**Genetic variation helps rescue endangered panthers**
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This fall, biologists announced the apparent success of a last-ditch conservation effort: the Florida panther, once slated for [extinction](http://evolution.berkeley.edu/evolibrary/glossary/glossary_popup.php?word=extinction), has been given a second lease on life by the infusion of [genetic variation](http://evolution.berkeley.edu/evolibrary/glossary/glossary_popup.php?word=genetic+variation). In the 1900s, this [population](http://evolution.berkeley.edu/evolibrary/glossary/glossary_popup.php?word=population) nosedived because of hunting and habitat loss. By the 1990s, there were fewer than 30 Florida panthers left. To make matters worse, those survivors were in bad physical shape. They were riddled with diseases and parasites and had poor sperm quality and low fecundity, as well as a host of problems like undescended testicles, kinked tails, and heart defects. Scientists predicted that the Florida panther would be extinct within 20 years and, in 1995, formulated a bold plan to save them. |

**Where's the evolution?**
The conservation plan involved improving the genetic status of the population with new blood. In 1995, eight female pumas from Texas (a different subspecies of panther) were moved into the area and took up residence with their Florida cousins. How could just eight panthers help save a whole population? The new panthers brought with them new [gene](http://evolution.berkeley.edu/evolibrary/glossary/glossary_popup.php?word=gene) versions, which help counteract two negative side effects of small population size: reduced genetic variation and [inbreeding](http://evolution.berkeley.edu/evolibrary/glossary/glossary_popup.php?word=inbreeding). To understand how the conservation plan worked, it helps to understand the evolutionary importance of genetic variation and the [evolutionary](http://evolution.berkeley.edu/evolibrary/glossary/glossary_popup.php?word=evolution) underpinnings of [inbreeding depression](http://evolution.berkeley.edu/evolibrary/glossary/glossary_popup.php?word=inbreeding+depression).

Genetic variation refers to all the different gene versions that are present in a population. In general, when a population loses a lot of individuals (i.e., decreases in size), its genetic variation goes down as well. This makes intuitive sense. The fewer individuals in a population, the fewer different gene versions they may carry. Over long time scales, decreased genetic variation can be a problem for a population because genetic variation is the raw material of evolution. [Natural selection](http://evolution.berkeley.edu/evolibrary/glossary/glossary_popup.php?word=natural+selection) acts on the genetic variation present in a population, favoring some gene versions over others and eventually producing [adaptations](http://evolution.berkeley.edu/evolibrary/glossary/glossary_popup.php?word=adaptation) that allow individuals to thrive in new circumstances. So without a sufficient amount of genetic variation, a population cannot evolve in response to changing environmental conditions. Hence, bringing in new panthers probably improved the Florida panthers' evolutionary potential.

Over short time scales, genetic variation is important for a population's survival as well. For example, a genetically variable population is more resistant to pathogens and parasites. This occurs at two different levels. At an individual level, populations with high levels of genetic variation generally include many individuals who are [heterozygous](http://evolution.berkeley.edu/evolibrary/glossary/glossary_popup.php?word=heterozygote) — that is, they carry two different gene versions. Individuals with many heterozygous genes are less likely to be susceptible to diseases and parasites than are individuals with many genes that are [homozygous](http://evolution.berkeley.edu/evolibrary/glossary/glossary_popup.php?word=homozygote). That's because individuals that are heterozygous for genes involved in parasite and pathogen resistance have twice the chance of carrying the right gene version to resist the pathogen-of-the-day than do individuals homozygous for those genes. It's a bit like buying two tickets for a raffle instead of one. The more tickets you have, the more likely one of them will be a winner. The same reasoning applies at the population level. A genetically variable population is likely to include some individuals who happen to be genetically resistant to the disease or pest — enabling the population to survive to the next generation, even if many individual animals die or become sick. For the Florida panthers, bringing in new blood increased heterozygosity, improving the health of individuals, and made the population less likely to be wiped out by a single disease or parasite.

Another genetic side effect of small population size is inbreeding — a situation in which individuals mate with their close relatives. In very small populations, like that of the Florida panthers, this happens simply because the population is so small that all the individuals are closely related to one another. The offspring resulting from inbreeding tend to have health problems and lower reproductive success. Closely related individuals are likely to carry the *same* deleterious recessive gene versions and pass two copies of that gene on to their offspring. Hence, the offspring of inbred matings tend to express many deleterious recessive genes, resulting in lower [fitness](http://evolution.berkeley.edu/evolibrary/glossary/glossary_popup.php?word=fitness). Introducing the new panthers to the Florida population helped reverse the effects of inbreeding by bringing in new gene versions that masked the negative effects of the recessive gene versions already present in the Florida panther population.



With an evolutionary perspective, it's easy to understand why Florida panthers once seemed doomed. Their small population size not only put them closer to extinction in terms of sheer numbers, but also introduced the genetic risks of reduced genetic variation and increased inbreeding. Similarly, an evolutionary perspective helps explain why this conservation experiment was a success. Bringing in eight new panthers might seem like too little too late, but in fact, the genetic diversity they brought with them seems to have had significant benefits for the population. The new gene versions from the eight panthers outlasted their original carriers and have been passed down through the generations to individuals alive today. Now, the population size has tripled, genetic variation is up, and signs of inbreeding are down. And over the past 30 years, the panthers have gotten a further boost from increased legal protection and the establishment of additional protected panther habitat, as well as simple measures, like new freeway underpasses that help the cats avoid vehicles. Of course, the Florida panther is still endangered and will need continued protection and even more habitat to survive for the long term — but, as we've seen, understanding the evolutionary underpinnings of the panthers' plight will help biologists develop effective conservation plans for their future.

http://evolution.berkeley.edu/evolibrary/news/101201\_panthers