–45°	□ > 45°	
Relief	**Stony woodlot in a pastureland**				
Determinant vegetation layers	□ **tree**	□ shrub	□ **herb**		
Soil texture class	**loamy**			Ground water	□ yes □ **no**
Soil skeleton	□ < 10%	□ 10–25%	□ **25–50%**	□ > 50%	
Rooting	□ none	□ **weak**	□ middle	□ heavy	
Substratum type	□ **anthropogenic**	□ natural		Water source (m)	**270**
Den use	□ **occupied**	□ abandoned		Communication (m)	**40**
Breeding den	□ yes	□ **no**		Residential realty (m)	**350**
Yesteryear occupation	□ **yes**	□ no			
Cohabiting carnivores	□ **European badger**	□ Raccoon dog			
Remark	**Stones gathered by human activity; regular cohabitation of fox and badger**				

Entrance	h/w (cm)	Aspect	Use	Function	Entrance mouth
1	**18** **39**	**SW**	□ used □ **abandoned**	□ passable □ **upcast**	□ roots □ stones	□ **earth** □ waste
2	**22** **40**	**SE**	□ used □ **abandoned**	□ **passable** □ upcast	□ roots □ **stones**	□ **earth** □ waste
3	**24** **44**	**SW**	□ **used** □ abandoned	□ **passable** □ upcast	□ roots □ stones	□ **earth** □ waste
4	**39** **34**	**SW**	□ **used** □ abandoned	□ **passable** □ upcast	□ roots □ stones	□ **earth** □ waste
5	**33** **40**	**S**	□ **used** □ abandoned	□ **passable** □ upcast	□ roots □ **stones**	□ **earth** □ waste
6	**36** **43**	**SW**	□ **used** □ abandoned	□ **passable** □ upcast	□ roots □ stones	□ **earth** □ waste
7	**27** **33**	**SE**	□ **used** □ abandoned	□ **passable** □ upcast	□ roots □ stones	□ **earth** □ waste
8	**24** **29**	**S**	□ used □ **abandoned**	□ **passable** □ upcast	□ roots □ stones	□ **earth** □ waste
9	**41** **42**	**SE**	□ **used** □ abandoned	□ **passable** □ upcast	□ roots □ stones	□ **earth** □ waste
10	**22** **36**	**W**	□ used □ **abandoned**	□ passable □ **upcast**	□ roots □ **stones**	□ **earth** □ waste

11	**23** **37**	**NW**	□ used □ **abandoned**	□ **passable** □ upcast	□ roots □ **stones**	□ earth □ waste
12	**28** **28**	**S**	□ used □ **abandoned**	□ **passable** □ upcast	□ roots □ **stones**	□ **earth** □ waste
13	**33** **55**	**SW**	□ **used** □ abandoned	□ **passable** □ upcast	□ roots □ stones	□ **earth** □ waste
14	**28** **37**	**E**	□ **used** □ abandoned	□ **passable** □ upcast	□ roots □ stones	□ **earth** □ waste
15	**26** **44**	**W**	□ **used** □ abandoned	□ **passable** □ upcast	□ roots □ stones	□ **earth** □ waste

Locality	**Rataje**				
Cadastral territory	**Rataje u Bechyně**				
District	**Písek**			Date	**17.04.2010**
Altitude (m a.s.l.)	**400**	Slope orientation	**SW**	Area (m^2)	**10**
Slope gradient	□ **< 15°**	□ 15°–30°	□ 30°–45°	□ > 45°	
Relief	**Mild wooded slope**				
Determinant vegetation layers	□ **tree**	□ shrub	□ herb		
Soil texture class	**sandy**			Ground water	□ yes □ **no**
Soil skeleton	□ **< 10%**	□ 10–25%	□ 25–50%	□ > 50%	
Rooting	□ none	□ weak	□ middle	□ **heavy**	
Substratum type	□ anthropogenic	□ **natural**		Water source (m)	**50**
Den use	□ **occupied**	□ abandoned		Communication (m)	**600**
Breeding den	□ yes	□ **no**		Residential realty (m)	**600**
Yesteryear occupation	□ yes	□ **no**			
Cohabiting carnivores	□ European badger	□ Raccoon dog			
Remark	**Old den**				

Entrance	h/w (cm)	Aspect	Use	Function	Entrance mouth	
1	**31** **40**	**E**	□ **used** □ abandoned	□ **passable** □ upcast	□ **roots** □ stones	□ **earth** □ waste
2	**22** **38**	**N**	□ **used** □ abandoned	□ **passable** □ upcast	□ **roots** □ stones	□ **earth** □ waste
3	**21** **38**	**S**	□ **used** □ abandoned	□ **passable** □ upcast	□ roots □ stones	□ **earth** □ waste
4	**22** **19**	**NW**	□ used □ **abandoned**	□ passable □ **upcast**	□ **roots** □ stones	□ **earth** □ waste

Locality	**Sedlečko - pod čističkou**				
Cadastral territory	**Sedlečko u Karlových Var**				
District	**Karlovy Vary**			Date	**10.04.2010**
Altitude (m a.s.l.)	**410**	Slope orientation	**E**	Area (m^2)	**150**
Slope gradient	□ < 15°	□ 15°–30°	□ **30°–45°**	□ > 45°	
Relief	**Woody-bushy slope between field and brook**				
Determinant vegetation layers	□ **tree**	□ **shrub**	□ herb		
Soil texture class	**loamy-sandy**			Ground water	□ yes □ **no**
Soil skeleton	□ < 10%	□ **10–25%**	□ 25–50%	□ > 50%	
Rooting	□ none	□ weak	□ **middle**	□ heavy	
Substratum type	□ anthropogenic	□ **natural**		Water source (m)	**10**

Den use	□ **occupied**	□ abandoned	Communication (m) **200**
Breeding den	□ **yes**	□ no	Residential realty (m) **300**
Yesteryear occupation	□ **yes**		□ no
Cohabiting carnivores	□ **European badger**		□ Raccoon dog
Remark	**Den regularly used for reproduction of both species in past**		

Entrance	h/w (cm)	Aspect	Use	Function	Entrance mouth	
1	**39** **34**	**N**	□ **used** □ abandoned	□ **passable** □ upcast	□ **roots** □ stones	□ **earth** □ waste
2	**29** **36**	**N**	□ **used** □ abandoned	□ **passable** □ upcast	□ **roots** □ stones	□ **earth** □ waste
3	**32** **40**	**NE**	□ used □ **abandoned**	□ **passable** □ upcast	□ **roots** □ stones	□ **earth** □ waste
4	**31** **28**	**E**	□ used □ **abandoned**	□ passable □ **upcast**	□ **roots** □ stones	□ **earth** □ waste
5	**15** **17**	**N**	□ used □ **abandoned**	□ passable □ **upcast**	□ **roots** □ stones	□ **earth** □ waste
6	**17** **14**	**N**	□ used □ **abandoned**	□ passable □ **upcast**	□ **roots** □ stones	□ **earth** □ waste
7	**16** **33**	**E**	□ **used** □ abandoned	□ **passable** □ upcast	□ roots □ stones	□ **earth** □ waste
8	**32** **33**	**NW**	□ **used** □ abandoned	□ **passable** □ upcast	□ roots □ stones	□ **earth** □ waste
9	**30** **30**	**SE**	□ **used** □ abandoned	□ **passable** □ upcast	□ **roots** □ stones	□ **earth** □ waste
10	**16** **19**	**NE**	□ used □ **abandoned**	□ passable □ **upcast**	□ **roots** □ stones	□ **earth** □ waste
11	**24** **31**	**E**	□ **used** □ abandoned	□ **passable** □ upcast	□ **roots** □ stones	□ **earth** □ waste
12	**34** **42**	**W**	□ **used** □ abandoned	□ **passable** □ upcast	□ roots □ stones	□ **earth** □ waste
13	**31** **49**	**W**	□ **used** □ abandoned	□ **passable** □ upcast	□ roots □ stones	□ **earth** □ waste
14	**16** **17**	**N**	□ **used** □ abandoned	□ **passable** □ upcast	□ roots □ stones	□ **earth** □ waste
15	**17** **25**	**E**	□ used □ **abandoned**	□ passable □ **upcast**	□ **roots** □ stones	□ **earth** □ waste
16	**30** **48**	**E**	□ **used** □ abandoned	□ **passable** □ upcast	□ **roots** □ stones	□ **earth** □ waste
17	**14** **21**	**NE**	□ used □ **abandoned**	□ passable □ **upcast**	□ **roots** □ stones	□ **earth** □ waste
18	**22** **25**	**NW**	□ used □ **abandoned**	□ **passable** □ upcast	□ **roots** □ stones	□ **earth** □ waste
19	**45** **53**	**E**	□ **used** □ abandoned	□ **passable** □ upcast	□ **roots** □ stones	□ earth □ waste
20	**26** **38**	**E**	□ **used** □ abandoned	□ **passable** □ upcast	□ **roots** □ stones	□ **earth** □ waste
21	**26** **32**	**NE**	□ **used** □ abandoned	□ **passable** □ upcast	□ **roots** □ stones	□ **earth** □ waste
22	**31** **39**	**E**	□ **used** □ abandoned	□ **passable** □ upcast	□ **roots** □ stones	□ **earth** □ waste

23	**35** **42**	**E**	□ **used** □ abandoned	□ **passable** □ upcast	□ **roots** □ **stones**	□ earth □ waste

Locality	**Sedlečko - pod hnojištěm**				
Cadastral territory	**Sedlečko u Karlových Var**				
District	**Karlovy Vary**			Date	**10.04.2010**
Altitude (m a.s.l.)	**390**	Slope orientation	**SW**	Area (m^2)	**100**
Slope gradient	□ < 15°	□ **15°–30°**	□ 30°–45°	□ > 45°	
Relief	**Stony slope with construction waste**				
Determinant vegetation layers	□ **tree**	□ shrub	□ **herb**		
Soil texture class	**loamy-sandy**			Ground water	□ yes □ **no**
Soil skeleton	□ < 10%	□ 10–25%	□ 25–50%	□ **> 50%**	
Rooting	□ none	□ **weak**	□ middle	□ heavy	
Substratum type	□ **anthropogenic**	□ natural		Water source (m)	**50**
Den use	□ **occupied**	□ abandoned		Communication (m)	**130**
Breeding den	□ **yes**	□ no		Residential realty (m)	**670**
Yesteryear occupation	□ yes	□ **no**			
Cohabiting carnivores	□ European badger	□ Raccoon dog			
Remark	**Stones also gathered by human activity; old den**				

Entrance	h/w (cm)	Aspect	Use	Function	Entrance mouth
1	**42** **83**	**S**	□ used □ **abandoned**	□ **passable** □ upcast	□ roots □ stones	□ **earth** □ **waste**
2	**24** **26**	**SW**	□ **used** □ abandoned	□ **passable** □ upcast	□ roots □ **stones**	□ earth □ waste
3	**35** **17**	**W**	□ **used** □ abandoned	□ **passable** □ upcast	□ roots □ stones	□ earth □ **waste**
4	**20** **24**	**S**	□ used □ **abandoned**	□ passable □ **upcast**	□ roots □ **stones**	□ earth □ waste
5	**51** **17**	**SW**	□ **used** □ abandoned	□ **passable** □ upcast	□ roots □ **stones**	□ earth □ waste

Locality	**Součkův les**				
Cadastral territory	**Šemnice**				
District	**Karlovy Vary**			Date	**11.04.2010**
Altitude (m a.s.l.)	**440**	Slope orientation	**N**	Area (m^2)	**5**
Slope gradient	□ **< 15°**	□ 15°–30°	□ 30°–45°	□ > 45°	
Relief	**Stony balk between forest and field**				
Determinant vegetation layers	□ **tree**	□ **shrub**	□ herb		
Soil texture class	**loamy**			Ground water	□ yes □ **no**
Soil skeleton	□ < 10%	□ 10–25%	□ 25–50%	□ **> 50%**	
Rooting	□ **none**	□ weak	□ middle	□ heavy	
Substratum type	□ **anthropogenic**	□ natural		Water source (m)	**50**
Den use	□ **occupied**	□ abandoned		Communication (m)	**310**
Breeding den	□ yes	□ **no**		Residential realty (m)	**390**
Yesteryear occupation	□ yes	□ **no**			
Cohabiting carnivores	□ European badger	□ Raccoon dog			
Remark	**Old den**				

Entrance	h/w (cm)	Aspect	Use	Function	Entrance mouth

1	**21** **19**	**N**	□ **used** □ abandoned	□ **passable** □ upcast	□ roots □ **stones**	□ earth □ waste
2	**24** **23**	**N**	□ **used** □ abandoned	□ **passable** □ upcast	□ roots □ **stones**	□ earth □ waste

Locality	**Stráň - buldozerová cesta**		
Cadastral territory	**Stráň**		
District	**Karlovy Vary**	Date	**24.04.2010**
Altitude (m a.s.l.)	**400**	Slope orientation	**S**
Area (m^2)	**150**		
Slope gradient	□ < 15°	□ **15°–30°**	□ 30°–45° □ > 45°
Relief	**Earth road and its embankment; near brook**		
Determinant vegetation layers	□ tree	□ **shrub**	□ **herb**
Soil texture class	**loamy**	Ground water	□ yes □ **no**
Soil skeleton	□ < 10%	□ **10–25%**	□ 25–50% □ > 50%
Rooting	□ none	□ weak	□ **middle** □ heavy
Substratum type	□ **anthropogenic**	□ natural	Water source (m) **10**
Den use	□ **occupied**	□ abandoned	Communication (m) **300**
Breeding den	□ **yes**	□ no	Residential realty (m) **640**
Yesteryear occupation	□ **yes**	□ no	
Cohabiting carnivores	□ European badger	□ **Raccoon dog**	
Remark	**Den system supported by big old spruce stump burried in road construction**		

Entrance	h/w (cm)	Aspect	Use	Function	Entrance mouth	
1	**43** **31**	**S**	□ **used** □ abandoned	□ **passable** □ upcast	□ roots □ **stones**	□ **earth** □ waste
2	**17** **31**	**SE**	□ used □ **abandoned**	□ passable □ **upcast**	□ roots □ stones	□ **earth** □ waste
3	**18** **36**	**S**	□ used □ **abandoned**	□ passable □ **upcast**	□ roots □ **stones**	□ **earth** □ waste
4	**29** **37**	**E**	□ **used** □ abandoned	□ **passable** □ upcast	□ roots □ stones	□ **earth** □ waste
5	**25** **50**	**S**	□ **used** □ abandoned	□ **passable** □ upcast	□ **roots** □ stones	□ earth □ waste
6	**18** **44**	**SE**	□ used □ **abandoned**	□ passable □ **upcast**	□ roots □ stones	□ **earth** □ waste
7	**36** **46**	**NE**	□ **used** □ abandoned	□ **passable** □ upcast	□ **roots** □ stones	□ earth □ waste
8	**30** **32**	**SE**	□ **used** □ abandoned	□ **passable** □ upcast	□ **roots** □ stones	□ earth □ waste
9	**26** **36**	**E**	□ used □ **abandoned**	□ **passable** □ upcast	□ roots □ stones	□ **earth** □ waste

Locality	**Šemnice - pod statkem - elektrovod**		
Cadastral territory	**Šemnice**		
District	**Karlovy Vary**	Date	**11.04.2010**
Altitude (m a.s.l.)	**380**	Slope orientation	**E**
Area (m^2)	**5**		
Slope gradient	□ **< 15°**	□ 15°–30°	□ 30°–45° □ > 45°
Relief	**Slope above brook; under power line; edge of meadow**		
Determinant vegetation layers	□ tree	□ **shrub**	□ **herb**
Soil texture class	**clay-loamy**	Ground water	□ yes □ **no**

Soil skeleton	□ **< 10%**	□ 10–25%	□ 25–50%	□ > 50%
Rooting	□ none	□ weak	□ **middle**	□ heavy
Substratum type	□ anthropogenic	□ **natural**	Water source (m)	**20**
Den use	□ **occupied**	□ abandoned	Communication (m)	**120**
Breeding den	□ yes	□ **no**	Residential realty (m)	**240**
Yesteryear occupation	□ yes		□ **no**	
Cohabiting carnivores	□ European badger		□ Raccoon dog	
Remark	**Den excavated in spring 2010**			

Entrance	h/w (cm)	Aspect	Use	Function	Entrance mouth	
1	**42** **49**	**E**	□ **used** □ abandoned	□ **passable** □ upcast	□ roots □ stones	□ **earth** □ waste

Locality	**Šemnice - pod statkem - u zrcadla**			
Cadastral territory	**Šemnice**			
District	**Karlovy Vary**		Date	**11.04.2010**
Altitude (m a.s.l.)	**370**	Slope orientation **E**	Area (m^2)	**200**
Slope gradient	□ < 15°	□ **15°–30°**	□ 30°–45°	□ > 45°
Relief	**Slope between pastureland and brook**			
Determinant vegetation layers	□ **tree**	□ shrub	□ herb	
Soil texture class	**clay-loamy**		Ground water	□ yes □ **no**
Soil skeleton	□ **< 10%**	□ 10–25%	□ 25–50%	□ > 50%
Rooting	□ none	□ weak	□ **middle**	□ heavy
Substratum type	□ anthropogenic	□ **natural**	Water source (m)	**10**
Den use	□ **occupied**	□ abandoned	Communication (m)	**80**
Breeding den	□ **yes**	□ no	Residential realty (m)	**110**
Yesteryear occupation	□ **yes**		□ no	
Cohabiting carnivores	□ **European badger**		□ Raccoon dog	
Remark	**Cubs regularly 2007-9; badger presence not registered in 2007-9**			

Entrance	h/w (cm)	Aspect	Use	Function	Entrance mouth	
1	**24** **32**	**E**	□ **used** □ abandoned	□ **passable** □ upcast	□ **roots** □ stones	□ **earth** □ waste
2	**43** **23**	**E**	□ **used** □ abandoned	□ **passable** □ upcast	□ **roots** □ stones	□ **earth** □ waste
3	**20** **39**	**NE**	□ **used** □ abandoned	□ **passable** □ upcast	□ **roots** □ stones	□ **earth** □ waste
4	**35** **44**	**NW**	□ **used** □ abandoned	□ **passable** □ upcast	□ **roots** □ stones	□ **earth** □ waste
5	**21** **25**	**SW**	□ used □ **abandoned**	□ passable □ **upcast**	□ **roots** □ stones	□ **earth** □ waste
6	**42** **54**	**NE**	□ **used** □ abandoned	□ **passable** □ upcast	□ roots □ stones	□ **earth** □ waste
7	**41** **33**	**NE**	□ **used** □ abandoned	□ **passable** □ upcast	□ roots □ stones	□ **earth** □ waste
8	**35** **40**	**NE**	□ **used** □ abandoned	□ **passable** □ upcast	□ roots □ stones	□ **earth** □ waste
9	**40** **32**	**E**	□ **used** □ abandoned	□ **passable** □ upcast	□ **roots** □ stones	□ **earth** □ waste
10	**32** **18**	**NE**	□ used □ **abandoned**	□ **passable** □ upcast	□ **roots** □ stones	□ **earth** □ waste

11	**19** **24**	**SE**	□ used □ **abandoned**	□ **passable** □ upcast	□ roots □ stones	□ **earth** □ waste

Locality	**Tankovka**				
Cadastral territory	**Bražec u Hradiště**				
District	**Karlovy Vary**		Date	**15.04.2010**	
Altitude (m a.s.l.)	**570**	Slope orientation **E**	Area (m^2)	**5**	
Slope gradient	□ **< 15°**	□ 15°–30°	□ 30°–45°	□ > 45°	
Relief	**Gentle slope in forest**				
Determinant vegetation layers	□ **tree**	□ shrub	□ herb		
Soil texture class	**loamy**		Ground water	□ yes	□ **no**
Soil skeleton	□ < 10%	□ 10–25%	□ **25–50%**	□ > 50%	
Rooting	□ none	□ weak	□ middle	□ **heavy**	
Substratum type	□ anthropogenic	□ **natural**	Water source (m)	**230**	
Den use	□ **occupied**	□ abandoned	Communication (m)	**3,200**	
Breeding den	□ **yes**	□ no	Residential realty (m)	**3,200**	
Yesteryear occupation	□ **yes**		□ no		
Cohabiting carnivores	□ European badger		□ Raccoon dog		
Remark	**Military region**				

Entrance	h/w (cm)	Aspect	Use	Function	Entrance mouth	
1	**49** **39**	**E**	□ **used** □ abandoned	□ **passable** □ upcast	□ **roots** □ stones	□ earth □ waste

Locality	**Trniny - na kopci**				
Cadastral territory	**Stráň**				
District	**Karlovy Vary**		Date	**24.04.2010**	
Altitude (m a.s.l.)	**470**	Slope orientation **SW**	Area (m^2)	**40**	
Slope gradient	□ < 15°	□ **15°–30°**	□ 30°–45°	□ > 45°	
Relief	**Bushy slope**				
Determinant vegetation layers	□ tree	□ **shrub**	□ herb		
Soil texture class	**loamy**		Ground water	□ yes	□ **no**
Soil skeleton	□ < 10%	□ **10–25%**	□ 25–50%	□ > 50%	
Rooting	□ none	□ weak	□ **middle**	□ heavy	
Substratum type	□ anthropogenic	□ **natural**	Water source (m)	**230**	
Den use	□ occupied	□ **abandoned**	Communication (m)	**310**	
Breeding den	□ yes	□ **no**	Residential realty (m)	**310**	
Yesteryear occupation	□ **yes**		□ no		
Cohabiting carnivores	□ **European badger**		□ Raccoon dog		
Remark					

Entrance	h/w (cm)	Aspect	Use	Function	Entrance mouth	
1	**20** **38**	**W**	□ used □ **abandoned**	□ **passable** □ upcast	□ roots □ stones	□ **earth** □ waste
2	**14** **28**	**NW**	□ used □ **abandoned**	□ passable □ **upcast**	□ **roots** □ stones	□ **earth** □ waste
3	**16** **42**	**N**	□ used □ **abandoned**	□ passable □ **upcast**	□ **roots** □ stones	□ **earth** □ waste
4	**22** **22**	**W**	□ used □ **abandoned**	□ **passable** □ upcast	□ **roots** □ stones	□ **earth** □ waste

5	**20** **28**	**W**	□ used □ **abandoned**	□ **passable** □ upcast	□ roots □ stones	□ **earth** □ waste
6	**23** **31**	**SE**	□ used □ **abandoned**	□ **passable** □ upcast	□ **roots** □ stones	□ **earth** □ waste
7	**20** **20**	**SW**	□ used □ **abandoned**	□ **passable** □ upcast	□ **roots** □ stones	□ earth □ waste
8	**23** **33**	**W**	□ used □ **abandoned**	□ **passable** □ upcast	□ **roots** □ stones	□ **earth** □ waste
9	**30** **16**	**SE**	□ used □ **abandoned**	□ passable □ **upcast**	□ roots □ stones	□ **earth** □ waste
10	**30** **36**	**NW**	□ used □ **abandoned**	□ **passable** □ upcast	□ **roots** □ stones	□ **earth** □ waste
11	**28** **34**	**NE**	□ used □ **abandoned**	□ **passable** □ upcast	□ **roots** □ stones	□ **earth** □ waste
12	**23** **37**	**SW**	□ used □ **abandoned**	□ **passable** □ upcast	□ **roots** □ stones	□ **earth** □ waste

Locality	**Trniny - na liščím**		
Cadastral territory	**Stráň**		
District	**Karlovy Vary**	Date	**24.04.2010**
Altitude (m a.s.l.)	**450**	Slope orientation **NE**	Area (m^2) **200**
Slope gradient	□ **< 15°** □ 15°–30°	□ 30°–45°	□ > 45°
Relief	**Forest - pastureland edge**		
Determinant vegetation layers	□ **tree** □ shrub		□ **herb**
Soil texture class	**loamy**	Ground water □ yes	□ **no**
Soil skeleton	□ **< 10%** □ 10–25%	□ 25–50%	□ > 50%
Rooting	□ none □ weak	□ **middle**	□ heavy
Substratum type	□ anthropogenic □ **natural**	Water source (m)	**40**
Den use	□ **occupied** □ abandoned	Communication (m)	**560**
Breeding den	□ **yes** □ no	Residential realty (m)	**560**
Yesteryear occupation	□ **yes**	□ no	
Cohabiting carnivores	□ European badger	□ Raccoon dog	
Remark			

Entrance	**h/w (cm)**	**Aspect**	**Use**	**Function**	**Entrance mouth**	
1	**30** **25**	**SW**	□ **used** □ abandoned	□ **passable** □ upcast	□ roots □ stones	□ **earth** □ waste
2	**28** **32**	**E**	□ **used** □ abandoned	□ **passable** □ upcast	□ **roots** □ stones	□ **earth** □ waste
3	**24** **37**	**NW**	□ used □ **abandoned**	□ **passable** □ upcast	□ **roots** □ stones	□ **earth** □ waste
4	**32** **35**	**NW**	□ **used** □ abandoned	□ **passable** □ upcast	□ **roots** □ stones	□ **earth** □ waste
5	**21** **26**	**E**	□ **used** □ abandoned	□ **passable** □ upcast	□ roots □ **stones**	□ **earth** □ waste
6	**33** **23**	**SE**	□ **used** □ abandoned	□ **passable** □ upcast	□ roots □ **stones**	□ **earth** □ waste
7	**25** **46**	**NE**	□ **used** □ abandoned	□ **passable** □ upcast	□ roots □ stones	□ **earth** □ waste

8	**28** **36**	**E**	□ **used** □ abandoned	□ **passable** □ upcast	□ **roots** □ stones	□ **earth** □ waste
9	**26** **29**	**E**	□ **used** □ abandoned	□ **passable** □ upcast	□ **roots** □ stones	□ **earth** □ waste
10	**23** **36**	**NE**	□ **used** □ abandoned	□ **passable** □ upcast	□ **roots** □ stones	□ earth □ waste
11	**42** **35**	**NE**	□ **used** □ abandoned	□ **passable** □ upcast	□ **roots** □ stones	□ earth □ waste
12	**40** **43**	**N**	□ **used** □ abandoned	□ **passable** □ upcast	□ **roots** □ stones	□ **earth** □ waste
13	**22** **35**	**N**	□ **used** □ abandoned	□ **passable** □ upcast	□ **roots** □ stones	□ **earth** □ waste
14	**20** **32**	**N**	□ **used** □ abandoned	□ **passable** □ upcast	□ **roots** □ stones	□ **earth** □ waste

Locality	**Trniny - pod krmelcem**					
Cadastral territory	**Stráň**					
District	**Karlovy Vary**			Date	**24.04.2010**	
Altitude (m a.s.l.)	**435**	Slope orientation	**SE**	Area (m^2)	**50**	
Slope gradient	□ **< 15°**	□ 15°–30°		□ 30°–45°		□ > 45°
Relief	**Gentle slope towards swamp**					
Determinant vegetation layers	□ **tree**		□ **shrub**		□ herb	
Soil texture class	**loamy**			Ground water	□ **yes**	□ no
Soil skeleton	□ **< 10%**	□ 10–25%		□ 25–50%		□ > 50%
Rooting	□ none		□ weak	□ middle		□ **heavy**
Substratum type	□ anthropogenic		□ **natural**	Water source (m)		**10**
Den use	□ **occupied**		□ abandoned	Communication (m)		**660**
Breeding den	□ **yes**		□ no	Residential realty (m)		**660**
Yesteryear occupation	□ **yes**				□ no	
Cohabiting carnivores	□ **European badger**				□ Raccoon dog	
Remark						

Entrance	**h/w (cm)**	**Aspect**	**Use**	**Function**	**Entrance mouth**	
1	**28** **64**	**SW**	□ **used** □ abandoned	□ **passable** □ upcast	□ roots □ stones	□ **earth** □ waste
2	**28** **34**	**NW**	□ **used** □ abandoned	□ **passable** □ upcast	□ roots □ **stones**	□ earth □ waste
3	**35** **24**	**SW**	□ **used** □ abandoned	□ **passable** □ upcast	□ **roots** □ stones	□ earth □ waste
4	**32** **46**	**SE**	□ **used** □ abandoned	□ **passable** □ upcast	□ **roots** □ stones	□ earth □ waste
5	**23** **26**	**SE**	□ **used** □ abandoned	□ **passable** □ upcast	□ **roots** □ stones	□ earth □ waste

Locality	**Trniny - pod rybníčkem**					
Cadastral territory	**Stráň**					
District	**Karlovy Vary**			Date	**24.04.2010**	
Altitude (m a.s.l.)	**450**	Slope orientation	**SW**	Area (m^2)	**50**	
Slope gradient	□ **< 15°**	□ 15°–30°		□ 30°–45°		□ > 45°
Relief	**Pile of excavated earth under pond dam**					

Determinant vegetation layers	□ tree	□ **shrub**	□ **herb**		
Soil texture class	**loamy**		Ground water	□ **yes**	□ no
Soil skeleton	□ < 10%	□ **10–25%**	□ 25–50%	□ > 50%	
Rooting	□ none	□ **weak**	□ middle	□ heavy	
Substratum type	□ **anthropogenic**	□ natural	Water source (m)	**10**	
Den use	□ **occupied**	□ abandoned	Communication (m)	**500**	
Breeding den	□ yes	□ **no**	Residential realty (m)	**590**	
Yesteryear occupation	□ **yes**	□ no			
Cohabiting carnivores	□ **European badger**	□ Raccoon dog			
Remark					

Entrance	h/w (cm)	Aspect	Use	Function	Entrance mouth	
1	**26** **25**	**NE**	□ used □ **abandoned**	□ passable □ **upcast**	□ **roots** □ stones	□ **earth** □ waste
2	**26** **24**	**S**	□ **used** □ abandoned	□ **passable** □ upcast	□ **roots** □ **stones**	□ earth □ waste
3	**20** **27**	**E**	□ **used** □ abandoned	□ **passable** □ upcast	□ **roots** □ stones	□ **earth** □ waste
4	**15** **20**	**N**	□ used □ **abandoned**	□ **passable** □ upcast	□ roots □ stones	□ **earth** □ waste
5	**24** **19**	**E**	□ used □ **abandoned**	□ passable □ **upcast**	□ **roots** □ stones	□ **earth** □ waste
6	**25** **28**	**N**	□ **used** □ abandoned	□ **passable** □ upcast	□ roots □ stones	□ **earth** □ waste
7	**19** **24**	**NW**	□ used □ **abandoned**	□ **passable** □ upcast	□ roots □ stones	□ **earth** □ waste

Locality	**Velichovský sad**				
Cadastral territory	**Velichov**				
District	**Karlovy Vary**		Date	**24.04.2010**	
Altitude (m a.s.l.)	**380**	Slope orientation **E**	Area (m^2)	**15**	
Slope gradient	□ < 15°	□ 15°–30°	□ 30°–45°	□ **> 45°**	
Relief	**Spruce windfall on a steep slope**				
Determinant vegetation layers	□ tree	□ **shrub**	□ herb		
Soil texture class	**loamy**		Ground water	□ yes	□ **no**
Soil skeleton	□ < 10%	□ **10–25%**	□ 25–50%	□ > 50%	
Rooting	□ none	□ weak	□ middle	□ **heavy**	
Substratum type	□ anthropogenic	□ **natural**	Water source (m)	**250**	
Den use	□ **occupied**	□ abandoned	Communication (m)	**210**	
Breeding den	□ **yes**	□ no	Residential realty (m)	**210**	
Yesteryear occupation	□ **yes**	□ no			
Cohabiting carnivores	□ European badger	□ Raccoon dog			
Remark	**2009 breeding den**				

Entrance	h/w (cm)	Aspect	Use	Function	Entrance mouth	
1	**32** **37**	**E**	□ **used** □ abandoned	□ **passable** □ upcast	□ **roots** □ stones	□ **earth** □ waste
2	**50** **33**	**SE**	□ used □ **abandoned**	□ passable □ **upcast**	□ **roots** □ stones	□ **earth** □ waste
3	**31** **35**	**SE**	□ **used** □ abandoned	□ **passable** □ upcast	□ **roots** □ stones	□ earth □ waste

Locality	**Znojmo - Hradiště**				
Cadastral territory	**Znojmo**				
District	**Znojmo**		Date	**21.04.2010**	
Altitude (m a.s.l.)	**340**	Slope orientation **S**	Area (m^2)	**5**	
Slope gradient	□ < 15°	**□ 15°–30°**	□ 30°–45°	□ > 45°	
Relief	**Upper part of ravine edge**				
Determinant vegetation layers	**□ tree**	□ shrub	□ herb		
Soil texture class	**loamy-sandy**		Ground water	□ yes	**□ no**
Soil skeleton	**□ < 10%**	□ 10–25%	□ 25–50%	□ > 50%	
Rooting	□ none	**□ weak**	□ middle	□ heavy	
Substratum type	□ anthropogenic	**□ natural**	Water source (m)	**670**	
Den use	**□ occupied**	□ abandoned	Communication (m)	**1,150**	
Breeding den	**□ yes**	□ no	Residential realty (m)	**1,410**	
Yesteryear occupation	□ yes	**□ no**			
Cohabiting carnivores	□ European badger	□ Raccoon dog			
Remark	**Den excavated in spring 2010**				

Entrance	h/w (cm)	Aspect	Use	Function	Entrance mouth	
1	**31** **30**	**S**	**□ used** □ abandoned	**□ passable** □ upcast	□ roots □ stones	**□ earth** □ waste
2	**28** **28**	**S**	**□ used** □ abandoned	**□ passable** □ upcast	□ roots □ stones	**□ earth** □ waste

Locality	**Zuzánková paseka**				
Cadastral territory	**Jilemnice**				
District	**Semily**		Date	**25.04.2010**	
Altitude (m a.s.l.)	**545**	Slope orientation **SE**	Area (m^2)	**5**	
Slope gradient	□ < 15°	□ 15°–30°	□ 30°–45°	**□ > 45°**	
Relief	**Balk between forest and field**				
Determinant vegetation layers	**□ tree**	□ shrub	□ herb		
Soil texture class	**clay-loamy**		Ground water	□ yes	**□ no**
Soil skeleton	**□ < 10%**	□ 10–25%	□ 25–50%	□ > 50%	
Rooting	□ none	□ weak	**□ middle**	□ heavy	
Substratum type	□ anthropogenic	**□ natural**	Water source (m)	**190**	
Den use	**□ occupied**	□ abandoned	Communication (m)	**850**	
Breeding den	□ yes	**□ no**	Residential realty (m)	**1,130**	
Yesteryear occupation	**□ yes**	□ no			
Cohabiting carnivores	□ European badger	□ Raccoon dog			
Remark					

Entrance	h/w (cm)	Aspect	Use	Function	Entrance mouth	
1	**27** **62**	**SE**	**□ used** □ abandoned	**□ passable** □ upcast	**□ roots** □ stones	**□ earth** □ waste
2	**37** **30**	**SE**	**□ used** □ abandoned	**□ passable** □ upcast	□ roots □ stones	**□ earth** □ waste

Locality	**Žabičák**				
Cadastral territory	**Konojedy**				
District	**Praha-východ**		Date	**21.04.2010**	
Altitude (m a.s.l.)	**375**	Slope orientation **SW**	Area (m^2)	**90**	
Slope gradient	□ < 15°	**□ 15°–30°**	□ 30°–45°	□ > 45°	

Relief	**Lower edge of tiny plateau in slope; root system of spruces**		
Determinant vegetation layers	□ **tree**	□ shrub	□ herb
Soil texture class	**sandy-loamy**	Ground water	□ yes □ **no**
Soil skeleton	□ < 10%	□ **10–25%**	□ 25–50% □ > 50%
Rooting	□ none	□ weak	□ middle □ **heavy**
Substratum type	□ anthropogenic	□ **natural**	Water source (m) **260**
Den use	□ **occupied**	□ abandoned	Communication (m) **50**
Breeding den	□ yes	□ **no**	Residential realty (m) **920**
Yesteryear occupation	□ **yes**		□ no
Cohabiting carnivores	□ **European badger**		□ Raccoon dog
Remark			

Entrance	h/w (cm)	Aspect	Use	Function	Entrance mouth	
1	**17** **19**	**SE**	□ used □ **abandoned**	□ **passable** □ upcast	□ **roots** □ stones	□ **earth** □ waste
2	**20** **31**	**S**	□ **used** □ abandoned	□ **passable** □ upcast	□ **roots** □ stones	□ **earth** □ waste
3	**28** **24**	**NW**	□ **used** □ abandoned	□ **passable** □ upcast	□ **roots** □ **stones**	□ earth □ waste
4	**26** **33**	**SW**	□ **used** □ abandoned	□ **passable** □ upcast	□ roots □ **stones**	□ earth □ waste
5	**17** **15**	**SE**	□ used □ **abandoned**	□ passable □ **upcast**	□ **roots** □ stones	□ **earth** □ waste
6	**46** **22**	**S**	□ **used** □ abandoned	□ **passable** □ upcast	□ **roots** □ stones	□ earth □ waste
7	**28** **43**	**S**	□ used □ **abandoned**	□ **passable** □ upcast	□ **roots** □ stones	□ **earth** □ waste
8	**13** **28**	**SW**	□ used □ **abandoned**	□ **passable** □ upcast	□ **roots** □ stones	□ earth □ waste
9	**20** **43**	**SW**	□ **used** □ abandoned	□ **passable** □ upcast	□ **roots** □ stones	□ earth □ waste
10	**17** **21**	**SW**	□ used □ **abandoned**	□ **passable** □ upcast	□ **roots** □ **stones**	□ earth □ waste
11	**34** **43**	**W**	□ **used** □ abandoned	□ **passable** □ upcast	□ **roots** □ stones	□ **earth** □ waste
12	**29** **32**	**SW**	□ **used** □ abandoned	□ **passable** □ upcast	□ **roots** □ **stones**	□ earth □ waste

9.2 Picture Supplements

Fig. 1. Locality „Bouská - hraniční strouha“.

Fig. 2. Locality „Chlívek - pod Trianglem“.

Fig. 3. Locality „Meliorační kanál pod Součkovým lesem“.

Fig. 4. Locality „Meliorační kanál pod Součkovým lesem“.

Fig. 5. Locality „Nejda - násep“.

Fig. 6. Locality „Nová Kyselka - pískovna u jezu I.“.

Fig. 7. Locality „Nová Kyselka - pískovna u jezu I.“.

Fig. 8. Locality „Nová Kyselka - pískovna u jezu II.“.

Fig. 9. Locality „Pod skálou - u včelína“.

Fig. 10. Locality „Sedlečko - pod čističkou“.

Fig. 11. Locality „Součkův les“.

Fig. 12. Locality „Součkův les“.

Fig. 13. Locality „Stráň - buldozerová cesta“.

Fig. 14. Locality „Stráň - buldozerová cesta“.

Fig. 15. Locality „Šemnice - pod statkem - u zrcadla“.

Fig. 16. Locality „Trniny - na liščím“.

Fig. 17. Locality „Trniny - na liščím“.

Fig. 18. Locality „Trniny - na liščím“.

Fig. 19. Locality „Trniny - pod krmelcem“.

Fig. 20. Locality „Trniny - pod krmelcem“.

Fig. 21. Locality „Velichovský sad“.

Fig. 22. Locality „Znojmo - Hradiště“.