Name:
Class:

Text: **Genetic Variation Helps Rescue Endangered Panthers**
Environmental Science

A. Preview the text: title/sub-title, source, date, hook; number the paragraphs

B. Read, marking up the text as follows:
• *Circle and then define/find synonyms for new vocabulary*
• *Annotate Content (2 color highlights):* • *Reasons why the Florida population seemed doomed*
• *Why this conservation effort appears to be a success*

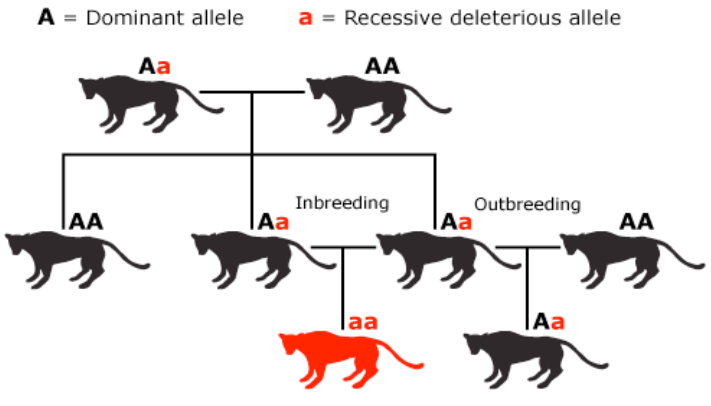
This fall, biologists announced the apparent success of a last-ditch conservation effort: the Florida panther, once slated for extinction, has been given a second lease on life by the infusion of genetic variation. In the 1900s, this population of *Puma concolor* nosedived because of hunting and habitat loss. By the 1990s, there were fewer than 30 Florida panthers left. Scientists predicted that the Florida panther would be extinct within 20 years and, in 1995, formulated a bold plan to save them.

The conservation plan involved improving the genetic status of the population with new blood. In 1995, eight female *P. concolor* from a Texas population were moved into their Florida cousin's habitat. How could just eight individuals help save a whole population? The new panthers brought with them new gene versions, which help counteract two negative side effects of small population size: reduced genetic variation and inbreeding.

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 acts on the genetic variation present in a population, favoring some gene versions over others and eventually producing adaptations 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. populations with high levels of genetic variation generally include many individuals who are heterozygous — that is, they carry two different gene versions — at important locations in the genome. Individuals with many heterozygous genes are less likely to be susceptible to diseases and parasites than are individuals with many genes that are homozygous For the Florida panthers, bringing in the Texas cats improved 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. This is known as inbreeding depression — and was seen in the Florida panthers in the form of poor sperm quality, low fecundity, undescended testes, kinked tails, and heart problems. Inbreeding depression occurs because of a quirk of natural selection and genetics. As natural selection acts on a population, it weeds out genes that have disadvantageous effects, but it can only weed out these genes if they are actually expressed in an individual. For dominant gene versions, that's no problem. Individuals carrying dominant genes with a detrimental effect will be selected against, and eventually, these genes will be purged from the population. Recessive genes, however, are only expressed when an individual carries two copies of them. Once natural selection has removed most of the detrimental recessive genes from a population, these seldom wind up paired with an identical copy and are effectively hidden from the effects of natural selection. This means that most populations carry many deleterious recessive gene versions that are very rarely expressed — except in cases of inbreeding. 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 mating tend to express many deleterious recessive genes, resulting in lower 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.

Today, the Florida *P. concolor* population has tripled in size, 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.

"Genetic variation helps rescue endangered panthers." *Understanding Evolution*. N.p., n.d. Web. 3 Apr. 2014. <http://evolution.berkeley.edu/evolibrary/news/101201_panthers>.

C. In Your Own Words: Write an article conclusion by using your highlighted text to complete the following:

With an evolutionary perspective, it's easy to understand why Florida panthers once seemed doomed.

Similarly, an evolutionary perspective helps explain why this conservation experiment was a success.

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Genetic Variation in Panthers: Follow Up Questions

1. What is gene variation?

2. How does population size affect gene variation?

3. Choose one sentence from paragraph 3 that best supports why gene variation is needed.

4. What are some short-term consequences to the lack of genetic variation.

5. What is inbreeding?

6. What are some of the health problems in Florida panthers as a result of inbreeding?

7. Inbreeding did not create the bad genes, they were already there, so why does an inbreed population have a higher percentage of these bad traits that should be removed by natural selection?

8. What is the purpose of introducing Texas panthers to the Florida panther population?

9. What was the change to the Florida panthers after Texas panthers have been added to their population?

10. Which mechanisms of evolution does this scenario describe? Name and defend each.