

Fire Management in the Tanzania National Parks

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ANY management consultant will tell you that one of the prerequisites of a good manager is that he should define the objectives of his organization with care and precision. But unlike a business, whose primary purpose is normally to maximize its profits, a National Park's objectives cover a wide range, some of which are mutually conflicting. Perhaps the best example of this conflict is contained in the statement of policy by Secretary Lane in his famous letter to Mr. Mather in 1918, when he outlined the administrative policy that should govern the Parks:

“First, that the National Parks must be maintained in absolutely unimpaired form for the use of future generations as well as those of our own time; and, second, that they are set aside for the use, observations, health, and pleasure of the people.”

At that time, neither Secretary Lane, nor indeed the newly established Parks Service, realised how irreconcilable these two fundamental objectives would prove to be within a few decades; nor how much public controversy would ensue as to how best to resolve the dilemma of having to meet the ever-increasing demand for “enjoyment” and yet at the same time to fulfill the obligation to conserve in absolutely unimpaired form. What is the correct management aim in this essentially ecological field? The argument still rages.

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In those days, too, ecology was an infant science and the need for management in an ecological sense was largely unappreciated. In fact it was not until 1962 that this subject first came onto the agenda of an international conference when it began to be realized that some very difficult problems of definition would have to be tackled.

At that time, we in Tanzania had started to build up an ecological research team and as our knowledge increased of the main factors operating in the Serengeti ecosystem, various specific management problems became apparent. We found that when management asked the scientists for advice on what to do, the scientists replied, quite rightly, "You must first tell us fairly precisely what your management aims are in this matter and we can then tell you what we think can and should be done." After this had happened on several occasions, it became obvious that our general management aims would have to be spelt out in much greater detail.

To do this, we were very fortunate in being able to enlist the help of Professor Walter Russell who has a wide and relevant experience in the field of East African ecology and who produced a most valuable report for us, setting out the general principles we should follow in our management policies in the Parks.

I am going to quote the key statement in this report which should, of course, be read in its entirety to set it in its full and proper context.

"The primary object of the management is to conserve the present variety of the different habitats within the parks and of the different species of fauna using these habitats."

He defines this variety as that which one would reasonably expect to find in the area if the disturbance due to man is confined to controlled dry season fires.

Professor Russell considered, but rejected, the proposal that we should aim to maintain the different habitats and species of fauna as nearly as possible in their present distributions and proportions because, as he said: "the environment is constantly changing and I do not believe that there is anything sacrosanct about their present numbers and proportions at any one instant in time."

Further he recommended that positive management of the biological environment should be used as sparingly as possible and felt that

it was generally "a wise policy to allow the natural interactions between animals and vegetation, and between different types of vegetation, to take place without human interference as far as is compatible with the maintenance of reasonable areas of the major habitats and reasonable numbers of the more important species. Active management of the biological environment thus should only be necessary when major and irreversible changes are threatened."

Nevertheless this general policy of minimal interference did not and could not extend to fires in Africa, as they are almost always due to man, and at their current frequency and extent must be considered to be "unnatural" to the ecosystem. In these circumstances the control of fire is a necessary and very powerful tool for the control or alteration of both the plant and animal populations. Professor Russell argued that: "in most Parks uncontrolled fires come through every dry season, and the management decision is either to let them come through, or to prevent any fire coming through, or to control the fire so that it comes through at a pre-determined time or at a pre-determined interval of years. These decisions are of great importance in acacia woodlands and parklands which form such a characteristic habitat in parts of most National Parks, for these are fire induced habitats carrying a very distinctive group of wild animals and birds, and which must therefore be maintained, but they can be quite sensitive to the burning regime that is practiced. There are still very many difficult research problems to be solved before we can use this tool of the controlled burn to the best advantage in maintaining this group of habitats."

Professor Russell's recommendations have in general been adopted by the Board of Trustees. In brief summary, the essence of our policy is therefore as follows:

- 1) Our primary management aim is to maintain the present variety—variety of habitat and variety of fauna.
- 2) Leaving the question of fire aside, management interference with these still largely natural and very complex ecosystems should probably be restricted as much as possible.
- 3) But fire, man-made fire, which is the main modifier of the ecosystem, must be controlled.
- 4) How best to control it requires research, including research into

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the most effective methods and means of control, bearing in mind the practical limitations of finance and staff.

The history and prehistory of fire in the Serengeti, and I am going to concentrate on this Park to begin with, is not known with any precision. But there are two safe assumptions. First, that fire has been a factor of primary ecological importance for millennia, that is as long as the Serengeti ecosystem has been substantially in the state it is today; for it is characterised essentially by fire modified vegetation. And, second, that the incidence of fire has increased during the last few decades due to the rapidly increasing population round its borders. Obviously, therefore, the control of fire referred to by Professor Russell must lie broadly in the direction of reducing but not eliminating the impact of fire in the Park.

What in fact, is the impact of fire in the Park? The present position and current trends are now being studied by the Serengeti Research Institute who have been able during the last few years to produce monthly maps of the incidence and frequency of burning throughout the Park. In these years the percentage of the woodland burnt each year has varied between 50–85 percent. Comparison of aerial photographs taken at a ten year interval shows conclusively that, over many portions of the Park, woodland is in a state of decline.

It may well be that a contributing factor in this decline is the overall climatic trend in Africa towards a drier climate but there is no firm evidence as to how important a part this factor has played in the Serengeti during the last decade. There is however abundant evidence that fire and elephant have both been major factors in certain woodland habitats. And of these two it is certain that fire is the preponderating influence in causing and accelerating the decline. It is fire that is the major inhibitor of recruitment by destroying or burning back the seedlings or young trees before they can achieve a state of fire-tolerance. Elephant may well play some part in retarding young trees, but on present evidence this is relatively small; other animals, such as giraffe, rhino and impala, could have a greater impact than elephant.

With respect to more mature trees, however, it is the elephant which appears to be the major agent of change, either by pushing the trees over or, to a lesser extent, by barking them. This type of ele-

phant damage is thought to have reached its present intensity within the last decade. There is evidence that during the last few years elephant numbers in the Serengeti have remained constant, having increased considerably in the early sixties due to human pressures on elephant outside the Park. At its current level of impact, research indicates that the Serengeti would probably be able to sustain the damage only if sufficient recruitment of young trees could be safeguarded. Fire control appears to be the only way of doing so; shooting of elephants could possibly retard the decline of the woodland for a time, but is unlikely to provide a long term answer.

Research in the National Parks will have to continue for many years before the more important facts about fire, its control, and the relationship of its impact to that of the animals, are known. To enable these facts to be established, a long term ecological monitoring programme has been set up by the Serengeti Research Institute to include climate measurements, aerial photography and its interpretation on ecological lines, photogrammetry, photo-sampling by quadrats and transects, landscape classification, woodland ecology, vegetational surveys and mapping, and the population dynamics of tree species. The data are being computerized.

Very valuable work of a pioneer nature in this field is also being carried out by Dr. Vesey-FitzGerald, as described in the paper to be read to this conference.

But research must not be allowed to become an excuse for inaction, a technique of evasion. Facts of significance to management policy have already been established and more are steadily coming in. Broadly speaking, we already know enough to be able to lay down general guide lines as to what form controlled burning should take in any particular habitat.

But, and this I cannot emphasise strongly enough, the real and very intractable problem is, of course, the implementation of management guidelines, having regard to the little money and the few staff available to carry them out.

Let me illustrate these practical difficulties. Within the boundaries of the Serengeti, for example, we have 4,000 square miles of woodland in which some form of fire control must be initiated as a matter of urgency; the other 1,000 square miles of open plains present a lesser

problem. Most fires start outside our borders and by the time they reach the Park they are being swept along on a wide front by strong winds. Throughout the year poachers and honey-hunters are active, using fire to facilitate their illegal activities, and Masai cattle raiders pass through the length and breadth of the Park when raiding their neighbours, often burning behind them to conceal their tracks.

To cope with this situation we have a total staff in the park of about 350, rangers, artisans, labourers, the lot. The fire season coincides with the poaching and the main construction seasons. Only a small fraction of the total staff can be made available at any given time for work on fire control. Many fires start at 50–80 miles away from the Park Headquarters, often in trackless bush, and by the time they are discovered and reported they are burning fiercely over a wide area. Late fires have resulted in a blanket burn of up to 700 square miles of country. Roads are few and far between, and sited for touristic reasons rather than for the control of fires. Experience has shown that graded fire-breaks often entail unacceptable risks of gullying and soil erosion. Transport is chronically short; so is effective and knowledgeable supervision.

Funds are also extremely tight. The total available for everything that goes into running the Serengeti is less than \$240,000 a year. At the present stage of the rapid development of the Park only a small fraction of this can be set aside for fire control. It is politically impossible to obtain more funds from the government for this purpose.

In these circumstances, any management policy aimed at the total exclusion of fire over most of the Serengeti, except in a few small areas of special value to visitors, is doomed to failure. Because of the inadequacy of the animal impact on the pasture in the woodlands and the consequent dangers of building up a supply of fuel, it is also probably unsound.

Uncontrolled late hot burning is the commonest form of fire at present. It needs no encouragement from management.

This leaves us only with the early burn as making any sense either from the practical or ecological points of view. This type of burn is often called a cool burn, though its coolness is only relative. Even early fires will normally burn back any seedlings or young trees they reach almost as effectively as a hot burn. But it is patchy and this is

its most valuable characteristic; it produces, and tends to maintain, a fire mosaic.

Fifty years ago, this part of Africa was sparsely inhabited and many areas were a form of no-man's land between warring tribes into which few dared to enter. Fires were fewer and patchier and this patchiness gave regenerating trees a chance to survive their fire-tender years. Only the existence previously of a more balanced fire mosaic can explain the former healthier state of the woodland from which it is now declining. Admittedly little is known about the extent of animal impact at that time; the great rinderpest epidemic at the end of the last century must have affected this. Nevertheless elephants, rhino, giraffe and impala, all those species which have a browse-impact on woody vegetation, have been in the Serengeti off and on for many thousands of years.

Clearly, therefore, the main management goal in the Serengeti must be to increase the patchiness of fire, to encourage the formation of fire mosaics and to reverse the present trend towards blanket burns.

How can we hope to achieve this? It would of course be ideal if we could educate our neighbours not to light fires but, although some progress might conceivably be possible in this direction, it presents no solution to our immediate problem. An intensification of our anti-poaching measures could have some effect on the number of fires lit within the park, but to count on this would be sanguine indeed. Virtually the only practical method is to increase early burning when the grassy vegetation has still considerable variations in its readiness to catch fire. The time span when this is possible in any given spot is often a matter of days rather than weeks.

Fraser-Darling, in his thought provoking chapter on fire in his book "Wild Life in an African Territory", sets out very clearly the dangers of indiscriminate early burning. He emphasises that early burns, when used, should be planned to protect as much vegetation as possible from late blanket burns by increasing the effectiveness of fire-breaks, whether these be roads or natural features, and so to improve the chances of achieving each year a balanced fire mosaic over the Park as a whole. As the tourist development of the Park proceeds, more roads will be constructed. Their potential role as fire-breaks must be given high priority among the factors determining their

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alignment. This is already being done in the Tarangire at the instance of Dr. Vesey-FitzGerald.

Professor Russell's concern about the acacia woodlands and the decline of riverine forests needs to be reflected in the priority of effort given to particular areas. Both these varieties of habitat must be conserved if humanly possible.

Meanwhile adequate staff will have to be made available and be properly trained in the use and control of fire on a team basis. Priorities need to be reconsidered. What is the proper allocation of park rangers in the field force during the burning season? At that time of year, may not fire control be more important than antipoaching, if we take a long term view?

The main immediate task of research must be to determine which areas most require to be given the chance of having a fire mosaic and to evolve practical methods of achieving the optimum fire mosaic with the minimum demands on money and staff. This will entail research into better and more economical fire-making equipment as well as applied research along the lines laid down in Dr. Vesey-FitzGerald's paper.

Unless both management and research can together meet these objectives, the ecological monitoring programme can look forward in the years to come only to recording diminishing diversity, a loss of habitats, lower productivity and a less aesthetically pleasing landscape—the same bleak environmental future which stares so much of Africa even more menacingly in the face.

So far I have been dealing mainly with the Serengeti. For the sake of completeness, as the subject of my paper refers to all the National Parks in Tanzania, I would like to conclude with a very brief reference to the fire problems of the other seven Parks.

In the relatively small Arusha and Manyara Parks the picture is much less gloomy. Here, because of the considerable animal impact and the fact that we are dealing with 50 square miles instead of 5,000 the conversion of fire from a master to a servant, in Dr. John Phillip's words, appears to be entirely practicable. However, in the Tarangire (1,010 square miles) and Ruaha (5,000 square miles) the problems are on a scale similar to those of the Serengeti. In Mikumi, little ecological research has yet been done but, on an entirely superficial level,

it would appear that the fire impact is not resulting in marked changes in the habitat. On Kilimanjaro, about to be established as a National Park, there is going to be the very difficult long term problem of maintaining the forest girdle around the mountain at the lower altitudes; this will lie outside the boundaries of the Park.

And, lastly, in the Gombe National Park our aim must be to exclude the fires which sweep down from outside over the crest of the escarpment, causing grasslands to encroach into the edge of the beautiful indigenous forest on which the chimpanzees depend. Here, unfortunately, there is little animal impact on the grassland, though, I suppose, there is always the danger that one day some chimp may himself add fire to the tools he has already learnt to use and so be ready, waiting in the wings, to understudy man as the destroyer of his own environment.