

REDUCTION OF BADGER (*MELES MELES*) SETTS DAMAGE TO ARTIFICIAL ELEMENTS OF THE TERRITORY

ALESSANDRO BALESTRIERI AND LUIGI REMONTI

Dipartimento di Biologia Animale, Universita di Pavia, P.zza Botta 9, 27100 Pavia

ABSTRACT - In the Alessandria section of the Turin railway-basin (northern Italy), the presence of the badger (*Meles meles*) setts in railway embankments causes progressive track subsidence. Rail traffic is dangerous and continuous maintenance and surveillance are required. In the past, the problem was managed without success, by trying to damage and disturb the setts. In 1997 the Italian Railways decided to promote some specific research. Four used setts have been found along the surveyed lines. The choice of a suitable site to dig the sett appears to be influenced only by pedological parameters. A comparison of used and unused banks revealed that soils with significantly lower percentages of gravel and higher percentages of fine sands are preferred. Badgers have been deterred from using one of the found setts, and successively the railway embankment has been covered with chain link fencing. Methods and results are discussed.

Key words: *Meles meles*, badger setts, wildlife management, North western Italy.

INTRODUCTION

Badgers generally cause modest damage to human activities. Game-species predation is negligible and, most of the time, damage to agricultural crops is slight. However, badger setts may be built in the sides of artificial slopes, such as road and railway embankments or flood levees, causing lack of stability.

Along the railway lines of the Alessandria section of the Turin railway-basin (northern Italy), the presence of badger setts in the railway embankments causes progressive track subsidence. Continuous surveillance and maintenance are required to avoid risks in human safety.

This situation has been known for many years and attempts at disturbing the setts have proved unsuccessful. This approach to the problem leads to short-term results and may cause unnecessary suffering.

At the beginning of 1997, the Italian Railways promoted some research, whose first aim was to limit badger-sett damage to the

railway tracks. Definite solutions which took badgers safety into consideration were required. In the autumn of the same year, a sample experiment of exclusion of the animals from one of the found setts was performed.

This paper deals with: habitat factors affecting sett-site choice; methods for excluding badgers from artificial slopes and for preventing further problems; the sample experiment performed.

MATERIAL AND METHODS

The study area covers approximately 2100 km², with about 250 km of railway tracks, between Lombardy and Piedmont. It is characterized by flat farmland (mainly rice, maize and wheat); provided by flood levees or road and railway embankments, are the only forms of sloping ground. These areas are covered with robinia (*Robinia pseudoacacia*), elders (*Sambucus nigra*), *Euonymus europaeus*, *Cornus sanguinea*, brambles (*Rubus* sp.) *Phytolacca decandra* and nettles

(*Urtica dioica*). There are few oaks (*Quercus robur*) and ashes (*Fraxinus excelsior*) or willows (*Salix* sp.) and alders (*Alnus glutinosa*) near trenches and canals.

The embankment where the sample experiment has been performed is 250 m long and has a mean height of 10 m. It joins the roadway to a railway and road bridge over the Sesia river (Candia Lomellina town, Pavia). The sett had 9 entrances (4 well-used holes) and covered a 70 m long portion of the embankment.

Habitat factors affecting sett-site choice

In the study area, 4 railway embankments occupied by badgers and 6 unused banks were compared taking into consideration the following variables: mean height of the slope; percentage of scrub-cover; percentage of wood-cover: pedological parameters.

From the 10 banks, 5 kg samples of soil were collected and dried. They were sieved by 11 sieves with meshes ranging from 30 mm to 0.038 mm. The times of sedimentation of the samples with more than 15% of fine components (diameter <0.038 mm) were measured by dipping 100 g of material (< 2 mm) in a 4% solution of Sodium esametaphosphate.

Results were expressed as a percentage of gravel (2-60 mm), thick sand (0.6-2 mm), medium size sand (0.2-0.6 mm), fine sand (0.075-0.2 mm), silt (0.002-0.075 mm) and clay (<0.002 mm).

Methods for excluding badgers

Badgers were excluded from their sett by closing its entrances during the night, when the animals were expected to be out foraging. For one month, the sett was controlled weekly, using a monocular image intensifier (Wild Leits 3x), to determine the times of emergence. Night-watching started about half an hour before the sunset and ended at 02.00 a.m. Nocturnal badger activity started between 20.40 and 22.15 hours. Two animals were observed. The sett entrances were closed at 23.00 hours.

Each side of the railway embankment was covered with a 2.7 mm thick galvanized chain link fencing, with 8 cm meshes, pegged down securely by iron stakes. Vegetation was previously cleared and successively it was allowed to grow back through, so hiding the net.

The fencing was laid down in a couple of weeks (October 1997), 10 days after badgers exclusion and in that time no attempt to re-enter the sett was observed.

After the end of the work, the area was checked monthly to monitor the activity of the badgers by looking for latrines and footprints (last control: October 1998).

RESULTS AND DISCUSSION

In the monitored area, 4 used setts were found along about 28 km of railway embankments (0.14 setts/km). Only pedological parameters seem to affect sett-site choice (Table 1).

The slopes selected as a sett-site are composed of significantly higher percentages of fine sand ($U=1, p=0.02$ Mann-Whitney U Test) and lower ones of gravel ($U=0, p=0.01$).

Having protected the embankment, many footprints were observed along the slope in more than one check, and a latrine was dug nearby. No attempt to re-enter the sett was observed. By the autumn 1998, the fencing had been completely covered with vegetation.

The pedological parameters of soils are of major importance in the choice of sett-sites (Dunwell and Killingley, 1965; Kruuk, 1978). In the investigated area, badgers avoid soils with a prevalence of large-size components (gravel), which probably are not easy to dig and are not sufficiently cohesive and plastic. According to other studies (Clements, 1974), badgers prefer soft soils, with a high percentage of fine sand and silt. However, comparisons with other studied areas are difficult, because several research projects do not express the percentages of the various soil components in any details.

Table 1 - Factors affecting sett-site choice.

PARAMETERS	UNUSED SLOPES							USED SLOPES					MANN-WHITNEY U TEST	
Height (m)	8	7	8	1	6	6	1	3	8	1	2	7	3	U=8, ns
% wood cover	80	80	90	80	40	60			10	90	80	0		U=9, ns
% scrubcover	30	90	60	60	30	70			40	80	30	0		U=10, ns
% gravel	51	20	36	46	27	34			1	1	1	1	2	U=0, p=0.01
% thick sand	2	12	3	12	14	7			2	9	1	6		U=5.5, ns
% medium sand	6	22	5	34	18	11			18	49	11	19		U=8, ns
% fine sand	9	12	10	6	18	13			17	26	38	21		U=1, p=0.02
% silt	29	32	42	2	22	32			52	15	45	39		U=6, ns
% clay	3	2	4	0	1	3			1	0	0	4	3	U=8, ns

To deter badgers from a sett, English authors (Harris *et al.*, 1990; Neal and Cheeseman, 1996) suggest two main methods: their forced exclusion, immediately followed by the protection of the slope, or their translocation. The first one is preferred, leaving badgers free to find another sett-site in their own territory, without suffering excessive stress. Moreover, translocating badgers, to look for a suitable release site is really difficult and time expensive.

It is necessary to determine whether there are any alternative sett-sites within the territorial boundaries of the badger group. Our sett was near the river banks of the Sesia, which offered many suitable habitats. This factor and probably the continuous disturbance suffered in previous times helped make the experiment a success.

Neal (1977) suggests closing the sett entrances between 23.00 hours and midnight. However emergence times vary according to several factors, which include day-length, weather, disturbance and the amount of cover around the sett. So at least some night-watching is necessary to determine the best times for closing badger holes.

Three methods are reported to protect flood levees and embankments (Harris *et al.*, 1990): to cover the slopes with a chain link fence, to build a fence around the bank, or to protect it with electric fences (Wilson, 1993). We preferred the first option, which,

even if expensive, guarantees long-term efficacy. Moreover it does not require maintenance, it's completely hidden by vegetation, and it doesn't prevent other species of vertebrate from using the banks for protection or feeding. Electric fences, which are cheaper and easier to place, can only be used as a temporary solution, before more expensive but definitive interventions.

Wild mammal management and the reduction of their possible damage to human activities require careful planning. Badgers are not an exception. This first Italian study allowed us to check the presence of badger setts along the railway embankments of the investigated area and to plan successful actions in order to minimize undesirable damage.

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