FMF Paper

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Paper # 900501

1990

Privatizing the rhino industry

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PREFACE

Many conservationists have expressed great concern over the multitude of environmental crises that afflict modern society. Amongst these, the extinction of animal species is a singularly pressing, and often emotional issue.

Individual greed is frequently blamed as the culprit responsible for all types of environmental disasters, and the problem I address here is no exception. Rhinos are threatened with extinction because they are being poached extensively for their horn, which can be sold for a substantial price on Asian black markets. The common view is that rhino poaching is morally wrong, and associated with greed and evil intentions. This view, however, does little to help solve the problem, while a simple and objective economic analysis may. Indeed, while the root of the problem is in fact economic, economic considerations are playing only a small role in the decisions of policy makers.

There are different approaches to the subject of economics; often the choice of approach is affected by ideological influences. The traditional view in welfare economics, held by economists such as Pigou, was that in all cases where the market system failed to provide for social welfare, the problem could be solved simply by government intervention. Ronald Coase, who was one of the first economists to provide a clear explanation of the relationship between property rights and economic behaviour, rejected this notion. Coase's 1960 article, "The Problem of Social Cost", raised some poignant questions over much of the conventional wisdom of contemporary welfare economics.

Coase urged all economists to consider each case on its individual merits. Subsequently, other economists have identified many cases where government intervention has led to situations worse than those created by the market. Environmental problems are no exception, but conservationists have been slow to realize this.

Environmentalists have laid a great deal of emphasis on individual greed thereby discrediting the private sector and the market system. The general attitude has been that the private sector cannot be entrusted with any conservation responsibility; this role must be fulfilled by the state. Unfortunately, the state seldom seems to do a better job. While the intentions of many state employees may be quite honourable, they fail to meet their objectives because of certain inherent tendencies in public sector operations.

This report is not intended as a direct criticism of the policies of certain conservationists, but rather as an instrument to create awareness of the economic nature of environmental problems. The objective is simply to prevent the extinction of rhinos in the wild.

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1 INTRODUCTION

Scope

The rapid decline of the African rhinoceros over the last decade has evoked considerable interest and concern throughout the world. Newspaper and magazine articles on the subject appear almost daily in South Africa. Most of the literature, however, discusses the situation from the point of view of scientists and lay persons. Very little attention is given to the economic factors underlying the problem. This situation needs to be redressed.

There are currently five biologically classified species of rhinoceros (Penny 1987, 6-8), three of which occur naturally in Asia, the Indian rhinoceros, Javan rhinoceros and Sumatran rhinoceros. These three species have all experienced drastic decreases in populations and in 1985 numbered 1,893, fifty and between 483 and 877, respectively. Their decline is attributed to competition with crop farming and excessive demand for meat, hides and horns (for medicinal purposes).

There are two species of African rhinoceros, the black (*Diceros bicornis*) and the white (*Ceratotherium simum*). Seven separate races of black rhino have been described (Smithers 1983, 562) and two of the white, one of which (the northern race) currently numbers some 20 individuals (Clarke 1989) and could become extinct in the wild. Three races of the black occur in South Africa (Hall-Martin 1988, 15-17), two naturally (*D.b.bicornis* and *D.b.minor*) and one having been introduced from East Africa (*D.b.michaeli*). The southern race of white rhino (*C.s.simum*) is indigenous to South Africa and is currently the most commonly found variety.

Present numbers of African rhinos existing in the wild have been estimated at less than 3,350 of the black, with about 650 of these in South Africa (Walker 1990, interview), and 5,000 of the white, of which 4,600 are in South Africa (Hall-Martin 1989, interview).

There are a number of differences between the two species. The black rhino is a browser, and usually very aggressive in the wild, unlike the white rhino which is slightly larger, more docile and a grazer. The noticeable difference between the two species is the shape of the mouth area which is squarish and wide in the white, and more pointed ("hook-lipped") in the black. As a result of their feeding adaptations, white rhino prefer more open, grassy habitat, and black rhino prefer thick bush. There is no difference in colour between the two species despite what their names imply.

Rhinos have a number of commercial uses, and the concept of the "rhino industry" is an attempt to embrace these. The Collins Dictionary of the English Language (Hanks 1986) defines an industry as, *inter alia*, "a branch of commercial enterprise concerned with the output of a specified product". The rhino industry is thus a branch of commercial enterprise concerned with the output of rhinos.

Rhinos in themselves do not necessarily constitute the end product. Live rhinos in zoos and game reserves provide "rhino services" to spectators and tourists. Rhinos in hunting concession areas provide hunting services as well as a good, the trophy, to hunters. Finally all rhinos, once dead, can provide various goods to consumers. Uses have been documented for a wide variety of rhino goods including meat, skin, bones, feet, toes, toenails, ears, genitals, tails and horns. Rhino horn is a particularly valued commodity. In Asia it is used widely for medicinal purposes and in North Yemen, in the making of ceremonial dagger handles (Penny 1988, 3).

The concept of "privatizing" the rhino industry is used in this paper in its broadest sense, namely that of "reducing state involvement in industry and commerce" (Letwin 1988, vii). It thus follows that all my discussion on privatization includes the associated concept often referred to as "deregulation". I use the term "market regulation" instead of deregulation, as this provides a more accurate description of the concept - allowing market forces to act as a regulating factor instead of government intervention.

The Problem

This essay relies on a normative assertion: that it is desirable to conserve rhino species in their habitat. "Habitat" is defined by the Collins Dictionary (Hanks 1986) as "the natural home of an animal or plant". There may be some disagreement among scientists over an accurate definition of the term "natural". I assume, however, that most readers will reach a significant consensus on this issue.

The problem is simply that rhinos in Africa are disappearing from their habitat at a fairly rapid rate. Numbers of black rhinos in the wild have decreased by some 95% over 20 years. According to Clarke (1989) there were an estimated 65,000 in 1970, and only about 3,000 in 1989. Hall-Martin (1988, 12-13) reports a 75% decrease for the continent over a seven year period, from 14,795 in 1980 to 3,717 in 1987. Numbers of the northern race of white rhino dropped from 821 in 1980 to 17 in 1986 (Penny 1987, 38), a decrease of 98% in just six years.

The large decline of rhinos in Africa is attributed to poaching aimed at serving the needs of Asian consumers. In 1987 an estimated 75% of all surviving black rhinos could be found in three Southern African countries, Zimbabwe, Namibia and South Africa, and at the time of writing this proportion is likely to have increased. As black rhinos become increasingly rare further north, pressure on South African rhino populations is likely to intensify. Unchecked, the poaching of rhino could lead to the extinction of both species in the wild.

Whether the disappearance of rhinos in the wild would ultimately lead to their complete extinction is a question open to debate. A total of some 640 white rhinos have been exported to other continents over the past thirty years, most of them to zoos. These have thrived and there are thought to be some 1,500 individuals currently living outside Africa. According to Chilvers (1990, 19), the black rhino zoo population currently numbers 183, with most individuals representing the subspecies *D.b. michaeli*.

The continued survival of either species could ultimately depend on successful cross-breeding programs between zoo populations. Biologists stress the importance of preserving genetic diversity to ensure the long-term survival of a particular species. Whether the size of the zoo populations would be "genetically safe" is an issue that would need to be addressed. It seems unlikely that the current small zoo population of black rhinos would have any long-term prospect for survival.

Most rhinos in South Africa live in areas controlled by the state. The entire black rhino population survives in game reserves owned by state conservation agencies (with the exception of one or two individuals). Historical accounts indicate that this species was once widespread in South Africa, but in the last century, hunters exterminated the species through most of its range. In recent years, the number of black rhinos in this country has started to increase, aided by the efforts of various conservation agencies.

The white rhino population also fell drastically in the nineteenth century, and at one time was restricted to the Umfolozi complex in Northern Natal, an area administered by the Natal Parks Board. It is not known to what extent numbers of this population dropped. According to Montgomery (1989b, 10) in the 1920's, only 22 white rhinos remained. Other estimates by Vincent (1969) and Mentis (1970) indicate that numbers were in the region of 650 in 1960, and 500 in 1952, which suggests that the previous figure may be too low. In any event, the existence of white rhinos in the wild in South Africa can largely be attributed to the Natal Parks Board's program known as "Operation Rhino" which took place in the early 1960's. Large numbers of rhinos were captured and translocated to start new breeding populations. Most of these animals were moved to other state reserves, but the Board started selling white rhinos to private landowners in 1963, and have been doing so ever since.

Concern over the success of sales to private landowners as a measure to increase populations, led to a recent investigation by Daan Buys, into the number of white rhinos on private land. The "Buys Report" (Buys 1987) revealed that out of the 1,440 rhinos sold to private owners, only 931 were still surviving in 1987, despite the fact that

breeding should have led to a further increase in numbers. A number of reasons for the decline were considered, notably the role of trophy hunting, mortality as a result of poor land management or unsuitable habitat, and the fact that populations with a single mature male had very limited breeding success.

The overall impression created by the report led to a negative perception of "the ability of private landowners to manage rhino to enhance the status of the species" as reflected by an article in the *Rhino and Elephant Journal* entitled "Disquiet was Justified - White Rhinos on Private Land" (Buys and Anderson 1989). The Buys Report was presented at the Rhino Conservation Workshop held at Skukuza in the Kruger National Park in 1988 where concern was expressed at its findings (Montgomery 1989b, 10). The "glowing success" of the record of (state-run) conservation agencies was contrasted with the failure of the private sector to contribute to an increase in populations.

The Rhino Conservation Workshop passed several resolutions on future rhino management. All of these centred on banning trade in rhino products, clamping down on illegal hunting and implementing a management strategy for the black rhino that did not consider any direct participation by the private sector. The current black rhino conservation plan for Southern Africa concentrates almost exclusively on public sector management strategies (Brooks 1989, interview). Even Thomson (1986, 183-96) in his progressive book on wildlife conservation does not consider private sector participation in his proposed bold action plan to boost rhino numbers.

The attitude toward the private sector as being irresponsible when it comes to managing rhino populations, is not justified in the light of the role that the public sector has had in providing incentives for the actions of the private sector. (I elaborate on this point at a later stage in this paper). Even more unfortunate is the attitude of some people that the role of private enterprise should be merely a passive donatation to conservation projects without any expectation of a profitable return.

The private sector could, and should play a valuable role in the rhino industry. The decline of rhinos on private land, and through poaching, is a result of the public sector's failure to understand some first principles of economics, and apply them to the situation.

The idea of using economic analyses to devise methods of saving wild animals from extinction may be abhorrent to some people. This stems from the attitude that rhinos (and other wild animals) are somehow sacred, instead of viewing the rhino through the eyes of an average consumer: as a renewable resource with commercial value.

The rhino problem is greater than one is generally led to believe. A successful solution depends on a complete understanding of the situation. There is considerable evidence that the economic forces driving the current predicament are not widely understood. It is thus necessary to consider whether the policies of the public sector provide the most effective means of tackling the problem, or whether some of these policies are not aggravating it instead.

Methodology

The traditional approach to environmental problems has been to examine their nature in the context of environmental and resource economics. Stauth (1983), considers two areas as important in the application of microeconomic principles to environmental planning, namely "the need to establish legal rights" and "the search for market solutions". I discuss these two areas under the headings "Property Rights" and "Market Regulation".

My theoretical approach is not restricted to traditional resource economics methods, and I make use of some broader principles of welfare economics and particularly, industrial economics. This is significant in that natural resources are not normally viewed in this context, yet I believe that this approach is relevant in the light of the nature of the problem. The concept of the "rhino industry" lends itself well to such an analysis. The discussion on market regulation also addresses certain essentials of investment and decision theory.

In recent years a new area of privatization theory has developed. This theory arose out of certain government initiatives to improve the allocative efficiency of their economies by allowing and encouraging increased private sector involvement in activities traditionally under state control. This area of privatization theory relies on many of the principles inherent in property and market theories and combines them to reach certain conclusions. Applications to the rhino industry are dealt with separately.

2 NATURE OF THE RHINO INDUSTRY

The use of rhino products for human consumption is certainly not a modern phenomenon. According to Kyle (1987, 8) rhinos were hunted extensively for their meat some 80,000 years ago and formed the greater part of the diet of certain humans in Western Europe. Martin (1980, 11-12) has established that various rhino products have been used for a number of purposes in both Africa and Asia for several centuries. Traditionally, the most prized part has always been the horn, followed by the skin. In Borneo, the body parts of rhinos have played a significant role in local cultures.

Martin (1980, 13) considers that the virtual extinction of rhinos in Borneo can be attributed to demand for their meat. He also notes that in nineteenth century South Africa, British and Dutch settlers preferred white rhino meat to that of any other game animal. Certain populations were almost exterminated on account of their meat alone. While this demand for rhino meat seems to have dwindled, recent years have seen the advent of a demand for rhino services - trophy hunting and tourism.

The rhino industry has had a long historical precedent and has undergone some changes over time. What remains today is only a vestige of a previously extensive range of utilization, certain aspects of which could possibly be revived; for example, the consumption of rhino meat.

The Complexity of the Industry

It is difficult to view the modern rhino industry in isolation. Rhinos are produced in captivity as well as in their habitat. In zoos, they are managed as part of a large system which provides for numerous different species. In their habitat they form a small element of natural ecosystems, and function in concert with many other elements. These ecosystems usually need to be managed integrally. Any examination of the rhino industry must include a broader look at zoos, other forms of captive breeding and what I refer to as the "wildlife industry".

The wildlife industry includes tourism, hunting and the production of wildlife products. There is a distinct demand for natural ecosystems, reflected by the numbers of people who visit such areas every year. Wildlife in its habitat would appear to have higher spectator value to many people than animals held in captivity, and the sport of trophy hunting is dependent on the availability of wildlife in its natural surroundings.

Although the production of wildlife products can take place under a system of intensive captive breeding, only certain wildlife species, for example ostriches and crocodiles, are managed in this way. Many other wildlife products are simply harvested as part of the process of managing large natural areas. It is possible to manage rhinos under intensive breeding schemes, but in practice this has not occurred to any significant extent. The existing South African rhino industry cannot be separated from the larger industries of which it forms a part.

Not only is it hard to view the rhino industry in isolation, but the industry itself consists of a number of different components. There is a demand for rhinos in zoos which, when supplied, leads to the exclusion of all other uses. There is also a demand for rhinos in their habitat, for both tourism and hunting. Hunting can only be compatible with tourism if the number of animals removed is a small proportion of the total number of live animals.

There is also the demand for various rhino goods. The demand for rhino trophies

(head and neck) is virtually inseparable from hunting. Though the hunter may not be the ultimate user of the trophy, virtually all rhinos need to be killed in order to obtain trophies (I ignore special cases where trophies may be extracted from natural mortalities).

Unlike trophies, in the case of other goods, black and white rhinos can be regarded as very close, if not perfect substitutes. Both Penny (1987, 79) and Martin (1980, 21) have noted possible preferences for black rhino horn amongst Yemeni and Chinese consumers respectively, but there appears to be some confusion surrounding this issue. Since it must be very difficult, if not impossible, to distinguish between the horn of a black rhino and that of a white, I assume they are perfect substitutes.

Supplying rhino horn and rhino hunting trophies can be regarded as mutually exclusive activities for one rhino, with two possible exceptions; one is where the horn is removed from a live rhino and grows back before being hunted, the other is where the horn is removed from the trophy and replaced with some kind of fake.

Other rhino goods such as meat, hides and bones can be provided by any dead rhino, and the supply of these is thus compatible with hunting, but (as with hunting) only to a small extent with tourism (again ignoring natural mortalities). The supply of rhino horn is also largely incompatible with tourism, since even the removal of horns from live rhinos is likely to result in a significant loss in spectator value.

The Current State of the Industry

Certain aspects of the rhino industry have been restricted since the advent of the 1973 Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). Initially, only certain countries agreed to bind themselves to the CITES regulations, although in recent years the number of signatories has increased to include virtually all countries involved in the international trade of endangered species.

CITES applies certain criteria to determine whether a species is threatened with extinction, and to establish the severity of the threat. According to this assessment, each species is assigned a certain status to which specific trade restrictions apply. Rhinos are listed on CITES Appendix 1, the most severe rating. This means that all international trade in rhino products is prohibited. Live rhinos may only be traded with a CITES permit.

An exception is made for the southern white rhino, which is listed on Appendix 2. Restricted trophy hunting of white rhino and the international transportation of trophies is allowed for those in possession of a CITES permit. Trade in other white rhino products is still forbidden.

As a signatory to CITES South Africa is bound by its regulations. Additionally, local conservation authorities impose certain veterinary and other restrictions on the transportation of wildlife within the country. In order to transport any wild animal it is usually necessary to acquire a permit from the relevant authority.

The highly restricted nature of the rhino industry has created a situation where black rhinos may only be used legally for purposes of tourism, and white rhinos for tourism and hunting. (Both species may be sold to zoos and other captive breeding programs with the necessary permission). The imposition of restrictions on goods aspects of the industry has led to the creation of a black market, so that in practice, certain illegal activities also take place, notably poaching for rhino horn.

Roles of the Private and Public Sectors

The legal market for black rhinos is controlled by the public sector, with all breeding populations currently owned by state conservation agencies. In June 1990, the Natal Parks Board aims to auction a single breeding package (two males and three females), but supply of live black rhinos will remain tightly restricted.

Supply of live white rhinos is relatively unconstrained, with individuals quite frequently being offered for sale at game auctions. Consequently, the private sector is significantly involved in this market. According to figures established by Buys

(1987), roughly 20% of the South African white rhino population is in private hands.

There is also considerable private sector involvement in both tourism and trophy hunting. A number of successful private game reserves operate exclusively to provide game-viewing and other related tourist services. Many reserves provide hunting in addition to the usual services. Raphaely (1990, 14-18) observes that big game hunting is a rapidly growing industry in South Africa, attracting a great deal of private sector interest. With South Africa being the only African country where hunting of white rhino is allowed, it has become a highly attractive venue for all overseas visitors wanting to hunt the "Big Five" game animals.

The public sector is involved chiefly in providing tourist services, and owns a number of game parks. By far the largest number of rhinos occur in these parks. It is important to note that the reserve which will eventually harbour the largest populations of both black and white rhinos is the Kruger National Park (Hall-Martin 1988; Pienaar 1989). The Kruger Park is controlled by the National Parks Board, and rhino management in this area is thus regulated by the Board's policies.

The National Parks Board, which also controls certain other rhino populations, has a policy of "minimum interference in natural processes" ("National Parks in South Africa", 3). In practice, the Board manages its veld areas quite intensively, but culling of animals is restricted to situations where populations have reached levels in excess of the reserve's carrying capacity and are damaging their habitat. According to these criteria, only elephant and buffalo are culled in the Kruger National Park.

The National Parks Board also manages the entire infrastructure of its reserves ("National Parks in South Africa", 8). This includes all building and maintenance as well as administration of tourist facilities. Visitors are charged standard subsidized rates for accommodation, which is frequently fully booked a year in advance, and subject to excess demand.

The Natal Parks Board practices game removal to a greater extent, largely because of the smaller size of game parks. Game is also supplied to the private sector; previously subsidized prices were charged, but there has been a move towards auctions to achieve market prices. Recently, a hunting concession area has been set aside, and all tourist camps have been given a directive to become economically self-sufficient.

Agencies in the so-called independent states and homelands have varying policies - the Kwazulu Bureau of Natural Resources allows the removal of certain natural resources on a sustainable basis by local people living on the borders of reserves, as do the Kangwane and Bophutatswana Parks Boards. The latter organizations currently also allow some trophy hunting as well as the operation of selected private tourist industries in their parks.

Problems Facing the Industry

The greatest problem facing the rhino industry at present is the threat of poaching. Martin (1980, 9) has established that the demand for rhino products in Asia is both strong and extensive. Recent indications are that demand has dropped somewhat in North Yemen, but that in parts of Asia, especially Taiwan, it is on the increase (Martin and Vigne 1988). Evidently, attempts to curb demand by implementing CITES regulations have met with limited success.

A realization of the growing urgency of the situation has induced some conservationists to certain action. The public sector has responded by intensifying anti-poaching efforts, and the private sector is attempting to spread awareness of the problem and raise funds for the cause. A collaboration of public and private sector interests led to the formation of the Rhino and Elephant Foundation in 1986 (Ledger 1986, 4). The Foundation is a non-profit organization that raises funds and creates publicity.

Funds raised are used mainly for purchases of additional land and the acquisition of anti-poaching vehicles, equipment and uniforms for rangers. Some funds are also used to assist agencies with the translocation of black rhinos. Virtually all money raised is donated directly to the

public sector in South Africa and to conservation agencies in neighbouring countries.

Co-operation between various public sector agencies has led to the creation of a joint conservation plan for the black rhino and the formation of a "rhino specialist group". This group is made up of several conservation officials with expertise in the area of rhino management. The aim of the conservation plan is to develop, as rapidly as possible, genetically viable populations of the two subspecies of black rhino indigenous to Southern Africa, as well as a population of the East African subspecies, *D.b. michaeli*. Population targets are set at 2,000 for the first two subspecies, and 100 for the latter (Brooks 1988, 4).

In order to achieve the desired rapid growth in rhino numbers, conservation agencies attempt to translocate surplus rhinos to reserves where new breeding populations can be formed. A number of translocations have taken place, but recently this process has led to several deaths (Meiklejohn 1989, interview). Public sector agencies are unlikely to sell black rhinos to the private sector without an express undertaking to breed them for conservation purposes alone (Brooks 1989, interview). However, captive breeding programmes should receive some state support (Brooks 1988, 4).

The only private concern known to have expressed an interest in captive breeding, is a professional game capture operation, Brooker Wildlife. At the time of writing, a single male of the sub-species *D.b. michaeli* had been imported, and there were plans to import a further twelve from various overseas zoos. According to Brooker (1990, interview), certain South African conservation authorities were initially reluctant to grant him the necessary permission, despite the fact that he was in possession of a valid CITES import permit.

Any individual seeking to enter the black rhino industry faces innumerable obstacles. To start with, substantial capital outlays are required. Live black rhinos can command a price of anything between 20,000 and 100,000 US dollars, and rhino-proof fencing costs between ten and fifteen rands per metre. Black rhinos can only be used for purposes of tourism (hunting is banned), or can be bred and resold. A prospective private owner may also be subjected to stringent transportation controls imposed by state authorities.

Private sector involvement in the white rhino industry is somewhat easier. At prevailing market prices, entry is expensive, but there are less restrictions, and rhinos are reasonably easy to obtain. Previously, white rhinos could be purchased at exceptionally low prices; prior to 1980 the Natal Parks Board were selling them at R800 each. Prices were increased gradually during the early 1980's, but then rose sharply after the implementation of the auction system in 1986. In 1989, the highest price obtained was R72,000 (about $30,000).

Until 1989, the Natal Parks Board continued to supply a few white rhinos at subsidized prices. The Board has since decided that all white rhinos should be auctioned (Brooks 1989, interview). The subsidy system was originally intended to encourage private landowners to breed rare species on their land, but with the present booming wildlife market, this policy is no longer necessary.

Both subsidized Natal Parks Board prices and recent auction prices obtained for white rhino are displayed in Appendix 1 of this report. It should be immediately apparent that prices were heavily oversubsidized prior to the advent of the auction system.

Appendix 2 shows some of the prices obtained for rhino trophies during the same period. A comparison between the prices reflected in the two appendices, reveals that private buyers could make considerable profits by allowing their rhinos to be shot by trophy hunters.

In 1986, for example, the Natal Parks Board price for a live rhino was R4,000. That same year, some private owners were selling trophies for as much as R30,000 (Buys 1987). It is hardly surprising that many rhinos sold to the private sector were shot - very few investors would pass up an opportunity to make an instant gross profit of 650%.

It is possible that even greater profits could be made by dealing in the illegal rhino horn market. Martin (1980, 55) estimated

that the average retail price of horn in Asia was almost $9000 US per kilogram in 1979.

There appears to be some confusion over current prices (Montgomery 1989a, 233). Block (1990, 308) suggests that the horn of a fully grown rhino may fetch as much as $160,000. According to Martin and Vigne (1988, 23), average prices in Taiwan were close to $38,000 for a complete horn in July 1988, but were increasing rapidly. Even the lowest estimates of retail values placed on a single horn exceed the highest price obtained for a live white rhino on auction.

The failure of prices of live rhinos to reflect their true value in the past, has created a serious threat to the industry. With much higher values being placed on both trophies and horns, there have been powerful economic incentives to kill rhinos. Although recent market prices of live rhinos appear to be approaching a more realistic level, individuals in relatively unprotected areas are still attractive targets for poaching. Poachers are currently willing to risk their lives in Zimbabwe's Zambezi Valley for $500 a day, a small fraction of the horn's retail price (Masland 1989).

As the more vulnerable populations of rhino disappear, pressure on other areas will intensify. Since it is highly improbable that the demand for horn will be contained in the near future, prices are likely to increase and push up the rewards to poachers. There is evidence that poaching is already on the increase in South Africa. Recently, over twenty seven rhinos were shot inside the Kruger National Park by a Parks Board ranger ("27 Rhino" 1989).

Throughout Southern Africa, penalties for rhino poaching are being increased dramatically, but even the Zimbabwean "shoot to kill" policy has failed to discourage poachers sufficiently.

The inability of existing measures to bring poaching to a halt has prompted a number of alternative ideas. Martin (1988, 24) believes that all governments of Asian countries involved in the rhino horn trade must be persuaded to impose tight controls to prevent trade. However, this ignores the fact that demand for the horn is unlikely to disappear in the foreseeable future. As long as there is any demand for horn, the black market will continue to exist. The worst of this simple reality is that government officials are likely to contribute to it.

Some other suggestions take the existing demand into account, and focus on either flooding the market with the existing stocks of horns held by conservation authorities, or by supplying the market with fake or contaminated horns. A controversial method has been attempted in the Damaraland region of Namibia, where live black rhinos have been dehorned (Montgomery 1989a). This project, called "Operation Bicornis", has been labelled as a "desperation move" and has been criticized for several reasons.

The operation is quite costly and complicated and exposes the rhinos to a potentially fatal situation. Furthermore, the effects of the loss of horns on rhino behaviour are unknown. It has been suggested that there may be greater exposure to predation by hyenas, or death in territorial disputes with other rhinos still possessing their horn.

Finally, it is only possible to remove roughly two thirds of the weight of the horn off a live rhino, and the horn grows back at a rate of 6 centimetres a year. Since rhino calves are known to have been shot by poachers, it is uncertain whether dehorning will act as an effective deterrent for any length of time.

Despite all the criticism levelled at the project, it appears to have been successful up to the time of writing (Pauw 1990). It should also be noted that the Damaraland region is more suitable for this kind of project than other areas because of its open terrain (Montgomery 1989a, 231-233).

Martin and Vigne (1988, 23) have observed that the rhino horn trade is still flourishing. In 1989 there were numerous incidents of poaching in Zimbabwe (Masland 1989), Namibia (Montgomery 1989a), Swaziland (L'Ange 1989) and South Africa ("27 Rhino" 1989). The situation does not appear to be improving significantly. A number of sources have suggested that the only solution to the problem would be the commercialization and privatization of the industry (Fiske 1988; Masland 1989; Mentis 1989; Louw 1989).

Private ownership serves as an incentive for protection. It also serves to establish

legitimate markets that prevent the uncontrolled exploitation of resources. The present laws and regulations governing the industry offer little incentive for anyone but the staunchest conservationists to take effective action that would lead to a significant increase of live rhinos in their habitat.

Thus, current public sector policies are in many cases exacerbating the problem by interfering with natural economic processes, while the public sector could achieve its objective of saving rhino species and subspecies from extinction simply by allowing and encouraging greater private sector involvement in the rhino industry.

3 PROPERTY RIGHTS

It is a conventional wisdom of modern economic theory that any analysis of social problems relating to scarce resources would benefit greatly if the structure and nature of property rights in the relevant society were taken into account (Alchian and Demsetz 1973, 16-17). Particular property right structures have certain consequences for social interaction, and an examination of these often proves worthwhile, as it does in the case of the rhino problem.

In treating rhinos as "property", however, it is first necessary to have a clear understanding of the property rights concept. As Friedman (1973, 3-4) points out, it is important to distinguish between the rights of property and the rights to property. The former approach is one adopted by some conservationists and animal rights movements, who would assert that rhinos have a right to live. This is not the approach used in my analysis.

According to Alchian and Allen (1972, 142) property rights are actually human rights to the use of goods, and my approach thus examines the rights of humans to the use of rhinos. I consider this approach to be relevant in seeking a solution to the problem, as it is humans who control the rhino's destiny. Whether rhinos should have any rights themselves or not is a moral issue which is irrelevant for the purposes of this report.

Alchian (1987, 1031) defines a property right as "a socially enforced right to select uses of an economic good". An economic good is

> (A)nything, whether a physical commodity or service, which yields utility and which could command a price if bought or sold on a market (Bannock, Baxter, and Rees 1984, 137).

This is contrasted with a free good - any good that is not relatively scarce and therefore does not command a price. Air and seawater are often given as examples of free goods.

Rhinos clearly fall into the category of economic goods, since they are scarce and do provide utility (to tourists, hunters and rhino-product consumers alike). Some rhinos are bought and sold on the market, as are their products, and do command a price. Having established this, it becomes necessary to examine the consequences of certain property rights arrangements with respect to rhinos.

The significance of property rights was brought to the attention of many economists by Ronald Coase in his journal article entitled "The Problem of Social Cost". Coase's proposition, now widely accepted, was that in any situation of conflict between two parties with predetermined property rights, the solution of the conflict reached between the two parties would always be socially optimal (in economic terms), provided that market transactions were costless (Coase 1960, 15).

In other words, the value of production would always be maximized where there was conflict between two parties, because the parties would bargain until an optimal solution was reached. The only reason why socially optimal solutions were not always reached, was because of so-called "transactions costs", costs involved in the bargaining process such as those of acquiring information, negotiation, contracting, and policing and enforcing contracts. The existence of such costs prevents many transactions from being carried out.

Many social arrangements do not provide an optimal allocation of resources; for this reason it is necessary to examine the nature of property rights. An initial delineation of property rights can lead to

certain economic behaviour which may not be socially optimal, because transaction costs can impede a market solution.

In order to move closer toward an optimal solution, it may be necessary either to reduce transactions costs or to alter the structure of property rights. Coase (1960, 44) appealed to economists to take into account the total effect of different social arrangements.

Ownership and Invasions

Ownership is simply the placement with a person (or persons) of a certain group of rights to property: the rights of possession, use and disposal of worth (Harper 1974, 18). As Alchian and Demsetz (1973, 17) note, a resource is incapable of being owned itself; it is only "a bundle, or a portion, of rights to use a resource that is owned". These rights are always circumscribed, usually by a prohibition on certain actions. The strength of any ownership right "can be defined by the extent to which the owner's decision over how a resource shall be used actually determines its use".

According to Alchian (1987, 1031), the strength of a property right is measured "by its probability and costs of enforcement which depend on the government, informal social actions, and prevailing ethical and moral norms". Closely, but not always, related to the strength of rights, are their exclusivity and transferability. These two factors are regarded as essential determinants of the nature of ownership. Private property is characterized by the possession of exclusive rights which are voluntarily exchangeable (Alchian and Allen 1972, 142).

Not all property is owned privately; much is owned collectively or publicly, frequently by government. The nature of ownership is often governed by characteristics of the property in question, but not necessarily so. Public ownership may be conferred on certain rights which are quite capable of being owned privately, but are not, simply because of certain historical precedents or prevailing social norms. Any infringement upon property rights constitutes an "invasion". (Dolan 1974, 210). Invasions of private property include destruction, trespassing and theft. These are more likely to occur when property rights are weaker. Invasions of publicly-owned property could be reduced in certain cases by the creation of private rights, which are frequently afforded greater recognition by the law, and can thus be regarded as stronger.

As mentioned above, invasions in the form of poaching form the greatest threat to the rhino industry. Rhino poaching exists not only due to the lack of a legitimate market for horns, but also because of the very nature of the property rights to rhinos. In the first instance, ownership of rhinos often tends to be of such a nature that incentives to protect them are not directly related to their value (I discuss this point in greater detail below). Secondly, the protection of rhinos is an expensive activity in itself, in other words ownership of rhinos is subject to a high policing cost.

The traditional method of dealing with invasions, has been to subject the responsible party to a penalty. The imposition of fines and prison sentences, however, has not brought an end to rhino poaching, and is an unsatisfactory method of dealing with the problem, for several reasons. First, poachers need to be arrested, and many manage to avoid being caught. Secondly, when they are caught it is usually too late to save the rhino, since it has already been killed, and thirdly the punishment imposed on poachers who are caught generally acts neither to compensate society adequately for the loss, nor to discourage poaching sufficiently. I elaborate on this point in the next chapter.

To effectively eliminate poaching, one must address its root causes. In the case of rhino poaching, it is necessary to examine the implications of the current property rights structures in the industry.

The Reciprocal Nature of Rights

Demsetz (1967, 347) notes that "property rights convey the right to benefit or harm oneself or others", and Coase (1960, 2) raises some important issues with regard to the right to inflict harm. As he points out:

> The traditional approach has tended to obscure the nature of the choice that has to be made. The question is commonly thought of as one in which A inflicts harm on B and what has to be decided is: how should we restrain A? But this is wrong. We are dealing with a problem of a reciprocal nature. To avoid the harm to B would inflict harm on A. The real question that has to be decided is: should A be allowed to harm B or should B be allowed to harm A? The problem is to avoid the more serious harm.

This analysis can be applied in the context of the rhino problem, where the traditional approach adopted by conservationists is that it is the consumers of rhino products that are inflicting harm on owners of rhinos, be they private or public, and all attention is focused on restraining consumer markets. But these actions inflict harm on the consumers by depriving them of the right to purchase these products, and for the greater part of the Asian market, this amounts to a denial of the right to obtain a basic pharmaceutical remedy.

It has been argued that scientific evidence indicates that the fever-reducing qualities of rhino horn are minimal to nonexistent, but this is irrelevant for the purposes of this analysis. What is relevant is the perception of Asian consumers, as it is this that influences their buying behaviour and demand for rhino horn.

The question that must be asked in this instance, is whether rhino producers should prevent their products from reaching consumers or whether consumers should be allowed to obtain them. In the case of the latter option, it should be noted that consumers using products for medicinal purposes are likely to be equally concerned about the extermination of rhinos, as this would lead to an end of their supply of horn, thus harming both parties. The obvious solution is to supply consumers on a renewable and sustainable basis - this would avoid the more serious harm, and both parties would benefit.

The first step toward the elimination of rhino poaching, would be to allow a legitimate market for rhino horn, thus obviating the necessity to acquire horn by poaching. It is worth asking why this solution is currently not being pursued by decision makers. I return to this question later.

It is unlikely, however, that this action alone would prevent poaching; it is also necessary to examine the incentives created by relatively weak property rights combined with high policing costs. Since the reasons for rhino poaching flow mainly from the nature of certain property rights arrangements, I now turn my attention to some of their features.

Implications of Certain Social Arrangements

What incentives are created by various social arrangements and their concomitant property right structures? This question has received much attention by economists in recent years and the two factors of importance would seem to be the exclusivity and the strength of rights. It is widely accepted that private owners "have strong incentives to use their property rights in the most valuable way", and that a diffusing of ownership leads to incentive problems (Alchian and Demsetz 1973, 22).

Common property resources are often subject to "free-rider" abuse (Miller and Meiners 1986, 608). Individuals make independent decisions regarding their use of the resource without considering the consequences for others, often resulting in overexploitation of the resource. This is the well documented "tragedy of the commons" (Hardin 1968, 1244). Although some of the assumptions made in Hardin's original formulation have been criticized (Dasgupta 1982, 13-14), it is generally accepted that extinction of a species is most likely when a resource is common property (Fisher 1981, 86).

Alchian and Demsetz (1973, 22-23) provide an effective analysis of the situation:

> Under a communal right system each person has the private use of a resource once it is captured or taken, but only a communal right to the same resource before it is taken. This incongruity between ownership opportunities prompts men to convert their rights into the most valuable form; ... into resources owned privately.

Private rights provide protection of animals whereas communal systems encourage their exploitation. Block (1990, 307) contrasts the fate of two biologically similar animals, the domestic cow and the American buffalo (bison) to illustrate this point. While it is almost unthinkable that the domestic cow could ever be threatened as a species, "it is only fortuitous that the buffalo - which for many years was allowed to run free, unowned by man - was saved from extinction".

It is useful to distinguish between resources which are common property by virtue of their nature and those which are owned in common simply because of prevailing social norms. The former are often referred to as "collective" or "public" goods. The term "public" has created some confusion, as it is frequently assumed that it implies public or government ownership, but this is incorrect. Such goods can be privately produced or owned.

Collective goods are characterized by the fact that there is an absence of exclusivity of property (Miller and Meiners 1986, 603); in other words the good can confer equal benefits on a number of people simultaneously. One person's use of it does not render it unavailable to others (Mishan 1981, 429). As Aronson (1985, 26) points out, "pure public goods" are an extreme case of absolute non-exclusion and jointness of consumption, and "pure private goods" are the opposite extreme of total exclusivity and single consumption. In reality most goods can be classified somewhere between the two extremes.

Dolan (1974, 210) classifies common property as either regulated or unregulated, depending on whether or not there is some sort of collective control and enforcement mechanism regulating resource use. Intuitively, it is unregulated common property that is most vulnerable to overexploitation, followed by regulated common property and then by private property.

An examination of the disappearance of the rhino populations in countries to the north of South Africa reveals trends that confirm this theory. The first populations to disappear are usually those in unprotected areas, followed by those in National Parks where there is at least some measure of control. Chilvers (1990, 17) points out that current measures used to protect rhinos in Kenya and Zimbabwe involve relocation to smaller patrolled sanctuaries, "safer" parks and private lands.

It is worth noting that the effectiveness of regulated common property institutions depends not only on size and security of land areas, but also on factors such as incentive structures within management and the strength of property rights. Where efforts to protect common property do not enjoy the full support of government, they are less likely to be successful. Masland (1989) notes that antipoaching efforts in Zimbabwe are subject to such problems, with rangers often facing harassment from local police.

The significance of property rights has been understood by some conservationists. Thomson (1986, 155), for example, recognizes that "(T)he people who use a natural resource are those most concerned about its proper management". This conventional wisdom has been applied to several conservation problems in Southern Africa, with considerable success.

A notable case is the Endangered Wildlife Trust's Auxiliary Game Guard Project to save threatened wildlife species, including black rhinos, in Northwestern Namibia (Weaver 1989, 14-20). This project has resulted in the successful conversion of poachers to game guards simply by altering their perception of property rights. Local tribes' attitudes toward wildlife changed once they perceived the wildlife as their own property which could directly benefit them.

Perceptions of the nature of property rights can have a profound effect. Alchian and Allen (1972, 141) assert that where property rights in goods are weaker, ill defined or vague, such goods are likely to be less attractive and subject to "lower offers and bids". The recognition of this fact is extremely important - the stronger the property rights in (live) rhinos, the more attractive they are likely to be as property, and the higher their values are likely to be to owners. An increase in the strength of property rights to rhinos is thus desirable. To consider how this could be achieved, it is necessary to examine the current legal status

of property rights to South African rhinos.

The Legal Status of Property Rights in South Africa

The present legal status of property rights to game, has been a recent focus of the South African Law Commission (SALC). According to the Commission, "game farming has in recent times developed into a very promising branch of agriculture", with the single greatest problem encountered by farmers being the theft of game (SALC 1989, 2). The Commission is critical of the present legal status of ownership rights to game under the Common Law.

The nature of rights over wild animals under the Common Law is dealt with by van der Merwe (1987, 133) as part of "The Law of Things". Any wild animal in South Africa is regarded as a *res nullius*, or "unowned thing". This means that a wild animal is incapable of being owned unless it is subjected to *occupatio* by some person. In practice, ownership can be claimed over a wild animal if it is killed, captured or domesticated.

Van der Merwe (1987, 133) lists three requirements for occupation. First, the object of occupation must be a *res nullius*, but one capable of being privately owned. Secondly, the acquirer must have *animus domini*, the intention to be the owner of the thing; and thirdly, the acquirer must exercise the necessary physical control over the thing. Any wild animal which has been captured, regains its natural state of freedom once it escapes and is no longer in sight, or is still in sight but difficult to pursue. Tamed animals regain their natural state of freedom as soon as they lose the habit of returning to their former owners (van der Merwe 1987, 133).

The nature of legal rights over wild animals under the Common Law described above, has existed historically for several centuries, and has its roots in Roman Dutch Law. Before the advent of game reserves and game fences, wildlife was effectively an unregulated common resource. Predictably, this led to mass extermination, and the extinction of several species.

This state of the law resulted in the capture and breeding of certain species with high commercial values. These tended to be species which could easily be kept within the confines of a small area and thus protected from theft, such as ostriches and crocodiles. It is worthwhile noting that, far from threatening these animals with extinction, their commercialization actually guaranteed their long term survival.

Species such as rhinos and elephants presented some difficulty because of their size and the nature of their space and food requirements. In addition, their relative abundance in the rest of Africa lowered their value, and therefore detracted from their commercial viability. The significant drop in rhino numbers in recent years, has increased their value and rendred them a commercially attractive resource. Despite this, production of rhinos on a scale similar to that of ostriches and crocodiles has not taken place.

The South African Law Commission (1989, 5) notes that farmers have often experienced problems in proving ownership of game. There appear to be some contradictory opinions in the literature on the issue of poaching, but most writers argue that the unlawful taking into possession of wild animals does in fact result in acquisition of ownership. Thus, as a consequence of the Common Law, a person can become the legal owner of a wild animal by *occupatio* even when that possession is taken on someone else's land (SALC 1989, 9). This implies that a landowner may be unable to institute an action for damages against a poacher for the loss of game.

Two cases illustrate some of the practical problems experienced in the past. In *Richter v Du Plooy* [1921 OPD 117] (SALC 1989, 15), a farmer hand-reared six wildebeest, which he then released onto his 800 morgen property. The wildebeest subsequently wandered onto the land of a neighbour who shot two of them, chasing away the others. The owner was unsuccessful in his claim against the neighbour.

In *Lamont v Heyns* [1938 TPD 22] (SALC 1989, 16), the facts of the case were slightly different. The farmer bred blesbuck which he allowed to roam in a 250-300 morgen enclosure. The court held that an intruder on the property who shot several

blesbuck, was guilty of theft. One of the main reasons given for this decision, which was contradictory to the decision in the previous case, was the smaller size of the enclosure. The Commission (SALC 1989, 3-4) indicates that legal remedies granted to farmers for theft of game are weak. Any farmer able to prove possession is entitled to apply to the court for compensation of not more than R5,000 in a magistrate's court, or R20,000 in a regional court. There is no onus on the court to bring this fact to the farmer's attention, and most farmers do not seem to be aware that this measure of relief exists. Aside from this remedy, a poacher can be convicted for violating a provincial conservation ordinance. In the Transvaal, the maximum penalty for violating an ordinance is a fine not exceeding R1,500, or eighteen months imprisonment.

Neither of the above remedies offer just compensation for the loss of a rhino worth at least R30,000. Since most landowners allow their rhinos to roam in fairly extensive areas, they would have some difficulty in proving ownership, because of the precedents set in the case law. They would therefore be unable to claim any damages against poachers, who could only be convicted for the violation of an ordinance.

It appears that some ordinances are in the process of revision and that there is a general move to increase penalties for certain violations of environmental legislation. The fact that these regulations may vary depending on which province the land happens to be in, as well as whether the area has a particular conservation status or not, only serves to complicate the whole legal issue. Furthermore, as the South African Law Commission (1989, 28) points out, adjustment of the ordinances "can hardly be regarded as a solution to the problem of theft of game".

The present state of the law has created significant incentive problems for landowners. As an illustration of these, consider the case of X, a game rancher purchasing a rhino. Once the rhino is allowed to roam free, the strength of X's rights are limited. In the event of the rhino wandering on to neighbour Y's property, Y could claim possession by shooting it. X may have recourse to the law if the rhino was originally released into a relatively small enclosure, but proving ownership may be difficult, especially if Y is also in the business of breeding rhinos.

In practice, there have been cases where wandering white rhinos have been chased back onto their owner's property by obliging neighbours. It should also be relatively simple for X to indicate intention of ownership by placing an identifying mark on each rhino (e.g. by using a brand). X may not want to do this for aesthetic reasons, but there are likely to be other acceptable means of legitimately identifying rhinos as private property - they just need to be recognized by the law.

The South African Law Commission (1989, 28-9) discusses proposed amendments to the present status of ownership rights to game. One suggestion is that all wild animals could be awarded to the state, who would then transfer ownership to any "persons displaying an exceptional interest in and willingness to conserve wild animals on their land", by making use of a permit system. The preferred suggestion, however, is that the Common Law should be amended so as to allow traditional private law remedies such as vindicatory action (recovery), possessory interdicts and action for damages, thereby assisting owners in the protection of their property.

The Commission (SALC 1989, 48-9) goes on to describe the details of its proposed amendments. It recommends that a general measure be laid down to establish whether a person exercises sufficient control over a game to be regarded as its owner, that ownership of unlawfully caught game should not be transferred to the thief, and that loss of possession should not denote loss of ownership. In addition, any owner, lessee or occupier of land should be granted powers to search trespassers as well as seize stolen property under some circumstances.

Although the recognition of private property rights to game would improve incentives for private rhino owners, these rights would remain circumscribed by the CITES regulations. White rhinos may be bred and used for tourism and hunting, but owners are powerless to sell their horn on a legitimate market. Black rhinos pose an even

greater problem, as they may not even be used for trophy hunting. South African conservation authorities are adamant that all black rhinos should be bred for conservation purposes only.

The Rationale for Creating Private Rights

There could be some debate as to whether private property rights to wildlife should be recognised. As Dolan (1974, 209) points out, many environmental economists believe "that the various aspects of the natural environment should be viewed as multi-purpose, multi-user, natural assets, owned in common".

Is it necessary for wildlife to be owned in common? There are certainly some cases where private ownership becomes virtually impossible. If one considers a migratory bird, such as a swallow, the difficulty becomes apparent. One could attempt to claim ownership of a nesting pair of swallows on private property, but as Colinvaux (1980, 153-7) points out, some birds are denied the opportunity to breed in certain years because of territorial limitations. To claim ownership of a non-breeding swallow that spends most of its time on the wing is certainly a daunting task.

In the case of rhinos, however, the situation is somewhat different. Confinement of any rhino to a particular area is a practical possibility. Furthermore, the rhino itself has the characteristics of a predominantly private good. It can be transferred from one owner to another and all products obtained from a dead rhino possess the feature of exclusivity.

Call and Holahan (1983, 452) make the valid observation that a single production process often gives rise to multiple outputs. This frequently results in jointness in production or consumption, which in turn can generate so-called "externalities". Externalities, or external effects, exist when certain activities result in costs or benefits that "spill over" and affect certain outside parties. Common examples of externalities are air and water pollution (as negative effects) and the benefits conferred to society by education and health services (as a positive effect).

Call and Holahan (1983, 455) argue that market failure occurs when joint production generates external benefits for which there is no effective demand. This takes place when exclusivity is absent from certain aspects of the production process, and this fact is often used as a rationale for public ownership. The jointness in both production and consumption of rhinos has been mentioned in the previous chapter. Although rhino goods possess the characteristic of complete exclusivity, other forms of value generated by rhinos do not. Could there be an argument for public ownership?

It is possible for several tourists to enjoy the benefit of rhino services at the same time, although the effects of crowding would effectively impose a limit on numbers. There is, however, one benefit that rhinos can theoretically confer on an infinite number of people, that of "existence value". This is the value which people place on merely knowing that rhinos exist.

Tourism is an industry which can be privately regulated, and with the exception of the positive externality of existence value, rhinos display characteristics of a private good. There does not appear to be a strong argument for public ownership of rhinos, yet in South Africa 82% of all rhinos are owned by state conservation agencies. This suggests that there is scope for improvement in the current situation through wider recognition of private rights in rhinos and an increased proportion of private ownership.

Apart from the fact that private rights offer greater incentives for the effective protection and management of property than do shared rights, they also form a crucial role in the functioning of the market mechanism. I discuss this relation between property rights and markets in the chapter on privatization, and now focus my attention on the way in which the market acts as a coordinator and regulator of resource use in society.

4 MARKET REGULATION

Economics is concerned with the problem of resource scarcity and satisfaction of human wants and needs. Alchian and Allen (1972, 3,

11) point out that resource scarcity is inevitable, because human wants are unlimited, and that this in turn implies that there must be competition for resource use in any society. The way in which these resources are allocated is determined by the type of social organization employed for the co-ordination of activities among individuals (Miller and Meiners 1986, 4).

Boulding (1978, 140) classifies types of social organization into three categories: the threat system, the exchange system and the integrative system. The exchange system forms the basis of most economic behaviour. Exchange takes place when all parties involved feel that they can benefit from it (Boulding 1978, 165). A market economy is an economic system characterized by voluntary exchange (Lipsey 1983, 60-1). Other economic systems may rely on various combinations of central planning, commands and votes to allocate scarce resources, whereas market economies achieve this through the price system.

Prices act as a social control mechanism by providing information, affecting incentives and thereby guiding the flow of resources to their highest valued use (Miller and Meiners 1986, 5). This market mechanism of resource allocation is not without its critics, and it is thus necessary to consider its possible shortcomings.

Social Welfare

> A central insight in microeconomics is that free exchange tends to move resources to their highest valued use, in which case the allocation of resources is said to be Pareto efficient (Cooter 1987, 457).

Pareto efficiency is said to occur when an allocation of resources is such that, when compared to any other allocation of resources, "all parties are at least as well off and at least one of them is actually better off" (Miller and Meiners 1986, 567). Pareto efficiency should be a desirable objective for any economic planner, because it implies maximization of social welfare.

An economy cannot meet the Pareto criterion unless the criterion of productive efficiency is also being satisfied (Hyman 1973, 14-15). Productive efficiency is accomplished when it is not possible to increase production of any good or service without reducing the production of some other good or service.

The Pareto criterion can be used to determine the efficient allocation of resources, but is incapable of offering a basis to compare situations that differ in terms of income distribution. The scope of this report does not extend to issues relating to initial income distributions, but Pareto efficiency in the rhino industry can be considered a desirable goal. This is because it is not only important that rhinos be allowed to survive in the wild, but also that humans derive the maximum possible benefit from this situation. It thus needs to be considered whether a Pareto optimal allocation of rhinos can be achieved through the market mechanism.

Market Failure

Does a system of "free exchange" always guarantee a Pareto optimal allocation of resources? This question has received the attention of many economists concerned with issues of social welfare. It is generally accepted that the market mechanism works efficiently under certain conditions, and less so when these conditions are not satisfied, in which case "market failure" could occur.

The existence of market failure is frequently used as a case for state intervention, although Wolf (1979, 107) argues that "this rationale is really only a necessary, not a sufficient, condition for policy formulation." Coase (1960, 18) believes that economists and other policy-makers have tended to overestimate the advantages of governmental regulation. Lipsey (1983, 467) also notes that the word "failure" tends to convey the wrong impression: "(M)arket failure does not mean that nothing good has happened, only that the best attainable outcome has not been achieved."

Market failure can be viewed in two different senses. Strictly defined, it refers to allocative inefficiency, but is frequently used to identify sources of distributional inequity (Wolf 1979, 110). My discussion shall concentrate on the alleged failure of the

market to achieve efficiency.

Wolf (1979, 108-10) considers three sources of market failure with respect to efficiency. The first is the existence of externalities and public goods. Most issues in this category are simply property rights problems, such as those discussed in the previous chapter. Externalities, absence of exclusivity and common property rights are all supposed to result in market failure.

It should be noted, however, that this type of failure usually exists because certain property rights are weak or poorly defined, a situation which can be rectified by the creation of recognized private rights. Since the creation and enforcement of property rights is the responsibility of government, it is worth considering whether it is correct to imply that the market has failed in such instances, rather than the government.

A particular case of the externality problem that has received much attention from conservationists as well as economists, is the question of transgenerational equity. This issue, which is one of both allocative efficiency and equity, arises out of the concern that the market does not take sufficient account of the needs of future generations (Borcherding 1990). Private discount rates are supposedly higher than social discount rates, leading to decision-making which is biased toward the present, rather than the future.

The second source of market inadequacy occurs where increasing returns to scale give rise to the existence of "natural" monopoly. Thirdly, there may be certain market imperfections, caused by a departure from the normal characteristics of perfect competition (Wolf 1979, 110). The model of perfect competition is a purely theoretical one, and in reality, all markets are "imperfect" in this sense, to at least some extent.

Miller and Meiners (1986, 314) list the four conditions under which a theoretically perfectly competitive market arises. They are product homogeneity, unconstrained resource mobility, large numbers of buyers and sellers, and perfect information. Under these conditions, no buyer or seller is able to influence price. Although prices are subject to some influence in reality, this fact only becomes of importance when distortions are large enough to have a significant impact on social welfare.

Hayek (1948, 92-106) criticizes the extent to which economists use the theoretical model of perfect competition to determine the effectiveness of competition in the real world. Miller and Meiners (1986, 315) make the observation that the perfect competition model is actually characterized by a lack of rivalry. This stems from the fact that it is a static model, but Hayek argues that competition should be seen as a process, and "we should worry much less about whether competition in a given case is perfect and worry much more whether there is competition at all."

The two sources of market failure relating to natural monopolies and market imperfections are both largely concerned with the ability of the competitive process to bring about the functioning of the market system. Where the process of competition is impeded, it is necessary to ask whether the market mechanism has failed itself, or whether there are other factors preventing efficient market solutions.

The ability of the market system to bring about Pareto efficient resource allocation is limited in certain cases. Where property rights are ill-defined and it is not possible to create specific and legally enforceable rights, the effectiveness of the market mechanism is reduced. Other imperfections are created when prices do not reflect true social values, and when competitive forces are inhibited.

Value and the Price System

According to Hayek (1948, 77-8), the economic problem of society is not merely one of how to allocate "given" resources, but rather "a problem of how to secure the best use of resources known to any of the members of society, for ends whose relative importance only these individuals know." In other words, it is a problem of the utilization of knowledge which is widely dispersed in society, and "not given to anyone in its totality". Hayek (1948, 84) notes that the most efficient way to deal with this problem, is to allow decentralised decision making, but that "the man on the

spot" requires additional information "to fit his decisions into the whole pattern of changes of the larger economic system".

Hayek (1948, 86) concludes that the price system acts as such a mechanism for communicating information, and asserts that it is important to understand this as its real function. The information content of prices can affect certain behaviour considerably, and when prices are distorted, this can have unfortunate consequences.

How are prices determined? Friedman (1986, 36) indicates that the market mechanism arranges a triple equality between price, the cost of production, and the value to the user. Market forces of demand and supply determine an equilibrium price at which the optimal allocation of resources takes place. There are two instances where prices cannot be considered equal to value; one is in the case of market failure, and the other is where intervention in the market system causes a distortion in prices.

Cottrell (1978, 4) describes two broad theories of value. One is the production theory of value, originally developed by the classical economists, including Marx. Marx asserted that the value of any product is equivalent to the value of human labour put into producing it. This theory has been recently been criticized as it suggests that natural resources have no value of their own. The production theory has thus been modified in recent years, and now asserts that the value of any good is related to the amount of energy consumed in its production.

The other theory is the consumer theory of value, according to which the value of a scarce resource is whatever a consumer is prepared to pay for it. Cottrell (1978, 6) considers that the consumer theory of value implies an intrinsic value of scarce resources and is therefore nearer to reality under present world conditions than the production theory. Resource economists extend the consumer theory of value slightly by taking externalities and future values into account.

Sowell (1980, 51) observes that value is ultimately subjective. It is not possible to objectively determine the value of any good or service in a laboratory experiment, nor can "any political or philosophical process" determine a real measure of worth. Value varies "not only from person to person, but from time to time with the same person, and varies also according to how much of the given good he already has".

The knowledge of changing values may be reflected by price changes in a market economy, and by voting changes or direct orders in other types of economies (Sowell 1980, 52). Values determined in non-market economies seldom reflect preferences of all consumers.

Cottrell (1978, 8) emphasizes the importance of pricing to reflect value, under all types of social arrangements:

> Whatever the form of the social solution, it has to be one that recognizes that the resource, being finite and exhaustible in extent, thereby has value and because of this must be priced, in some form or other, so as to restrict its consumption and to pay for its care and maintenance.

An examination of the rhino industry reveals certain discrepancies between pricing and value. It is only recently that white rhino prices have begun to reach realistic market levels, and the price-value relationship of black rhinos still remains something of an enigma. The reasons for these discrepancies are not hard to find. The rhino industry is characterized by intervention with market forces, leading to a distortion of prices. Additionally, there are certain natural market imperfections in the industry that deserve attention, but these form the lesser part of the problem.

What is the true value of a live rhino? It is indicated above that rhinos have certain value to various consumers of rhino goods and services. It therefore follows that a live rhino has a consumer value equal to the aggregate sum of its potential uses. Rhinos are capable of providing tourist and hunting services when alive, as well as certain goods once dead. The value of a live rhino could thus be expected to be higher than any one of the individual goods and services it provides. This value should be further enhanced by the fact that live rhinos have the potential to reproduce, leading to an additional increase in value.

In reality, prices of rhino horn and trophies have been notably higher than live

rhino prices, although the gap may be starting to close with the advent of the auction system. Whereas average trophy prices were six times as much as live rhino prices in 1982, in 1989, they were slightly less than double (See Appendixes 1 and 2). As subsidized prices have been phased out over the last few years, price increases have been dramatic.

Sowell (1980, 182-3) discusses the effects of price subsidies:

> Information about the availability of goods is distorted ... when the government subsidizes goods. Some of the people consuming a subsidized good would be unwilling to pay the cost of it if that cost were accurately conveyed to them in price. Instead, third parties are forced to pay the cost in taxes, regardless of their evaluation of the good and even regardless of whether they ever used it.

Subsidizing live white rhino sales has distorted the information content of prices. By being able to pay such low prices, private landowners could have been led to believe that rhinos were in greater supply and more easily obtainable than they actually were. As a result, rhino owners may not have exercised as much care in managing their populations as they might have done if they had paid higher prices. Furthermore, they may have had the impression that rhinos would be in reasonably endless supply, and could therefore be replaced if used for hunting.

Sowell's discussion on subsidies suggests that there may be excess demand for a subsidized good. The Natal Parks Board previously used a waitlisting system to allocate white rhinos. According to Meiklejohn (1989), in September 1989 there were 145 names on the standby list, with applications for over 1,200 rhinos. The supply for 1990 is unlikely to exceed 150 animals. Clearly, there is excess demand, which would be corrected by the auction system. Rhinos would be awarded to those landowners who are able to put them to their highest valued use.

It could be argued that if private owners were to put rhinos to their highest valued use, they would probably have them killed to remove and sell the horn. In my opinion, this view is incorrect for two reasons. First, it is not necessary to kill a rhino to extract its horn. Fiske (1988) notes that it would be possible to cut the horns of a live rhino every second year, which would yield a reasonable harvest. Rhinos could be used for horn production purposes for the greater part of their lifespan, after which the horn could be allowed to grow for trophy purposes. This could coincide with continued breeding.

Secondly, under present circumstances, rhino owners would need to engage in black-market activities to sell the horn. The difficulty and risk associated with this would act as a strong disincentive. On the other hand, if the sale of rhino horn was allowed on an unregulated basis, the price would probably drop. This would reduce the incentive to kill rhinos possessing potential for breeding and other uses.

Friedman (1986, 457) explains why illegal markets give rise to higher prices. As a first reason, "(W)hen one input to production is eliminated, substitutes become more valuable"; thus when the legal production of horn is stopped, the alternative method of poaching has to be employed, and therefore yields higher rewards, while pushing up costs. Secondly, "handling of information" also becomes more costly because of the risk of detection. This implies that in order for African rhino horn to reach its destination in Asia, it may have to pass through the hands of more middlemen than would normally be the case, and that additional expenses would need to be incurred to acquire black market information. These factors would tend to create abnormally high prices.

Under a system of market-regulated pricing, it is likely that prices of live rhinos would increase, and that prices of rhino horn would drop somewhat. With no inappropriate government interference, any inability of the price system to prevent the continued exploitation of the rhino would arise out of certain imperfections inherent in the rhino market itself.

Baumol and Oates (1979, 119-20) describe some situations where prices do not reflect true social values. One instance is where an individual may view an investment as a greater risk than society would, and is discussed below under the section on

extraction and investment decisions. The second relates to certain externalities, an important aspect in the issue of rhino conservation. Rhinos may have existence value to certain persons who are not users of rhino goods and services.

One can distinguish between the present intangible benefits people derive from rhinos, and those values that future generations may obtain. In the case of the former, "armchair conservationists" are likely to derive a certain amount of pleasure simply from the knowledge that there are still rhinos living somewhere out in the wild. It is very difficult to measure the exact value of a rhino to such a person, although the total of all contributions made to wildlife conservation charities may indicate the aggregate values.

It is also possible for rhinos to have negative existence values. A rural peasant may regard wild rhinos as a threat to safety, or may perceive them as the property of a "tourist elite", usurping potentially valuable agricultural land. Owen-Smith (1987) indicates that such negative existence values are indeed prevalent in many rural communities. Thus, in countries where rural peasants outnumber armchair conservationists, aggregate existence values are likely to be negative (i.e. in all African countries).

Existence values to future generations are also termed "options values". The importance of conserving biotic diversity for future generations is a subject of constant concern to conservationists (Huntley 1989). It is considered desirable to maintain the widest possible diversity of species and intraspecific varieties. While it is obvious that the prevention of the extinction of any species is desirable, it is not clear to what extent such diversity needs to be maintained within a species.

Anderson (1983) discusses the points of view of two different authors on the subject of genetic conservation in rhino populations. One author believes that the minimum size of a population that is to be viable in the long term is 500 individuals, whereas the other regards fifty adult pairs as being sufficient. It appears that certain conservationists are sceptical even of the higher estimate, and believe that a total population in excess of 2,000 individuals is desirable (Brooks 1989).

The question of genetic diversity within both rhino species and sub-species seems to be important, but to what extent, is not known. It appears to be virtually impossible to determine the exact minimum size of a genetically safe population, thus impeding the ability of the price system to clearly reflect the value of genetic diversity. This highlights the problem of imperfect knowledge inherent in the price mechanism (Baumol and Oates 1979, 120). The price system is thus, likely to improve upon, but not completely resolve, the issues currently of concern to conservationists.

Competition

McNulty (1968, 639) observes that the principle of competition is "so basic to economic reasoning that not even such powerful yet diverse critics of orthodox theory as Marx and Keynes could avoid relying on it". As indicated above, the existence of competition is inherent in a society of limited resources and unlimited wants. Furthermore, competition is the driving force behind the market mechanism. When economists refer to market forces, they are in fact referring to a product of the competitive process.

In competitive markets, producers that choose the best combination of output qualities, quantities, and price will survive, forcing other producers to imitate if they also wish to survive (Miller and Meiners 1986, 414). This state of affairs is analogous to the biological maxim of "survival of the fittest". This mechanism is, however, unable to function efficiently when entry into the market is restricted. As Miller and Meiners (1986, 343) point out, "we usually define a competitive industry in terms of conditions that mean the lack of control over price". Those conditions are met by "the freedom of any firm to enter into or exit from the industry".

Microeconomics textbooks frequently compare the two theoretical extremes of competition, perfect competition and pure monopoly (Miller and Meiners 1986, 377-81). Neither model provides an accurate indication of situations commonly found in the real world. Baumol (1982) proposes that

instead of using the model of perfect competition, which is a given static market structure, economists should examine the potential threat of competition in a given market structure.

This notion of "contestability" can be used to evaluate the potential of competition as a regulating force in any market, irrespective of the number of producers. The key to determining contestability is ease of entry and exit. A realization of this fact has led to a fairly substantial body of literature on so-called "barriers to entry". Unfortunately, as Fisher (1979, 23) remarks, "the analysis of barriers to entry is ... the single most misunderstood topic in the analysis of competition and monopoly". He points out that true barriers to entry exist only "when entry would be socially beneficial but is somehow prevented".

Rice (1987, 23-9) examines some of the literature on barriers to entry, and makes an observation similar to that of Fisher. According to these authors, the relevance of examining barriers to entry must stem from the fact that they have an effect on social welfare and efficiency. Any "obstacles" to entry such as high initial capital requirements, the reputation or superior efficiency of established competitors and product differentiation, are not "barriers" that need be of any concern. They are faced by all producers seeking to enter an industry.

Obstacles that are not inherent in the nature of an industry are created when producers enjoy legal protection against competition. Leach (1989) highlights the distinction between legally protected industries and those that are simply subject to market regulation. He considers that monopolies can be classified either as statutory or market share monopolies, depending on whether they receive any state protection or not.

Market share monopolies are subjected to at least some threat of entry, and are therefore not able to exercise as much market power as the textbook monopoly model might imply. An exception to this case would be the existence of a natural monopoly, where it may not be feasible for a competitor to enter the industry. This situation would occur where a particular market is best served by a single producer (Leach and Vorhies 1989). On the other hand, statutory monopolies are legally protected against entry, and are thus able to use their monopoly power to adjust output and price levels to their advantage.

The only types of entry barriers that should be of concern to economists are those that deliberately impede market forces. Legal protection against competition would appear to be unjustified in most, if not all cases. The existence of a natural monopoly may provide grounds for some sort of government intervention, but does not justify any protection against competition.

The rhino industry is certainly not a natural monopoly. The South African Law Commission (1989, 6) notes that there are 1,100 game farmers in the Transvaal alone. Buys (1987) reports over ninety privately owned white rhino populations in South Africa. Even the black rhino population in this country is divided amongst several different conservation agencies within the public sector.

The control exercised over black rhino populations in South Africa by the public sector amounts to a statutory monopoly in the form of a state supported cartel. There are certainly barriers to entry created by the unwillingness of the state agencies to sell black rhinos to private individuals, and by the restrictions imposed by CITES and various conservation authorities on the transportation and trade of these animals.

Although the rhino horn market is presently illegal, the state agencies have the potential to create a statutory monopoly in the trade of horn, with barriers to entry of a similar nature to those above. Although the public sector does not have exclusive control over the white rhino market, it does own some 80% of the South African population, and would therefore be able to exercise at least some power over the entire industry within the country.

Is the extent of state involvement and monopoly power in the rhino industry at all significant? The possession of monopoly power allows producers to vary both output and prices. The traditional model predicts that monopolistic producers will increase prices and decrease output levels relative to competitive industries (Miller and Meiners

1986, 380). Since state conservation agencies have not traditionally been involved in profit seeking activity, excessive prices have not been charged. As I have mentioned above, prices charged for live white rhino have in fact been too low in relation to market-determined prices.

In the case of output, it must be noted that rhino production can only be performed by rhinos themselves. Rhino "producers" are only responsible for managing the production process to ensure that it takes place as efficiently as possible. Thomson (1986, 186-96) suggests that black rhino production in Southern Africa has not been particularly efficient in the past, and that some populations are known to have actually decreased quite substantially. Anderson (1983, 48) notes that from 1970 to 1983 the white rhino population could have theoretically increased to 7,250 individuals, but in fact only reached 4,000. (There were 5,000 at the time of writing).

As Buys (1987) has pointed out, white rhino numbers have been adversely affected by the actions of the private sector. But it is incorrect to attribute sub-optimal population increases to private sector activity alone. If Vincent (1969) is correct in estimating the Umfolozi white rhino population at 650 individuals in 1960, and Anderson (1983, 47) is correct in estimating a potential 10% growth rate, numbers could have been increased to in excess of 11,000 at the time of writing. It is certainly true that many white rhinos have been shot for trophy hunting, but under efficient management it is not necessary for this to have any impact on breeding rates. Surplus males and older non-fertile individuals could be used for hunting.

An increase in competition would be most likely to lead to the more efficient production of rhinos, as well as price levels that would provide a more accurate reflection of market conditions. Although the white rhino market is already quite competitive, the black rhino market is effectively a statutory monopoly. Allowing competition in this sector of the industry can be desirable.

While increased competition is likely to result in more efficient production, it is also likely to result in more efficient use. Many conservationists may be concerned that this would mean a greater exploitation of rhinos for trophy hunting and other rhino goods. To establish whether private owners are likely to produce more live rhinos or not, it is necessary to examine the types of decision-making processes employed by a rational investor.

Extraction and Investment Decisions

Resource economists have developed rigorous models for optimal extraction of both renewable and non-renewable resources. Any renewable resource is capable of being harvested on a sustainable basis at an optimum rate. Hartwick and Olewiler (1986, 243-87) show that if the reproductive and growth characteristics of a species are known, it is possible to determine an optimum harvest rate under various conditions, using mathematical methods. The maximum sustainable yield of most animal species is achieved at a population level significantly lower than the carrying capacity of their habitat.

It is thus possible to calculate the socially optimal rate of resource extraction, but in practice, private decision makers are likely to perform different calculations. To demonstrate the way in which the private decision-making process may lead to results diverging from the social optimum, I consider the cases of three separate individuals involved in the rhino industry. The first is a rhino horn trafficker, the second, a poacher, and the third, a game farmer contemplating an investment in white rhinos.

I assume that the rhino horn trafficker purchases horn from poachers, and then smuggles it out of Africa and into Asia, where it is sold to a local dealer. I also assume that rhino horn smuggling is a competitive business, which is openly contestable (apart from the fact that it is illegal).

The trafficker is in a similar position to any person faced with a decision of optimal resource extraction. Since the rate of extraction is partially determined by the rate of production as well as market structure, it is important to take these factors into account. It is worth noting that the current rate of rhino production has been

significantly lower than the extraction rate for at least the past thirty years, and that the market is quite competitive, with many different poachers and dealers involved.

The trafficker's position can thus be likened to that of a miner, extracting a non-renewable, common property resource. Solow (1974, 4) describes how the optimal extraction of non-renewable resources could take place. Extraction would take place at the least costly source first, until it is exhausted. The next least costly source would then be used, and this process would continue until the resource is completely exhausted. As the resource becomes scarcer, however, its net price would rise exponentially; extraction would become more expensive, and therefore gradually slow down.

An examination of past trends of rhino horn extraction reveals a similar pattern. Less secure (and therefore less costly) sources of horn have tended to be exploited first, followed by better protected sources. Prices have also experienced the forecasted dramatic increases. The trend is reflected by the observation of Martin and Vigne (1988, 23), that Taiwanese are starting to buy rhino horn for investment purposes.

If this current trend continues, one could expect prices to rise and extraction to continue at a decreasing, yet persistent rate, up to the point where rhino extraction costs exceed the benefits, and the demand is choked off to zero (Solow 1974, 4). Whether this cessation of demand would occur at a population level above the critical species minimum, would depend on the opportunities faced by the trafficker.

The trafficker would consider the potential cost and benefits, and weigh these up against the risk of getting caught. It is crucially important to comprehend the relationship between these factors. A high penalty might be insufficient to discourage illegal dealings if the risk of detection is low.

As an example, the trafficker may be able to purchase horns from an African poacher for R2,500 each and then sell them in Hong Kong for 20,000 US dollars (about R50,000). If additional transport expenses of R10,000 (a liberal estimate) were incurred, four horns could yield a profit of R180,000. If the fine for smuggling was R100,000 per horn, one might expect this to act as an adequate disincentive to any trafficker; yet if the probability of detection is reasonably low, the penalty could be wholly inadequate.

Smuggling rhino horn need not be a particularly challenging task. Since horns are not excessively bulky, and can even be cut into small pieces or ground into powder form, it should be a relatively simple exercise for a professional smuggler to move a package of four horns across borders (Lategan 1990, interview). If the trafficker reckoned with a 10% chance of getting caught, the options faced would be as follows:

OPTION 1
Do not attempt the deal; no net gain or loss.

OPTION 2
Attempt the deal, in which case there may be one of two outcomes:

A Success (Probability = 0.9); gain R180,000 or

B Failure (Probability = 0.1); lose R400,000.

Brealey and Myers (1984, 209-13) demonstrate that, given the above variables, the better option can be determined by using decision tree analysis. Using this technique, the expected net gain under option 2 is:

(0.9 x R180,000) - (0.1 x R400,000) =
R162,000 - R40,000 = R122,000

Under the above circumstances, it is most worthwhile to attempt the deal. This example should demonstrate the importance of the trafficker's expectations of getting caught.

The same analysis can be applied to the alternatives faced by a poacher. If the poacher is an employee of a game reserve (as is frequently the case), the direct cost of poaching may be virtually zero. If the horn could be sold for R2,500, the fine for poaching is equivalent to R50,000 per rhino, and the probability of getting caught is estimated at 2% (inside information reduces the chance of detection), the options faced would be:

OPTION 1
Do nothing; no net gain or loss.

OPTION 2
Attempt poaching one rhino, which could result in:

A Success (probability = 0.98); gain R2,500 or

B Failure (probability = 0.02); lose R50,000.

The expected net gain under Option 2 works out to R1,450. If the probability of failure was increased to 5%, however, there would be an expected net loss of R125. A slight increase in the risk of detection could have a more profound effect than a large increase in the penalty for poaching.

In an extreme case where a rural peasant's family is faced with starvation, even the risk of the death penalty is an insufficient deterrent. If the peasant manages to poach one rhino, the entire family could possibly receive the equivalent of a year's income. If this attempt is not successful, the remainder of the family may still have a chance to survive. In this instance, the risk of getting shot would have to be at least greater than 50% to act as a significant deterrent.

The incentives to engage in poaching and smuggling activities are great, as long as the probability of detection is low. Increasing penalties for these activities is a relatively ineffective method of tackling the problem.

In the above examples, I only consider the penalty of a fine, to demonstrate the effective choice that has to be made. It should be noted, however, that as fines are raised to higher levels, most offenders would be unable to afford them, and would therefore be subjected to prison sentences. This may not be a daunting hardship to a hungry peasant, and ultimately society may have to bear both the loss of a rhino and the costs of a prisoner's maintenance.

Apart from the financial incentives to engage in illegal dealing, both the rhino horn trafficker and the poacher are faced with the fact that, on the black market, rhinos amount to common property. As Mentis (1989) aptly points out, "if Sam doesn't bag the rhino today, Ahmed will tomorrow". There are thus not only incentives to poach rhinos and sell their horn, but also incentives to do it sooner rather than later. Under the present circumstances, pressure to poach vulnerable rhinos is considerable.

If illegal participants in the rhino industry have incentives to extract rhinos as quickly as possible, why should any private investor not do the same? Intuitively, the first reason must be related to the nature of private rights vis-a-vis common property. Private investors bear the loss of a rhino as an additional cost, whereas poachers do not. Whether the loss of the value of a live rhino is a sufficient deterrent or not, depends on certain other factors, which deserve serious consideration.

My discussions on value have, up to this point, largely ignored the time value of money. However, as Brealey and Myers (1984, 11) point out, "(A) dollar today is worth more than a dollar tomorrow, because the dollar today can be invested to start earning interest immediately". For this reason, it is necessary to discount future values, using an appropriate rate, in order to determine their present values.

The discount rate used often has a critical effect on investment decisions. Brealey and Myers (1984, 12) suggest that an assessment of any potential investment can be effectively performed by the determination of its "net present value" (NPV). This net present value can be calculated by subtracting the required investment sum from the present value. If the NPV thus determined is positive, the investment is worthwhile; if NPV is negative, it should not be attempted.

Discounting is the opposite of compounding (Hartwick & Olewiler 1986, 4) and it follows that future values diminish over time as the cumulative discount rate increases. The higher the rate, the more rapidly future values diminish. It follows that low discount rates reflect confidence in the future, and are used for low risk investments, whereas high rates reflect high risk, and require rapid returns for NPV to be positive.

Both Anderson (1983, 48-51) and Fiske

(1988) suggest that farming rhinos on a commercial basis could yield significant returns. The assumption they make, however, is that rhino products could be sold on a legal market, which is not the case. Currently, private owners can only use their (white) rhinos for tourism and hunting purposes, both of which require the additional component of rhino habitat. There is little incentive for intensive captive breeding of white rhinos, as this requires costly feeding techniques which only serve to increase overhead expenses.

Bearing in mind that intensive breeding is probably not viable in the absence of a legitimate market for rhino products, one should consider whether the incentives for "private conservation" are great enough under present circumstances. Gordon (1958, 117) points out that "the degree of conservation will depend on the expectations of the resource owners", and Solomon (1986, 133) adds that

> (W)hen we believe our future rights to be threatened, our present behaviour towards them is inevitably affected, usually in ways that are inimical to conservation.

Returning to the example of the game farmer considering investment in white rhinos, it is likely that future expectations will have a decisive effect on whether the animals are harvested immediately, or allowed an opportunity to breed. The discount rate used will ultimately determine whether white rhinos are a viable long term investment or not. Since the discount rate is a reflection of risk, it is necessary to contemplate possible sources of risk to the farmer.

The likelihood of theft is the main source of risk for owners of white rhinos. Whether this occurs by poaching, or by another ownership claim if the rhino wanders off the property, there is a significant risk that the loss of value would not be adequately compensated, because of the unsatisfactory provisions of the law. Unless there are three or more males in the herd, the farmer risks losing the entire breeding potential through the loss of a single bull. With no legal goods market available, the farmer can either sell trophies or establish a breeding herd and use it for tourism purposes.

The breeding alternative might be followed if the farmer has an established tourist-orientated operation, or is planning to have one, and when prices of live animals are expected to increase to an acceptable extent. On the other hand, if the risk of loss is perceived to be high, and there are sufficient short term rewards, the farmer is likely to sell the rhinos as trophies.

In the same way that the probability of detection has a greater influence on the actions of traffickers and poachers, the discount rate provides the key to farmer's harvesting decisions. Since a reduction in risk reduces the discount rate, the greatest impact on farmer's decisions can be achieved by reducing perceived risk.

An example of the importance of future expectations and perception of risk is provided by Ilsley (1989, 24-5), an ivory trader who recently disinvested from the market. Although the ivory trade was still legitimate at the time of his withdrawal from the industry, his future expectations led him to his actions.

In my previous discussion on shortcomings of the price system, I have indicated that certain differences between social and private discount rates tend to undermine the ability of prices to allocate resources effectively. Under present circumstances, private rates are certainly higher than social rates, but this situation is one that could be corrected through a reduction of private risk.

Would the calculations of private investors differ greatly from a social cost:benefit analysis performed by a resource economist if the identical discount rates were used? I have indicated above that, in the case of the rhino industry the only source of value not likely to be reflected in private assessments is that of societal existence value. I have also indicated that this type of value could be classified as either current existence value, or future options value, depending on whether the benefits accrue to present or future generations of society.

In reality, current existence value can be disregarded, as it is at best, indeterminate, and most likely to be negligible or even

negative if taken as an aggregate of the entire South African population (assuming that this could be regarded as a proxy for "society"). Additionally, at least some existence value is reflected by the contributions of non-profit conservation agencies, such as the Rhino and Elephant Foundation, which provide assistance towards the protection of rhino species.

Future options value is also indeterminate because of the inherent lack of knowledge about the future, but this does not mean that it is necessarily insignificant. The uncertainty surrounding the issue of genetic diversity provides a further complication. It is thus difficult to predict both the measure of importance that rhinos may have to future generations of society, as well as the exact number of rhinos that present generations need to maintain, for any future values to be realized.

It would appear, therefore, that the presence of future options values represents the only potentially significant divergence between private and social costs in a privatized rhino industry. If the market mechanism were to fail in providing for the needs of society, it would probably be in the provision for future generations.

5 PRIVATIZATION

A combination of the knowledge gained through a study of property rights and market regulation has led to the recent development of the so-called "theory of privatization". The basic principle of this theory is that industries placed in the hands of private owners, and not regulated or protected by government, should perform more efficiently in meeting the needs of society than would enterprises owned by the state. Many of the principles underlying this theory have been discussed in the previous two chapters, and I therefore turn my attention to some of the broader aspects of privatization.

Basic Privatization Theory

Kent (1987, 10-12) discusses the rationale for privatizing state-owned enterprise. He suggests four reasons why privatized industry is desirable. First, people wanting goods and services provided by the government should pay the full costs for them; secondly, competitive production in the private sector is likely to be more efficient and thus less costly than government provision; thirdly, consumers are likely to be most satisfied when they are faced with a variety of alternative producers; and finally, unleashing the entrepreneurial skills in the private sector will result in new innovations and improved technologies.

Leach and Vorhies (1989) suggest that, in addition to these reasons, privatization can be used to increase government revenue, promote economic growth, spread share-ownership democracy, and depoliticize managerial decision-making.

Pirie (1985, 1-6) argues that the main rationale for privatization has been provided by "the recognition that private programmes are subject to economic disciplines, and respond to choices made by the beneficiaries of these programmes", whereas the public sector "expresses the priorities of legislators and bureaucrats". He goes on to discuss the performance of the public sector, and considers that recent evaluations have indicated that it is "afflicted by a number of serious economic and institutional problems".

Pirie (1985, 6-13) describes ten basic problem areas which have emerged from an examination of public sector operations. These areas can be briefly summarized as follows:

1 *Production costs*
Research has consistently shown that, on average, public sector production costs are much higher. This is attributed to the fact that there are stronger, market-induced pressures to keep these costs down in the private sector.

2 *Efficiency*
Research has shown similar trends in the case of efficiency; public operations use higher manpower levels and make less efficient use of machinery. Once again, the lack of the competitive

discipline is cited as a plausible explanation.

3 *Labour costs*
The monopoly power possessed by many public sector operations tends to increase their vulnerability to the pressures which increase labour costs. This is because a lack of alternatives gives additional power to labour unions in wage negotiations.

4 *Capital cost*
Public sector operations tend to skimp on capital spending and favour current spending instead, often as a result of political pressures to maintain labour forces and the extent of services in the face of budget cuts. As a result, there is a far greater incidence of capital obsolescence.

5 *Consumer input*
Since public sector enterprises are not directly responsive to consumer decisions, and can often only be influenced by the remote method of electoral control, they frequently serve the interests of their workforce more than the interests of their customers. A clear indication of this is the shorter hours of availability of many publicly provided services.

6 *Innovation and flexibility*
Because public operations tend to deal with customers in broad categories, such operations tend to disregard any individual consumer preferences. Private firms adapt quickly to changing market conditions in order to maintain the competitive edge, whereas public operations change far more slowly, and employees generally resist this change where possible.

7 *Decision-making*
Private sector decisions are based largely on economic factors, whereas public sector decisions are frequently influenced by political considerations. Consequently, public sector decisions tend to ignore the supply and demand realities of the market.

8 *Condition of equipment*
Since public sector equipment is not owned by the people using it, it is seldom treated with the care and attention that is afforded to privately owned property.

9 *Interruption of service*
Although government provision is usually regarded as necessary for the uninterrupted supply of public services, in practice interruption is less likely to occur when such services are provided by the private sector. Reasons for this are related to the monopolistic nature of state enterprises, and the resultant lack of alternative suppliers. Private firms are subjected to the discipline of existing and potential competition.

10 *Responsiveness to cost control*
Private sector costs are controlled competitively, and managers have incentives to keep costs as low as possible. Public sector activities are financed out of taxation, and funds are allotted by a process of lobbying. Cost controls are seldom effective; public servants have little interest in reducing costs, and often have interests in increasing them. The public sector is placed under continuing pressure to expand, and increase costs.

Pirie (1985, 14-19) goes on to discuss certain attempts made by the public sector to overcome these problems, and concludes that they have been largely unsuccessful. Most of the problem areas mentioned are inherent products of the structures of state enterprise, and can only be solved by applying techniques of privatization. The selection of specific techniques would be determined by the characteristics of the industry in question.

Vickers and Yarrow (1988, 3) describe the theoretical rudiments of privatization theory. The first factor to consider is the nature of ownership. This issue is important, because of the difference between the incentives created by private and public ownership structures. The type of structure affects both the objectives of management

and systems of monitoring managerial performance. It thus follows that a change in property rights could materially affect managerial behaviour.

"The efficiency implications of these changes in incentives depend very much upon the competitive and regulatory environment in which a given firm operates" (Vickers and Yarrow 1988, 3). It could even be argued that the elements of competition and regulation are more crucial to the success of privatization policies than ownership itself. Kay and Thompson (1986, 31) support the view that a lack of competition thwarts the effectiveness of a change in ownership.

Privatization in the Rhino Industry

It is clear that privatization theory is based to a large extent on the property rights and market theories discussed in the two previous chapters, and it is therefore worthwhile to reflect on some of the issues raised. The most important factors in the case of the rhino industry appear to be the strength of property rights and the extent to which market regulation affects the decisions of those involved in the industry.

The strength of rights to rhinos affects the extent to which they are valued by their owners. Weaker rights tend to reduce value, because they increase the element of risk. They also make rhinos more susceptible to invasions. Rights can be strengthened by the granting of greater legal recognition. Rhinos are capable of being owned privately; they possess the characteristics of predominantly private goods; the only notable "public" goods aspects are certain intangible existence values.

Whether it is necessary for rhinos to be owned "by the public" is an issue that deserves serious consideration. Not only are the collective aspects of rhino ownership limited, but the concept of public ownership has recently come under attack from a number of critics. Adie (1989, 117), for example, expresses the opinion that public ownership is a misnomer, since there is no evidence of any of the normal benefits of ownership being conferred on the public. It would be more correct to say that public enterprises are owned by nobody, and that control is effectively exercised by government employees who possess the right to appropriate residual funds.

Rothbard (1988, 264) is particularly critical of state ownership of natural resources. He argues that since

> government bureaucrats control but do not own the resource 'owned' by government, they have no incentive to maximize or even consider the long-run value of the resource.

He continues to claim that:

> it should not be surprising that every instance of 'overuse' and destruction of a natural resource has been caused, not by private property rights in natural resources, but by government intervention or crippling of such a market.

In the case of the rhino industry, state ownership has led to the elimination of the rhino goods market. As I have mentioned in the chapter on property rights, the logical approach to the current predicament would be to supply Asian markets with rhino products on a renewable and sustainable basis. The reason why policy-makers have not followed this alternative is probably related to the fact that they do not need to bear the full costs of their decisions. Since it appears that there is considerable public pressure to protect rhinos in the "traditional way", conservation officials are likely to yield to this, rather than advocate any controversial alternative methods.

I have indicated that the only rationale for state ownership of rhinos is the collective nature of various existence values, although this reason is not sufficient in itself. It would be possible for the state to encourage production of rhinos by the private sector by contracting out, for example. While it could well be argued that government should be responsible for ensuring that rhino species are saved from extinction, it does not necessarily follow that rhinos need to be state-owned property.

In terms of social welfare, it appears that the current policies being pursued leave

much room for improvement. Taking the view that "society" extends beyond the borders of South Africa, one cannot say that a ban on rhino products is beneficial to a majority of people. The only benefits provided by the current policies are reaped by criminal elements. There is productive inefficiency because productive potential is being wasted, and consequently, the Pareto-optimal allocation of resources is not being achieved.

A market-related pricing system would assist in achieving a true reflection of rhino values. In this paper, I support the consumer theory of value, while acknowledging that the price system may not always be capable of providing for the needs and preferences of future generations. It is worth noting, however, that the public sector may be just as incapable of assessing future needs as the private sector, unless governments have access to certain information that markets do not.

A superficial examination of possible consumer values of live rhinos suggests that provision of rhinos for future generations would take place automatically in a market-regulated economy. Since the demand for rhino goods and services is fairly substantial and likely to remain so, the market would cater for the needs of both present and future consumers by ensuring the continued survival of rhino species.

For the market system to function correctly, it would be necessary to allow competitive forces to operate, and to remove superfluous barriers to entry. The state should not be allowed to exercise any monopoly power over the industry. Competition would promote more efficient production and use of rhinos, as well as innovations and improvements in these areas.

A competitive market would lead to a drop in the price of rhino horn, and discourage illegal trade. A combination of competition and private ownership would also result in the gradual evolution of more efficient anti-poaching techniques, which would increase risk of detection and thereby act as a further deterrent. Future expectations of rhino owners would be improved through greater recognition of private rights and the prospects of expanding product markets. This would help to lower private discount rates and encourage breeding rather than exploitation.

The relationship between private property rights, market pricing and competition is manifest. Waters (1987, 103) asserts that "the beneficial results of competition and price signals cannot be achieved unless effective ownership rights are established". Alchian (1987, 1031) elaborates on this point:

> For the decentralized coordination of productive specialization to work well, ... in a society with diffused knowledge, people must have secure, alienable private property rights in productive resources and products tradeable at mutually agreeable prices at low costs of negotiating reliable contractual transactions.

Demsetz (1964, 16-17) claims that in certain cases, policing costs can be so high "as to cause additional complications". He argues that in such cases, the effectiveness of the market mechanism is reduced because of insufficient recognition of legal rights. "The value of what is being traded depends crucially on the rights of action over the physical commodity and on how economically these rights are being enforced".

If this analysis is correct, one can conclude that there is one crucial role that does need to be played by government, and that is the recognition and enforcement of private property rights. It is obvious that this role has not been particularly well fulfilled in the past. Indication of this is provided by the comments of the South African Law Commission (1989, 1, 52), expressing criticism of the unsatisfactory legal protection afforded to owners of game, as well as the serious shortage of conservation law enforcement officials.

It is therefore necessary to consider whether the rhino problem has in fact been caused by market failure, or whether it is not rather the result of "government failure". Since the market is still managing to provide some Asian consumers with rhino horn, it would seem more correct to say that government has failed to prevent uncontrolled resource use.

To eliminate the source of this failure,

government may need to review its position in the rhino industry. Cooter (1987, 459) makes the observation that "the role of government in lubricating private agreements, rather than issuing commands, is much favoured in the contemporary economic understanding of regulation". An appropriate policy for government would therefore be to withdraw from direct participation in the industry, and use other means to encourage the continued private production of rhinos.

My treatment of the rhino problem has thus far used the concept of the rhino industry as an abstraction, and although I conclude that it is desirable to "privatize the rhino industry", in practical terms this is difficult. As mentioned above, this industry is often a component of various other industries, from which it is largely inseparable. Practical aspects of privatizing the industry thus need to be addressed by examining specific problems, to which certain techniques can be applied, in the context of the broader industries of which rhinos form a part.

A radical approach would be to privatize these larger industries in their entirety, which would involve, *inter alia*, privatizing certain game reserves and national parks. Since there are numerous other factors that need to be taken into consideration, I hesitate to recommend such a course of action, and leave the investigation of this possibility to another report.

6 CONCLUSION AND RECOMMENDATIONS

A Reappraisal of the Problem

Buys (1987, 8) claims that "with few exceptions, the distribution of white rhino to private landowners in South Africa is not the most effective means of enhancing the status of the species". This statement appears to be unfounded, for a number of reasons. Buys considers four possible causes of the "disappointing record in management", and while his observations are probably correct, they seem to suggest that the fault lies with the private sector and not the public sector.

In my opinion, this view is mistaken. An examination of these four reasons indicates that private sector mismanagement of white rhino populations occurred largely out of ignorance. The reasons given by Buys (1987, 8) were :

a Rhinos were introduced onto properties with unsuitable habitat.

b Properties were overstocked with other species, leading to the degradation of white rhino habitat.

c Rhino populations with only one bull do not generally produce calves, and many landowners shot all but one of their bulls.

d The enhanced value of rhino trophies created the incentive to harvest animals at a faster rate than they could be supplied by the Natal Parks Board, leading to excess demand.

With regard to the first two points, improper veld management and introduction of species into inappropriate habitats, it seems that the private sector generally has a poor record of managing certain rarer game species that are sensitive to habitat changes. Private landowners frequently overstock their farms, possibly because they prefer to see more game. This results in the proliferation of more adaptable species that are capable of surviving on degraded land. Anderson (1989, interview) uses this fact as a convincing argument against complete private sector involvement in certain critical conservation activities.

While it is certainly true that private land is often mismanaged, the public sector could tackle this problem in a different manner. If rhinos were sold in "breeding packages" at market prices, the recipients would be likely to consider their purchase with greater care. Furthermore, if prospective purchasers were informed regarding the suitability of their land for rhino breeding, and were made aware of the "single-bull breeding problem", they would be

able to plan more efficiently, and make fewer mistakes.

It is possible that state conservation agencies could have provided better information to private rhino buyers. While white rhinos were being sold at subsidized prices, prospective buyers may not have been fully aware of certain management requirements. This would have resulted in misinformed decisions being made. If the public sector is in any way supposed to be responsible for conservation, then surely a vital function should be the supply of adequate information to all private landowners. Unfortunately, it appears as if the attitude of some public agencies toward these landowners has only served to make matters worse.

The excess demand for live white rhinos can be eliminated simply through auction pricing, which would ration available stocks to the highest bidders. These highest bidders would more often than not be those landowners who felt confident that they could manage their rhinos in such a way as to achieve a satisfactory return on their investment.

Buys (1987, 9), however, suggests that the cure for the present problem would be further government intervention. He recommends the creation of a national plan for white rhino, stricter criteria for allocation to landowners, an "objective" system for ranking applications, and the blacklisting of certain landowners on the basis of previous management records.

The tighter control of the rhino industry by the public sector can achieve little toward solving the greater rhino problem, and could even aggravate it further. In my discussion above, I have pointed out that the root of the rhino problem lies with the refusal of agencies to acknowledge a legitimate market for rhino horn and to supply this market. On the black market, supply and demand forces will ensure that, as supply of horn decreases, price will increase to meet the demand. Rewards to poachers and traffickers will also increase, providing additional incentives to take risks.

It is most likely that, because of the high cost of policing, all rhino populations in larger areas will eventually become seriously threatened. Public agencies would be forced to incur considerable expenditure in moving populations to smaller, safer enclosures and intensifying policing and antipoaching efforts. This would need to be financed using taxpayers' money, and there may also be a limit to the amount that government would be able to contribute to rhino safety measures. While the fundraising efforts of the Rhino and Elephant Foundation and other non-profit organizations may be very successful at present, there is a limit to the amount the private sector will be prepared to contribute without receiving acceptable returns.

It is worth noting that all recent incidents of rhino poaching in South Africa have had at least one public sector employee involved (Lategan 1990, interview) and that the most serious incidents throughout Africa are frequently "inside jobs" involving corrupt government officials, sometimes at high levels. While private owners face stronger incentives to protect their property than do government officials to protect public property, under present circumstances, rhinos have become a risky proposition for long term investors.

A combination of unsatisfactory legal protection of rights, the high risk of poaching and the lack of legitimate markets for many rhino products acts to discourage private sector investment in live rhinos. Only a few wealthy conservation-minded individuals and successful tourist operations would be prepared to invest in live rhinos in the long term. Other rhino owners would be likely to opt for short term, secure returns.

With the unsatisfactory ownership and incentive structure within public agencies and a fairly unmotivated private sector, prospects for the medium term survival of rhino species in the wild do not look particularly good. It is simply a matter of time before the opportunities for continued poaching in Zimbabwe become limited, leading to an increase in incidents in Namibia and South Africa. A final factor that should be considered, is the relatively unstable political situation currently prevailing in Southern Africa. In most situations of political upheaval, the first areas to suffer are publicly-owned reserves,

where poachers take full advantage of the disrupted state of public agencies.

It should be of concern that public agencies are translocating large numbers of black rhinos to the Kruger National Park, where their safety could be seriously threatened in the future. The Park is a particularly extensive area to patrol, and there are numerous refugees from Mocambique passing through on a regular basis. The fact that a Parks Board ranger could shoot so many rhinos inside the Park without being detected for some time is an indication of the potential problems that could arise.

Public agencies should ensure that the risk of rhino loss is minimized through the spread of populations over as wide an area as possible. This could be achieved by distributing small breeding populations to various private lands. This strategy would help to frustrate concerted poaching attempts, and lead to the eventual creation of a more competitive industry.

The elimination of the black market for rhino horn by the lifting of trade restrictions would certainly help to stabilize the entire industry. However, there are two problem areas that will remain an inherent part of the rhino industry. The first is the high policing cost in larger areas, and the second is the question of genetic diversity. These two problems are not insurmountable though, and can be tackled by appropriate government action aimed at guiding private decision makers in the right direction.

Recommendations

Thus far, I have examined the economic mechanism of the rhino problem and concluded that it could be solved through an application of the principles of privatization. This process, however, is one that involves radical change which would probably need to take place over a protracted period of time. For this reason I consider some practical steps which can be taken towards such a solution, and the way in which they might be implemented.

Before this is done, however, it is necessary to define certain objectives, and the order in which they should be achieved. In describing the problem above, I make the initial assertion that it is desirable to conserve rhino species in their habitat. Two points need to be made. The concept of "conservation" differs from that of "preservation". Thomson (1986, 25) makes the distinction between these two terms and considers that whereas conservation implies "wise use", preservation implies "protection of harm". Secondly, the term "habitat", by implication excludes any artificial captive environments.

It should be clear, therefore, that this report is not concerned with whether rhinos can be protected in zoos or other captive situations, but whether they can survive in their natural home, where they can be of value to humans under sensible management. Having established this, it is possible to prioritize desirable management objectives for South African rhino species. I assume that biotic diversity is important in ensuring the long-term survival of any species.

While these objectives are set in a South African context, it should be noted that achieving these may also benefit other countries and societies. For example, the legal provision of African rhino horn to Asian markets may help relieve some of the pressure on the three highly endangered Asian rhino species.

The objectives I consider are:

1 To prevent either species of African rhinoceros from becoming extinct in its habitat.

2 To build up genetically viable populations of both species as quickly as possible.

3 To maximize genetic diversity by ensuring the survival of as many different subspecies and biologically separate groups as possible.

4 To maximize social welfare by ensuring that the number of live rhinos is the optimal number for society; in other words, to ensure that there are neither too few nor too many live rhinos in existence.

Taking the factor of time into account, these objectives could be re-interpreted as follows:

Short-term objective: to reduce the incidence of rhino poaching to a minimum.

Medium-term objective: to build populations of all species and subspecies.

Long-term objective: to create a market regulated industry that would provide society with the optimal amount of live rhinos, rhino goods and rhino services.

Rhino poaching could be reduced either by eliminating demand for rhino horn, or by legitimately supplying it. It is unlikely that demand will be eliminated for some time. Persuading governments to enforce CITES regulations does not amount to the elimination of demand, but merely the suppression of it. Furthermore, legitimate commercialization of rhino products would increase the value of rhinos to society, whereas the lack of such markets would force rhinos to be entirely dependent on demand for tourism and hunting for their long-term survival.

The gradual creation of a legitimate rhino goods market seems advisable. The first step toward achieving this should be the granting of maximum legal and other protection to all rhino populations. While the penalties for poaching could be increased to higher levels, this will only have a really significant effect if the probability of getting caught is also increased. Private rhino owners should be allowed all the legal privileges normally granted to owners of private property, including the right to claim for damages.

A robust private market would lead to innovations in protective devices and various other technological advancements, that would enable private owners to take more effective care of their assets. The key to the creation of such a market is the full recognition of private legal rights. Public agencies could either move their vulnerable rhino populations to safe camps, or sell them to the private sector. It would be prudent to establish a secure "buffer" population of rhinos in a well protected area.

These techniques would all effectively reduce policing costs, thereby facilitating a reduction in poaching. Some rhinos should be used for intensive "horn farming", and the state could contract out to the private sector for this. However, there would need to be an undertaking by government to eventually lift the trade restrictions on rhino products. To achieve this, it would be necessary for the public agencies to persuade CITES to lift its ban, at least in South Africa and some Eastern trading centres.

As soon as an arrangement is made with CITES (failing which the public sector should consider reneging on the agreement), agencies should commence selling any accumulated stocks of horn. There have been a number of suggestions to "flood the market" or produce fake or contaminated horns and distribute them. I do not advocate these methods for certain reasons. First, it appears that potential demand for horn is both substantial and widespread (Martin 1980). It is likely that any sudden increase in supply would be rapidly absorbed by the market. Prices would drop temporarily, after which the market would resume its "normal" operation.

By selling fake or contaminated horns, buyers would simply be alienated, and would rely more heavily on established sources. The chances of newcomers entering the industry would be severely jeopardized. Instead, the public sector should ensure that any prospective legitimate seller gains credibility in the market.

Public agencies should sell off their stocks of horns at a slow, but consistent rate, and attempt to achieve the highest possible selling price. This could be done by auctioning horns in an established Eastern market such as Hong Kong or Taiwan. These auctions could take place on a fairly regular basis (e.g. twice a year), and the number of horns made available could be gradually increased, until a reasonably stable market is established, at which point different selling methods could be employed. Needless to say, the money thus earned could be used to improve policing of reserves.

To ensure the eventual creation of a competitive market, private owners should gradually be allowed to sell horns as well. This could encourage more intensive rhino

farming. Such farms would be vital in acting as a buffer to illegal poaching in game reserves. More rhinos should be auctioned off to the private sector. White rhinos should be sold either in breeding packages with at least two bulls, or as single bulls specifically for trophy purposes. If the latter are not offered for sale, private owners will utilize breeding groups to meet the demand for trophies.

Agencies should not exercise strict controls over the allocation of auctioned rhinos, but should rather provide information as to habitat requirements and other considerations for breeding. The importance of this public sector role cannot be overemphasized. It follows that all auctions should be widely publicized. Without adequate information, the private sector will not take full advantage of the opportunities created.

Black rhinos should also be auctioned to the public. Again, this could be done by separating breeding packages from trophy bulls. The ban on black rhino hunting should be lifted, and those public agencies involved in hunting and in possession of surplus males, should auction the trophy rights to these. Once again, the money raised could be put to effective use.

The public sector could aim to establish a few large, genetically viable populations of both species, as well as the various subspecies of the black. All other rhinos should be sold to the private sector. For those buyers concerned about genetic purity, all rhinos could be auctioned on a basis of origin. A stud-book system could be established to keep a record of rhino genetics. Since the perpetuation of various pedigrees seems to occur without much difficulty in the cases of privately owned domestic animals, there is no reason why this should not be the case with rhinos.

Once a stable population of all species is established, the public sector could consider withdrawing from the industry altogether. However, since this would entail privatizing the entire operations of certain game reserves and national parks, this is a possibility that requires further investigation. It certainly seems desirable to maintain not only genetic diversity in the long-term, but also to achieve the social welfare that only a system of market pricing and unrestricted competition could provide. Whether this would be possible or not, is a fact that would probably emerge if some of the above steps are taken.

I have neglected to deal with certain specific details in these recommendations, since there are some areas that merit further study. The issue of rhino genetics seems to be of importance, and should be examined carefully to achieve a better understanding of required minimum population sizes. The rhino horn and other goods markets, while having been extensively covered by Martin (1980), still leave room for further examination, particularly to determine such important factors as price elasticity of demand.

Finally, the general commercialization of wildlife merits far greater attention. The African elephant is being placed under considerable pressure for reasons similar to those of the rhino. Once again, CITES has recently intensified restrictive trade agreements. The illegal ivory trade is still flourishing, and seems to have much in common with the illegal rhino horn trade, although there are some differences which justify a separate study of the elephant issue.

This report has also raised some doubts about the large scale government control of natural resource areas, as well as its involvement in associated industries such as tourism. In a country of political uncertainty and economic instability, it is worth considering whether the private sector could not play a far greater role in ensuring the long-term conservation of natural resources.

APPENDIX 1

Prices Obtained from Live White Rhino Sales, in SA Rands

Year	A. Subsidized Prices i. Natal	ii. Other	B. Auction Prices Average
1979	760	800	-
1982	1,000	1,100	-
1983	1,800	2,300	-
1984	3,000	3,500	-
1985	3,800	4,300	-
1986	3,800	4,000	10,167
1987	4,500	5,500	14,790
1988	10,000	10,000	34,714
1989	25,000	25,000	48,732

Notes:
All prices were obtained from Keith Meiklejohn, Natal Parks Board Head Office, Pietermaritzburg.

A. *Subsidized Prices*
Different prices were charged to buyers inside Natal, and those outside the province. Most Natal sales were bulls, intended as trophies. No rhinos were sold at subsidized prices in 1989.

B. *Auction Prices*
Prices reflected are the annual mean of all public auctions. In 1989, prices varied between R30,000 and R72,000.

APPENDIX 2

Some Prices Obtained for White Rhino Trophies

Source:	A		B	
Year	US Dollars	SA Rands	US Dollars	SA Rands
1982	6,500	6,500	6,000	6,000
1983	6,600	7,333	6,354	7,060
1984	7,000	9,859	5,680	8,000
1985	7,500	15,957	8,700	18,511
1986	7,500	18,763	8,660	21,665
1987	10,000	20,833	10,357	21,577
1988	10,000	20,000	17,500	35,000
1989	23,000	57,500	36,669	91,673

Notes:
These prices are not necessarily an accurate indication of true market conditions, as they do not take all operator's prices into account. Some trophies are also sold as part of a package, and additional surcharges may be added, which are not reflected in these figures.

Prices were obtained from two sources:

A Duncan Paul, Bophutatswana National Parks Board. Official Parks Board trophy fees (in dollars, converted to rands at prevailing exchange rates.

B Spud Ludbrook, Natal Parks Board. Estimated averages of South African trophy fees (in both dollars and rands).

SOURCES CONSULTED

A SELECTED BIBLIOGRAPHY

ADIE, D K. 1989. *Monopoly Mail: Privatizing the U.S Postal Service*. New Brunswick, New Jersey: Transaction.

ALCHIAN, A A. 1987. Property Rights. In *The New Palgrave Dictionary of Economics*, ed. John Eatwell, Murray Milgate and Peter Newman, 1031-34. London: MacMillan.

ALCHIAN, A A and W R ALLEN. 1972. *University Economics*. 3rd edn. Belmont, California: Wadsworth.

ALCHIAN, A A and H DEMSETZ. 1973. The Property Rights Paradigm. *Journal of Economic History* 33: 16-27.

ANDERSON, J. 1983. Bestandsaufname und Zukuenftige Entwicklung des Breitmaulnashorns [Survey on the present and future status of the square-lipped rhinoceros]. In *International Stud-book of African Rhinoceros*, 46-52. Berlin: Zoological Gardens Berlin.

ARONSON, R J. 1985. *Public Finance*. New York: McGraw-Hill.

BANNOCK, G, R E BAXTER and R REES. 1984. *The Penguin Dictionary of Economics*. 3rd edn. Harmondsworth, Middlesex: Penguin Books.

BAUMOL, W J. 1982. Contestable Markets: An Uprising in the Theory of Industry Structure. *American Economic Review* 72 (March): 1-15.

BAUMOL, W J and W E OATES. 1979. *Economics, Environmental Policy and the Quality of Life*. Englewood Cliffs, New Jersey: Prentice-Hall.

BLOCK, W E 1990. Environmental Problems, Private Property Solutions. In *Economics and the Environment: A Reconciliation*, ed. Walter E. Block, 281-332. Vancouver: The Fraser Institute.

BORCHERDING, T E 1990. Natural Resources and Transgenerational Equity. In *Economics and the Environment: A Reconciliation*, ed. Walter E. Block, 95-115. Vancouver: The Fraser Institute.

BOULDING, K E 1978. *Ecodynamics*. Beverly Hills, California: Sage Publications.

BREALEY, R and S MYERS. 1981. *Principles of Corporate Finance*. New York: McGraw-Hill.

BROOKS, P M 1988. Proposed Conservation Plan for the Black Rhinoceros *Diceros bicornis* in South Africa, the TBVC States and SWA/Namibia. Pietermaritzburg, Natal: Natal Parks Board.

BUYS, D. 1988. A Summary of the Introduction of White Rhino onto Private Land in the Republic of South Africa. Bedfordview, Transvaal: Rhino and Elephant Foundation.

BUYS, D and J ANDERSON. 1989. Disquiet was Justified - White Rhinos on Private Land in South Africa. *The Rhino and Elephant Journal* 2: 26-31.

CALL, S T and W L HOLAHAN. 1983. *Microeconmics*. 2nd edn. Belmont, California: Wadsworth.

CHILVERS, B. 1990. Rhino's Last Stand in Africa. *The Rhino and Elephant Journal* 3: 12-19.

CLARKE, J. 1989. A Conspiracy of Conservationists. *The Star*, 28 June, 13.

COASE, R H. 1960. The Problem of Social Cost. *The Journal of Law and Economics* 3: 1-44.

COLINVAUX, P. 1980. *Why Big Fierce Animals are Rare*. Harmondsworth, Middlesex: Penguin Books.

COOTER, R D. 1987. "Coase Theorem". In *The New Palgrave Dictionary of Economics*, ed. John Eatwell, Murray Milgate and Peter Newman, 457-60. London: MacMillan.

COTTRELL, A. 1978. *Environmental Economics*. London: Edward Arnold.

DASGUPTA, P. 1982. *The Control of Resources*. Oxford: Basil Blackwell.

DEMSETZ, H. 1964. The Exchange and Enforcement of Property Rights. *The Journal of Law and Economics* 7: 11-26.

DEMSETZ, H. 1967. Toward a Theory of Property Rights. *American Economic Review*, Papers and Proceedings 57: 347-59.

DOLAN, E G. 1974. Environmental Policy and Property Rights. In *Property in a Humane Economy*, ed. S L Blumenfeld. 209-24. LaSalle, Illinois: Open Court.

FISHER, A C. 1981. *Resource and Environmental Economics*. Cambridge: Cambridge University Press.

FISHER, F M. 1979. Diagnosing Monopoly. *Quarterly Review of Economics and Business* 19 (Summer): 7-33.

FISKE, S. 1988. Rhinos: By the Horn? *Effective Farming*, January, 21.

FRIEDMAN, D. 1973. In Defense of Property. in *The Machinery of Freedom*. New York: Harper & Row.

FRIEDMAN, D. 1986. *Price Theory: An Intermediate Text*. Cincinnati, Ohio: South-Western Publishing.

GORDON, S. 1958. Economics and the Conservation Question. *The Journal of Law and Economics* 1: 110-21.

HALL-MARTIN, A. 1988. Conservation of the Black Rhino - The Strategy of the National Parks Board of South Africa. *The Rhino and Elephant Journal* 1: 12-17.

HANKS, P, ed. 1986. *Collins Dictionary of the English Language*. 2nd edn. Glasgow: Collins.

HARDIN, G. 1968. The Tragedy of the Commons. *Science* 62 (13 December): 1243-8.

HARPER, F A. 1974. Property in its Primary Form. In *Property in a Humane Economy*, ed. S L Blumenfeld, 1-22. LaSalle, Illinois: Open Court.

HARTWICK, J M and N D OLEWILER. 1986. *The Economics of Natural Resource Use*. New York: Harper & Row.

HAYEK, F A. 1948. *Individualism and Economic Order*. South Bend, Indiana: Gateway Editions.

HUNTLEY, B J, ed. 1989. *Biotic Diversity in Southern Africa*. Cape Town: Oxford University Press.

HYMAN, D N. 1973. *The Economics of Governmental Activity*. New York: Holt, Rinehart & Winston.

ILSLEY, J D. 1989. I am an Endangered Species. *The Rhino and Elephant Journal* 2: 24-25.

KAY, J A and D J THOMPSON. 1986. Privatization: A Policy in Search of a Rationale. *The Economic Journal* 96 (March): 18-32.

KENT, C A. 1987. Privatization of Public Functions: Promises and Problems. In *Entrepreneurship and the Privatizing of Government*, ed. Calvin A. Kent, 3-22.

KYLE, R. 1987. *A Feast in the Wild*. Oxford: Kudu.

L'ANGE, G. 1989. Swazis Get Tough on Poaching. *The Star*, 26 October.

LEACH, D F. 1989. "Statutory Monopoly vs. Market Share Monopoly." Johannesburg: Department of Business Economics, University of the Witwatersrand.

LEACH, D and F VORHIES. 1989. "Privatisation and Natural Monopoly." Johannesburg: Department of Business Economics, University of the Witwatersrand.

LEDGER, J. 1986. Editorial. *Quagga* 15: 4.

LETWIN, O. 1988. *Privatising the World: A Study on International Privatisation in Theory and Practice*. London: Cassel.

LIPSEY, R G. 1983. *An Introduction to Positive Economics*. 6th edn. London: Weidenfeld and Nicholson.

LOUW, L M. 1989. Privatization for Preservation. *Portfolio* 29: 5-6.

MARTIN, E B. 1980. *The International Trade in Rhinoceros Products*. Gland, Switzerland: International Union for Conservation of Nature/World Wildlife Fund.

MARTIN, E B and L VIGNE. 1988. Abetting the Rhino Horn Trade. *Quagga* 24: 23-24.

MASLAND, T. 1989. Zimbabwe Losing War to Save Rhino. *Chicago Tribune*, 27 January, 4.

MCNULTY, P J. 1968. Economic Theory and the Meaning of Competition. *Quarterly Journal of Economics* 82(4): 639-656.

MENTIS, M T. 1970. Estimates of Natural Biomasses of Large Herbivores in the Umfolozi Game Reserve Area. *Mammalia* 34(3): 363-93.

MENTIS, M T. 1989. Auctions Could Stamp Out Rhino Extinction. *The Star*, 18 August.

MILLER, R L and R E MEINERS. 1986. *Intermediate Microeconomics*. 3rd edn. New York: McGraw-Hill.

MISHAN, E J. 1981. *Introduction to Normative Economics*. New York: Oxford University Press.

MONTGOMERY, S. 1989. Operation Bicornis: A New Initiative to Save Damaraland's Black Rhino. *African Wildlife* 43(5): 229-33.

MONTGOMERY, S. 1989. Towards National Strategies: Report on the 1988 Rhino Conservation Workshop. *The Rhino and Elephant Journal* 2: 8-12.

National Parks in South Africa: Policy Statement of the National Parks Board of Trustees. n.d. Pretoria: National Parks Board.

OWEN-SMITH, G. 1987. Wildlife Conservation in Africa: There is Another Way! *Quagga* 17: 18-23.

PAUW, C. 1990. Dehorning Critics Stumped! Rhino Cow in Controversial Programme Proves Capable Mother. *African Wildlife* 44(1): 8.

PIENAAR, D. 1989. Too Many White Rhino? *The Rhino and Elephant Journal* 2: 15-17.

PIRIE, M. 1985. *Privatization in Theory and Practice*. London: ASI (Research) Ltd.

PENNY, M. 1987. *Rhinos: Endangered Species*. London: Christopher Helm.

RAPHAELY, C. 1990. Bucks in the Bag: SA is Number One Big Game Hunting Destination. *Finance Week* 44(8): 14-18.

RICE, E M. 1987. A New Look at Disagreements about Barriers to Entry. in *Modern Finance and Industrial Economics*, ed. T E Copeland, 23-35. New York: Basil Blackwell.

ROTHBARD, M. 1988. Government vs. Natural Resources, in *The Free Market Reader*, ed Llewellyn H. Rockwell, Jr., 263-6. California: The Ludwig von Mises Institute.

SMITHERS, R H N 1983. *The Mammals of the Southern African Subregion*. Pretoria: University of Pretoria.

SOLOMON, D. 1986. Saving the World: A Rejoinder. *Businessman's Law* 15: 131-3.

SOLOW, R M. 1974. The Economics of Resources or the Resources of Economics. *American Economic Review*, Papers and Proceedings 64: 1-14.

SOUTH AFRICAN LAW COMMISSION. 1989. *Working Paper 27, Project 69: Acquisition and Loss of Ownership of Game*.

Pretoria: South African Law Commission.

SOWELL, T. 1980. *Knowledge and Decisions*. New York: Basic Books.

STAUTH, R B. 1983. Environmental Economics. Part III of *Environmental Concerns in South Africa - Technical and Legal Perspectives*, ed R F Fuggle and M A Rabie. Cape Town: Juta.

THOMSON, Ron. 1986. *On Wildlife "Conservation"*. Cape Town: United Publishers International.

"27 Rhino Shot in Kruger National Park". 1989. *The Citizen*, 2 November, 1-2.

VAN DER MERWE, C G. 1987. *The Law of Things*. Durban: Butterworths.

VICKERS, J and G YARROW. 1988. *Privatization: An Economic Analysis*. London and Cambridge, Massachusetts: The MIT Press.

VINCENT, J. 1969. The Status of the Square-lipped Rhinoceros *Ceratotherium s. simum* in Zululand. *Lammergeyer* 10: 12-21.

WATERS, A R. 1987. Economic Growth and the Property Rights Regime. *The Cato Journal* 7(1): 95-115.

WEAVER, T. 1989. Story of Survival. *Sunday Star*, Sunday Supplement, 21 May, 14-20.

WOLF, C. Jr. 1979. A Theory of Nonmarket Failure: Framework for Implementation Analysis. *The Journal of Law and Economics* 22: 107-39.

B SELECTED INTERVIEWS

ANDERSON, J. 1989. Interview by author, 27 October, Kangwane Parks Corporation,Nelspruit.

BROOKER, J. 1990. Interview by author, 20 February, Broederstroom.

BROOKS, M. 1989. Interview by author, 9 June, Natal Parks Board, Pietermaritzburg.

HALL-MARTIN, A. 1989. Interview by author, 26 October, National Parks Board, Skukuza.

LATEGAN, P. 1990. Interview by author, 9 March, South African Police, Pretoria.

MEIKLEJOHN, K. 1989. Interview by author, 15 September, Natal Parks Board, Pietermaritzburg.

WALKER, C. 1990. Telephone interview by author, 16 February, [Rhino and Elephant Foundation].

ACKNOWLEDGEMENTS

It would be difficult to acknowledge all the help, support and inspiration I received while writing this report, yet there are certain names I must mention. First, I would like to thank all the staff and members of the Free Market Foundation for their support, especially Sandy Kidd, Danie Swanepoel and Joan Evans. I am most grateful to Caroline Gillespie for her invaluable assistance with the proof-reading, editing, layout and printing of this report. I am also deeply indebted to Garth Owen-Smith, leader of the Endangered Wildlife Trust's Auxiliary Game Guard Project in the Kaokoveld, for providing me with much of the background information which helped inspire my initial interest in this topic. Jay Leitch, of North Dakota State University (USA), was extremely helpful during the early stages of the project in giving advice as well as teaching me some useful resource economics principles.

There are a number of dedicated people currently involved with the various aspects of rhino conservation. I am most grateful to all of those who provided me with valuable information during the course of this project: John Ledger of the Endangered Wildlife Trust; Rozanne Savory, Jane Zimmerman and Clive Walker of the Rhino and Elephant Foundation; Rupert Lorimar, environmental spokesman for the Democratic Party; Anthony Hall-Martin of the National Parks Board; Martin Brooks, Keith Meiklejohn and Spud Ludbrook of the Natal Parks Board; Steve Johnson and Duncan Paul of the Bophutatswana Parks Board; Jeremy Anderson of Kangwane Parks Corporation, and Captain Piet Lategan of the new Endangered Species Protection Unit of the South African Police.

I would also like to thank Doug Wimble and Jan Glazewski of the Wildlife Society for their valuable legal information, and John Brooker of Brooker Wildlife, for an interesting private sector perspective. I am greatly indebted to all those who collected newspaper and magazine articles for me, especially Noreen Wallace who kept supplying me with a constant stream of useful material.

Many thanks to Mike Mentis and all the other members of the Wits Resource Ecology Group for their extremely helpful input, and to all the staff in the Department of Business Economics at Wits who assisted me at various stages of my project - Mike Cohen, Johann de Villiers, Henry Kenney and Dan Leach.

Finally, I would like to say a special word of thanks to both Frank Vorhies and David Solomon of the Department of Business Economics for their encouragement and guidance. Without their unstinting support, this report could not have been written.

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