



Photos by Gerardo Ceballos

A green arboreal frog.

Many species of frogs are threatened by pollution and the depletion of the ozone layer.

Mexico's End-of-Century Challenge Preserving Biological Diversity

Gerardo Ceballos*

“A Mexican named Figueroa... appeared one morning bringing us three superb woodpeckers, magnificent examples of the *Campephilus imperialis*, extraordinarily large ones. This splendid bird stands two feet high; its plumage is black and white, and the male sports a red crest on its head that stands out particularly against the snow.”¹

That is how Norwegian anthropologist Carl Lumholtz described the imperial woodpecker at the beginning of the century. Considered the largest woodpecker in the world, this bird lived exclusively in the foothills of Mexico's Sierra Madre Occidental, from Sonora to Michoacán. Unfortunately, it is now only a

memory perpetuated in chronicles of old books and on museum shelves. No longer can anyone enjoy the spectacle of these birds among the pines on lands broken by deep ravines and jagged



Habitat destruction is causing the extinction of species like the black-tailed prairie dog.

mountains. One by one the *pitorreales*—a name they were known by locally—disappeared, exterminated by intense logging and hunting. It is likely that the last imperial woodpecker spent months, perhaps years in an intense, fruitless search for other specimens of his or her kind until one clear morning, like many others in those mountains, it took its last breath. Except for a small group of scientists, the world took no notice of its extinction. Unfortunately, this was not an isolated case, and it is representative of one of the most severe environmental problems in the history of humanity: the loss of biological diversity.

In the last four centuries, more than 400 species of vertebrates and hundreds of invertebrates and plants have become

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extinct. These figures speak for themselves, but they pale when compared with today's rate of extinction. Despite there being no precise figures because of the problem's complexity, thousands of species become extinct every year; some approximations put the figure at 50,000. At the same time, thousands, perhaps millions of species are endangered. The overwhelming, seemingly endless list contains several species of every group of plants and animals, and it gets longer every day.

The causes of extinction vary widely, but they all boil down to a single factor: the sheer magnitude of human activity. Its environmental impact in recent centuries has been severe. Global problems like atmospheric warming, the thinning of the ozone layer, pollution, the destruction of forests and jungles, the desertification of enormous expanses of the planet's surface, and the loss of biological diversity are caused exclusively by the population explosion, the most significant event of the Earth's last 65 million years.

This population explosion, practically unknown until this century, is a recent phenomenon. Scientific and technological advances such as the discovery of vaccines and antibiotics caused a considerable drop in the death rate and the population began to grow rapidly. At the beginning of this century, the Earth had about 1 billion inhabitants; 30 years later, that figure had doubled. By 1970, there were about 3.5 billion human beings on the planet, a number that increased by approximately 70 million yearly. Today, there are 5.9 billion of us, and the yearly increment is 85 million. As incredible as it seems, the human population has grown as much in the last 25 years as it did in the time since the first human being appeared millions of years ago.

Mexico is no exception. Its population has also grown rapidly in this century. In 1910, when the country celebrated the first centennial of independence and the total population was nearly 8 million, enormous stretches of land were unin-

habited. This changed drastically in the following decades. By 1940, there were already 19.7 million Mexicans; by 1990, 81 million; and five years later, 95 million. This makes an increase of over 1000 percent since the beginning of the century. Estimates indicate that this figure will double in the next 25 years, and it is to be expected that the negative impact on the environment will parallel that growth.

The extinction of species has profound biological, cultural and economic implications. The history of the evolution of humanity and the development of rites, art and customs have been intimately linked to nature's diversity. Therefore, the impoverishment of biological resources limits the possibilities for cultural enrichment and diversification. Nevertheless, the importance of preserving biological diversity can only be appreciated in its true magnitude if we look at its role in natural systems and the services it offers to humanity. Biological



Toucans are among the many species of birds affected by illegal pet trade.



The Mexican wolf (*Canis lupus baileyi*) and the California condor (*Gymnogyps californianus*) became extinct in the wild.

diversity is the basis for the structure and functioning of nature. Each species is like a cog in an extremely complex series of interactions among them and their physical and biological environment. The progressive disappearance of species, that is, of the cogs, first weakens and then impedes the correct functioning of biological systems.

Under normal conditions, human beings gather an enormous variety of benefits—called nature's services—from natural ecosystems. The long list of environmental services includes the maintenance of the proportions of gases in the atmosphere; control of the hydrological cycle that provides fresh water; provision of products for agriculture, food, raw materials, medicine and industrial processes; the purification of the air and water; the mitigation of floods and droughts; the detoxification and decomposition of waste; the generation and renovation of the soil, as well as the maintenance of its fertility; the pollination of crops and natural vegetation; the control of major pests that endanger crops; the dispersal of seeds; the translocation of nutrients; protection

from the Sun's ultraviolet rays; the stabilization of the climate; and the moderation of extreme temperatures, wind and waves. Clearly, the reasons for preserving biological diversity are not only philosophical, moral, religious and ethical, but above all, pragmatic.

Mexico, a country of legendary cultures, described in the nineteenth century by German scientist Alexander von Humboldt as a biological paradise, is suffering today from one of the world's most severe extinction problems. The situation of Mexican flora and fauna is extremely precarious: around 25 percent of all the vertebrates, almost 750 species, are in danger of extinction. Many of them, like the 300 remaining scarlet macaws scattered throughout the Lacandon Jungle, or the perhaps 500 *vaquita* porpoises still swimming in the dun-colored waters of the upper Gulf of California, are at imminent risk of extinction if intensive programs to preserve them are not established.

Like the imperial woodpecker, at least 44 other vertebrate species have become extinct in Mexico during this century, among them the Mexican grizzly bear,

the Mexican wolf, the sea otter, the Guadalupe *caracara*, the California condor, the passenger pigeon and the Salado shiner (Table 1). What is worse, no one knows how many plant or invertebrate species have been lost without even being registered by science.

The anthropogenic causes of the extinction of species can be classified as direct and indirect activities. The former are those that, like trafficking in animal species, illegal hunting and eradication programs, that expressly seek to obtain a species with desirable characteristics like its fur or flesh, or to eliminate "undesirable" species like pests or predators. This kind of activity has caused the extinction of species like the Mexican wolf (*Canis lupus baileyi*) and the Mexican grizzly (*Ursus arctos*).

Indirect activities include pollution, deforestation and fragmentation of natural environments. These activities do not have as their express object any particular species, but they do affect flora and fauna simultaneously and are the main cause of the disappearance of many species world- and nationwide. For exam-



Wood storks are threatened in Mexico.



Many species of reptiles endemic to Mexico, like the skink, are sold illegally in the U.S. and Europe.

ple, the deterioration of the environment precipitated by the destruction of enormous stretches of natural habitats with the rapid advance of the agricultural, forest, cattle raising and urban frontiers, seriously endangers the perpetuation of entire ecosystems and thousands of plant and animal species. It is estimated, for example, that approximately 700,000 hectares of land are deforested every year in Mexico, putting it among the countries of the world with the highest rates of deforestation.

More than three decades ago, celebrated naturalist A. S. Leopold summed up the situation, saying, "Mexico is facing an enormous and difficult problem in the conservation of its resources. No palliative measure will solve it. What is required is a nationwide effort... The conservation of wild fauna is impossible without paying attention to other resources—soil, forests and water... The future... will be determined in the final analysis, by the country's response to the challenge of conservation."²

Leopold's appreciation was correct. Actually, conservation of biological diver-

sity should be the priority in Mexico's natural resource management. Conservation and development should not clash since there can be no long-term harmonious development if natural resources deteriorate. The conservation of Mexico's biological riches is important for philosophical, ethical, moral, biological, cultural, economic and social reasons. This wealth represents an enormous source of economic resources which can be transformed into noticeable improvements in the quality of life and well being of all Mexicans. However, conservation of Mexico's natural resources is only being carried out thanks to the efforts of a small group of people and institutions and is insufficient. For example, only between 3 percent and 4 percent of Mexico's territory is included in the National System of Protected Areas. Despite some advances in the last six years, the situation in protected areas is critical: most reserves have severe problems of land tenure, human settlements, illegal logging, fires, hunting and lack of infrastructure.

Government and society must join forces to create a national plan for the con-

servation of biological diversity. A plan of this kind would make it possible to know in detail the country's biotic resources and determine development strategies compatible with the conservation of these resources, particularly with the long-term maintenance of endangered species. This would be only the first step in consolidating conservation efforts and in demonstrating that despite a complex environmental situation, the necessary vision exists to adopt measures aimed at correcting the problems. The federal government's development model requires profound revisions to minimize damage to the environment and harmonize it with rational management and long-term conservation of natural resources. This is probably one of the most outstanding challenges that both society and government must meet in the twenty-first century. **NM**

NOTES

¹ Carl Lumholtz, *El México desconocido* (1902; reprint, Mexico City: Instituto Nacional Indigenista, 1979).

² A.S. Leopold, "Fauna silvestre de México," *IMERNAR* (Mexico City) (1965).

TABLE 1

Vertebrate species exterminated or that have become extinct in the last century in Mexico. Most of the species have disappeared due to a change in or the destruction of their habitat, hunting and the introduction of exotic species.

Species		Causes			
Common name	Species	OV	DH	IES	OR
FISH (21 in all)					
Shovelnose sturgeon	(<i>Scaphyrhynchus platyrhynchus</i>)	-	X	-	-
*Ameca shiner	(<i>Notropis amecae</i>) ©	-	X	X	-
*Phantom shiner	(<i>Notropis orca</i>)	-	X	-	X
*Durango shiner	(<i>Notropis aulidon</i>)	-	X	-	X
*Salado shiner	(<i>Notropis saladonis</i>)	-	X	-	-
*Potosi pupfish	(<i>Cyprinodon alvarezii</i>) ©	-	X	X	-
*Violet pupfish	(<i>Cyprinodon ceciliae</i>)	-	X	-	-
*Memorial pupfish	(<i>Cyprinodon inmemorian</i>)	-	X	-	-
*Longfinned pupfish	(<i>Cyprinodon longidorsalis</i>) ©	X	-	-	-
*Parras pupfish	(<i>Cyprinodon latifasciatus</i>)	-	X	-	-
*Catarina pupfish	(<i>Megupsilon aporus</i>) ©	-	X	X	-
*Stumptooth minnow	(<i>Stypodon signifer</i>)	-	X	-	-
*Parras charcodon	(<i>Characodon garmani</i>)	-	X	-	-
*Graceful priapella	(<i>Priapella bonita</i>)	-	X	X	-
*Endorheic chub	(<i>Evarra tlahuacensis</i>)	-	X	-	-
*Plateau chub	(<i>Evarra engelmanni</i>)	-	X	-	-
*Mexican chub	(<i>Evarra bustamantei</i>)	-	X	-	-
Golden skiffia	(<i>Skiffia francesae</i>) ©	-	X	-	-
Tequila splitfin	(<i>Zoogenecticus tequila</i>)	-	X	X	?
Colorado squawfish	(<i>Ptychocheilus lucius</i>)	-	X	-	-
Razorback sucker	(<i>Xyrauchen texanus</i>)	-	X	-	-
BIRDS (11 in all)					
*Imperial woodpecker	(<i>Campephilus imperialis</i>)	X	X	-	-
Carolina parakeet	(<i>Conuropsis carolinensis</i>)	X	-	-	-
Passenger pigeon	(<i>Ectopistes migratorius</i>)	X	X	-	-
Whooping crane	(<i>Grus americanus</i>)	X	X	-	-
Trumpeter swan	(<i>Cygnus buccinator</i>)	X	X	-	-
California condor	(<i>Gymnogyps californianus</i>)	X	X	-	X
Eskimo curlew	(<i>Numenius borealis</i>)	X	-	-	-
*Guadalupe Island petrel	(<i>Oceanodroma macrodactyla</i>)	-	-	X	-
*Guadalupe caracara	(<i>Polyborus lutosus</i>)	X	-	-	-
*Slender-billed grackle	(<i>Quiscalus palustris</i>)	-	X	-	-
*Socoro dove	(<i>Zenaida graysoni</i>) ©	-	-	X	-
MAMMALS (12 in all)					
Mexican wolf	(<i>Canis lupus baileyi</i>)	X	-	-	-
Mexican grizzly bear	(<i>Ursus arctos</i>)	X	-	-	-
Sea otter	(<i>Enhydra lutris</i>)	X	-	-	-
Northern river otter	(<i>Lontra canadensis</i>)	X	X	-	-
Caribbean monk seal	(<i>Monachus tropicalis</i>)	X	-	-	-
Elk	(<i>Cervus elaphus</i>)	X	-	-	-
*San Quintin kangaroo rat	(<i>Dipodomys gravipes</i>)	X	-	-	-
*Todos Santos Island woodrat	(<i>Neotoma anthonyi</i>)	-	-	X	-
*Coronados Island woodrat	(<i>Neotoma bunkerii</i>)	-	-	X	-
*Tres Marias Island rice rat	(<i>Oryzomys nelsoni</i>)	-	-	X	-
*San Pedro Nolasco deer mice	(<i>Peromyscus pembertonii</i>)	-	-	-	X
*Angel de la Guarda deer mice	(<i>Peromyscus guardia</i>)	-	-	X	-

OV= overkilling DH= Destruction and modification of the habitat IES= Introduction of exotic species OR= Other reasons

* Indicates that a species is endemic to Mexico

© Indicates a species surviving only in captivity