SURPLUS POPULATION:
A FALLACIOUS BASIS FOR SPORT HUNTING

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Introduction

At some point in the slightly heated conversation, the anti-hunter says, "How can you kill those innocent deer?", and the hunter responds, "But they're just surplus; they would die a cruel death of starvation during the winter if I didn't kill them." Shortly thereafter, the conversation will come to a quick halt because the two speakers, while talking to each other, are not communicating. They are talking from different perspectives, in this case, one moral and the other pseudo-scientific; neither may understand the complexity of the issues that underlie their confrontation. A restatement of the above conversation might be: "Is there any situation where it is morally justifiable to kill wild animals through the use of general hunting permits?" Response: "It is justified when there is a surplus of wildlife, more than can be naturally supported in a particular ecosystem." While the hunter has replied with a wildlife management concept rather than a moral argument, it should be considered carefully so that a more fruitful dialog may be entered into [1].

It is the purpose of this paper to examine the nature of the surplus population argument which is often proposed by hunters in justification of sport hunting. It will be shown that the term "surplus" is misleading and that the annual cycle of animal population does not mandate or require the existence of sport hunting. In order to explain or justify this conclusion, it is necessary to take up the science of ecology and explain some of the concepts which are part of wildlife population theory.

In researching this topic an extensive literature search was made. Both of the authors were very surprised by the lack of scientific research dealing directly with issues of the impact of human hunting on wildlife population [2]. It was much easier to find vegetation surveys or hunter surveys [3]. While granting that scientific research in the natural environment is difficult because of the number of variables to be considered, it is still surprising how little research has been done to confirm the scientific theories found in the writing and literature of the area. Therefore, we are limited in large part to a discussion of theories and concepts rather than detailed field observation.

Part I: Wildlife Population Dynamics

As the term dynamics implies, there is constant change in the population levels of wildlife in a natural setting. Many times these changes can be expressed in terms of cycles, which will vary in duration from months to decades. The cycle which dominates the concern of the paper is the annual cycle of wildlife population. A particular species in a given habitat will normally have a high and low point in population level which occurs on a regular basis. Most birds and mammals in areas such as Michigan have a low point in population numbers after the winter season and a high point after breeding in early summer. Before getting to the annual cycle, it is important to understand all the various factors which impact the population level of a species.

A. Biotic or Breeding Potential

Every different species has a theoretical maximum growth rate referred to as its biotic or breeding potential. The clearest example of this is a yeast cell put into a dish under ideal environmental conditions, and where all the needed nutrient is provided the dividing cells. If the growth rate is one division every five minutes, and you start out with 1 cell, then at the end of the first hour over 2048 cells are present. The growth would continue to be exponential until some of the cells no longer divide, either because of death, lack of resources or some contaminating factor. Of course, this growth rate can occur only where humans artificially control all the conditions. In natural settings, a growth rate approaching the theoretical limit occurs only in unique situations such as when a new species is introduced into an area where food is plentiful and competition from other species at a minimum. Initial growth can be very rapid for two reasons: first, the population density of the species is usually so low that there is little intra-species competition to hinder reproduction; and secondly, often a species finds a favorite resource in virtually unlimited supply [4]. (See Figure 1.) As will be explained, however, this growth rate will be reduced substantially as various limiting factors become operative.

Growth of a population is measured in terms of natality or birth rate (synonymous terms) expressed as the number of new individuals produced per unit of time (natality rate) or the number of individuals produced per unit of time per breeding individual in the particular population.

The theoretical maximum birth rate of a particular species is directly related to the biological characteristics of the species. The characteristics are a result of the forces of evolution. Each species has had to adopt a particular survival strategy for their environment. One significant variable is the number of young produced per breeding cycle. With humans, one child per cycle is the norm, but occasionally two or three per cycle may occur. In the animal kingdom, the African elephant on the one extreme produces only one offspring at a time. Rabbits on the other hand can produce litters of 4-10 babies and quail may have clutches of 12-14 eggs.

In the natural environment, the frequency of the birth of young as well as the number of young per cycle are both dependent upon a variety of environmental factors. When food is available to the female in abundance, the number of births per cycle will approach the maximum for the species, thus, when rodent populations increase, the clutch size of owls and hawks also increase [5]. It has been reported that the conception rate of southern Michigan corn fed does was nearly seven times higher than among the doe fawns from the Upper Peninsula [6]. One report on white-tailed deer found that the productivity of the high-diet yearlings was an average 2.5 times greater than low-diet yearlings [7]. Conversely, if food is not available then there will be a reduction in the reproductive rate. The reabsorption of embryos in deer has been observed in time of poor food supply [8].

The number of litters or clutches produced per year is influenced by many factors including: the length of the breeding season, the gestation period of the young, and the fate of the preceding clutch or litter. In most temperate regions the breeding season is restricted so that the young are born in either the spring or early summer. This is not necessarily true in the tropics where species may or may not have distinct breeding seasons.

Clearly, the length of a species' gestation period affects the number of young produced per year. A species with a short gestation period such as the meadow vole (21 days) and the ability to breed immediately after giving birth can quite obviously produce more young per year than the African elephant that even under the best of circumstances produces only one calf every three or four years. (See figure 2.) Several birds, including many species of ducks, though they ordinarily do not nest twice a season, will do so if the first clutch is destroyed or dies early in the breeding season.

The minimum and maximum breeding age of individuals of a population also affect the number of young produced per year. Elephants for example under optimal conditions reach puberty at 11 years of age and give birth to their first calf at age 13. The mourning dove conversely, if spring hatched, is capable of attaining sexual maturity and having a brood of its own within the same calendar year.

The sex ratio and mating habits of a particular species will also impact the population rate. For example, a population of monogamous swans consisting of 25 females and 20 males will result in only 20 females nesting. In a polygamous species such as the white-tailed deer, however, if the population is composed of 10 males and 70 females it would not be unusual for all the females to become pregnant. Additionally, in several species such as the wild dogs of Africa where there exist social groups, only the alpha, or lead, female will be allowed to reproduce.

Thus, there are many factors which combine to determine the first part of the population formula for a species, the reproductive rate of a species being a combination of biological potential and environmental factors. The second portion of the formula, the death rate, shall now be considered.

B. Decimating Factors

Returning for a moment to the rabbit and elephant examples. Since we are not up to our knees in rabbits, it is obvious that the survival rate of the rabbits must be much less than that of the elephants. The various factors which play a role in determining the death rate of a species are called decimating factors in wildlife biology. Just as it was important to understand the factors affecting the birth rate of populations, it is also important to understand the factors that affect the mortality, i.e. death rate, of populations. Each factor deserves attention and will be discussed in turn.

As might be imagined, predators play an important role in determining population levels. Generally, the smaller an animal the greater the effect predation has upon it as a decimating factor. Thus, an elephant has very little to worry about but a rabbit must constantly be on guard for attack both from the ground and air. Predation though an important and widespread decimating factor rarely operates to seriously limit populations below their capacity to survive. Because of the "law of diminishing returns," no predator is going to expend more energy in the pursuit of a prey than it is capable of gaining from capturing it. Once a species' density reaches a low point, it becomes difficult for the predator to find members of the species to hunt. In this event, the predator will turn to other less desirable prey species. It must go elsewhere or it will starve. Since there are less of s species in the area, there is less intraspecies competition and thus the population level may increase if given a chance.

Most wild animals at some time are subject to various diseases and serve as hosts for numerous parasites. Often the host-parasite relationship is tolerated and causes little problem; for example, the brain worm, Parelaphostrongylus tenuis, which is found in the white-tailed deer. Harmless as it is in the white-tailed deer, when this worm is contracted by the moose it causes a fatal neurological disease known as "moose sickness." The disease occurs under unusual conditions where deer and moose occupy the same range with deer acting as the reservoir hosts. Under normal conditions, most animals have adjusted to the presence of disease organisms and parasites since they have evolved and coexisted over a long period of time in the same environment. It is only when the ecological balance is disturbed or a new disease is introduced to an area that unusual levels of death ensue. The local balance might be disturbed by very dry conditions which result in large numbers of animals congregating around the limited water supplies, increasing exposure to risk significantly. Of course, individual animals can become more susceptible to disease if they become weakened by poor nutrition or accident.

Besides weakening animals, accidents can be the direct cause of death. All wild animals are subject to accidents be they natural or caused by human activity. Fires, floods, falls, highway mortality, power lines, etc., all take their toll. Usually accidents are a small but constant decimating factor. Sometimes, however, an entire herd can be swept away by a flood. An example of this that recently occurred was the Mount St. Helens eruption which virtually decimated thousands of animals of various species.

Where man erect fences, builds roads or creates any other unnatural obstacles, he increases the hazards for wild animals. Animal-car collisions are a common sight on our highways [9]. For example, it has been estimated that approximately 19,000 car-deer accidents occurred in Michigan during 1980 [10]. The death count of skunks, porcupines, opossum and others is sadly familiar to all interstate travelers.

When weather patterns deviate from the local norm, it may act as a decimating factor. Tornados, hurricanes and tidal waves are one quick extreme which causes death; the other slower changes in temperature and rainfall may be as important. In the presence of unseasonable weather, death rates particularly among the young, who have fewer resources, would be expected to increase. Cold weather can cause death from exposure; lack of rain may cause death if water sources disappear. Long term weather changes, besides causing mortality directly, cause it indirectly. Prolonged drought or severe winters may affect the supply of food or water which in turn can either lead to starvation or being taken by a predator in their weakened condition. Weather tends to eliminate the weaker and less capable of a species, leaving the strongest to reproduce when favorable conditions return [11].

Another decimating factor that operates directly and indirectly is starvation. Many different factors may combine to bring about a state of starvation -- intra- and interspecies competition, weather patterns, and accidents or diseases which render an individual unable to find his usual food supply. It is often difficult to assess just how widespread this mortality factor is because once an animal becomes weakened from lack of food, it may fall prey to other decimating factors such as predation or accident before actually starving [12]. (See Figure 3 for summary of above factors.)

The final factor to be considered is human hunting. Modern man represents one of the few decimating factors which have the capability of reducing a wildlife population to very low levels and even to extinction (e.g., passenger pigeon) [13]. In the early history of mankind there was probably little difference between the predation of man and

any other large mammal. Through the development of hunting technology, however, humans now possess many extremely efficient means for killing animals. The near extinction of the American buffalo will always stand as an example of the potential of individual greed unrestrained by any social, legal control [14]. Today while the number of animals killed can be astounding, 165,000 deer per year in Michigan alone, it is unlikely that this large decimating factor will threaten the existence of the species [15]. This is because in the United States the vast majority of the sports hunters abide by the regulations passed by the wildlife agencies in each state [16]. Because of their large numbers and different motivations, the human hunter must be considered in a separate category from other predators. The issues surrounding the propriety of this activity will be considered in a later portion of this article.

C. Carrying Capacity

The concept of carrying capacity acts as both summation and integration of all the factors discussed above and many more. In a given habitat (forest, open meadow, marsh or desert) the resources of water, vegetation, cover, etc. will support only a certain level of population of each of the species [17]. Over the long term, the population levels (densities) of each species will tend to approach this safe upper limit: For example, consider a particular field/edge forest habitat in which there are no rabbits. Because of observations in other situations it would be expected that ten rabbits could live within the 10 acre area. The carrying capacity of that habitat for rabbits is 10 even though no rabbits are present. If rabbits do migrate in, it would be expected that their number would increase fairly quickly. If the numbers increase over 10 for the area, then an increase in the decimating factors (predators, starvation, etc.) and a decrease in breeding rate [18] would combine until the population level is brought back within the carrying capacity of the area. (See figure 4.) It might also be noted that the introduction of the rabbits would change the carrying capacity of the area for predators like owls and foxes. The introduction of new prey allows the population of predators to increase; whereas previously one fox might have been able to survive, now two can survive [19].

Carrying capacity can be given only for a particular point in time, for in the same area long term succession or shifting weather patterns will change the carrying capacity [20]. As time proceeds, the open land and vegetation which the rabbit needs will evolve into a forest. As this happens, the ability of the land to support other animals may increase. (See figure 5.) The present population of deer undoubtedly greatly exceeds the historical level before the arrival of white men. This is in large part a result of the destruction of the climax forest during the logging of Michigan with the secondary, replacement growth resulting in a much higher carrying capacity for deer. So long as humans keep cutting the trees, the climax forest will never be reestablished, to the benefit of those who wish high levels of deer population.

Now one final variable needs to be added to allow the discussion to reach the issue of hunting. All of the previous figures have been simplified in that they have not reflected the annual population changes. Besides the long term changes in carrying capacity, there are significant changes within the cycle of a year. Herbivores such as rabbits and deer are dependent on vegetation. Late spring and early summer would represent the high point of the carrying capacity. It is during the spring abundance that the young of most animals are born, maximizing their chances for survival.

Evolution through the force of the genes has adopted the strategy of multiple births during the times of high carrying capacity to maximize the chances of survivability. The genes for many animals have learned that because of the multiple decimating factors many must be born in order that a few survive the annual cycle. One study of quail showed that while e quail might have 14 young born each spring, only about 4.6 would be expected to survive the winter [21]. On the other hand, the elephant has only one offspring, but very few decimating factors operate upon elephants and the longer life of breeding elephants combine to assure the survival of the genes. The genes have also learned how many newborn can be supported by the higher spring/summer carrying capacity. Since each species does this, it is evident that many individuals will die on an annual basis as the carrying capacity is reduced, going from fall through winter.

In northern states like Michigan, the winter carrying capacity acts as the ultimate limiting factor on the population level of a species. Because of this, a Michigan program to increase deer population focused part of its efforts at improving the winter habitat. It is hoped this program will increase the carrying capacity for deer and thus shift upwards the annual population cycle of deer. (See Appendix B for full explanation of program.)

D. "Surplus" Population

As can be seen by figure 6, there are a certain number of white-tailed deer which would not be expected to survive from fall through winter [22]. Hunters argue that these deer are going to die in any case during the ensuing months so why not allow hunters to harvest them a little early. The cycle is real. While the wildlife manager must predict the winter kill in advance, it cannot be denied that deer and many other game animals produce more young than would

normally be expected to survive the annual cycle of the carrying capacity. To denote these as surplus, however, shows a narrow vision of the operation of ecological principles.

The various species produce the large numbers of offspring because history has shown this is the best way to assure the long term survival of the species. No scientific studies have focused on the issue of whether or not hunting by humans would kill the same individual animals which would be expected to die during the period of lowest carrying capacity. We do not know the long term effects upon the gene pool of hunting replacing other decimating factors -- although it must be admitted that the effect might not be observable except in very limited populations such as bears or mountain sheep.

No life form is wasted or unneeded as the term "surplus" would imply. Even when an animal is killed by natural decimating factors, in death it is a resource to other living entities. When the hunter removes the animals from the natural habitat, they can no longer be part of the natural cycles, thus perhaps reducing the carrying capacity of the area for other living entities.

A final consideration in this area is the propensity of humans to manipulate the natural environment to their own ends. One of the primary concerns of state wildlife managers is determining the carrying capacity for game species. In promoting the interest of the hunter in having abundant game to shoot at, there is a strong incentive to manipulate the environment in order to maximize the carrying capacity for the desirable game wildlife at the expense of others. This has become a significant part of the activities of the Wildlife Division of the Michigan Department of Natural Resources (see Appendix B for full discussion). Whether this is the wisest thing to do from a broader ecological perspective is difficult to judge with the present lack of scientific information. But many individuals would operate upon the premise that the least interference by man is the best course of action [23].

In concluding this section on "surplus" population, it should be noted that while an annual cycle does exist for most game animals, this cycle has existed since the beginning of time and there is no basis to support the claim that sport hunting is required to keep wildlife populations under control [24].

Part II: Management and Hunting of Game Animals

Having developed a background in what science can tell us about population dynamics and the carrying capacity of habitat, now we must turn to the more difficult task of human decision making in the area of wildlife management. Science seeks to provide an explanation of what "is" in the world, what is out there and how it all interrelates. Science cannot tell us what decisions to make. In theory, scientific information should be value neutral, simply suggesting the potential consequences for alternative human actions. Science will not provide us with the "ought" of wildlife management. What ought we to do?

One must cast around for the alternatives, must seek out the proper questions to discover the answers and set the goals. In the area of hunting and wildlife control the duty to ask the questions and find the answers has fallen upon one agency within each state's bureaucracy. The titles vary from Game Commission or Fish and Game to Wildlife Division (as within the Michigan Department of Natural Resources). That the task has fallen upon these agencies is primarily a matter of historical development which is beyond the scope of this article [25]. This historical development has resulted in a certain narrowing of options, for the questions asked are not as broad as one might hope. The primary question asked by many within these special agencies would be something like, "How do we provide the best hunting experience for the hunters of our state?" The literature is replete with surveys of hunter desires and preferences in an attempt to serve these constituents [26]. Other questions might lead to different goals and programs. For example, if the question was, "How should society deal with the relationship between deer and humans?" or "What concerns and interests do the various groups within our state have about wildlife and natural ecosystems?", then a much broader discussion would be expected.

As an example, consider the management goals of the Wildlife Division in the state of Michigan. In 197I, the agency set as a goal the build-up of the deer herd so that by 1881 there would be a stable fall population of one million animals. To achieve this goal a substantial amount of funds and effort had to be expended by the Division to increase and improve the habitat which is best suited for deer. Deer and deer habitat became a focal concern of the agency (see Appendix B for full details of Michigan program).

This internal view of the role of the agency, to provide quality hunting, is unlikely to change from any internal thinking or pressure. Three factors support the status quo within the agency. First, as with most bureaucracies, individuals are hesitant to question their own ongoing programs. The questions raised are about how to do things, not what things ought to be done. Secondly, besides the normal bureaucratics most state game agencies have a

substantial group of individuals who are strong advocates for the hunters of the state. They are not neutral, but very supportive of the hunting ethic and would not be expected to raise broader based questions.

Finally, and in many ways most importantly, is the funding mechanism. Most of the game or wildlife agencies are self-funded, that is, they are not dependent upon general state revenues as is every other agency of a state. The monies are derived from license fees within the state and from an assortment of federal funding programs (Robbinson-Pittman, Land and Water Conservation Fund, Migratory Birds, etc.) [27]. Since a large portion of the funds which run the department and pay the salaries are from hunters and fishermen, there is a strong tendency for the agency to consider itself not as representing and working for the general public but that they need only serve their financial sponsors, the hunters and fishermen of the state. If your financial support is dependent on the activity of hunting, obviously very few are going to question the ecological or ethical problems therewith.

If change of perspective is ever going to arrive at the game agencies, funding and political pressure are going to have to come from new sources. Only if these special interest agencies are forced into the political mainstream of social and financial debate will the broader issues be faced. How this might be accomplished is not within the purpose of this article, but the new directions which might be taken will be briefly looked at before returning to the focal point of hunting.

Broad-Based Management

Management is the human mechanism for carrying out policy. There is nothing inherently right or wrong, good or bad about management [28]. Management must be measured by its success in carrying out the goals of society, as set by public institutions such as the legislature. Using deer as an example, there are several different concerns which management might address:

1. How to minimize the damages done by deer upon agricultural crops, both small gardens and commercial enterprises [29].
2. How to minimize the number of deer-car accidents.
3. How to maximize the opportunity for human nonconsumptive purposes of observation (i.e., scientific research, picture taking, general viewing).
4. How to obtain stable and diverse ecological systems within the state where deer are but one component of a complete system.
5. How to maximize the number of deer in the state, for the consumption of hunters.

To varying degrees all five of the concerns are within the consciousness of wildlife managers; however, the last one seems to so dominate thinking and goal setting that all other concerns are secondary. Indeed, it may well be argued that by maximizing the deer numbers for the hunter the DNR is aggravating the negative impacts of deer upon accidents and agricultural losses. It is doubtful that the general population would support such an ordering of priorities. There needs to be a much fuller and more open discussion about we humans are going to handle our relationship with wild animals and natural ecosystems.

Undoubtedly, much could be said about all the concerns, but the remainder of this article will focus on the last one, for there is a growing debate over the propriety of allowing any hunting at all. This is a moral debate; it is not an issue of science or of wildlife management. Rather, it is an ethical issue for which society must decide what is acceptable conduct.

The Moral Issue of Hunting

As the prior section which dealt with population levels pointed out, certain facts may be accepted. First, within some rough degree of prediction a certain number of deer will die each winter in northern habitats because the carrying capacity of the land is at its low point of the cycle during that period. Secondly, the reproductive capability of deer is such that a measurable fraction can be killed each year without apparent harm to the long term productivity of the herd. On the other hand, science can not yet tell us the long term effect of removal of tons of biomass from the natural ecosystem or the effect of hunting on the genetic pool of the deer herds. Scientific information does not support the idea that hunting is necessary for the betterment of the deer herds. If general permit hunting were disallowed other natural decimating factors would balance out the number of deer within the carrying capacity of the different habitats.

Science does not mandate an answer to the issue of hunting, neither does wildlife management for it will do whatever society demands of it. The issue of hunting has arisen in a conflict of human history and human ethics. It must be recognized that hunting is a historically accepted human activity. Without doubt, until very recently hunting was a necessity for human survival. While this may still be the case in a few areas of the world, for most hunters in

the United States, this is no longer the necessity it once was. Given that hunting has been acceptable to society in the past, the burden is clearly on the opponents to hunting to persuade society to their point of view.

This is nothing unusual or unique; as societies mature, becoming more concerned about the ethics of their actions, the burden is always on those who seek the change. This was the case with the issues of slavery and women's suffrage. There were always arguments and past practice to support the status quo. In both cases, the ethical arguments eventually won out, blacks and women began their road to equality. As represented by these two examples, there was also a substantial price paid by individuals and by society in resolving the issues. While it is unlikely a war will ever be fought over the issues of wildlife and hunting, there can be expected significant commitment of human and financial resources toward the effort of change.

Most hunters would rather be left alone; claiming it is a personal decision, to hunt or not, and that nobody has a right to dissuade their decision. The same argument was undoubtedly made by the owners of slaves. No one forced you to own slaves, if you decided it was all right, then you should be allowed to do so. In other cultures and other times, what a man did with his wife and children were of no concern to society. We in the United States have made certain commitments about the rights of being a human, and society through its legal and ethical pressures will control unacceptable conduct. Physical abuse of wives and children, child labor and other negative infringement on humans previously uncontrolled are now unacceptable behavior. The historical cycle of ethical or moral concerns seeking to change human conduct is now being repeated in the area of human/animal relationships.

But what does all this have to do with the issue of hunting? Life, the respect for life, has been the underlying motivation for ethical arguments and new laws. granting that most prior examples deal with increasing respect for the right of human life, it is still the element of life which is fundamental. Life particularly non-human life, is deserving of our respect. Respect is not reflected in an activity which promotes killing on whim or for personal gratification. The unnecessary infliction of pain upon living entities is to show disrespect for all living things. This perspective of life and seeking to protect it is not particularly new. Jeremy Bentham and Albert Schweitzer raised these points a long time ago [30]. In addition to this historical concern with the ethics of human action upon individual animals, there is now an additional scientific concern about how human actions impact species of animals and entire ecosystems [31].

Animal life is not found in fairy tales or Disney productions. Life is difficult, intertwined with death, with pain, with the struggle for survival. This struggle for individual survival has over the millions of years developed the ecosystems and individuals now observed. The struggle has produced human beings through the process of evolution. We are now aware of two relationships with our fellow creatures on the planet Earth. First is the common basis of life itself, that the nature of life for the bear, mouse and bird are not significantly different from that of humans. Not to say that bears are like humans or should be treated as humans, but that as mammals we share commonality of birth, child bearing, pain and suffering, happiness, and death. Even if other animals do not possess the same awareness of self and life, we are aware and as with the unaware human infants if we respect our own life we must respect life in others.

Secondly, our tie to other life is through the existing ecosystem which supports all present life. Notwithstanding man's often expressed attitude that he is above and distinct from other living creatures on this plant, he is just as dependent on the ecosystems of Earth as is the oyster or the eagle. Humans are but on the threshold of understanding all of the intricate relationships involved in supporting life. Given that natural processes have operated effectively for millions, billions of years, it is rather presumptuous of humans to step in and say they know best. Nature, natural ecosystems and all the contained plant and animal life should be left alone to the fullest extent possible. Humans should interfere only for good cause shown, only where the interference is required, and some understanding of impact is available. The desire of hunters to kill birds or mammals is insufficient reason; it is not good cause shown. Where a particular animal is causing significant damage to human population interference may be warranted. The nature of the interference, however, could vary from building a fence , to capture, to killing.

Even when sufficient numbers of people express their opinion so that general permit hunting is stopped, deer and other animals will need to be controlled in various situations. Wildlife will not simply recede into a distant forest. There will still be problems that must be dealt with. But the difference will be that these problems rather than being a justification for hunting will have to be addressed directly by wildlife managers.

Conclusion

There does not exist anything denoted as surplus population which would require hunting. There is no management requirement for general hunting. There is but the conflict between the historical and "practical" or economic arguments for hunting versus the ethical argument on

behalf of life and ecosystems. It is a difficult and intense conflict, but it is a healthy sign within a maturing human society. The arguments are not going to be resolved easily. Ideas versus action is always an energy and time consuming conflict. It is hoped that this article has cleared away some of the misconceptions and provided a perspective from which the arguments can be understood and perhaps judged. Ultimately, the argument must deal with man's relationship to other forms on Earth and our role within the ecosystems that control our lives.

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Footnotes

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10. Natural Resources Register, October 1981, p. 8, Michigan DNR.

11. Conversely, milder weather supports higher reproductive rates. John G. Mudinger, White-Tailed Deer Reproductive Biology in the Swan Valley Montana, J. Wildlife Management, 45(1): 132-139, 1981.

12. For example, one Michigan survey showed that after the 1978-79 winter 121,702 carcasses of deer were found--31.4 percent died of starvation and 42.2 percent died of unknown causes. Burgoyne and Moss, Estimated Winter Losses in Michigan 1978-79, Surveys and Statistical Services Report No. 187, December 1979, Michigan DNR.

13. George Burger, Principles of Wildlife Management, in Wildlife Conservation, p. 93 (published by Wildlife Society, 1979) [hereafter referred to simply as Wildlife Cons.].
Driven to extinction have been such species as the easter bison, the sea mink, the Labrador duck, the Caroline parakeet, the heath hen, and the passenger pigeon. R. McClung, Lost Wild American, p 28-53, 1969.

14. For a full account of how herds of buffalo consisting of millions of animals were reduced to hundreds, see James Trefthen, An American Crusade for Wildlife, p. 3-19, 1975.

15. It has been predicted that the Michigan kill of white-tailed deer by firearms, archery and muzzle loader will approach 180,000 to 190,000 in 1981. Detroit Free Press, Sunday, July 19, 1981, p. 9H.

16. Unquestionably, the destruction of habitat by human activities, usually in pursuit of profits, is a much more serious threat to the existence of species of animals. See Norman Myers, The Sinking Ark, 1979.

17. Leopold has designated many of these categories as welfare factors. game Management, 26 (1933).

18. It has been noted that in a given area, as the number of breeders increases, the production and survival of their offspring is proportionally reduced; this is sometimes referred to as "inversity" (Allen, supra note 4 at p. 52).
O'Roke and Hamerstrom, J. wildlife Management, 12(78), 1948, kept track of the reproductive rates of a deer population on the George Reserve in Michigan, and found that the lowest fawn crops were produced (38 percent) when the population was at its highest concentration. Many other investigators have reported similar results providing further evidence for this control mechanism. Verme (supra note 8) found that among prime-age does the sex ratios of the fawns born were substantially different from the high and low nutrition mothers. to these mothers of restricted rations, 70 percent of the fawns born were males. The well-fed deer, on the other hand, produced only 46.7 percent males. This could, he felt, be a natural mechanism by which the deer regulate their population. A limited fawn production in addition to a disproportionate number of male births would curtail the population on deteriorating range. Or, if the habitat was capable of sustaining more deer, higher productivity and a greater percentage of female births would result in an expanding population.

19. Raymond Dasmann, Wildlife Biology, p. 153-179, 1964.
Richard Taber and Kenneth Raedeke, Population Dynamics, Wildlife Cons., supra note 13.

20. The manager may often take advantage of, or be frustrated by, an additional factor of complexity in natural communities. The vegetation he works with is frequently unstable over time. Where vegetation has been disturbed by nature or man, as is the case in most areas in modern times, the process of "plant succession" is underway. A typical midwestern farm field, if abandoned, will, for a period of two to three years, be overgrown with annual weeds. These will eventually give way to perennial forbs and grasses and finally will be invaded by such sun-loving, hardy shrubs and trees as honeysuckle, sumac, Siberian elm, and box elder. Later, slower-growing, longer-lived trees, such as oaks, maples, or basswood, may dominate the old field as a mature forest. The rate of change, the number of stages, and the specific plant characters in this sequential drama vary from area to area, dependent upon climate, soil, and other factors. George Burger, Principles of Wildlife Management, Wildlife Cons., supra note 13.

21. Allen, supra note 4 at p. 42.

22. One writer referred to them as the "doomed surplus". For a more mathematical explanation of the concept of surplus population, see H. Charles Romesburg, Wildlife Science, supra note 2.
Michael E. Nelson and L. David Mech, Deer Social Organization and Wolf Predation in Northern Minnesota, p. 14, published as a Wildlife Monograph of the Wildlife Society, July 1981, No. 77. This study

of deer with radio collar tracking suggests the following data for one annual cycle in Superior National Forest of Minnesota:

Summer fawn production	130 fawn per 100 does
November survivorship	113 fawns per 100 does
April survivorship (after winter)	42 fawns per 100 does

23. "The real immorality of the hunting movement is not its willingness to kill, per se, but its unwillingness to respect the biological and esthetic integrity of the natural world. In its selective, self-serving attitudes toward wildlife, in its eagerness to manipulate the environment for the sole sake of its sport, the hunting movement displays an ultimate insensitivity to all lower life forms: it exemplifies the belief that the only legitimate function of our planet and its organic community is to satisfy the wishes of mankind, no matter what form these wishes may take. This is the same inglorious ethic that guides the conscience of a strip miner or real estate speculator." Jack Hope, Hunters: Useful Pruners of Nature or Just Killers?, Smithsonian, January, 1974, p. 84 (Vol. 4, #10).
Also see Coggins and Ward, The Law of Wildlife Management on the Federal Public Lands, 60 Or L Rev. 59, 66 (1981).

24. In conversation with Arnold, Assistant Director of the Wildlife Division of the Michigan DNR, it was admitted that if hunting were stopped, deer herds would remain approximately the same (Conversation, July 2, 1981).

25. Trefthen, supra note 14, at p. 174-268.

26. See supra note 3.

27. This situation arises because of a requirement in a 1933 federal law, The Pittman-Robertson Act, which requires any state agency which is to receive federal funds under the act to have full control of all license fees received by the state. 16 U.S.C. Section 669, 1976.

28. "Wildlife research is a system for producing inputs to management decisions. Inputs to managerial decisions, typically called wildlife decisions, are measurements, counts, lists, and estimates about populations, habitats, and people. This follows naturally from my definition of wildlife management: The science and art of making decisions and taking actions to change the structure, dynamics, and interactions of habitats, wild animal populations, and people to achieve specific human goals by means of the wildlife resource." Robert H. Giles, Research to Meet Future Management Needs, Wildlife Cons., supra note 13, at p. 219.

29. For an article describing the impact of deer on a county in northern lower Michigan, See Appendix C. One individual estimated deer damage to the 1981 potato crop in upper Michigan at $270,000. Natural Resources Register, Oct. 1981, p. 9, Michigan DNR.

30. The full historical argument can be found compiled in Animal Rights and Human Obligations, Edited by Tom Regan and Peter Singer, 1976.

31. See D. Favre, Wildlife Rights: The Ever-Widening Circle, 9 Environmental Law, 241, 1979.