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The influence of railway lines on the life of wild animals

Abstract: Railway lines have an impact on the surrounding environment, both during the construction or modernization phase and during operation. Animal mortality due to collisions is an increasingly well-known impact, but usually the barrier effect that occurs as a result of line fencing is a much more serious threat. Collisions also have other aspects: train delays and damage, and a threat to traffic safety. Most often they occur in the morning and afternoon hours, and in the annual cycle during the mating season of a given species and after the separation of young animals from their mothers. Since the train does not resemble a predator, wild animals do not instinctively fear it and learn to ignore the movement of the trains.

Keywords: Railway lines; Environmental impact; Wildlife

One of the most significant markers of biodiversity in Europe is found in Poland. There are many particularly valuable areas in the country, protected as national and landscape parks, nature reserves, and Natura 2000 areas.

When carrying out investments of a linear nature, it is impossible to omit all protected and valuable natural areas. In such conflict locations, on the one hand, the most effective environmental protection measures should be applied, and on the other hand, research should be carried out on the impact of the railway line on nature. They will be able to be used in future planning processes as the basis for preparing environmental impact assessments of planned investments.

The impact of communication routes on the environment depends on numerous factors: traffic intensity, location, and track structure. Roads and railways cause some negative effects in the form of landscape degradation, fragmentation of ecosystems, noise emissions, and others. Natural and semi-natural areas are transforming unfavorable for animals.

The impact of railway investments on animals can be generally divided into short-term (occurring only during the investment implementation phase) and long-term (occurring during the investment operation phase). In each of them, a temporary impact and a permanent impact can be distinguished. The temporary impact during the implementation of the investment is associated with scaring animals caused by noise, the presence of people and machines, and the work performed. The permanent impact results from the occupation of land for the construction site, fencing it, and the temporary transformation of the land. The momentary impact in the operation phase of the railway line is the passing of the train; permanent impact is associated with the presence of railway infrastructure, which is often a barrier for certain groups of animals. In the further part of the article, we will only deal with long-term impacts, as they are much more important for the problem of animal protection.

The railway lines themselves (track and embankment) have a relatively small impact on the natural environment. On the other hand, the removal of vegetation from the roadsides and the presence of anthropogenic elements may cause concern for the most sensitive species of animals, which discourages them from approaching or crossing the tracks (behavioral barrier). Deep excavations and high embankments make it difficult for most groups of animals to move. For small animals (rodents, amphibians), the tracks covered with crushed stone and the rails (a vertical barrier

several centimeters high) are serious physical obstacles. An additional barrier may also be drainage elements—deep, prefabricated concrete elements with steep walls. Fortunately, the so-called Krakow troughs, which were often a trap for small animals, have been abandoned with new investments. Bats and birds die by colliding with elements of the catenary or after hitting the front of the locomotive.

Barrier effect

Each railway line causes a greater or lesser barrier effect. The character of the train traffic is important, but the fence along the track is the most important. A complete barrier to animal migration routes is the worst solution for them, despite the fact that accidents on the tracks are one of the causes of wildlife mortality. The number of animals killed depends on the route of the line and the number of animals in its vicinity, as well as on the intensity of train traffic and their speed.

However, from an environmental point of view, habitat fragmentation poses the most serious threat associated with any linear development. The free migration of animals is crucial for the sustainable functioning of the population. The fencing of transport routes leads to changes in the current migration routes of animals and often prevents the exchange of genes between subpopulations. The inability to exchange genes and inbreeding may result in a decrease in the condition of separated populations, increased susceptibility to diseases, and consequently a decrease in the number of animals. Many species function properly only when ecological corridors are preserved.

The impact of barriers has more serious population consequences than the mortality of animals hit by trains. For common animal species, it is many times lower than, for example, that obtained by hunters. However, unlike hunters, trains do not choose their victims, and valuable representatives of various, often unique species also die on the tracks. It's one thing when a fox dies on the tracks; it's another thing when an elk or a bear is killed. In the case of species threatened with extinction, such as the lynx or the white-tailed eagle, the death of each individual is a serious loss to the population. It is therefore necessary to introduce effective protective measures, especially in areas where representatives of valuable, protected species occur.

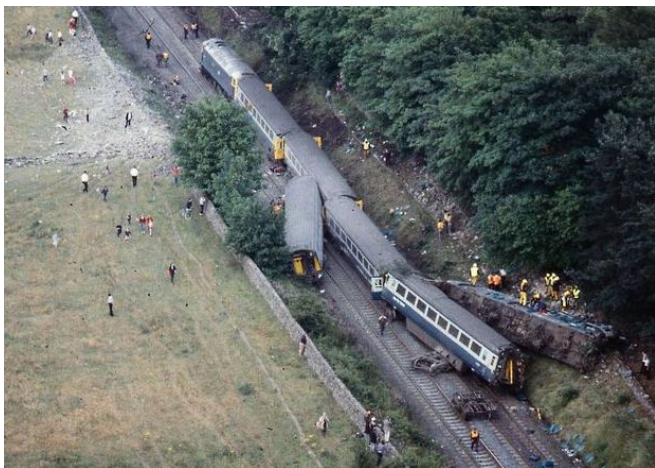
The map (Fig. 1) shows the overlapping routes of the main ecological corridors with a network of main railway lines. All intersections are areas with significantly increased collision risk.



Train traffic safety

It should also be remembered that collisions involving animals are associated with a threat to the safety of railway traffic - a frequent result of a collision is damage to the locomotive or traction unit. There are also cases of trains derailing as a result of running into a herd of animals. Special situations are conducive to such accidents - an example is the winter movement of large mammals on snow-covered tracks. Most often, this road is used by species that are extremely undesirable on the tracks from the point of view of traffic safety: elk and wild boar. Summing up, it should be stated that there is a conflict of interests between the needs of the environment (leaving the possibility of free migration) and traffic safety (protection against the possibility of a collision).

And what the tragic effect of a push-pull train with a pushing locomotive and a light steering car at the front of the train looks like on one or several large animals, see photos **2a** and **2b**.



a)



b)

2. Consequences of the collision: a) near Polmont in Great Britain, b) near Langenhorn in Germany

Photo **2a** shows the result of the collision near Polmont, Great Britain, in 1984. One cow weighing 400 kg, a train speed of 136 km/h, 13 fatalities, and 61 injuries. Photo. **2b** shows the catastrophe near Langenhorn in Germany, 2012, speed 125 km/h, herd of cows, 1 person killed, 4 injured (EBA crash report 22.08.2013).

When do collisions typically occur?

Railway lines cross territories and animal migration routes. Animals inhabiting the vicinity of the railway line often cross the tracks as part of their normal daily activity, in search of food or moving from resting places to feeding grounds. Most accidents take place in the morning, afternoon, and evening hours, i.e., at times of the highest activity of both animals and people (rush hours). Animals are prone to traveling long distances during their migrations across various terrain obstacles, including tracks. The risk of collision with some species remains at a similar level throughout the year; this applies to animals not attached to a specific territory, e.g., elk. In other species, there are periodic increases in mobility associated with the mating season and the search for mates, as well as with the migration of juveniles after separation from the mother. Inexperienced cubs and males engaged in fights for females are not very careful, which makes them more vulnerable to accidents. Road statistics show that the highest annual accidents occur in April, May, and October. In the case of herd animals, the reluctance to separate from the group is of great importance. If the herd leader decides to cross the tracks, the other individuals follow him. In the time between the first animal crossing the tracks and the last animal crossing the tracks, a train may arrive. An animal determined to stick to the group will risk running right in front of the vehicle despite the danger.

Escape from a predator

A situation that is particularly conducive to collisions is the appearance of another danger in the form of a predator or a human. The frightened animal runs away in a panic, almost blindly. At such times, the devices that warn animals about the train will not work because the emitted signals will be ignored. A predator chasing a potential victim also does not pay attention to many signals from the environment, which increases the risk of being hit by a train. There are also situations in which animals come especially near the tracks or even on the tracks. The railway line is sometimes treated by animals as a feeding ground. The mowed strip of vegetation is a high-quality pasture for roe deer and hares. For omnivores, garbage thrown from trains and the remains of killed animals may be attractive. A strip of mowed vegetation and the track itself can also be a convenient hiking trail. Unfortunately, any appearance of animals near the tracks could potentially result in a collision. An important factor contributing to the mortality of animals on roads and tracks is the fact that animals do not treat motor vehicles as their natural enemies. Train passengers can often observe herds of deer grazing by the tracks and not paying attention to the passing train. The train itself does not cause fear and does not provoke escape.

The art of survival

In order to survive in the natural environment, animals try to avoid threats while optimizing energy consumption for life needs. All signals that may indicate the presence of a predator cause instinctive anxiety and readiness to escape. At the same time, animals learn very quickly which phenomena do not pose a real threat and stop reacting to them. This applies to many elements introduced into the environment by humans; if they do not resemble natural threats, animals quickly get used to their presence. A train traveling on the tracks does not resemble a predator in any respect, nor does it pose a threat to animals located several meters from the tracks, so there is no need to run away from it. The danger arises when the animal is on the tracks when the train passes. Because trains do not trigger a natural escape response and, at the same time, move at speeds many times higher than those achieved by predators, the endangered animal often reacts too late to escape in time. Therefore, special devices are developed and installed to warn animals of danger by increasing alertness and readiness to escape or by scaring them away from the tracks just before the train passes.