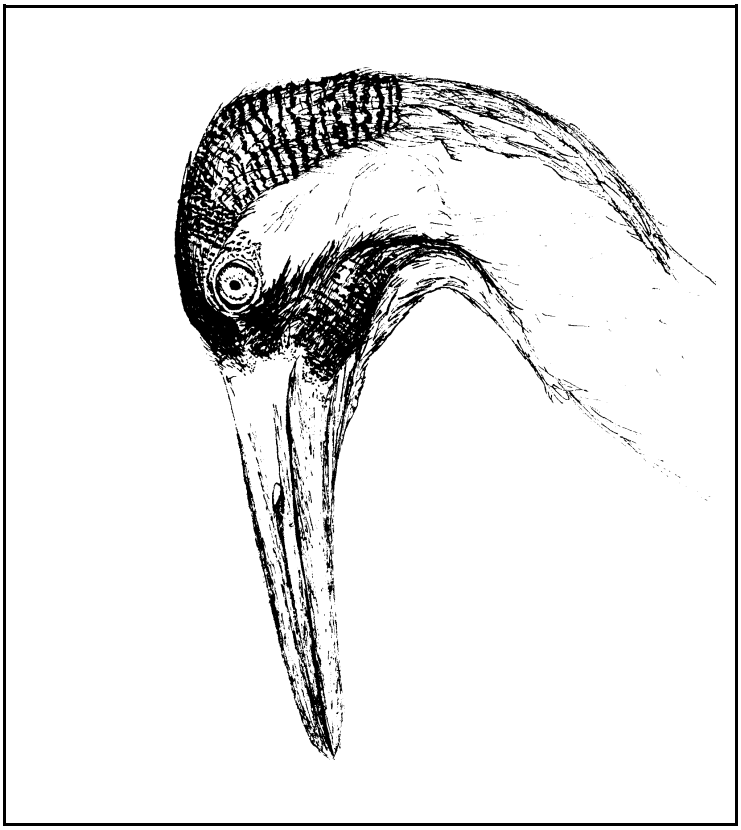
Patuxent Research Notes

Importance of genetic diversity in whooping cranes

Life has been hard for whooping cranes, which are some of the largest and most majestic birds in the world. Man has converted most of their breeding grounds in central North America to farmland, which is unsuitable for breeding. By 1941 only 21 birds survived in the wild. Now they are protected under the Endangered Species Act and have had lands set aside as refuges for them. In 1994 about 140 birds survived in the wild. The whooping crane population also is exposed to a threat quite different from hunting and loss of habitat. It is a threat that is not obvious to most people. The whooping crane population was so greatly reduced that it lost most of its diversity (variety). The surviving birds closely resemble each other. This loss of diversity reduces their ability to fight threats to their survival.

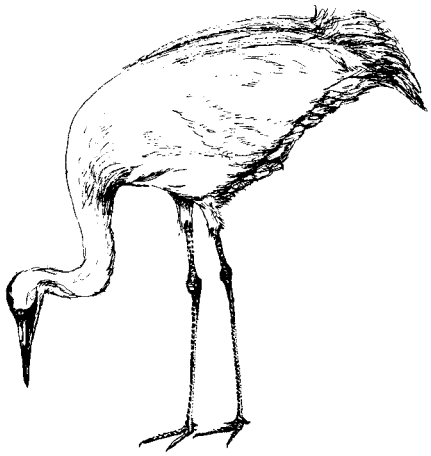


The importance of diversity to wild plants and animals should be explained, since, at first, uniformity might seem best. When raising animals or crops on a farm, a farmer usually wants uniformity. A dairy farmer, for example, wants cows that give the most milk. The farmer has specific goals in mind. Wild organisms, in contrast, cannot be judged by one trait, such as milk production. The best adapted oak tree is not necessarily the one with the most or the biggest acorns. In one year it might be the tree that can survive a drought, and the following year, the one that can survive a plague of insects or a fire. The oak must also compete well against other trees for light and nutrients. If a population of oaks contains trees with a variety of traits, at least some trees are likely to survive each challenge. Diversity means a species can cope with different threats. Uniformity means the population is vulnerable and could go extinct. Uniformity may also lead to deformities in animals.

Diversity is tied to **genes**, which are the basic units of **heredity**. A daughter resembles her parents because she inherited half of her genes from each parent. Brothers and sisters resemble each other because they have many genes in common. Identical twins look the same because all of their genes are the same. Genes carry the information used to produce the proteins required by an organism. Biologists recognize that the combination of an organism's genes and its environment determines how it grows and functions. Sometimes a gene's function is obvious. For example, genes determine eye color. At times a gene may be harmful and at other times useful. Its value depends on the

other genes present and the environment. Organisms contain so many genes and require so many different proteins that it is doubtful that the functions of most genes will be understood for many years.

Genes are arranged in long strings, which are folded and bundled up into chromosomes. These chromosomes may be seen in some kinds of cells with the help of a microscope. Most kinds of organisms have chromosomes in pairs, one from each parent. Most chromosomes have some genes that are potentially harmful or even deadly. Fortunately however, because chromosomes come in pairs, if the gene on one chromosome cannot produce the protein it should, the gene on the matching chromosome probably can produce it, and the organism is healthy. The population is also healthy if it has a wide diversity of chromosomes and genes. Some of the genes that might seem harmful



in some circumstances might be just what the animal needs under other circumstances. But think about what happens when the two chromosomes of a pair contain the same harmful gene. Then the harmful effects of the genes are expressed and the animal may die. When a population is large and has many different chromosomes it is unlikely that two harmful genes will be found together. However, when a population decreases, the diversity of chromosomes is reduced, and harmful genes are much more likely to come together in combination.

Let us think about whooping cranes again. Some of the birds were brought into captivity at the Patuxent Environmental Science Center and the International Crane Foundation. They were protected from predators and given the best care possible by the veterinarians. Even under these circumstances, some of the young that hatched were crippled. Several of the young had such twisted hocks that they could not survive and had to be humanely killed. (The "hock" of a bird's leg is the lower joint, below the knee.) The veterinarians caring for the cranes concluded that the deformities were the result of the loss of diversity of the genes, caused by the small population size. Their best strategy to minimize the number of deformities was to match up whooping cranes that were not closely related, to take advantage of whatever diversity remained. Breeders of rare captive species recognize the importance of maintaining thorough records of family trees. They try to match animals that are unrelated. Zoos all over the world cooperate, trading animals and keeping records to

maintain genetic diversity.

Captive breeding of whooping cranes has been successful enough that wild populations can be increased and cranes can be released into protected areas. However, we know that the populations may not be as healthy as they might have been if whooping crane numbers had never dropped so low. Saving an endangered species means more than saving individual plants and animals. It means protecting the genetic diversity of the species.

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