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Biodiversity Loss in the Developing World and Sustainable Development

Plants and animals are major components of the Creator's comprehensive provision for human existence, contributing to man's physical needs and providing the basis for aesthetic and intellectual fulfilment. They also provide a demonstration of God's power and creative genius, meant to engender humility and worship. Humankind has a God-given mandate to exercise responsible stewardship over the whole of the material creation, including global biodiversity, which entails increasing their understanding of it and using it carefully to meet a variety of needs. Based on his own professional experience, the author examines selected aspects of the stewardship of tropical biodiversity, using examples from Asia and Africa including the arid vegetation of Arabia, the Borneo rainforest, the Asiatic lion, Great Indian rhinoceros and the African elephant. As elsewhere in the world, these resources are frequently threatened by a lack of care and over-exploitation driven by short-term economic considerations which jeopardise their availability to future generations. Ways are explored by which a biblical concept of stewardship can influence the sustainability of man's use of living natural resources. The aim is to achieve a balance between the various original purposes of creation, avoiding destructive over-utilization on the one hand and excessive protection and veneration of charismatic species on the other. Christians should recognise their responsibility to both care for biodiversity and encourage proper human development.

Keywords: Biodiversity; stewardship; conservation; sustainable development; wildlife utilization.

Introduction

Biodiversity, defined by IUCN as 'an umbrella term for nature's variety, including number and frequency of ecosystems, species or genes in a given assemblage' is the living context in which humankind has been placed by God and with which s/he shares biological commonality. It also represents a major part of the Creator's comprehensive provision for human existence. Plants and animals provide food (Gen. 1.29; 2.9), aesthetic satisfaction (Gen. 2.9) and a basis for intellectual activity (Gen. 2.19, 20). Together with the rest of the material creation they also furnish a striking demonstration of God's personality, power and creative genius (Rom.1.20) and are intended to lead mankind to humility (Job 38, 39 and 40.1–4) and engender wonder and worship of the Creator (Rom. 1.25; Rev.4.11). While recognising their place within creation (Ps. 103.15), humankind has been

given a clear mandate by God to exercise responsible stewardship over the earth's biodiversity (Gen. 1.26, 29; 2.15), which includes developing their understanding of it (Gen. 2.19,20) and using it carefully to meet their needs (Gen. 2.15, 16). However, we do well to remind ourselves that the image of a garden used in Genesis implies much more than utilitarian stewardship and invokes ideas of beauty, peace and a setting for the rest and tranquillity of the human spirit among its fellow living creatures.

It must be noted that authority and stewardship in regard to creation were given to humankind as God's representative and at a time when they were in close fellowship with the Creator and eager to do his bidding. Now, by contrast, the majority are out of touch with the Creator and their lives are largely guided by anthropocentric considerations, not by what pleases God (Rom. 1.18–32). In addition, the human race is deeply divided by national, ethnic and religious considerations, with widely differing attitudes to nature. Both factors complicate and hinder the global task of responsible stewardship and the sustainable use of natural resources. As Christians it is our responsibility to ask how the task of tending and caring for nature and guarding it (Gen. 2.15) can be exercised in the world of the new millennium. How might the biblical concept of stewardship be applied to some current problems of biodiversity loss? For the Christian, is *conservation* – judicious, sustainable use – to be preferred to the outright *preservation* of some western wildlife enthusiasts? The paper considers a few selected examples, familiar to the author and drawn from the developing world, in an attempt to address these questions. The tropics, where biodiversity is often rich and its loss acute, is a region of great human need where socio-economic progress is frequently elusive, and thus provides a sharp focus for some of the problems of biodiversity conservation and sustainable development.

Unidentified Species

Illustrative of our inadequate stewardship of the earth's abundant biological biodiversity is the fact that some of the millions of plants and animals as yet unidentified by science are already threatened with extinction. In some cases the agent of threat may be over-exploitation but more commonly it is careless and destructive use of an organism's habitat. During a 6-week survey of the flora and fauna of the Dhofar region of Oman in southern Arabia in 1977, the author and his colleagues discovered some 45 taxa of plants and animals which were new to science. A woodland tree, extensively used to provide fuel and roof timbers for the houses of the local Jabali pastoralists, surprisingly turned out to be a new species (*Anogeissus dhofarica* A.J. Scott). A number of unnamed animals and plants of the semi-desert grasslands were also discovered, including a new genus of large grasshopper-like insect (*Omania splendens*), a new species of Spiny mouse (*Acomys whitei*), five new reptiles and a variety of new plants such as the euphorbiaceous *Jatropha dhofarica*.[1]

1 Radcliffe-Smith, A., 1980, The Vegetation of Dhofar. In *The Scientific Results of the Oman Flora and Fauna Survey 1977 (Dhofar). Journal of Oman Studies Special Report* No. 2, pp. 59–86.

It was alarming to find that a number of these newly identified scrub and grassland species were threatened by damage to the sparse vegetation, caused by the indiscriminate driving of motor vehicles over the flat terrain, estimated at 0.5 per cent of the total area in some regions[2]. Much higher incidences of threat to undescribed species are estimated to result from the clearance of moist tropical forests[3]. A serious consequence of this type of species loss is the fact that their potential usefulness to mankind will remain undiscovered for ever and some component of the Creator's provision has been carelessly discarded.

Habitat Destruction

The greatest threat to biodiversity is posed by habitat loss, whereby destruction of the specific environment to which certain plants and animals are adapted leads to the extermination of those species. Nowhere is this threat more serious than in the tropical rainforests, the largest areas of which are found in the Amazon Basin, the Congo Basin of Africa and the Indonesian-Malay Archipelago of South-east Asia. Occurring in a region where evolution was not impacted by glaciation during the last ice-age, these ancient and complex forest ecosystems provide habitat for over half the species on earth, living in conditions of constant temperature and high humidity. As well as contributing significantly to the stability of global weather patterns, the rainforests are a genetic treasure trove providing us with such diverse items as chocolate, chewing gum, jute, rattan, hardwoods, oils, perfume, spices and the wild relatives from which domesticated plants, such as maize, can be genetically rejuvenated. They also contribute the basis of many important pharmaceuticals such as aspirin, malaria drugs, contraceptive pills, treatment for certain types of heart disease and leukaemia.

Over 100,000 sq. km of these rainforests are being eliminated per annum[4] (other authors give a much higher figure e.g. 323,750 sq.km[5]), resulting in the daily loss of species. Forest clearance makes way for development schemes such as hydro power, cattle ranching (to supply the North American fast food trade), cash crops, resettlement of people from overcrowded areas and the growing of crops such as rice to feed burgeoning human populations. In addition, some forests are subject to wasteful shifting cultivation, whereby species-rich primary forest is replaced by more open vegetation types which have fewer species and are subject to weed infestations and erosion. Other rainforests are being depleted by the removal of their largest trees for the timber trade.

In Borneo the author has witnessed large-scale forest clearance to make way for plantation crops such as rubber, cocoa and oil palm, which provide cash from export to the more affluent areas of the world. Selective logging for hardwoods,

2 Sale, J.B. 1980, The Ecology of the Mountain Region of Dhofar. In *The Scientific Results of the Oman Flora and Fauna Survey 1977 (Dhofar). Journal of Oman Studies Special Report* No. 2, pp. 25–54.
3 Myers, N., 1979, *The Sinking Ark – a New Look at the Problem of Disappearing Species*. Pergamon Press, Oxford.
4 Aitken, R.S. and C.H. Leigh, 1995, *Vanishing Rain Forests*, Clarendon Press, Oxford.
5 Richardson, D'arcy, 1991, *The Rainforests*. Brompton Books, London.

which provides further much needed cash for development, and is in theory sustainable, appears a justifiable use of forest resources. However, annual extraction of timber exceeds the rate at which wood is being replaced by regeneration and up to 55 percent of remaining trees are destroyed or seriously damaged by the logging procedures in general use[6]. Moreover, logging roads open up access to the heart of forests for illegal settlers and poachers of timber and wildlife. Biodiversity degradation resulting from Bornean forest management policies includes threats to the survival of rare primates such as the Orang-utan (*Pongo pygmaeus*) and Proboscis monkey (*Nasalis larvatus*), the Sumatran rhinoceros (*Dicerorhinus sumatrensis*) and endemic orchid species, as well as a variety of epiphytic plants. Many invertebrate species, especially forest insects, are being put at risk and organisms sensitive to small changes in humidity and light, such as frogs and orchids, are particularly vulnerable. Birds like hornbills, which depend on holes in old trees for nesting, are seriously threatened by wholesale forest clearance which removes trees of all ages.

Carnivores

Carnivores are particularly vulnerable to threats to their survival. Being at the top of the food chain, they depend heavily on a variety of species lower down in the chain, such as the omnivores or herbivores which constitute their prey. Should the survival of any of these species be seriously threatened, the carnivore will be the first to suffer. In addition, the larger carnivores often come into conflict with pastoralists whose domestic stock they may injure or destroy, particularly at times when wild prey is in short supply.

The Asiatic lion (*Panthera leo persica*) provides an example of the way in which both types of survival pressure operate on the species population of a large carnivore over a long period of time. Originally occupying a range which extended from Syria and the Middle East (it is the lion of biblical times) to eastern India, the Asiatic lion today comprises a single population of only 300 individuals in the State of Gujarati in western India. This dramatic shrinkage of the lion's range within historical times was the result of human settlement and its ungulate prey species being greatly reduced by competition with domestic stock, as well as the destruction of lions by pastoralists and hunters – a threat which intensified with the advent of firearms. Lion hunting was banned in India in 1955 and the Gir Wildlife Sanctuary set up in 1965 for the lion's protection. However, the sanctuary was shared with some 3,000 Maldharis, semi-nomadic pastoralists who herd water buffaloes, camels and cattle. These all compete with wild herbivores for forage, thus reducing their numbers and causing the lions to turn to domestic stock for food. This conflict was somewhat ameliorated in 1975 by re-locating 79 Maldhari settlements and their livestock from a 260 sq.km central area of the reserve. Thus by the late 1980's domestic cattle and buffalo in

6 Burgess, P.F., 1971, The Effect of Logging Hill Dipterocarp Forests. *Malayan Nature Journal*, 24, pp. 231–237.

the lions' diet had been reduced from 75 to only 33 percent and the number of wild ungulates (deer, antelope, wild boar) in Gir had increased to 40,000 from a mere 6,000 in 1970.[7]

The resulting increase in the lion population led to the carnivores straying onto public land and renewed conflict with humans. For example, in 1988–90 some 100 people were mauled and killed, producing the dilemma of what to do with 'convicted' man-eaters and other problem animals from such a small population. The Indian authorities are now trying to identify an area to establish a second home to which some members of the present population could be translocated, thus lowering the lion density in the Gir Sanctuary and reducing the incidence of conflict with humans, as well as eliminating the likelihood of a cataclysmic extinction in a single location.

Rhinos and Elephants

Very large charismatic species of wildlife excite the enthusiasm of animal lovers but are increasingly difficult to protect in a world where human population increase is resulting in demands for more land for food production. In the case of rhinoceroses and elephants their survival is under additional threat from an insatiable demand for the products of their main organs of defence – the horn of the rhino and the tusks of the elephant. Two examples will illustrate the problems of these large animals.

The Great Indian rhinoceros (*Rhinoceros unicornis*) was originally distributed from the Hindu Kush in the west to Burma (now Myanmar) in the east. For the last two centuries there has been an enormous expansion of the human population in the Indo-gangetic plain, resulting in wholesale loss of the rhino's floodplain habitat to cultivation. Additional pressure on the species derived from trophy hunting during the nineteenth century by officers of the British administration and wealthy Indians. Today there is a mere handful of, mainly small, populations of rhino confined to north-eastern India and southern Nepal. Living in less than a tenth of the species' former range, the surviving 1,700 individuals are vulnerable to debilitating epidemics on account of their localised distribution. However, the most serious current threat to the rhino's survival is poaching, fuelled by a great demand for rhino horn by practitioners of oriental medicine who pay up to US$8,000 per kilogram for the raw product. Some populations have lost up to 6 percent of their rhinos per annum in recent years.[8]

In an attempt to counteract these threats to the rhino's survival, in the mid-1980's the author assisted the Government of India with reintroducing a small number of animals into Dudhwa National Park in north-central India, an

7 Chellum, R. and A.J.T. Johnsingh, 1993, The Management of Asiatic Lions in Gir Forest, India. In *Mammals as Predators* (N. Dunstone and M.L. Gorman eds.). *Symposia of the Zoological Society of London*, No. 65, pp. 409–424.

8 Martin, E.B., C.B. Martin and L. Vigne, 1987, Conservation Crisis – the Rhinoceros in India, *Oryx* 21 (4), pp. 212–218.

area which was last occupied by rhinos in the 1890's[9]. Nepal has similarly established several new rhino populations in the western part of their former range. Subsequent satisfactory reproduction within these reintroduced populations suggests this approach can be effective in rhino conservation and it has now been successfully used for both African species of rhino. However, translocating very large animals such as rhinos is an expensive exercise: in the first Indian translocation five adults had to be flown across the country in an Aeroflot IL76 cargo aircraft chartered from the Russians. Set against the poverty of India, conservation solutions of this kind inevitably raise questions about the morality of spending enormous sums of money to keep the country's biodiversity intact. The discomfort is eased somewhat when the funds are donated by a wealthy agency in the West but some will then question whether the money would not have been better used in alleviating India's human predicament. Tackling the serious poaching problem might appear to offer a more acceptable solution in this case but the high price of rhino horn means poachers will risk their lives (they are sometimes shot on sight by wildlife guards) to obtain it. A more radical approach would be to carry out scientific research aimed at investigating, and possibly disproving, the efficacy of rhino horn as a medicine and then convincing the millions of users to lessen their demand for the product. As in so much of conservation, human attitudes are a key factor.

The African elephant (*Loxodonta africana*) is still distributed across 37 countries but numbers declined at about 2 percent per annum, from a total of 5–10 million, during the nineteenth century, in the face of agricultural settlement and ivory hunting. In the first half of the twentieth century populations were relatively stable as new game laws took effect but after 1950 there was a steady decline as rising human populations resulted in lost and fragmented elephant habitat due to cultivation and poaching increased. In the 1970's poaching mounted alarmingly as ivory prices escalated and modern firearms became widely available in Africa in association with wars and civil unrest. In the decade 1979 to 1989 elephant numbers dropped by 50 percent from 1.2 million to 600,000 as the price of ivory peaked at US$ 150 per kilogram. This unsustainable rate of decline caused great alarm in conservation circles, resulting in the imposition of a ban on international trade in African ivory by the Convention on International Trade in Endangered Species (CITES) in late 1989. The price of ivory dropped dramatically and the incidence of poaching lessened significantly, although the level continued quite high in some regions of Africa.[10] The demand for ivory for ornamental carving still continues in some of the strong economies of South-East Asia.

Wholesale bans on wildlife products which include the entire range of a widespread species are not universally approved. The ivory ban was felt to be unfair

9 Sale, J.B. and S. Singh, 1987, Reintroduction of the Greater Indian Rhino into Dudhwa National Park. *Oryx* 21 (2), 81–84.

10 Dublin, H.T., T. Milliken and R.F.W. Barnes, 1994, Four Years after the CITES Ban: Illegal Killing of Elephants, Ivory Trade and Stockpiles. *A Report of the IUCN/SSC African Elephant Specialist Group*, IUCN, Gland, Switzerland.

on several nations in southern Africa which had good elephant conservation and wished to cull some populations to prevent overstocking and subsequent damage to elephant habitats. Money from ivory obtained from culling could be used to finance various aspects of conservation. In fact this possibility was provided for in drafting the amendment to the CITES regulations by the present author (representing the Government of Somalia), which contained arrangements whereby states with intact elephant populations could apply for a review by a specialist committee, with a view to CITES granting an exemption which would allow ivory from such populations to be traded. Many hardline preservationists took exception to this implicit recognition of the concept of utilizing wildlife as a way of raising revenue. However, representatives at the CITES conference from the developing world voted overwhelmingly for this pragmatic formula which balanced the desperate need to protect the elephant in the majority of range states with the feasibility of generating conservation funds from overabundant elephant populations. To the author, judicious utilization of wildlife seemed to conform to the biblical principles of good stewardship of the created order; conservation rather than total preservation.

Sustainable Development

The Brundtland Report defined *sustainable development* as 'meeting the needs of the present without compromising the ability of future generations to meet their own needs'. However, this definition does not recognise the limits to growth imposed by nature, and the World Conservation Strategy[11] suggests as a more robust definition 'improving the quality of human life while living within the carrying capacity of supporting ecosystems'. Unless sustainability is built into our patterns of resource use we are irresponsible stewards. Furthermore, catering for the needs of future generations is a biblical concept. Hence, as Christians we should aim to ensure that no part of God-given biodiversity is lost or endangered for posterity. At the same time we should not deny proper and responsible use of any component of biodiversity in the interests of human wellbeing. Development or progress toward a better quality of life is part of God's plan for humanity (e.g. Deut. 30.9) and yet in the developing world we currently witness a major proportion of the human population struggling to achieve a basically acceptable standard of living and real progress is often elusive. In spite of this there are still conservationists in the West who would wish to deny people any form of wildlife utilization, choosing rather to advocate absolute protection. Such an attitude does not reflect the Genesis view that all plants and animals are for human use, subject to appropriate care and an implied guarantee of sustainability. It would appear that God intends all biodiversity as potentially for human use and edification, making redundant any sharp distinction between wild and domestic organisms. After all, God did not create any species already domesticated but all were originally wild and

11 Anon., 1991, *Caring for the Earth*. The Second World Conservation Strategy. IUCN, UNEP and WWF, Gland, Switzerland.

just a few have so far been tamed by persistent effort on the part of our ancestors.

The few examples of current conservation in the developing world described above provide us with a sample of the attitudes and some of the problems that beset the present battle to preserve global biodiversity. Let us now briefly examine these in the context of the need for sustainable development. The fact that there are still very large numbers of unidentified plants and animals, some of which are disappearing before their uses are discovered, reminds us of the abundance of God's provision and underlines the need for continuing study and research in the biological realm. Part of success in sustainability surely lies in spreading human demands on the plant and animal world among a much greater variety of species than hitherto. In the seventeenth century the notable Christian and biologist John Ray put forward the view[12] that, so long as the world endures, man will never attain to the knowledge of all species and, with several million still to be described, we seem little nearer that goal than 300 years ago.

The decimation of tropical rainforests appears to provide an example of short-term expediency, whereby the development needs of the present are being met at the expense of future generations. To many western conservationists, the assumption that cash-generating activities, such as plantation agriculture or timber export, have priority over caring for nature seems highly questionable. But sound conservation entails the wise management of all natural resources, especially soil, water, vegetation and wildlife, *and* also an understanding of the needs of the human population. But whose needs? The pressing need for the people of Borneo, in the example given, to move forward in matters of nutrition, health care or education is undeniable. But should this be achieved by the unsustainable extraction of their forest resources, such as hardwoods, for sale to the luxury markets of Japan or Europe? Or by the irreversible replacement of their forests' rich diversity by cash crops largely aimed at supporting extravagant western lifestyles? Where does the balance and sustainability implied by good stewardship lie in a complex example of this kind? Certainly such situations point to the global perspective of genuine stewardship and the need for those concerned about its implementation to examine the implications of their own lifestyle for resource conservation worldwide. As western Christians, we must not allow the convenient fact that many of the effects of our patterns of consumption take place in far off regions of the globe to lead us to ignore those effects. It also points to the need for us all to take a concerned interest in ways in which human progress in the developing world can be financed on a sustainable basis.

The story of the Asiatic lion raises some interesting moral and ethical questions about the conservation of endangered species. For example, to what degree

12 Ray, John, 1691, *The Wisdom of God Manifested in the Works of Creation.* William and John Innys, London.

should human activities have priority over nature which can so easily be manipulated or even destroyed to accommodate man and his domestic stock? What principles should govern attempts to balance human need with the conservation of wild species which can be destructive of human life and property? The shifting of the Maldhari villages out of the Gir lion sanctuary benefitted both the pastoralists (who were given good housing and other facilities away from the lions) and the lion population (whose natural prey was able to proliferate). However, it is sometimes necessary in such cases to ensure that enthusiasm for the conservation of a majestic species does not result in a weakly enfranchised community getting a raw deal. That great lover of nature Indira Gandhi, when Prime Minister of India, was once accused of favouring tigers over poor Indian villagers who were being terrorised by the highly protected large cat. For the Christian, the wellbeing and dignity of his fellow humans must always take precedence over the rest of the created order. But the question also arises, that considering all species were created by God for a purpose, does man have the right to eliminate any species or is he duty-bound to protect all; even the large carnivore which the tormented cattle owner would happily exterminate? Should not our intimate experience of the Creator's wisdom inspire us to seek reasonable ways of preserving such species from total destruction, even in a world increasingly overstocked with our own species? We have a duty to the Creator to provide a counter balance to the utilitarian view that only species of obvious current 'usefulness' to humankind deserve space on our crowded planet. Naturalists, in particular, will be aware of the ecological disruption that can result from the removal of a top carnivore from the food chain and if enclosing such food chains in well managed protected areas (parks, reserves, sanctuaries) is the only realistic way at present to guarantee the survival of 'destructive' species, then we should give them our support and use our influence to ensure they are adequately funded.

Rhinos and elephants present a different problem in that their survival is threatened by over exploitation, in the one case for what is believed to be a powerful medicinal product and in the other for what is undoubtedly an elegant ornamental material. The core problem in both cases is that the enormous value humans attach to these products makes it extremely difficult to regulate their harvesting, which entails killing their animal producers. The isolated individuals who are the end users are perhaps less guilty than the greedy entrepreneurs who rapidly become wealthy by trading in rhino horn and ivory. Again, Christians should be looking for ways to strike a balance between the legitimate use of animals for health and aesthetic satisfaction and the unacceptable slaughter of creatures to make a few traders obscenely rich. While the admiration of these stately beasts in their own right is probably a part of the Creator's intention, can the Christian honestly support a total ban on their products if they do indeed confer health and pleasure on their users? Of course, there is some uncertainty surrounding the medicinal effectiveness of rhino horn and, as already indicated, scientific research is needed here.

Financing costly conservation measures, such as the translocation of very large animals to safe areas, is problematic. However, if it is the only way to save

a threatened species it should be undertaken and costs should be shared among the global community of conservation conscious nations. Very often nations that have these animals cannot afford adequate conservation procedures and a greater international willingness to assist in the rescue of species *in extremis* is called for. Such actions would be an appropriate reminder of our communal responsibility, as the human race, to care for the whole of the creation that God has entrusted to us as his sole stewards.

In summary, the Christian attitude to the stewardship of biodiversity supports a conservationist rather than a preservationist position. Properly controlled use of living species for the benefit, development and legitimate enjoyment of humankind is to be encouraged within the limits imposed by the fragility of ecosystems and susceptibility to extinction processes.

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