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## WHAT DO "WILD" AND "CAPTIVE" MEAN FOR LARGE UNGULATES AND CARNIVORES NOW AND INTO THE TWENTY-FIRST CENTURY?

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The terms "wild" and "captive" have stimulated considerable debate among academicians, animal protectionists and conservationists. Some argue that animals have a right to freedom and that there is a "moral predisposition" against holding them in zoos (Jamieson, 1985; 1995; Varner and Monroe, 1991). Others argue that modern zoos and their living collections are becoming increasingly important to wildlife conservation and science, and that the collective benefits so derived may override this predisposition (Hutchins and Wemmer, 1991; Conway, 1995; Hutchins et al, 1995; Norton, 1995). The purpose of this paper is to explore the concepts of "wild" and "captive" and their meaning for large ungulates and carnivores today and into the twenty-first century. However, it might first be useful to examine these terms and their definitions. Webster's New Collegiate Dictionary (1977) defines "wild" as: "a free or natural state of existence"; "not tame or domesticated"; or "loose from restraint or regulation." In contrast, "captive" is defined as: "taken and held as if a prisoner"; "kept within bounds"; or "held or controlled by another." From a human perspective, the connotations associated with each of these terms are powerful and undoubtedly affect our perceptions when applied to non-human animals. Debates between pro- and anti-zoo advocates are likely to continue. However, as I explain here, the distinction between the terms "captive" and "wild" is becoming increasingly blurred. The lives of zoo-held animals are managed by human caretakers, sometimes intensively. Never-the-less, newer zoo exhibits are relatively large and, with the exception of predators, parasites, and diseases, often replicate many critical aspects of an animal's natural environment (Swain, 1989; Tarpy, 1994; Maple et. al. 1995). At the same time, so-called "wild" animals are increasingly impacted by the activities of humans, thus often necessitating active management of their habitats and populations (Younghusband and Myers, 1986; Diamond, 1992; Hutchins and Fascione, 1993; Conway 1995).

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## ANIMAL WELFARE AND CONSERVATION REALITIES

In an ideal world, wild animals would have the freedom to live (and die) as they have for countless generations. The adaptations of animals have evolved in response to various environmental pressures and it is reasonable to assume that the best place for wild animals is in their natural habitat. However, this is not an ideal world and the activities of humans are rapidly pushing many species to the brink of extinction (Ehrlich and Ehrlich, 1981; Wilson, 1992; Conway, 1995). Thus, before considering the relative merits of captivity versus “the wild” and the philosophical viewpoints of animal welfare/rights advocates and conservationists, it is important to understand the many complex issues involved in modern wildlife conservation. An example is provided by the Javan rhino in Ujung Kulon National Park on the island of Java in Indonesia (Rusuli, 1991). Located on the western tip of the island, this isolated emerald peninsula is a grim reminder of the many challenges facing wildlife today. The fact that Ujung Kulon exists at all is remarkable. The island of Java is one of the most densely populated on earth, with more than 90 million people packed into an area roughly equivalent in size to New York state. The need to grow enough food to support this mass of humanity led the local people to convert over 99% of the island’s forests into farmland. As its forest habitat receded, so did populations of the rhino, and it is estimated that less than 65 survive on Java today—all in Ujung Kulon (Sadjudin, 1992).

Recognizing the importance of this unique species and habitat, the Indonesian government declared Ujung Kulon a national park in 1980 (MacKinnon, 1991). However, the creation of a protected area, in itself, is generally not enough to ensure the long-term existence of wildlife or the habitats on which they depend. Despite the best efforts of the Indonesian government, rhino poaching still occurs in the park (Tilson, pers. comm.). In Asia, rhino horn is prized for its presumed medicinal value, and for local people, the economic incentive to kill rhinos is great (Cohn, 1988). Simply put, to many a rhino is worth more dead than it is alive. When one also considers that park boundaries are not well marked or adequately patrolled, that nearby villages have exploding birth rates, and that the local people live in poverty, it is clearly a recipe for disaster (Lant and Rusuli, 1991). Obviously, many social and economic factors are working against the Javan rhino, but conservationists must also contend with biological reali-

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ties. The fact that the rhino population is so small and isolated is a major cause for concern (Macquire et al., 1987; Sadjudin, 1992). Before humans fragmented their habitat, the animals lived in a larger, more continuous population. When a particular area became over-populated, competition forced individuals to move to other areas, thus ensuring frequent genetic interchange. However, when animal populations become small and isolated, as occurs in fragmented habitats, there is a greater chance that inbreeding and genetic drift will occur. The subsequent loss of genetic diversity can have devastating effects on both individuals and populations, eventually leading to extinction (Soulé, 1987).

The relatively small size of the park (39,000 hectares) may also prevent the rhino population from expanding (Macquire et al., 1987). The number of animals that an area can support, also known as its "carrying capacity", is dependent on many factors, including the amount of space and food available. Their small population size also makes the animals more vulnerable to a variety of catastrophic events, both natural or human-caused (Ewens et al., 1987). A disease epidemic could wipe out the entire population in the course of a few months, as could a major fire.

All this leads to one inescapable conclusion: the Javan rhino is in serious trouble and without human intervention the probability of extinction is high. Unfortunately, this case is not unique; similar scenarios are being played out in a thousand parks and reserves around the world and with scores of different species of large ungulates and carnivores (Groombridge, 1993). One critical realization is that there are very few habitats left that are unaffected by humans. In short, there is no "wild", at least not in the classical sense, and some conservationists, have argued that unprecedented levels of human intervention will be necessary if many species are to persist (Duffy and Watt, 1971; Temple, 1977; Youngusband and Myers, 1986; Hutchins and Fascione, 1993). Intervention will take many forms, including: mediating conflicts between humans and animals, controlling indigenous animal populations, translocating animals or their genes to maintain genetic diversity in fragmented populations, controlling disease, manipulating or restoring habitats, and when necessary and appropriate, captive breeding for reintroduction. I will consider each of these in turn:

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## MEDIATING CONFLICTS BETWEEN ANIMALS AND HUMANS

Shrinking wildlife habitats, poor land use practices and growing human populations have led to an increase in direct and indirect conflicts between humans and wildlife (Newark et al, 1994). For example, conservationists face this type of challenge in their attempts to preserve the endangered Bengal tiger, Asiatic lion and African and Asian elephants (Sukumar, 1991; Saberwal et al., 1994; Parker and Graham, 1989). India is one of the world's most populated countries, and encounters between large carnivores and people occur frequently in areas surrounding national parks and equivalent reserves (Ward, 1994). Tigers and lions do not generally pose much danger to humans when their habitats remain intact and the animals have sufficient food to eat. However, if populations of these large cats become too large or prey populations drop, they may leave park boundaries and come into contact with humans (McDougal, 1991; Sabrwal et al., 1994). Near the Gir Forest in India where the world's last remaining population of 300 Asiatic lions exists, there were about 150 maulings from 1988-1992, some of which resulted in deaths (Ward, 1992). Similarly, there have been problems with "man-eating" tigers in the Sundarbans Delta on the India-Bangladesh border. Over 600 people were killed in a 10-year period from 1975-1985 (MacDougal, 1991). In an attempt to mediate this situation, park managers in the Sunderbans devised wooden effigies of human figures which are inoculated with human scent. The figures are then wrapped in electrified wire and placed along the paths that tigers travel; when a cat attacks the figure, it receives a severe shock. Park managers are hopeful that this and other innovative techniques will provide an effective deterrent (Jackson, 1991).

Besides presenting an imminent danger to humans, wildlife can also compete with, prey on or transmit diseases to domestic animals, and destroy agricultural crops. Attempts to mediate such conflicts are an important aspect of wildlife conservation, because if the conflicts persist, it is the animals that typically lose (Parker and Graham, 1989). For example, populations of large herbivores, such as African elephants, can do extensive damage to crops when they leave the confines of national parks or equivalent reserves (Thouless, 1994). As a result, many parks, such as Kruger National Park in South Africa, have erected fences to keep wildlife and humans apart (Ricciuti, 1993). Fences also have the added advantage of keeping the animals

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inside the park where they can be protected by rangers.

### **MAINTAINING THE BALANCE OF NATURE: CONTROLLING ANIMAL POPULATIONS**

When ecosystems become altered, it often becomes impossible for predators and prey to maintain their dynamic equilibrium. In the absence of large predators or the opportunity for normal migratory movements, populations of antelope, deer, elephants and other large herbivores can spiral out of control (Caughley, 1981). The ecological effects of such population "eruptions" can be devastating and are a growing problem for conservation biologists (Garrott et al., 1993). Overgrazing and trampling can cause extensive damage to vegetation, as well as permanently alter an entire ecosystem. Small or closed systems that occur as a result of fencing or habitat fragmentation are especially vulnerable to these destabilizing effects. Fenced reserves, no matter how large, are essentially "mega-zoos" which will require intensive management in order to sustain the wildlife contained within. In these restricted environments, populations of large herbivores must be constantly monitored and controlled, either through culling, translocation, or contraception (Younghusband and Myers, 1986; Diamond, 1992; Hutchins and Wemmer, 1987). Culling of elephants is a common practice in some African national parks and, although regrettable, is an absolute necessity if the delicate balance of nature is to be maintained (Pienaar, 1969). With their movements now restricted by park boundaries, these large herbivores overgraze the vegetation and, by destroying trees, convert woodland habitats into grasslands or semi-deserts (Swanepoel, 1993). If allowed to become overpopulated, large ungulates can eventually alter their habitat to the point that it becomes uninhabitable for many species, including their own (Novellie et al., 1991). One consequence of overpopulation and habitat degradation is often slow and painful death by starvation (Ricuiti, 1993).

### **MAINTAINING GENETIC DIVERSITY**

Inbreeding, or the mating of close relatives, results in a rapid loss of genetic variability. This factor alone can lead to population extinctions (Soulé, 1987). On an individual level, highly inbred animals tend to be more susceptible to disease or have higher rates of infant mortality (Ralls and Ballou, 1982). On a population level, inbreeding and



the consequent loss of genetic diversity can also have devastating long-term effects on the gene pool. Genetic variability is the raw material on which natural selection occurs, and when a gene pool becomes diluted, populations can lose their ability to adapt to changing environments (Soulé, 1987).

When a population becomes too small and isolated to maintain genetic diversity, then animals may have to be moved to introduce new variation. The need for translocations (of individuals or their genetic material) will increase as wildlife habitats become more fragmented, thus preventing normal migratory movements and genetic interchange from occurring (Wilcox and Murphy, 1985; Hutchins and Fascione, 1993). Recognizing this threat, biologists who design parks and reserves are giving more thought to including "wildlife corridors" so that movement between reserves, and therefore genetic interchange, can occur (Noss, 1991). In many cases, however, extensive intervention will still be necessary, especially when wildlife habitats are fenced to prevent human-animal conflicts. If animals are unable to move between populations on their own, it may be necessary to translocate them by artificial means (Hutchins and Fascione, 1993). However, the effectiveness of such techniques is often dependent on the biology and behavior of the species in question. Translocation of Asian elephants, for example, has not always been successful due to the animals' strong homing tendencies (Lahiri-Choudhury, 1993).

The need for translocations may be reduced through the development of modern biotechnology (Wildt, 1989). In the future, it may be possible to transport a male mammal's sperm or a frozen embryo rather than the whole animal. Techniques such as artificial insemination, or in vitro fertilization and embryo transfer may someday be used to introduce new genetic variation into an isolated population without having to release live animals. This would not only reduce the risk of exposing the host population to new diseases, it would also help to avoid social conflicts. While the use of frozen sperm and embryos may seem like science fiction, the techniques have been used successfully with a few endangered species, including tigers and wild cattle (Wiese and Hutchins, 1994).

## **CONTROLLING DISEASE**

Disease is a major factor controlling wild animal populations and

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has significant implications for wildlife conservation. Many evolving conservation strategies, such as translocation and reintroduction, involve the movement of animals from one location to another. When such movement occurs, there is always a risk of disease transmission (Ballou, 1993). In some cases, the susceptibility of animals to disease can be increased by the stress of relocation. The transmission of disease from wildlife to domestic animals can also be expected to affect conservation programs (Meltzer, 1993). For example, when the bison of Yellowstone National Park become overpopulated, they often invade adjacent ranches in winter. Local ranchers are fearful of these incursions because the bison carry brucellosis, a potentially fatal disease that can be transmitted to cattle (Meffe and Carroll, 1994). In an attempt to appease their neighbors, the National Park Service controls bison populations through shooting. The hunt is highly controversial, but what would be the economic and political consequences of inaction for the bison and the park?

Unfortunately, our current knowledge of wildlife diseases is poor. Much more research is needed on the etiology, diagnosis and treatment of various pathogens (Hutchins et al., 1991). When animals are moved to facilitate conservation, they will need be tested for evidence of certain diseases prior to their release (Woodford and Kock, 1991). The health of domestic animals will also need to be monitored in order to prevent the introduction of exotic diseases into indigenous wildlife populations. Knowing when or if to treat wild animals is often difficult (Rolson, 1992). In some cases, it may be better to let a naturally-occurring disease run its course. Those animals that do survive will have an immunity to the disease and are less likely to be affected in the future. However, exotic diseases are another matter. Immunologically naive animals are particularly vulnerable to new or exotic diseases to which they have not been exposed, and immediate veterinary intervention may be necessary, especially in small, isolated populations (Meltzer, 1993).

## **HABITAT MANIPULATION AND RESTORATION**

The continued existence of wildlife is dependent on there being sufficient habitat available to provide food, shelter and other necessities of life. Unfortunately, throughout much of the world, natural habitats have been or are being altered or destroyed at an alarming rate (Erhlich and Ehrlich, 1981; Wilson, 1992). In some cases, however,

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wildlife can still persist or even thrive if habitats are manipulated to enhance certain features.

A potential beneficiary of habitat manipulation is the endangered giant panda. This highly specialized carnivore subsists primarily on a diet of bamboo. About every 40 years, however, a bamboo species flowers and dies off. Under natural conditions, the animals would simply migrate in search of live bamboo or switch their preference to another bamboo species (Schaller, et al., 1985). However, habitat destruction has confined the remaining panda populations to small islands of habitat. If these patches do not contain more than one variety of bamboo, the pandas could starve during a bamboo die-off. Some conservationists have suggested that the status of bamboo stands be monitored in panda habitat, and that if only one species of bamboo exists, then other species should be planted (Reid et al., 1989).

### **CAPTIVE BREEDING FOR REINTRODUCTION**

It has become popular among certain circles to question the value of captive breeding and reintroduction programs for endangered animals (e.g. Varner and Monroe, 1991; World Society for the Protection of Animals and Born Free Foundation, 1994). By themselves, they certainly should not be viewed as panaceas for the endangered species problem (Hutchins and Wemmer, 1991; Wiese et al., 1994; Hutchins et al., 1995). The techniques are expensive (Kleiman et al., 1991), and there are simply too many species at risk for this approach to work in all cases (Ginsberg, 1993; Hutchins et al., 1995). Does this mean that captive breeding programs should be abandoned? Absolutely not. First, it should be recognized that there are many more immediate ways that zoos and their living collections can contribute to conservation beyond captive breeding for reintroduction, including public education, scientific research, the development of relevant technologies, professional training and technology transfer, and fund raising to support in situ conservation (Hutchins and Wiese, 1991; Hutchins et al., 1995; Wiese et al., 1994; Wiese and Hutchins, 1994; Hutchins and Conway, in press). Second, when a species' population is reduced to a level where it is no longer genetically viable or demographically stable, then captive breeding for reintroduction may offer the only chance for recovery (Hutchins and Wemmer, 1991; Stuart, 1991; Hutchins et al., 1995; Wiese and Hutchins, 1994; Conway, 1995). There are several documented suc-



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cesses, particularly when the reintroduction projects have been based on good science (Beck et al., 1994). Two of the best known examples involving large ungulates and carnivores are the Arabian oryx and red wolf. Populations of the oryx and wolf were severely reduced due to over-hunting and both species eventually became extinct in the wild. Fortunately, successful captive breeding programs by zoos have made it possible to reestablish these animals in nature (Stanley-Price, 1989; Smith, 1990).

Recognizing the necessity of captive breeding programs in carefully selected cases should not lessen our resolve (or take precedence over our efforts) to preserve as many large tracts of existing natural habitat as possible. There is no reason that both cannot be done simultaneously (Hutchins and Wemmer, 1991).

## SUMMARY AND CONCLUSIONS

In this essay, I have argued that human intervention will be necessary in order to preserve viable populations of large ungulates and carnivores now and into the twenty-first century. This is especially true in areas where wildlife habitats or populations have become smaller or fragmented as a result of human activities. Some decisions, such as culling or the capture of wild animals to create captive populations, will be controversial. In fact, I am uneasy about the prospect of manipulating nature and recognize that such attempts have not always been successful. However, difficult decisions must be made if many populations, species and ecosystems are to survive (Hutchins and Wemmer, 1987). Those that accuse wildlife conservationists of "playing God" must realize that this is the only responsible course of action; in the absence of divine intervention, it is up to us to find solutions. Because our knowledge of organisms and ecosystems is imperfect, there is no doubt that we will make mistakes. Such decisions may profit from the evolving science of risk analysis and management (Morgan, 1993).

If "free-ranging" animal populations must be managed intensively, then can we still call them "wild"? Perhaps not, although there are clearly different levels of human impact and intervention. In fact, British journalist Colin Willock predicted this situation over 30 years ago. After travelling through many of Uganda's national parks, he wrote: "I'm afraid that I believe that it is inevitable that the world's last

great collections of large animals will end up inside the isolated, defended islands we call parks or reserves. Outside such places there is not going to be much left. The areas of these parks may be vast, but this doesn't alter the fact that national parks are really just enormous zoos" (Willcock, 1964).

There are those who still hold onto the myth of wild Africa, Asia, and South America. Consequently, some individuals also believe that the best way to preserve wildlife is to simply "leave it alone" (Regan, 1983; Willers, 1992). However, I believe that this perception is based largely on the mistaken impression that there still is a "wild" out there, and I further stress that we must have "conservation without illusion" (Adams and McShane, 1992). Indeed, the decision to do nothing is a choice that also has many consequences. Given the realities under which conservation must occur now and into the future, to stand by and do nothing would be irresponsible. A policy of "benign neglect" can only lead to more extinctions (Soulé et al., 1979).

Certainly there is enough information from national parks in the United States to suggest that the long-term effects of habitat fragmentation are real and that in the absence of management intervention, many species will disappear (Conway, 1995; Diamond, 1992). A 1987 survey indicated that 14 national parks in western North America had, since their establishment, lost a total of 42 species of mammals from within their respective boundaries. Even the largest of our parks are apparently not immune. For example, the three million acre Everglades-Big Cypress Swamp park complex in Florida has lost 12 species of native birds and mammals in the last 200 years, including the red wolf, monk seal and ivory-billed woodpecker. The endangered Florida panther, wood stork, and many other species may not be far behind. I also disagree with those who argue that we can save species simply by preserving their habitats (e.g., Winckler, 1992). The preservation of wildlife habitat is essential for conservation and there certainly is need for more integrated conservation strategies (Scott et al., 1987). But, by itself, it will not be enough. The current threats to wildlife are simply too pervasive. For example, there is ample rhino habitat in Africa, but the animals continue to lose ground, primarily as a result of poaching (Ricciuti, 1992). If large ungulates and carnivores are to survive, then we must, develop the knowledge and technology to intervene when it becomes necessary to save individual species, to maintain the balance of nature in heavily

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altered ecosystems, and to restore natural systems whenever it becomes possible.

Does our terminology need to change to fit the times? Perhaps. Given the political, economic and biological realities facing wildlife today, it might be more accurate for certain zoo-held animal populations to be called "protected," or "secure" rather than "captive." Indeed, the intent behind such programs is not to treat animals "as if they were prisoners," but rather to protect and preserve some representatives of their species (and their genetic material) from an increasingly hostile world and to utilize such populations and materials in the service of wildlife and ecosystem conservation. Environmental philosopher, Bryan Norton, recently argued that "it is mainly the context, not the content, of our interactions with animals that determines our moral obligations to them" (Norton, 1995). Consequently, he views captive wild animals as "animal altruists," helping to perpetuate their species and natural habitats. One problem with wildlife and ecosystem conservation is that success cannot be measured in brief time intervals. We may not know for a hundred years or more whether or not we have been successful. In the meantime, it is important to recognize that we must try. Debates over the rights of individual animals versus populations, species or ecosystems, and over the relative merits of captivity versus the wild will become purely academic if we do not find ways to slow down and eventually stop the growing loss of biological diversity.

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## HUTCHINS - DISCUSSION

Clifton: There are two different approaches you can take to intervention, one of which is the North American model of active intervention which creates an economic constituency. An alternative approach is a form of management which includes such things as changing a particular crop or reintroducing a plant species that will have a particular desired effect. For example, it was recently discovered that Queen Anne's lace is a very powerful contraceptive in rodents. If you want to control the wild rodent population, you provide lots of Queen Anne's lace. There is no need for poisons or the introduction of a predator that doesn't naturally belong in the habitat.

Robinson: This discussion introduces the problem of specificity. In which cases is management necessary? I am not going to argue that we don't need management, for I believe we do. Another issue we need to consider is the concept of "wild" versus "tame." I think it is clear that there are and have always been human influences in the wilderness, that no captive management situation is totally controlled. However, I do not think habitat degradation is necessarily an argument for the lack of distinction between wilderness and captivity. For example, a forest can be degraded, and indeed ultimately converted into a field, but that does not mean that the forest, not even if badly degraded does not exist. It is worthwhile to try to maintain some concept of wilderness and wild animals and to try to define that over the course of the next couple of days.

Hutchins: I totally agree. I was not meaning to imply that we should degrade our concept of what we call the "wild." I was implying that this is a continuum and we are managing animals in the wild, we are regulating their movements, feeding and watering them, etc. It is a controlled situation in many cases. I think there is a difference between a zoo and a national park, and certainly the latter is what we are trying to preserve. But I think this clouds the issue. The fact is that this kind of management is going to have to occur, but there are differences and degrees between what we call the "wild" and what we call "captivity."

Lewis: The "wild," if it ever really existed, may become an ideal that we work toward in every national preserve, biosphere preserve, etc. I

realized a long time ago there is no wildlife population on earth that has not been touched by humans. I would also argue, however, for the least intervention possible and for the interventions that have the least impact in any given situation. There should be some kind of standard set up by people who do this kind of work. That would be the most valuable way to go about it. There are going to be situations where serious or high-level intervention will be necessary, the gray wolf being a good example of such a situation. We ought to start with the lowest level of intervention possible, and then increase it if necessary.

Hutchins: As a general rule I think that is probably a good idea. On the other hand I would hate to see us develop strict guidelines. I think conservation strategies must be extremely flexible. The intervention techniques will vary according to the problem and as a result of the species and the biological characteristics that are involved. Flexibility is very important. If the population goes below a certain level perhaps we should think of intervening and developing captive populations. However, decisions regarding colonial species would be subject to problems. There may be one half million or a million penguins in an area, but they may be in only two or three colonies. If an oil spill hits one or two of those colonies they will be destroyed. Different situations result in different approaches.

Bekoff: It is important not to downplay the necessity of the creation of an operational position. Hutchins stated that there is no wild, yet asserted that we can maintain great genetic variability in captivity when compared to "out of nature." I question that if there is no wild, what are we preserving? Do we need to come back to the issue that there is no wild? We could be compulsive and say there has been no wild from the time humans first made their appearance, but we are, or were at one time, a part of the wildlife process. It seems that people use a scale, thinking that something is less wild when humans enter the scene. I think the point made earlier about coming up with some definition is crucial. What are we preserving? Something less wild? When do we get off that slope? One of the things I have found impressive this morning is that this conference has rekindled the idea that although these animals are in captivity they are still doing what their counterparts are doing in their natural habitats, out in the "wild".

Hutchins: Norton was actually thinking about captive animals as "wild animals in captivity," which is a separate ethical category. They

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are not domesticated and that is a big difference. I ran into this issue when I was studying free-living mountain goats in a national park. Those animals had never been hunted and were habituated to humans. I continually had people ask why I was studying them in such an environment since they were tame. They are not tame. They do not take food from people. Yes, I could sit in the middle of a group of them and observe them closely, as Jane Goodall did with chimpanzees, but although they are habituated to people, these are not tame animals. They are not domesticated.

I think we are preserving the potential for future evolution, which brings us to some really interesting philosophical discussions. It makes us consider the relevance of a time scale. How long are we going to preserve these things? I have been thinking recently about the measurement of success for conservation. How do you measure the success of a conservation program, and under what time scale? One hundred years, two hundred years, one thousand years?

Pacelle : You were basically arguing that it is our duty as conservationists to intervene because the situation is so severe. You suggest a polarity, that there are some who believe in intervention and some who do not. I do not really see that as a legitimate framing of the issue. There is certainly considerable debate about the means of intervention, but I think most people accept intervention as necessary in many of these situations. It is common parlance in state fish and game agencies to say that the management of wildlife population is not simply a issue of the biological carrying capacity, but rather a question of the cultural carrying capacity. The cultural carrying capacity rarely reaches the number of animals people can tolerate and the types of behaviors in which they engage. That is really the salient question for the twenty-first century. I do not, however, think that we should look at the cultural carrying capacity in a similar manner that we look at the biological carrying capacity, which may be a type of scientific notion.

The cultural carrying capacity is something that can be raised or lowered, for example bison in Yellowstone national park are met with a sort of "hands-off" policy. The park does not engage in any culling or killing of the animals. These are free-roaming creatures, therefore boundaries are nonexistent. We have ranchers on national forests who have, in my opinion, an entirely irrational fear of the threat of Brucellosis to domestic cattle. There has never been a documented case

of Brucellosis transmission between bison and cattle, and some suggest that such a transmission is impossible. Yet the political powers that create the situation and create this notion that we have some great need to manage these animals. I think what we really need to do is educate people, to increase the cultural carrying capacity. If we cannot tolerate twenty-five hundred bison in the Yellowstone ecosystem, what are we preserving? And is it not absolutely preposterous that we talk about this sort of mismanagement of wildlife? I think that more and more of the animal protection and animal rights community accept the idea of intervention, but the intervention must be humane. We have to analyze some of these problems and not just think that animals are things for us to move around as chess pieces for frivolous or gratuitous social or economic needs.

Hutchins: I do not think economic needs are frivolous, especially in developing countries where people's livelihoods are at stake. We have a lot of food here and have certain perspectives that are based on the very easy lifestyle which we live. We think differently here than others do elsewhere. There are, perhaps, better examples than the bison where disease transmission is a reality. I tend to agree with your issue about the cultural carrying capacity, although I think the cultural carrying capacity and the biological carrying capacity are interrelated because the number of people reduce the biological carrying capacity of animals.

Bostock: I am interested in questioning the concept of "wild" that has been raised. I agree with Hutchins about the evolution of wildness; it is a very long timescale that we are never going to be here to see. There is a paradox here, for the wild is a system of managing itself. We have got to intervene when necessary, but we are intervening in order to make that intervention unnecessary. It is the same as a parent looking after a child, doing what they can in order for that child to become independent.

Clifton: I like the concept that trying to preserve a species is trying to preserve the possibility of future evolution. However, in order for evolution to take place there has to be a challenge to which a population responds. When you keep a population in an essentially advantaged situation that challenge is not there. As we develop genetic technology it is inevitable that there are going to be human conducted forms of evolution, hybridization, gene transplants, etc. We

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have got to let those animals go at some point, allow them to find their own niche and establish themselves. We are almost at that that point experimentally with some introduced, genetically manipulated characteristics of plants. There has been a tremendous scientific, political and legal battle. We are talking about a handful of large species, almost all the mammals, and we are not even noticing, for instance, squirrels or park bench pigeons. Most of the species are not in any trouble and are actually finding ways to co-exist, to survive perfectly well without us. It is when we notice them that their problems begin.

Hutchins: Regarding genetic manipulation, that is not the way that many technologies are being used. They are being used to preserve genetic diversity so that natural selection can occur as animals are put back out in nature.

Clifton: If that is the way it is being done within the wildlife conservation community, what is being done in the agricultural community?

Hutchins: That is different. That is domestication. Artificial selection, one of the hallmarks of domestication, is trying to manipulate the genetic material of an animal to do something you desire. That is the exact opposite of what we are trying to do with our genetic management programs, which are intended to preserve as much variation as possible so that the potential for future evolution is preserved.

Serpell: Some of our problem in defining what is wild and what is tame rests on the level of definition for which we are searching. Regardless of genetic factors, there are certainly animals, including the sparrows in the park, which are not directly controlled by humans. To my mind that is one definition of wildlife and it is one of the definitions quoted by Hutchins from Webster's. Conversely, all captive or domestic animals, even if they are given considerable freedom, are to some extent restrained or controlled, and I think it is very important that such a dichotomy continue to exist.

One of the reasons for its importance has to do with the public perception of wildlife and the pressure that comes from the public to conserve wildlife. If we lose sight of these creatures as wild things in wild places that are not controlled, we will lose the public pressure to conserve these very things. There will no longer be pressure to preserve because the thing people want to maintain is not the tiger in the



cage, but the tiger in its wild, raw state.

Hutchins: You bring up a very important point and I agree with you one hundred percent. That is one reason why zoo philosophies are changing rapidly. The concept of wild has got to be in the public mind in order for there to be some political momentum to pressure for wild areas and wildlife. We should not be looking to preserve animals just in captivity. That is not and should not be our goal.

Norton: When it becomes reproductive control you are moving into the realms of domestication. There is a gray area there, the barrier between wild and domestic that is a permeable one. There comes a point where an animal is so controlled that it will not ever return from being a totally domesticated species and could never survive in absence of that human dimension.

Hutchins: You are mixing up the difference between “captive” and “tame,” which some consider to be quite different. Wild animals in general are not tame.

Robinson: It may be useful to speak of control of individual behavior as a characteristic of captive animals, and human control of populations or habitats as being a wild situation.

Norton: Yes. The point I’m trying to get across is that there are animals out there making decisions about their lives which are entirely independent from any human intervention. Conversely, there are animals living in a state where they may not be able to make those decisions or choices because humans have made those decisions for them. That is an important distinction.

I would like to go back to this revision of the wilderness idea in a very general sense. It seems to me that there are really two intellectual changes taking place, and I feel it is important to keep them separate. One change that has taken place deepens our understanding of human and wild animals. It is our discovery that indigenous populations interacted with their landscape and with animals for a very long time. This should have been obvious from the beginning. As we learn that those human and non-human populations have evolved together we need to correct our conception of wilderness by recognizing that historically there really was not a wilderness in the sense of total separa-

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tion from humans but rather, because of low impacts and smaller numbers of people who lived in indigenous populations, there was rather a co-adaptation and a co-evolution.

The second revision taking place is incursions caused by highly technological societies, and there would be at least two important subparts to this revision. One would be, for example, acid rain, which is going to change habitats no matter how much we try to protect those areas. The second one, extremely important in third world countries, is social disruption as a result of rapid economic developments. Such developments are often very centralized, causing people to migrate into tropical forests, places they do not really want to go but have no alternatives.

As we revise the idea of wilderness and recognize that we are on a continuum we need to remember that there are two revisions going on simultaneously that are quite different. We need bring those two ideas back together again so that we are more critical of the different ways humans interact with nature. We should be looking for ways to live and co-evolve with other species, for that is the only realistic option open. This might mean putting very strong constraints on some of the things we do as a technological society.

Jamieson: One of the key issues here is what it is we are really trying to accomplish. Part of why our answers tend to be contradictory is that often in our rhetoric we suggest that certain things are necessary for the good of the animals, and in some cases that is true. But to a great extent what is at stake is our ideals of preservation. We place a very important value on preservation of species. The concept of preservation is a cite for values that conflict, that contradict each other. The problem there is that humans can be a selection constraint on evolution, so the potential for future evolution is in no way inconsistent with bioengineering or the very strong selection pressures being exercised by humans. Another thing I think a lot of us are interested in preserving is some idea of wildness, where that implies some independence of human control, and there we have a fairly direct contradiction between two things that we might think we are trying to do when we are preserving animals. Insofar as it really is true that we cannot preserve wildness, I think that the ideal of preservation becomes less urgent than it would otherwise be.

Hutchins: That is a very interesting point, although I think again that we are talking about a continuum and that makes it even more complex. There is a continuum of wildness and we want to go as far as we can along that continuum, but realities may be preventing us from reaching the ultimate end. That is where we presently find ourselves. We would like to reach the end of the continuum but the biological, political and economic realities in which conservation must occur, especially if we are going to double the human population in the next few decades, are going to put a limit on our ability to reach the end of that continuum.

Pokras: One of the questions I have concerns the establishment of guidelines for various types of conservation programs. It seems to me that many of the guidelines are soft, causing problems of scale. That is one of the problems in defining wild as well. Wild for a chickadee is very different from wild for an elephant or rattlesnake. The natural history of the species has to guide us on what it is we are looking at. Part of the problem is the eyes through which we look. When I see a Great Horned owl around South Station in Boston, it does not look wild to me. But how does it look to the owl's eyes? He is feeding on rats and nesting in abnormal places, but that is still a wild animal. I think we have a confusion between wild, what the animal feels and the wildness, which is a very different concept.

Hutchins: I agree with what you said completely and I think that a Great Horned Owl living on the edge of a building is a wild animal. I also believe that generalizations are dangerous for conservationists and that flexibility is critical. That is why I have such a difficult time with some ethical paradigms that do not allow flexibility, for I do not see how we will be able to respond to some of these issues and attempt to preserve species or ecosystems without it.

Jamieson: We have multiple ethical paradigms. One is a relatively inflexible or absolutist paradigm. The kind of ethical theory that I favor gets accused of being excessively flexible, a more consequentialist paradigm. I would argue that in this area we need to worry about not being excessively absolutist with the ideal of preservation, that sometimes in these types of discussions when we talk about what action is necessary it sounds as if we are setting up the ideal of preservation as the ultimate value to which every other consideration must be sacrificed. I think we need to be flexible about that value.

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Grandy: I have a number of disparate points I'd like to make. We are using contraceptives on truly wild animals and controlling their population. I agree that this does not add true domesticity to them. The wild ponies which are having their population controlled through reversible contraception are as wild as they ever were and hopefully will continue to be so without stripping off their habitat.

Nonetheless, I want to associate myself with the concept of "wild" that Jamieson put forth in his paper. Clearly all of us understand that the decreases in habitats around the country are requiring more and more intensive kinds of hands-on management systems. We may not all feel comfortable with that, but at some level recognize the necessity for it. However, I am concerned where taking that generalization too far may lead us. Use of the least invasive kinds of technology is clearly desirable, and the corollary response to it raises some fundamental questions about where we go. The response is that we as managers want more and more flexibility. Flexibility is an open invitation to abuse unless flexibility is limited by guidelines which reflect limits, priorities and societal norms. Even White Oak raises fundamental questions. White Oak is all of the best things that the zoo environment can be, all of the best values it can have and all of the best things it can do for animals. Nonetheless, we all know that there are one thousand or more places around the world where that standard is not even considered, much less approached, so I am concerned with where too firm a grasp of this generalization of the need for intensive management takes us, as well as the permissiveness associated with it.

Finally, I want to close with something that struck me as I read Hutchins' paper regarding the timescale of what we are dealing with. There is a lot of talk about habitat destruction and what that means. Tsavo Park in Kenya has been monitored for the last thirty years. Thirty years ago everyone said the park had been destroyed, that it was an ecological desert; it had been trashed by elephants. There is now a film that shows the park coming back, regenerating itself over this thirty year time span. What I am relating to here is the timescale in which we define damage and the apparent recuperative capacities of the ecosystems and habitats that we are dealing with.

Bekoff: In regards to what Pacelle said, I'm not sure that I agree that *in vitro* contraception is more humane than any other source of intervention. I think this notion comes about because we are not able to see

something "bad" result, but we are having a major intervention on a life when we change its reproductive habit.

There is also the importance of understanding evolution. We tend to throw the word evolution or selection around very loosely. I find Hutchins' point of looking backward for understanding of evolution a dangerous practice. The environments in which many animals evolved were very different than they are today. We may get some information about their evolution but I am not sure how much that is going to help us in understanding the sorts of habitats we need to provide for the animals so that they can evolve as they did in the past. No one has mentioned being concerned with the reproductive habits of the animals in regards to a time scale. How fast do they reproduce? How much genetic diversity is there in these populations? The time scale for evolution is different for each species and we need to be sensitive to these differences in reproductive habits.

I hear a lot about what we should do, how we should do it and how fast we should do it. I have not heard the question why we should do it. Is there a limit to how much biodiversity we should try to maintain? Maybe we are trying to do too much and need to concentrate our efforts in certain areas, come up with some consensus. There is a process of selection going on, and I wonder if perhaps we need to narrow our goals. We will not all agree about what species should be saved or which are "disposable," but I wonder if in trying to do too much we are really doing nothing.

Kaufmann: In many ways what we are talking about is what "wild" and "captive" mean to us as individuals. We repeatedly talk about "we" in conservation. Who is this "we?" At the same time we are seeing an increase in population. We have become more and more aware that we have to work with indigenous populations and be politically correct. I think there are two races going on. One has to do with preserving the animals, the genetic material, the individual animal. But what must happen at the same time is that the "we" must become enlarged so that it is not seen as merely zoos or animal rights groups. The general public in our own country has a poor understanding of conservation, of animals. Honesty must also include the notion that we are doing something that we are not sure is going to work, but we are doing our best.

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Hutchins: Inflexible values or philosophies do not allow us to take risks. Conservationists are going to have to take a lot of risks which will sometimes be successful and sometimes not. The problem is that if you are being constantly scrutinized or criticized you are not going to take those kinds of risks. This is a good reason for more unity within this community. If the fingerpointing and inter-agency infighting continues no one is going to take risks, a situation that does not create a good climate for learning about or doing conservation.

Lewis: Although I am representing an animal protection group and I think contraception is a viable alternative in many circumstances, it is true that it does have its impacts. All you have to do is look at the history of oral contraception in human women to understand that. If that is not being looked at, it needs to be. Zoo people have a long history of using contraceptives on captive animals and there have been some negative impacts.

In regards to timescales, I think Grandy was trying to make the point that we may be thinking in timescales that are too short in terms of survival of populations. We see elephants stripping bark off trees and deem it an emergency. I am not claiming that elephants never destroy their own habit, but saying that our knowledge is imperfect. If Tsavo is regenerating itself then maybe we need to think in longer scales when responding to those types of issues.

I think most animal protection people who are knowledgeable about conservation and wildlife issues understand the necessity of preserving populations. Some of the misunderstandings occur when one hears a statement claiming that an individual animal may have no importance. It is hard for our hackles not to go up because we are so connected to the idea that these animals are sentient and can suffer and that it is our responsibility to treat them with the maximum respect and least intervention possible.

Hutchins: I would not disagree with that, in fact I struggle within myself with the competing interests of the individual versus the population. There are real conflicts that can occur and difficult decisions that must be made. To discount these difficult decisions is a problem. I think that they are made every day in an animal shelters when an animal is put to sleep. I think that those of us involved in conservation are often faced with the lesser of two evils.



As far as longer time scales are concerned, I agree that we have an imperfect knowledge of how these cycles occur. However I also raise the point that this issue of humaneness is interesting when talking about natural cycles and scales. In the absence of human intervention, animal populations will control themselves and they will do it through starvation, less humane than shooting if you consider the relative pain involved. We need to follow the statements of animal protectionists to their logical conclusions and see what their impacts are.

Robinson: Regarding Beckoff's question of why do we do it, I think our definition of wilderness as "the absence of control or restraint" is culturally important because it re-approximates our ideals of paradise. I think that is one of the reasons that we are grappling with that question. There is also that wonderful internal contradiction that paradise is populated by all of these tame, captive animals, the lion lies down with the lamb. There is another concept of paradise out there and maybe this discussion is really about that.