

Genetic research on endangered suslik populations

Saving the Suslik



Aleksandra Gondek, PhD, has initiated and carried out a project to study the genetic variability of Poland's spotted suslik populations. She is interested in the use of molecular methods for conserving nature and population genetics

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By rearing up on their hind legs, susliks keep a lookout for predators. Yet low genetic variability now poses a greater threat than foxes, dogs, or cats to these small mammals, whose last colonies inhabit Poland's eastern meadowlands

The advance of human civilization and its mounting pressure are causing the natural habitats of many plant and animal species to disappear. Yet one does not have to look to the Amazon to find drastic examples of such ecosystem devastation - they are to be found here in our own backyard as well, as is shown by the case of a certain small rodent.

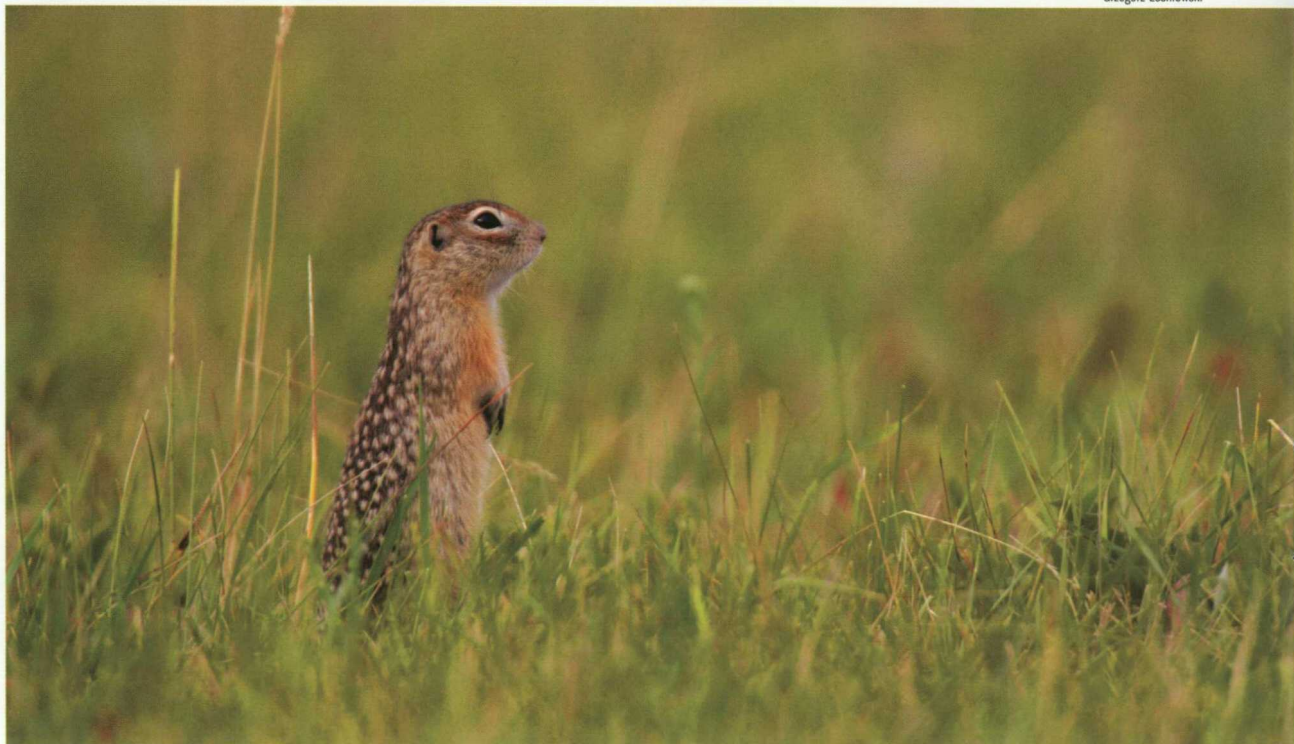
Susliks in the EU

Susliks are small mammals from the squirrel family, within the rodent order. The spotted suslik (*Spermophilus suslicus*), the rodent in question here, is now the only suslik species present in Poland. Under legal protection since 1984, it is listed as endangered in the Polish Red Data Book on Animals and all of its current colony sites have been protected under the European network NATURA 2000. Polish populations of the species constitute the northwestern limit of its range, which includes steppes from the banks of the Volga through Russia, Ukraine, and Moldova all the way to the Black Sea and the mouth of the Danube in the west. Polish (and Romanian) susliks are therefore the only populations to be found within the EU.

Watching over the broad steppes

Of medium size, with body length of 18-23 cm, the spotted suslik is distin-

Grzegorz Leśniewski



The spotted suslik *Spermophilus suslicus* is among the EU's rare and endangered species of mammals. Poland and Romania are the only EU countries to be inhabited by small numbers of colonies

The largest Polish colony of spotted susliks has been discovered at the airport in Świdnik, so the area has been incorporated into the Natura 2000 European Ecological Network. The susliks have thereby unwittingly become a source of problems for the regional authorities, who are planning to expand and upgrade the airport



Lukasz Zandrecki/BE&W

guished by the lighter hair ends which form characteristic white spots on its back. Susliks live in colonies which inhabit underground burrows, mainly feeding on sprouts and sometimes insects. During the autumn-winter period they go into hibernation for about 7 months, and in late April/early May they give birth to young which spend their first month still in the burrow. When above ground and not feeding, susliks spend most of their time observing their surroundings, a behavior that enables them to avoid attacks from predators such as birds, foxes, dogs, and cats. That is why one of the most important prerequisites for suslik survival is low-lying vegetation around a colony site.

The species' most typical habitat therefore consists of steppe areas, which do not occur at our geographical latitude. In Poland the suslik inhabits pasturelands, fallow fields with low-lying vegetation, unplowed balk strips between fields, and other poorly harnessed land. Drastic changes in how agricultural land has been harnessed in Poland over the past 50 years have caused significant fragmentation in these rodents' habitats. The intensive farming of previously unharnessed land and the elimination of large cattle herds have led to the demise of many of their previously extant colonies, while the destruction of ecological corridors and the now increased distance between populations have significantly limited potential migration between them.

Susliks at the airport

In the 1950s there were 143 suslik colonies in Poland containing a total of some 70,000 animals. By 1961 those figures had already shrunk by half, with some 24,000 individuals in 81 colonies. Aside from colonies destroyed by torrential rainfalls or

by the local human community, the basic cause for such a drastic drop in species numbers was the intensification of agriculture. As the agricultural industry developed and state-administered collective farms (called PGRs) were set up in Poland, most of the areas inhabited by susliks came under plow and constant mechanical intervention caused the complete destruction of many colonies. Subsequent research carried out in 1979-85 indicated a further drastic drop in numbers (only 32 suslik sites). The years since have seen the abandonment of PGRs and an attendant drop in numbers of grazing cows, horses, and sheep, and so the optimal terrain for the suslik has often become overgrown.

The susliks present in the Zamość region only occur in six close-knit colonies under nature reserve protection, with a small number of individuals. Quite an extraordinary discovery came in the 1990s, when a vast suslik colony was unexpectedly found at the Świdnik airport outside of the town of Lublin. It currently contains more than 11,000 individuals and represents the most northwestern site inhabited by the species. Although it was mostly established due to humans, this single colony now encompasses more than 90 percent of all Poland's susliks.

Isolated in "island" pockets

Although Poland's extant suslik populations are not numerous, under the current program of intense conservation and habitat-sustenance efforts they do stand chances of survival. However, their fate as a species likewise hinges upon another, "internal" parameter: genetic diversity, an important quality which isolated, widely-strewn populations are at risk of losing. If a given colony is founded by a small group of individuals, the pool of gene variants (alleles) available

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When above ground, susliks spend most of their time observing their surroundings by rearing up on their hind legs to watch for predators. That is why they inhabit areas with low-lying vegetation, generally steppes, but in Poland mainly pastureland, fallow fields with low vegetation, unplowed balk strips between fields, and other poorly harnessed land



Michał Sadowski/FOTOREFERA

to future generations naturally becomes narrower. This leads to the so-called *founder effect*, limiting the diversity seen within a population. Another consequence is called *genetic drift*, caused by the random loss of certain gene variants. Research on numerous species has shown that the degree of heterozygosity can affect many traits - among mammals, for instance, including dispersion, body weight, metabolic processes, and above all resistance to pathogens, the latter having a considerable impact on a population's flexibility to react to changing environmental conditions.

Susliks facing depression

Considering the size of the animals and their lifestyle, the distances between individual suslik colonies in Poland are rather big. The migration potential of individuals likely does not exceed more than several hundred meters, making it hard to expect any exchange of individuals among existing populations. Moreover, essentially all the Polish suslik colonies have recently passed through a *population bottleneck* of low specimen numbers, and have therefore undoubtedly been affected by genetic drift. Unfortunately, what is called *inbreeding depression* can continue to hamper a population even after classical methods alleviate all other causes for low numbers, frequently causing otherwise successful attempts to

reintroduce a species to end in failure. This fact has made it urgent to study the level of genetic variation among the surviving spotted suslik populations and to identify how much they differ from one another.

The use of molecular markers has become a common research tool in both population genetics and nature conservation, especially for the protection of endangered plants and animal species. Such research most often takes advantage of the variability of microsatellite *loci*, regions of genetic material that are not subject to natural selection. This means that each *locus* (certain position on the genome) can have many differing variants (alleles), and by analyzing many *loci* at the same time we arrive at unique combinations characterizing individuals or populations. Modern molecular biology methods enable DNA to be isolated from a very small quantity of tissue, even from hair or droppings, albeit only in small quantities. The larger quantities of DNA required for molecular marking can be multiplied using the Polymerase Chain Reaction (PCR) method. PCR uses short specific DNA fragments (primers) which correspond precisely to the sequence located on either side of a given microsatellite marker, enabling the specific fragment to be amplified.

Microsatellites have thus helped identify the degree of genetic variation present in

suslik populations both in Poland and just beyond our country's borders, in Ukraine. Ukrainian populations, even though a relatively small distance away from Poland's, inhabit a relatively unchanged habitat. Ukraine continues to have extensive tracts of uncultivated land left over from abandoned collective farms, and its more numerous cattle herds maintain vegetation on a level enabling susliks to rear up and watch out for predators.

Back from the brink

Research results show that the degree of genetic diversity within Polish suslik colonies is characteristic of critically endangered populations, and that the inter-population differentiation is so great that it attests to a complete lack of contact between them despite the relatively small geographic distances. Interestingly, the suslik colony at the Świdnik airport, despite its large numbers, shows a genetic diversity similar to that of populations consisting of merely a dozen individuals. That finding confirms suspicions that this colony was founded by a small group of susliks and thus evidences the founder effect. Ukrainian susliks, in turn, possess higher rates of diversity within colonies, and a comparison of different populations



Suslik individuals are thought to be unable to migrate further than several hundred meters, so small distances can easily isolate populations from one another

suggests that migration has occurred between them.

The Polish-Ukrainian suslik

These results suggest that the most favorable conservation approach would be to boost genetic variation by translocating individuals among the individual populations - especially since their differences stem more from recent genetic drift than from separate evolutionary processes. The most tempting solution, especially given existing plans to expand the Świdnik airport, might seem to be to use the susliks from the large colony there to replenish the remaining populations or to re-establish abandoned colonies. However, these findings make it clear that such a move could end up actually further lowering the genetic variation of the target populations. Given the Świdnik population's limited diversity, a better solution would involve replenishing Polish populations using individuals from Ukraine.

The spotted suslik's current situation is undoubtedly critical, yet joint efforts to rebuild its habitats and at least partially recover its genetic variation will give the species a significant chance of survival. ■

Further reading:

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The fundamental dangers faced by the Polish susliks include not just small numbers but also low genetic diversity. Traps such as this one are used to collect genetic material to test suslik DNA