Sleeping sickness control —how wildlife and man could benefit

W. E. Ormerod and L. R. Rickman

Tsetse eradication and control programmes are often carried out in order that cattle can be introduced into the cleared area. The resultant destruction to habitats and wildlife can be considerable, and the majority of Africa's human population does not benefit from increased beef production. The authors say that we need a different approach, one that would concentrate on controlling sleeping sickness in humans, and on conserving the indigenous vegetation and fauna. They illustrate their approach by describing what could be done in a part of northern Zambia where sleeping sickness is endemic.

Agricultural development policies in Africa tend to concentrate on domestic livestock production and arable farming, both of which destroy natural habitats. Many development programmes have failed to consider whether the land is suitable for such use in the long term, and the consequence has been the degradation of much pastoral and agricultural land.

The most severe and widely publicized example of such degradation has been in the Sahel. Some argue that the major causes are man's activities in removing vegetation by over-grazing with domestic stock and exposing the soil to sun and heavy rainfall (Charney, 1975; Ormerod, 1978; Zonnenfeld, 1980). Others say that climatic trends, independent of human activity, are to blame (Grove, 1977; Winstanley, 1973, 1985). Even if the existence of such climatic trends is acknowledged, it is still possible that the changes they produce could be accelerated and intensified by human activity. Similar ecological changes are occurring, where forest has been cleared and the land has been degraded by inappropriate agriculture and pastoralism, in many parts of Africa's tropical zone.

Such clearance has been justified on two counts: to control disease and to produce more food. Tsetse eradication schemes, undertaken because tsetse carry trypanosomes, which cause sleeping sickness in humans and 'nagana' in cattle, have been responsible for the destruction of much woodland in the past. Less damaging control techniques are now available (Matthiessen and Douthwaite, 1985), but those most widely employed involve the large-scale use of insecticides, which can be damaging to wildlife and man.

Even with more benign methods of control, the problems of land degradation remain. Tsetse-infested land is usually on infertile sandy or lateritic soils. Unless such soils are very carefully managed, agriculture and stock farming can result in the degradation and virtual destruction of the habitat by over-grazing and impoverishment of the soil, leaving the local farmers worse off than before. On such infertile soil, and in the presence of tsetse and trypanosomiasis, wildlife is a far more important resource in the long term.

Accordingly, we feel that efforts should concentrate on controlling tsetse in areas where sleeping sickness is endemic in the human population, and that appropriate land-use measures should be adopted.

The importance of sleeping sickness

In spite of scientific progress, trypanosomiasis in man and animals continues to present a

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formidable challenge to health and economy in many African countries (WHO/FAO, 1969). In 1987 the position has, if anything, deteriorated and sleeping sickness has increased in a number of places. Its importance as one of the major diseases in Africa lies not so much in the number of cases it actually produces as in its potential for causing a major outbreak. In Kampala, Uganda, in 1901, eight cases of sleeping sickness were diagnosed; by the end of 1906 total mortality from the outbreak considerably exceeded 200,000 (Bell, 1909). Today, Busoga district, east of Kampala, is again experiencing a major epidemic, which some believe exceeds that of 80 years ago (Knuttgen, 1985). Similar epidemics also threaten the Zumbo district of Mozambique and Equatoria province of Sudan, both of which have long histories of sleeping sickness.

For many years the control of sleeping sickness relied on the detection of the trypanosome and the removal of the infected people from the community. Removal of sufferers from the community was first carried out in Busoga; infected patients were taken to isolation camps where they died. In Tanzania in the 1930s and 1940s, villages were regrouped to avoid areas with high concentrations of tsetse, and the agricultural areas round them, where tsetse could not survive, were increased. These measures were effective, but the close control over people's lives could not be maintained after the country achieved independence. Moreover, the constant use of the same land without adopting specific measures for maintaining fertility meant that the 'sleeping sickness settlements' had no long-term agricultural future.

Today, powerful and persistent insecticides, improvements in aerial spraying techniques and, to a lesser extent, control by liberation of sterile male tsetse flies, feature in trypanosomiasis control schemes. Warnings that aerial spraying may be ineffective under some circumstances (Turner, 1986) and that tsetse populations have great powers of regeneration (Rogers and Randolph, 1985) need, however, to be taken into account. It should also be appreciated that the techniques adopted for eradication of tsetse have been developed primarily for the control of cattle trypanosomiasis, and that far less attention has been given to the development of techniques for the control of human trypanosomiasis epidemiological differences between the two diseases are widely misunderstood (Ormerod, 1986).

New methods of control

'Conical and biconical' traps (Challier, 1977) are very effective in reducing populations of tsetse; but their effectiveness is limited to certain species, and the important *Glossina morsitans* tends not to be collected. In Zimbabwe, traps and screens impregnated with insecticide and baited with synthetic components of 'ox-odour' have been developed. These kill large numbers of tsetse, of species that include *G. morsitans,* at very low cost (Vale, 1982). Although this technique has so far been used only for the control of cattle trypanosomiasis, we think that it also has potential for the control of sleeping sickness.

Although for many years there was little progress in the development of acceptable drugs for sleeping sickness, today new ones are being tested, and it is probable that several new drug systems for sleeping sickness therapy, and perhaps prophylaxis, will become available within a few years.

Wildlife management as a component of sleeping sickness control

Many species of wild, as well as domestic, animals in Africa are infected with trypanosomes, from which they suffer little if any disease unless they are stressed by starvation, drought or overwork. However, since this is the normal lot of cattle in a degraded African landscape, 'nagana' has achieved a reputation that is not wholly justified. Most of the 'nagana' trypanosomes do not infect man and do not cause sleeping sickness.

The study area

The sleeping sickness focus in Isoka district in northern Zambia was identified by Buyst (1970, 1974, 1977) and so far has produced, on average, 5–100 cases per annum.

The vegetation in the affected area is very thick and appears to be regenerated forest. Houses, paths and even primary schools are invaded by tsetse. Transmission of sleeping sickness seems to occur in, or near, the village because women and children (who tend not to leave the village) are just as likely to be affected as adult males (who are frequently outside it).

The predominant tsetse in the area is *G. morsitans morsitans; G. pallidipes* is also present, representing 7 per cent of catches. Tsetse blood meal analyses of 222 different samples taken from various sites in the study area show that 54 per cent of feeds are from Suidae (bush pig and wart hog), and 16 per cent from bushbuck; a few feeds (4 per cent) are from hippopotamus, which is not seen in the area by day, although it travels long distances by night to graze. Primates accounted for nine of the feeds (4 per cent), but the methods used for analysis are not, at present, able to distinguish human from non-human primates. Some of the blood meals may have been from baboon, vervet monkey or bushbaby, all of which abound in the area, but it is probable that most of them were from man.

Only a few different genetic types of *Trypanosoma brucei rhodesiense,* the strain that affects man, have so far been identified from patients in the study area. However, during a small localized outbreak of sleeping sickness in 1982, the 20 strains isolated from patients were all of the same genetic type. By contrast, trypanosomes taken from a bushbuck (one out of a total of 10 shot in the area of the outbreak, and immediately prior to it) proved to be *T. b. rhodesiense* of a totally different genetic type from those obtained from man.

It would be unwise to draw conclusions from such scanty evidence about the origin of the strains of *T. b. rhodesiense* that are being transmitted to man in the study area, but a working hypothesis is emerging, namely, that the transmission of the sleeping sickness trypanosome is by the route 'man–fly–man' and that the route 'animal–fly–man' is exceptional.

The proposed project in Isoka district

The following practical steps need to be carried out concurrently: (i) break the contact between man and tsetse; (ii) carry out surveillance and treatment of sleeping sickness cases; (iii) investigate the role of wildlife in sleeping sickness transmission. Finally, the wider aspects of wildlife management need to be investigated so that this valuable resource can be protected from over-exploitation.

Breaking the contact between man and tsetse

Whatever the genetic nature of the causative strain of *T. b. rhodesiense,* there is little doubt that the prevalence of sleeping sickness can be decreased dramatically by reducing the contact between man and fly. The older methods of accomplishing this, namely, by cutting back the bush and by restricting access to it, are no longer acceptable, but might now be replaced by the formation of a 'sanitary' zone around groups of villages, farming areas and important pathways by the judicious siting of odour-baited traps treated with insecticide. Other villages, either by having no traps or by placing traps unbaited with ox-odour or untreated with insecticide, could act as controls.

Surveillance and treatment of sleeping sickness

Strict surveillance of the disease in the affected villages would be an important feature of the study. The use of unprotected villages in the study (when they could be protected from this lethal disease) would, without such surveillance, be ethically unjustifiable. Late cases treated with the drugs in current use are placed in some danger, but early cases can be cured without danger, provided that their infections are detected and treated rapidly.

The role of wildlife in sleeping sickness

While it is evident that there is some transfer of strains of *T. b. rhodesiense* between wildlife and man, and vice versa, its extent is not clearly understood. We propose to introduce captive-bred animals in fenced enclosures near villages to act as 'sentinels'. Our objective will be to find out the rate at which they become infected, the genetic nature of the infection, the relationship of the infection to that found in man, the persistence of the infection, and its transmissibility by clean laboratory reared tsetse. Duiker and bushbuck will be the first animals to be studied in this way since they live closest to villages and might be expected to share their infection with man, and because the latter species holds the reputation, not necessarily justified, of being the prime reservoir host of *T. b. rhodesiense*.

Wider aspects of wildlife management

While the prime objective of our study will be to investigate the relationship between sleeping sickness and wildlife, and to control the one without having to drive out or exterminate the other, we would hope that it would improve the prospects of management for a number of different species.

Most of the hunting activities of the local people are illegal and, therefore, it would be difficult to discover how much game was being taken. Instead, wildlife ecologists would need to study the animal populations by other methods to find out the rate of culling and of replacement under cull. We believe the rate of replacement could be remarkably high, based on the numbers of animals shot over long periods in fenced areas for purposes of tsetse control in earlier schemes in Southern Africa (Chorley, 1958; Cockbill, 1960; Willett, 1963); it is probable that the animals in the study area would be able to maintain their populations in the face of considerable hunting pressure, provided that their habitat was not allowed to deteriorate. Although few animals are seen in the study area, the number of tracks seen by day, and the rapidity with which they are renewed by night, indicates that populations of these animals must be fairly large. The bush, moreover, is dense and the terrain rocky and difficult, so that it may be possible for quite large populations to survive even more intense hunting than is at present pursued.

Conclusions

Although the protection of animals and their habitat for purposes of hunting is an aim to which some preservationists may be unsympathetic, it must be recognized that the hunters concerned have very little else to live on, given the infertile nature of the terrain. Trypanosomiasis control has a poor record in terms of the conservation of African wildlife, and probably more populations of animals have been exterminated and their habitats destroyed for this reason than for any other. Views on the subject have, however, changed dramatically: Sir David Bruce (Bruce, 1915) recommended the destruction of most of the large African fauna. 'It would seem to be self-evident that these wild animals should not be allowed to live in fly-country, where they constitute a standing danger to the native inhabitants and their domestic animals. It would be as reasonable to allow mad dogs to live and be protected by law in our English towns and villages. Not only should all game laws restricting their destruction in fly-country be removed, but active measures should, if feasible, be taken for their early and complete blotting out.'

Compared with other changes introduced into African agriculture, trypanosomiasis control is one of the worst initiators of land degradation because its effects occur so rapidly. Tsetse need only be removed from an area for a single season for cattle to be introduced, often in excessive numbers, and for massive over-grazing to occur.

For this reason we advocate the control of sleeping sickness without the actual extermination of tsetse. Wildlife is a very much more stable food resource than agriculture on infertile land. It includes, in our study area, not only the larger mammals, but also rodents (e.g., cane rats), birds, fish and insects, including winged termites, grasshoppers (which are recommended as a child food supplement) and several species of caterpillar that are highly prized. Few of these animals would survive ecological degradation, particularly if it were preceded by spraying with insecticide.

An undesirable result of the control of sleeping sickness in such an area could be the over-exploitation of wildlife if the human population were to rise dramatically. People living in the study area, as in much of Africa, consider wild animals to be a common resource, and it is most unlikely that they could be persuaded to observe close seasons. However, this perhaps might not be necessary because a close season is imposed by the rains, and the rapid growth of impenetrable grass makes hunting virtually impossible for a few months.

The thickness of vegetation in the area is probably the best protection for wildlife. We believe that it can ensure such protection even perhaps at a much higher level of hunting, but it could rapidly be destroyed if cattle were introduced or more extensive agriculture developed. Moreover, we do not believe that such a development would be in the interest of the local people because the fertility of the soil and its response to agriculture would be inadequate for food production to be sustainable.

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W.E. Ormerod, The Old Rectory, Padworth, Reading RG7 4JD, UK.

L.R. Rickman, Tropical Diseases Research Centre, PO Box 71769, Ndola, Zambia.