Pan African Tsetse and Trypanosomiasis Eradication Campaign (PATTEC)

Strategic Environmental and Social Assessment

May 2006

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Strategic Environmental (and Social) Assessment of Tsetse and Trypanosomiasis Control and Eradication Program in Africa

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LIST OF ACRONYMS

AAT	African Animal Trypanosomiasis
ADB	African Development Bank
ADF	African development Fund
ADI	Acceptable Daily Intake
AU	African Union
AU-IBAR	African Union-
DANIDA	Danish International Development Agency
DFID	(UK) Department of Foreign International Development
EA	Environmental Assessment
EIA	Environmental Impact Assessment
ESAP	Environmental and Social Assessment Procedures (and Guidelines)
ESIA	Environmental and Social Impact Assessment
ESMP	Environmental and Social Management Plan
ESMF	Environmental and Social Management Framework
ETTSSA	Eradication of Tsetse and Trypanosomiasis in Sub-Saharan Africa
EU	European Union
FAO	Food and Agriculture Organization
FITCA	Farming in Tsetse Controlled Areas
HAT	Human African Trypanosomiasis
HOORC	Harry Oppenheimer Okavanago Research Center
IAEA	International Atomic Energy Agency
ILRI	International Livestock Research Institute
IUCN	International Union for the Conservation of Nature
JICA	Japan International Cooperation Agency
MDG	Millennium Development Goals
NEPAD	New Partnership for African Development
ODMP	Okavanago Delta Management Plan
OECD	Organization for Economic Co-operation and Development
OC	Organo-chlorine (insecticides)
OCP	Onchocerciasis Control Programme
PATTEC	Pan African Tsetse and Trypanosomiasis Eradication Campaign
RTCCP	Regional Tsetse and Trypanosomiasis Control Programme
SAT	Sequential Aerosol Technology
SIA	Strategic Impact Assessment
SIDA	Swedish International Development Agency
SIT	Sterile Insect Technique
SEA	Strategic Environmental Assessment
S&0	Scoping & Orientation
STEP	Southern Tsetse Eradication Program (Ethiopia)
UN ECOSOC	United Nations Economic and Social Council
USAID	United Stated Agency for International Development
WHO	World Health Organization

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PART I
INTRODUCTION AND CONTEXT

Introduction

1. In July 2000, during the Summit held in Lomé, the African Heads of State and Government collectively decided to establish the Pan African Tsetse and Trypanosomiasis Eradication Campaign (PATTEC), which was later launched, in October 2001. In accordance with the decision by the African leaders, the Commission of the African Union was assigned the task of initiating and coordinating the activities of PATTEC. Within the framework of this assignment, the Commission prepared a Plan of Action for an extensive program in support of the eradication of tsetse and trypanosomiasis in sub-Saharan Africa, through proper sequencing and coordination of interventions. The program is based on an integrated approach and involves all the 37 countries with tsetse flies, and an estimated area of 10 million km^2. Pest and disease management techniques were to focus on integrating suppression, control and eradication technologies while ensuring that the reclaimed areas would be equitably, sustainably and economically utilized. A PATTEC Coordination Office was later set up, in 2002, with the mandate of helping to initiate and coordinate the activities of PATTEC.

2. The Campaign is planned to be implemented as a series of successive *phases* involving a limited number of countries at the same time, and supported by different financiers including at the forefront the African Development Bank (ADB). Six countries, Mali, Burkina Faso, Ghana, Uganda, Kenya, and Ethiopia, were selected to participate in the first phase of the campaign. Phase I was started in 2005, with the main support from an ADB loan and an African Development Fund (ADF) Grant, totaling approximately 72$M US. Ten additional countries (Angola, Cameroon, Tanzania, Chad, Benin, Togo, Zambia, Botswana, Namibia and Rwanda) have been tentatively targeted for immediate continuation of the campaign as part of a second Phase (II).

3. As per the Bank's Environmental Policy (2004) and its Environmental and Social Assessment Procedures (ESAP, 2001), effective and timely application of Strategic Impact Assessment (SIA) of policy/program lending is a requirement. The Bank is committed to use the Strategic Impact Assessment as a systematic process in order to ensure environmental considerations are fully included and appropriately addressed at the early stage of decision making on par with social and economic considerations. Strategic Environmental (and Social) Assessment (SEA[1]) is a tool conceived and applied world wide to assist decision-makers and planners in the optimal design of policies, plans and programs in terms of environmental sustainability, and in the assessment of the compliance and coherence of those schemes to their own internal rules. The whole PATTEC falls under this requirement. While Phase I was the subject of a separate Environmental and Social Impact Assessment (ESIA), the Bank has commissioned the present Strategic Environmental and Social Assessment (SEA) in order to assist the Bank in providing timely decisions for, and guidance to, PATTEC and to the countries requesting co-funding in future phases of the Campaign.

Previous and on-going Environmental Assessment of the Programme

4. Two significant environmental assessments have been completed or are on-going, namely 1) the Environmental and Social Impact Assessment of the Phase I of the Program (the Bank) and 2) the "Framework for the Identification of Environmental and Socio-economic consequences of the Program" carried out by the International Livestock Research Institute (ILRI), based in Nairobi.

[1] SEA, which stands for "Strategic Environmental Assessment" is synonymous to the expression « Strategic Impact Assessment » in the Bank's terminology. Currently, SEA is more widely used worldwide.

5. ***Impact study (ESIA).*** The "impact study" (ESIA) of the "Multinational Programme of Eradication of Tsetse and Trypanosomiasis in Sub-Saharan Africa" was carried out in 2004, as a Bank's project under Phase I loan agreement and under the African Development Fund[2]. Phase I of the Programme has been classified as Category I for environmental assessment purposes and accordingly a comprehensive Environmental and Social Impact Assessment (ESIA) has been carried out in order to: a) identify the direct environmental and social impacts that integrated tsetse fly eradication activities would have on the biophysical and social environment in the six countries; b) assess the risks associated with such activities; and c) formulate appropriate mitigation measures for inclusion in the design and execution of the project. A multidisciplinary consultant team comprised of an environmentalist, an entomologist and an ecologist was contracted to carry out the ESIA. A mission was undertaken to the six countries selected for participation in the Phase I project of PATTEC, namely Burkina Faso, Mali, Ghana, Ethiopia, Uganda, and Kenya. During the field visits, extensive consultations were carried out with government representatives including those responsible for agriculture, livestock and environment. Interviews with officers responsible for tsetse control programme in each country, researchers and others concerned with trypanosomiasis and tsetse control as well as meetings with farmers in infested areas in each of the countries. The ESIA provides a substantial information base for the list of potential direct and indirect impacts associated with the program and potential mitigation measures that can and should be implemented, as well as a model Mitigation/Enhancement Plan, a feature which is normally part of a standard Environmental and Social Management Plan (ESMP). Those previous efforts are included and incorporated in the present assessment.

6. ***Framework Study (ILRI)***. A framework study for the "Identification and Management of Environmental and Socio-Economic Consequences of Tsetse and Trypanosomiasis Control and Eradication" was mandated by the PATTEC to the International Livestock Research Institute (ILRI) under financing by USAID as of March 2005. The study is being carried out in collaboration with the United States State Department Office, the PATTEC Coordination office in the African Union and the arm of the African Union responsible for activities related to livestock development in Africa (AU-IBAR). Part of the objectives of the Framework Study is to provide canvases for the assessment of both direct and indirect impact of the various projects that will be developed as the program unfolds. While not being an SEA for the purpose of the Bank, the scope of the Framework Study ranges partly over the previous ESIA and the present SEA. Consequently close ties have been established with the ILRI research team.

Mandate and Terms of References

7. The potential environmental effects of such a development program of an unprecedented scale in Africa (or elsewhere world wide) are sobering. Remarkable opportunities exist for planned and sustainable economic development to progress in parallel with the incremental clearance of more than 10 millions km^2 of tsetse infested land. Equally remarkable is the potential for unprecedented environmental impacts resulting from unforeseen and uncontrolled socio-economic and biophysical factors. Pitfalls might be uncoordinated planning for development, unforeseen and unmanageable impacts or consequences that might appear in ten or more years, or post-clearance development that might not be sustainable given the particular biophysical or ecosystemic context of opened areas. Opening or re-opening such large areas of land to possible new development and new usages might have effects on natural resources, biodiversity, conservation, social equity and many other issues, some of which entail the crossing of political boundaries.

[2] Akuamoah, R.K., Carvalho, A.L., and Adeola, M.O., 2004, Environmental and Social Impact Assessment Study (ESIA), Multinational Project: Eradication of TseTse and Trypanosomiasis in Sub-Saharan Africa (ETTSA); African development Fund, 68 pages.

8. Given the scale of the program, and the previous and on-going related environmental studies, specific objectives of the present SEA are to focus on indirect effects of the programme and provide guidance for, the various national or multinational development programs that need to be formulated and implemented in the land rendered free of tsetse, including non agro-pastoral use, to ensure sustainably managed and conflict-free use of the newly open areas. The overall objectives of the SEA are therefore:

1) To assess the compliance and coherence of Tsetse and Trypanosomiasis Eradication programs in Africa with the Bank's environmental policies and procedures;
2) To prepare a "Framework Environmental (and Social) Management Plan" to guide implementation of the projects in various countries or contexts,;
3) To provide guidance for the authorities responsible for the implementation of the Africa-wide program,
4) To review and assess the various national or multinational development plans for tsetse free zones, assess their sustainability and assess the inc-country capacity to monitor sustainability and apply effective Environmental Assessment process for projects within the tsetse cleared areas, and finally
5) To provide framework guidelines for the Environmental Impact Assessment (ESIA) of the various projects stemming from the campaign once they become defined in the various countries.

9. The Terms of Reference are appended as Annex 1 to this report. The mandate was given to a team of four consultants, over a period of 24 days. At the time of the preparation of this report, objective number 4 was not attainable as the various multinational or national plans for the development of the tsetse free zones were not available, or known to the present Team. The composition of the SEA Study Team is given as part of Annex 1.

The present Assessment

10. According to the Bank, SIA (SEA is the term used here) is an eight step process: ranging from 1) scoping, 2) identifying possible options for the program; 3) establishing standards, thresholds and sustainability criteria; 4) identifying the likely effects of each viable option; 5) determining what can be done to mitigate negative effects and enhance positive effects as well as integrating residual impacts; 6) developing an institutional strengthening plan to improve environmental and social management; 7) presenting the results of the analysis (and presumably recommending on the continuation or abandonment), and finally 8) monitoring the results. In the present SEA, steps 1, 2 and 3 were accomplished through a first phase, termed **Scoping and Orientation**; step 4 is included in the present report as the **Analysis of Alternatives** while step 7, which required Field work**,** is presented as the **Impact Assessment** section; finally steps 5, 6 and 8 are included in the **Environmental and Social Management Framework** section of this report.

11. ***Scoping and Orientation.*** Scoping and Orientation (S&O) was used as a preparatory stage for the present assessment. S&O included a) examination of previous and on-going environmental studies, b) preparation of a work plan, c) a quick literature search, d) consultation with African Development Bank Environmental specialists, and e) establishment of sustainability criteria. As part of this preparatory stage, a meeting was arranged with the ILRI Team in Nairobi working on the Framework Study of the Environmental and Social consequences of PATTEC. A summary of that meeting, as well as the Scoping and Orientation Report resulting from the preparatory stage are appended as Annex 2 to the present report. S&O was aimed at : a) reviewing the previous Environmental Assessment, particularly the assessment of the direct impacts, related to the suppression and control techniques, as presented in the ESIA of Phase I; b) determining the appropriate form to be adopted for the present SEA, c) whether or not there was some previous examples of large scale disease vector eradication

programs in Africa, that could be used as *ex-post* models and d) whether or not there were other continent-wide programs of different natures but for which Framework Environment and Social Management plans had been formulated, that could be used as *ex-ante* models.

12. As a result of S&O, the following main methodological orientations were taken for the present SEA:

a) The present SEA would be mostly streamlined as a mean of Sustainability Assurance for the Bank towards the Campaign;
b) Impact assessment would build up on the ESIA carried for Phase I. A clear distinction would be made between impacts associated with the techniques used to combat the vector, so-called direct impacts, and those impacts resulting associated with post-eradication, so-called indirect impacts, particularly those associated or induced by the occupation or re-occupation of the land rendered free of tsetse;
c) "Lessons learned" from the previous program of eradication of Onchocerciasis (river blindness) from 1974 to 1994 would be used as an *ex-post* example, particularly for the typology of indirect impacts, with appropriate updating and adaptations; in addition, lessons learned from previous tsetse control programs would be used as well for guiding the broad design of an Environmental and Social Management Framework.
d) Environmental and sustainable development Guidelines from continent-wide programs, such as the Africa Stockpile Program would be examined closely for possible use as templates for the Environmental and Social Management Framework (as well as for complementarity to the present project);
e) Duplications with ILRI deliverables would be avoided as much as possible, and reference for possible future usage of the Guidelines for Impact Assessment being developed under that initiative would be recommended;
f) The selection of sustainability criteria would be based on ADB Environmental Policy.

13. ***Field work***. As part of their mandate, one or more members of the SEA Study Team visited the following countries as selected by the Bank: Botswana[3], Tanzania, Cameroon and DR Congo[4]. In addition, direct links were established with the ILRI research Team in Nairobi, Kenya and with the PATTEC office in Addis Ababa, Ethiopia. The countries were selected on account of the following criteria: 1) they are part of the group presently targeted for Phase II, and therefore, would assure that some direct relevance to that Phase would be assured in the present SEA; 2) two of the countries selected have carried very successful campaigns using specific techniques, such as SIT and SAT[5] respectively in Tanzania and Botswana; the visit of these countries would therefore provide some direct insights into the potential and effective impacts of those techniques; 3) the two other countries, namely Cameroon and DR Congo were selected because they experience various degrees of prevalence of the human form of trypanosomiasis, providing insights into that particular situation and possible impacts related to the approach used there. The list of persons met, of field and technical visits, as well as the summary notes of the various meetings are appended as Annex 3 to the present report.

Scope and limitations of the Study

14. The present SEA comes at a time when the broad technical design of PATTEC was prepared and finalized (2001/2002) and while the appraisal for the first six-targeted countries identified in Phase I

[3] The visit to Botswana was mostly technical and did not involved official contacts with government representatives.
[4] The visit to DR Congo was effectuated by a single member of the team.
[5] SIT stands for "Sterile Insect Technique", SAT for "Sequential Aerosol Technology". These techniques are described in details in the appropriate section of this report.

programme has already been completed (July 2004). Although it does come in at a late stage and after the campaign has gained momentum from its Phase I, there are still opportunities for modifying or improving the Campaign from the point of view of sustainability assurance, and certainly, to insert fully the environmental and social concerns in the planning of future phases, including Phase II despite it being quite advanced in its planning stage. The present SEA does suggest various strategic avenues for the unfolding of the remainder of the programme over the coming years, including Phase II.

15. The SEA cannot and will not replace project level or country-level EIAs which could be required and conducted according to national rules and regulations or according to the Bank's specifications where there are no such regulation**s**. In fact, undertaking of country EIA might be included in Country's Project activities, (as well as the preparation of land-use plan for the tsetse free zones) and be conditional before engaging any disbursement). While not substituting for country level or phase level EIA, the present SEA, and the ILRI Guidelines soon to be issued, should provide clear guidance for the scoping and methodology of impact assessment to be used for those EIAs.

16. Similarly, the present general SEA cannot and will not replace phase-level or multinational ESIAs that will be required for subsequent phases of the programs, if each one is presented and submitted as a separate loan operation to ADB. For instance, the present SEA does not apply to Phase II and does not replace the ESIA that may be required specifically for that (and subsequent) phases, just as was done for Phase I. However, the level of effort required for each of these may be substantially reduced through the scoping provided by the present exercise, and may be progressively declining as the learning process increases through each successive phase ESIAs.

17. Despite its limitations, the present SEA does a) provide some practical recommendations for sustainability assurance and compatibility of PATTEC with the requirements of sustainable development as viewed by the Bank; b) provide some clues for further planning, a within the campaign; and c) provide an environmental and social management framework, applicable for many years to come and leading to cost-and time-effective streamlining of future phase-level or national SEAs and project-levels EIAs.

PART II
THE PROBLEM AND THE PROGRAM

Description of the problem

18. ***Tsetse fly and Trypanosomiasis***. The tsetse fly is an insect endemic to Africa that transmits a parasite that causes a devastating disease known as *trypanosomiasis* in both people and domestic animals, particularly cattle[6]. Tsetse occurs in 37 countries of sub-Saharan Africa spread over approximately 10 million km^2 of potentially arable and grazing land. Estimates of animal losses that are widely reported for the whole continent exceed US$1.3 billion annually (Kristjanson et al., 1999) to which must be added the cost of prophylaxis and treatment - estimated at US$30 million per year (Holmes et al., 2004). No reliable estimates of the benefits to agriculture of draught power and crop productivity have been produced[7].

19. The tsetse fly is a robust brown fly 6-14mm in size and similar to a housefly. It belongs to the group of two-winged insects known as the Diptera that includes several other families of flies. All tsetse flies belong to one genus, *Glossina* in the dipteran's family of Glossinidae. There are 29 known

[6] Although pigs, goats, sheep, camels and donkeys are also affected

[7] Reference is made by some authors to an estimate by FAO that Africa may lose 4,5G$ in potential crop production each year as a result of reduced livestock, resulting in turn in shortage of draught power and reduced soil fertility from a lack of manure (see Okhoya,N., 2003, Eradicating tsetse flies from Africa, Africa Renewal, United Nations (formerly Africa Recovery), volume 17, no 1, p.17.

species and subspecies of *Glossina* that are conveniently grouped into three, based on morphological differences and their favored ecological habitats; these are:

- The *morsitans* group that occur in the savannah woodland vegetation across Sub-Saharan Africa, (the *savannah flies)*
- The *palpalis* group which generally inhabits riverine and lacustrine vegetation, (*the riverine flies)*
- The *fusca* group associated with dense, humid forests, (*the forest flies).*

20. The savannah (*morsitans*) and riverine (*palpalis*) flies are the most important from the disease transmission point of view although all species of tsetse fly are capable of transmitting the parasite (that is acting as a vector) that causes trypanosomiasis. Savannah and riverine flies are therefore the most economically important since they most directly impede livestock and human productivity.

21. Tsetse distribution is determined by climate and influenced by altitude, vegetation and the presence of suitable host animals. Consequently, tsetse populations have a discontinuous distribution, that is, occur as more or less discrete populations in several areas. Locally, these areas may be referred to as "pockets", "patches", "islands", "foci", or in case they are associated with the localized occurrence of sleeping sickness in Cameroon, as "foyers". Concentrations of foci in zones corresponding to a set of physiographic conditions are some times referred to as "belts" or "zones" of occurrences of tsetse. Tsetse flies are generally absent from areas above an altitude of 2000m. They do not survive well in areas with temperatures higher than 38^{o}C or low relative humidity (less than 45%); in such areas, the flies become restricted to forest islands and thickets. These parameters act as natural barriers to fly expansion into lands that are arid, very hot or very cold, or very high. Because temperature and humidity are controlling factors of the distribution, climate changes may affect that distribution or the extent of the natural barriers in the future.

22. Trypanosomiasis occurs in two forms, one that affects people, commonly called *sleeping sickness* (and also known as Human African Trypanosomiasis, HAT) and the other affecting domestic animals, also referred to as *nagana* when in cattle. There are two different types of the human form of the disease, related to two dominant trypanosomes, *T. brucei gambiense* and *T. brucei rhodensiensis*. The latter, *T. b. rhodensiensis* causes acute sleeping sickness with death occurring after only a few months if not treated in time. The former, *T. b. gambiense* causes the chronic sleeping sickness, a form that afflicts its victims with barely any symptoms in the initial stages and can last for several years before the victim dies. It is therefore common to refer to the *rhodensiensis* or the *gambiense* form of the disease when referring respectively to the acute or chronic form.

23. Sleeping sickness is a disease of the nervous system whose initial symptoms are similar to those caused by malaria (fever, joint pains, anaemia, and general malaise) and later as the disease progresses, sensory disturbances, insomnia, before the victim slips into a coma and dies. The most affected people are typically rural otherwise productive members of society who work out in the fields where the flies occur and are therefore exposed. Early diagnosis of the disease is essential for any hope of recovery following treatment but in many cases the disease either goes undiagnosed due to the intrinsic difficulties to achieve a proper diagnosis or to the poor health systems prevalent in rural Africa or is diagnosed too late to make any difference to the victim's prospects for life. An estimated 60 million people are at risk of sleeping sickness with only 300,000 cases diagnosed annually out of an estimated 500,000 infected and about 40,000 die every year (WHO reports)[8].

24. Distribution of *morsitans* (left), *palpalis* (right), and *fusca* (below) group tsetse flies *(from PAATIS website*) are shown below.

[8] The incidence of *trypanosomiasis* is rapidly worsening, from 10,000 cases diagnosed in the 1970s to 40,000 cases in 2002.

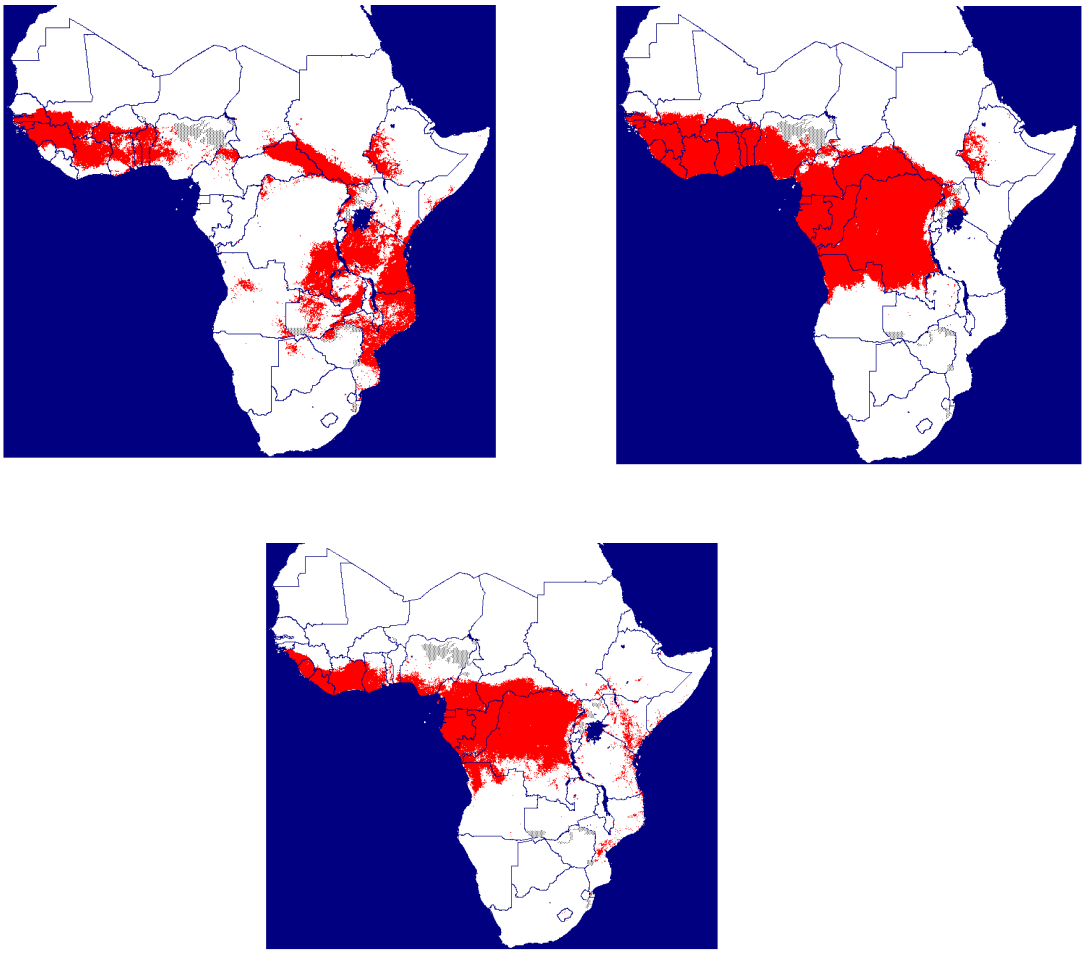

Figure 1. Distribution of *morsitans* (left), *palpalis* (right), and *fusca* (below) group tsetse flies *(from PAATIS website*)

25. The disease in livestock is known as African Animal Trypanosomiasis (AAT) or *nagana*, (a Tswana word meaning 'to be in low spirits') when it affects cattle. Animal trypanosomiasis is equally devastating to livestock and by extension to pastoral communities whose livelihoods are dependent on livestock. Between 46 and 62 million cattle in Africa are at risk of the disease. In cattle, the disease is characterised by intermittent fever, progressive anaemia, loss of body condition (vigour), stunted growth, abortion, infertility and if left untreated, mortality. Afflicted herds have reduced milk and beef yields (up to 50% less) and reduced calving rates (Swallow, 2000). The presence of trypanosomiasis reduces the work efficiency of draught animals, reduces the choices for farmers on the number of heads and type of cattle breeds to stock as well as influencing grazing and settlement patterns. In Ethiopia for example, farming communities in the Southern Rift Valley area are limited to stay in the tsetse free highlands while others have chosen to settle in the tsetse infested lowlands but without livestock.

26. Wild animals serve as natural reservoirs of the parasites but suffer no ill effects because they have lived with the parasites for so long that they have developed immunity to the disease, a feature referred to commonly, and later in this text, as 'trypanotolerance'. Some local and endemic species of cattle have developed a certain level of trypanotolerance as well, but these seem incapable of developing substantial yields and are considered sub-economic livestock. Domestic animals have been kept out of tsetse infested areas as much as possible and have therefore not had as much pressure to develop immunity to the parasites as wild animals. Furthermore, the breeding of domestic animals to improve

their characteristics results in changes in their gene makeup and often decreases their tolerance to the parasites. Deliberate attempts to introduce trypanosome resistance in domestic breeds have not been successful to-date because several genes control the trait, which complicates the introduction.

27. Except for one trypanosome parasite species, all other parasite species causing trypanosomiasis in Africa[9] are vectored by the tsetse fly. It has been suggested that certain species of biting flies (tabanids and *Stomoxys*) may also transmit the parasite mechanically but, while there are common observations that these do occur, there is no scientific data to support this as being widespread and it is unlikely that mechanical transmission of trypanosomiasis, if it occurs at all, could ever be significant. Therefore, for all practical purposes, the tsetse fly is considered the sole vector of trypanosomiasis.

28. Tsetse becomes infected with the parasite when it feeds on (takes a blood meal) an infected animal or person. The parasite causes no ill effects in the fly and travels from the gut to the salivary glands of the fly awaiting to be transmitted to the next animal or person that the fly will feed on. The fact that the parasite does not affect the fly, combined with the relatively long life-span of the fly (few months), creates of course the perfect conditions for the fly being an effective vector.

PATTEC – the Program and Strategy

29. According to PATTEC, the most viable approach to stop disease transmission in campaigns against insect-borne diseases is by eradicating the vector because it entails once-and-for all costs and avoid the recurrent costs of control and treatment of the disease. This applies to trypanosomiasis and therefore, PATTEC is definitely targeting the vector, and the program is aimed at suppressing and eradicating the tsetse fly.

30. There have been several previous attempts to control or eradicate the tsetse fly in Africa, some dating back to the beginning of the 20th century. Almost all those previous attempts have proven to be short-lived for a number of logistical and political reasons:

a) The areas in which the control efforts were undertaken were not isolated from surrounding areas that were still infested. Close and adjoining areas which were infested, often located in a neighboring country, were not cleared at all, or not at the same time and therefore continued to be large suppliers of flies ready to re-invade. For example, Burkina Faso succeeded in eradicating tsetse from 1,500km^2 in the south of the country but the flies were back within two years. Furthermore, these areas did not include natural barriers to fly distribution, which would have made it difficult for the populations to re-establish.

b) Insufficient or inappropriate measures to prevent re-invasion were put in place, due either to insufficient funding, insufficient monitoring, or lack of appreciation of the need of barriers and buffers for preventing re-invasion.

c) Discontinuity in control efforts. Decrease or termination of funding and efforts for post-treatment follow ups and maintenance of barriers and monitoring, due either to termination of budgetary allocations, or to a false and premature impression of success, compromised the long-term success.

d) Incomplete eradication from a specific cluster or belt. Whilst the techniques employed were successful in reducing tsetse population numbers, their deployment was always terminated as soon as the tsetse challenge was reduced. Remnant pockets of tsetse then recovered to re-infest the area.

e) Lack of appropriation of the initiatives by local communities, or lack of support given to them. In some areas, affected communities were either unable or unwilling to become involved in monitoring and control efforts. For instance, artificial barriers such as a target line

[9] Trypanosomiasis occurs in South America and Asia but is vectored by other organisms; tsetse does not occur outside Africa.

were often stolen, damaged or poorly maintained which led to re-invasion. Elsewhere, the donor community and structural readjustment programmes insisted that the control was devolved to cattle owners and the communities. In many instances, communities did participate effectively for example in trap and target construction and the maintenance of traps, targets and barrier systems, as well as assisting in monitoring, when and where they were properly trained, supported and funded. However, due to various socio-economic factors and without outside help, even these community-based efforts tended to relax over time.

f) Other important reasons for failure include political and civil strife, war and general lack of resources.

31. More specific examples of the "unsustainability" of some previous campaign are summarized below.

Box 1: Some factors leading to incomplete or unsustained success:

Adapted from Allsopp R. (2001) Options for vector control against trypanosomiasis in Africa. *Trends in Parisitology* 17: 15-19. (©Not for publication)

Large scale operations. Systematic ground spraying operations in Nigeria cleared 75,000km^2 from 1970 to 1975. With some aerial spraying this increased to 196,000km^2 by 1978 to 210,000km^2 by 1981and to 254,000km^2 by 1991. Over the past ten years, this progressive campaign has virtually stopped and although human settlement has delayed reinvasion, tsetse is now returning to many cleared areas. Similarly, in the Adamaoua Region of Cameroon where tsetse were cleared from 25,000 km^2 and trypanosomiasis was controlled for 18 years by helicopter spraying, disruption of the annual operations in the late 1980s resulted in significant reinvasion and the aerial campaign was suspended in the 1994. The situation is proving difficult to maintain with barriers. The substantial gains made with ground spraying in Uganda were lost as a result of political unrest in the 1970s.

Annual aerial spraying operations from 1972 to 1991 in Botswana reduced the distribution of tsetse from 20,000km^2 to 5000km^2 with the result that neither human nor animal trypanosomiasis occurred from the early 1980s to 1999. A tactical switch to targets in 1991/92, largely on environmental grounds, kept trypanosomiasis under control for several years but no new ground was cleared of tsetse. As the 20th Century drew to a close tsetse populations were gradually expanding their distribution limits and trypanosomes again began reappearing in horses, dogs and cattle in risk areas. SAT was also used between 1983 and 1988 in Somalia to successfully remove tsetse from 4500km^2 along the Shebelle River. Targets were used to prevent reinvasion but many were stolen and, as the security situation in the country deteriorated, activities were curtailed. Details are not available but the area will almost certainly have been reinvaded.

Zimbabwe's Tsetse Control Branch has ground sprayed some 148,000 km^2 and in the 1960s succeeded in pushing the tsetse distribution limits well back beyond the international borders. These extensive and effective annual campaigns were disrupted when the independence war escalated in the 1970s and much of this ground was reinvaded. After the war, aerial spraying was introduced to accelerate operations and targets were used to mop up surviving populations. By the turn of the 20th century tsetse distribution had been reduced from 54,000 km^2 to 14,500 km^2 but sustainability is now the major consideration. The Zimbabwe government has to protect these cleared areas and is currently operating barriers with targets and cattle dipping over 28,000km^2; mostly to prevent reinvasion along the border with Mozambique. External support will be required to maintain this level of control and any breakdown will have disastrous consequences.

Small scale operations. There are situations where farmers have no option but to manage the constraints on their livelihoods as best they can with whatever appropriate tools are available and without outside help. Some do succeed for a while, but the prospect of continuing indefinitely is daunting. Very often, as control success causes the problem to recede, so too does the effort to continue.

Hargrove[1] clearly identified the inherent difficulties of sustaining control achievements in small areas which remain vulnerable to reinvasion. Seven East African community based projects covering little more than 2000 km^2 in total were investigated. Even though community support was enthusiastic, the control achievements were difficult to sustain. Even in West Africa, where there is more of a culture of community involvement, sustainability can be a problem without outside help.

Community support is not always forthcoming or uniform. In Ethiopia, socio-economic factors such as ownership of livestock and the degree of exposure to trypanosomiasis affect the willingness of communities and individuals to participate in control activities. In the Congo, operational success was dependent on adaptation to local beliefs and mentalities.

Where traps or targets are used without full community support, theft can be a major problem and, as with large scale operations, this can be exacerbated by political instability. This problem can be overcome by using live bait techniques and to some extent this may explain their increasing popularity.

[1]Hargrove J (1999) A theoretical study of the invasion of cleared areas by tsetse flies (Glossina spp) PAAT report. FAO, Rome.

32. In an attempt to make a fundamental change in direction from never-ending, nationally-focused control, and to tackle the previous shortcomings, the PATTEC Task Force of Experts 1) outlined a phased, systematic, continent-wide approach and 2) resolved to target eradication (as opposed to control). It proposed the systematic creation of ever expanding tsetse free zones through the application of *area-wide*[10] approach employing modern appropriate tsetse suppression methods and involving the affected communities. The strategy called for successively tackling individual areas, establishing barriers and utilizing buffer zones where necessary and adopting necessary quarantine measures to prevent re-invasion. Interventions of variable types and scale were to be harnessed in a systematic programme designed to expand the tsetse and trypanosomiasis free zone to the boundaries of their natural range.

33. It is useful to emphasize that PATTEC does not in itself develop new technologies, find new drugs or work towards the design of vaccines. The value of PATTEC lies fundamentally in the sustained harnessing of the best available technology for vector control in an area-wide, largely continuous and cross-boundary approach.

34. The strategy to avoid the pressures of re-invasion through coordination of the interventions of suppression in a regional manner, at places across national boundaries, certainly provides for an accrued element of viability of the program. The approach primarily requires the cooperation of affected nation states and careful, integrated planning. In that sense, the coordinating activities of PATTEC is absolutely crucial to the success of the program. In terms of Environmental Assessment, it creates a challenge to deal within each phases with fundamentally multinational to transnational projects.

35. Quoting for its own documentation, activities aimed as achieving the objectives of the PATTEC include:

[10] According to the PATTEC documentation: "Area-wide approach refers to a method of work in pest control in which an insect population infesting a specific area is targeted and totally eliminated and the area in question is protected from re-infestation by insects from neighboring areas" Kabayo, J.P., "Africa will be free when it is Tsetse free", An Essay.

a) Identification and selection of project areas where successful intervention is feasible
b) Preparation of a bankable project document for each selected project area, including proposals for the sustainable use and exploitation of tsetse free land;
c) Mobilization of the financial, human and material resources necessary for the execution of each project;
d) Suppression of tsetse populations using conventional methods integrated eventually with the Sterile Insect Technique (SIT)
e) Monitoring and supervision of each initiated project;
f) Establishment and maintenance of barriers and buffer zones to inhibit re-invasion of treated areas;
g) Contact with operational focal points and essential offices in member states and other partners to expedite the process of formulation of national strategies and initiating action on new projects
h) Coordination of the activities of the campaign;
i) Seeks to encourage, support and facilitate other activities related to the objectives of the Initiative, including tsetse mass rearing, operational research, training and capacity building and organizing emergency tsetse and Trypanosomiasis control interventions.

PART III
ANALYSIS OF ALTERNATIVES

Justification

36. A key component of SEA is that it attempts to identify and broadly assess alternative options for proposed programs or policies. One of the options is the 'zero option or 'do nothing' alternative, as it provides the benchmark for comparison of other alternatives. Zero option is equivalent to ask the following question: *what would be the environmental and social implications, of not implementing the program at all?* It can also be formulated in the following way: *Is the program really justified?* If it is found that the answer is yes, because potential damages and hindrance in the absence of the program are larger than its foreseen potential impacts, then the next set of questions pertain to the best options. Other options stand as the choice of the means between attempting to suppress the vector, instead of addressing directly the issue of the parasite, or the disease itself. In the present context, this is equivalent to ask the following questions: *are there alternative to targeting the vector (the fly) as a mean of controlling or suppressing trypanosomiasis?* And finally, if it found that targeting the vector is indeed the best approach: why eradication vs control? Of course, the answers to these questions can only be given in broad terms, as a complete analysis would imply a full study of the whole set of impacts of each options and alternatives, an exercise way beyond the scope of the present report. However, in the following discussion, some of the elements are so rooted in common sense or, based on previous experiences that we may confidently conclude in the end, to the righteous justification and the adequacy of the design of the proposed program.

Zero option

37. There is no doubt that trypanosomiasis is both a serious public health problem, and a critical economic and social development issue. Because it prevents full development/occupation of extended tracts of land, the impediments of the occurrence of trypanosomiasis have bearings on poverty issues, and with it, a host of other social issues. According to some, it is estimated that overall Africa, trypanosomiasis may generate losses of up to 4,5G$ in potential crop production each year as a result of reduced livestock, resulting in turn in shortage of draught power and reduced soil fertility from a

lack of manure (see Okhoya, N., 2003, Eradicating tsetse flies from Africa, Africa Renewal, United Nations (formerly Africa Recovery), volume 17, no 1, p.17). Given those facts and figures, the "zero option", that is the *status quo* or the "do nothing" about trypanosomiasis and tsetse, is considered much more damaging than the existence of the proposed program, even though the latter may entail potentially some negative environmental and social impacts, as discussed later on. We do not see any serious arguments that could be brought in the forefront, be they economic, social, health wise, or environmental, to contradict the decision of the African Heads of State and Government to establish the Pan African Tsetse and Trypanosomiasis Eradication Campaign at their Lomé Summit in July 2000.

Alternative options

38. From the above summary description of the problem, one can see that eradication and control of sleeping sickness (HAT) and *nagana* (AAT) could have been approached by one or more or a combination of three possible options 1) attempts to control, or destroy the reservoir of trypanosomes; 2) attempts to control and treat the disease, and 3) attempts to control and eradicate the vector.

39. ***Targeting the reservoir***. As mentioned above, the parasites occur in wild animals who do not suffer from the disease because they have become adapted in varying degrees to them over the course of evolution. While the parasites that causes sleeping sickness is different from those that cause animal trypanosomiasis, all are capable of being maintained in animal populations. Because of that, wild animals, in addition to cattle and affected humans, serve as important reservoirs of the parasites and hence the disease. Earlier practises (late nineteenth and early twentieth century) of trypanosomiasis control and eradication attempted to eliminate that reservoir and consisted partly in shooting wildlife or clearing the bush (tsetse habitat) from vast tracts of land (Jordan 1986), a practise no longer acceptable and no longer used. There are no current plans for attempting to target reservoirs of trypanosomes alone as an effective mean of eradication and control of trypanosomiasis.

40. ***Treating the disease***. Earlier efforts to control trypanosomiasis in both people and livestock focused on treatment with drugs (trypanocides) to prevent and/or control the disease. Trypanocides are still used extensively in the management of animal trypanosomiasis but are also complemented by vector control methods, particularly the use of traps and targets. Sleeping sickness management is still entirely reliant on drugs but their long term usefulness is questionable as the parasites have become increasingly resistant to the drugs making them less effective over time. The drugs for sleeping sickness are most effective in the early stages of the disease, are difficult to administer and often toxic to the victims. No new trypanocides have been developed for more than 30 years and it is unlikely that any new drugs will be developed soon. In any case, while disease control is absolutely required in areas of high prevalence, it is realised and commonly accepted that disease control alone would not solve the problem if the vector was not tackled as well. However, in areas where human sleeping sickness is endemic and highly prevalent, control is most effectively based on disease surveillance and treatment, with tsetse suppression as a complementary tool.

41. ***Control and eradication of the vector***. Control and eradication of the vector seems to be the only viable and reasonable choice for tackling the tsetse problem in Africa, given the considerable progresses achieved in the combat techniques targeting the vector. Indeed considerable research has been undertaken in elucidating the biology and ecology of tsetse fly and in developing techniques to manage the fly. Some of the techniques that were developed earlier involved the use of persistent and relatively damaging pesticides, or modifications, most often destructive, to its natural habitat. All these early techniques have been abandoned and replaced by a range of modern methods which are both effective and have limited or insignificant impacts on the environment, as discussed further on. Most of the methods can adequately control the abundance and extent of the fly, achieving some control. Eradication generally requires a combination of methods, requiring suppression first and then final eradication.

42. **Control vs eradication**. This issue was discussed in Phase I ESIA, where it was concluded that: "*The reasons for selecting eradication are related to the difficulty of meeting recurrent costs associated with control, and also to taking advantage of the current high level of commitment by African governments, the resultant possibilities for regional co-ordination, and the availability of appropriate technologies."* The available technology requires a two step approach: a) ground based or aerial (SAT) use of pesticides to suppress the population to low levels, and b) the use of SIT (Sterile Insect Technique) for achieving eradication, (if not already achieved by the first step). These techniques are described in the next section and are shown to have relatively minor, and manageable, direct environmental impacts.

43**. In conclusion**,

a) The Program appears amply justified in view of the current economic, social and health costs of unchecked trypanosomiasis in Africa;

b) The option to target the suppression and eradication of the vector appears to be the most viable option

and finally,

c) Given the set of selected techniques, as discussed below, and the area wide, regionally coordinated strategy, as discussed above, the Program appears to have maximized the chance of success, and minimized its environmental consequences.

PART IV
ENVIRONMENTAL AND SOCIAL IMPACTS

Impacts

44. Modern techniques for the control of tsetse flies are highly effective and efficient. The achievable speed and scale of their use means that control can be realized faster than ever before. This reality raises a number of environmental questions that are either focused on the widespread use of insecticides in wildlands or the longer-term impacts of controlling tsetse and trypanosomiasis on subsequent land use. These issues are conveniently and conventionally divided into the so-called *direct* and *indirect* impacts of tsetse control. Thus the direct impacts relate to pesticide exposure and immediate implications of the control technology, while the indirect impacts relate more to land use and environmental change as a result of human activity, particularly the spectre of unsustainable use leading to degradation. The main issues associated with each category of impacts are shown as Table 1, and are discussed in the following paragraphs.

Table 1. Definition of impacts and associated issues

	FROM	ISSUES
DIRECT IMPACTS	Pesticide exposure Immediate impact of the Control methods	Acute and chronic toxic effects
		Ecosystem impacts
		Pollution and chemical Hazards
		Physical impacts
		Social impacts
INDIRECT IMPACTS	Post-project land uses and Environmental changes	Unsustainable land use and land management
		Economic, social and environmental consequences

Direct impacts

45. The potential direct impacts of tsetse control are: a) Acute and chronic toxic effects of insecticide-based techniques; b) Ecosystem impacts (function and process) of insecticide-based techniques; c) Pollution and chemical hazards to humans and livestock; d) Physical impacts of control and e) Social impacts related to gender issues in community involvement or changed access to resources as a result of the physical impacts of control Positive impacts are of course the suppression and eradication in an efficient manner and associated improved livelihoods, the reduction of long-term maintenance efforts and associated costs, and accessory protection from other insects considered as nuisance to cattle or humans. In the case of modern insecticide-based methods, the avoidance of residual effects avoids chronic or sustained exposure to insecticides. In the following paragraphs, the various negative impacts are reviewed in terms of magnitude or risks, together with the possible measures that are usually associated with their mitigation.

46. Insecticide-based techniques are nowadays much more environmentally friendly[11] with the result that the toxic side-effects on biota and ecosystems have been significantly reduced over the last 40 years. Nevertheless, all methods present definable hazards and risks to the receiving environment and these vary by species, ecosystem or the abiotic factors at the time of exposure: thus the specific impacts of one control method used in one ecosystem will never be quite the same as in another, albeit similar ecosystem. More than 50 scientist-years of research have gone into the impact assessment of insecticides used to control tsetse in savanna woodlands and riverine forests. Below we examine and summarize the potential environmental impacts of the contemporary methods of vector control. Direct impacts are discussed, as per the control method. Each impact is described in terms of immediate consequences, and in term of possible associated *cumulative impacts***,** defined as impacts which add-up to the immediate direct effects, affecting most often different compartments of the ecosystem. All impacts discussed here are generic and are not (cannot be) site specific. It will remain to phase-level ESIA or project-level EIAs to examine the site specific implications and to evaluate the magnitude of the various generic impacts discussed here. In addition to the present, a compendium of impacts associated with tsetse control is being compiled by ILRI as part of their mandate and should be available some time in 2006 according to their work plan (see Annex 2). This will come as an additional useful reference tool for project-level EIAs.

Description of the techniques and their environmental impacts

47. The techniques can be categorised as insecticide-based, including a) Odour baited targets and traps, b) Impregnated nets c) Insecticide-treated cattle (live bait) d) Aerial spraying - Sequential Aerosol Technique (SAT) and e) Discriminative ground-spraying or non insecticide-based, namely f) Traps (which may nevertheless use insecticide) and g) Sterile Insect Technique (SIT). [See Box 2 for a summary description of each]

Box 2. Contemporary methods of vector control

Odour-baited targets are comprised of insecticide-impregnated cloth suspended vertically on a metal hanger and pivoted to enable it to rotate in the wind. Bait sachets (attractants) are placed near the target to attract flies from downwind. Contact with the impregnated cloth knocks-down and kills the tsetse. The shape and coloring of the panels aids in the attraction. Targets are visited every three months for odor bait replacement and the cloth is recharged

[11] Until the development of organo-chlorine insecticides (OCs) in the 1940s, the extermination of game and destruction of bush were the principal means of tsetse control in Africa. By the mid 1950s, the use of OCs as an effective and inexpensive approach to tsetse fly control had virtually supplanted host and habitat destruction as the method of choice. Formulations of DDT, γ-BHC and dieldrin were applied to tsetse habitat from either the ground or air and the persistence of the toxic molecules was sufficient to kill many generations of flies. The more toxic organochlorine compounds were phased out in the '70s and '80s and the last recorded use of DDT were 1990.

regularly with a pyrethroid insecticide (3m-12m). Target densities depend on the habitat and fly species (e.g., 4 km^{-2} for *G. morsitans and brevipalpis* and 8 km^{-2} for *G.austeni.* A notice on the target explaining their purpose to local people.

Mono- and biconical **traps** create a visual stimulus to which tsetse respond by flying into them. Their efficiency has been improved by the addition of strips of insecticide treated material or chemical attractants and used linearly in riverine situations, they dramatically reduce tsetse populations at low cost.

Impregnated nets are being researched for use in protecting cattle (and herders). A ring of net about 1.3m high surrounds the boma/banda and acts as an odor-baited target, as flies encounter the nets on their way to the visual and olfactory stimuli of the cattle. The insecticide is either applied to the net or incorporated into the net polymer, which provides it with exceptional longevity. Nets may also aid in reducing the transmission of sleeping sickness and malaria.

Insecticide-treated cattle (live bait)

Pyrethroids have low mammalian toxicity and are effective for treating cattle which then act as live-bait for tsetse. The insecticide can be applied at a cattle dip (left) or as a spray or 'pour-on' (right). In a plunge dip the whole animal is covered with insecticide (or acaricide). Pour-ons are easily applied by an owner along the spine of the ox from where it migrates to the rest of the body. Sprayed pyrethroids can be selectively applied, avoiding areas where the animal can lick it off and thus saving costs without compromising tsetse control (tsetse tend to target flanks and legs).

Aerial spraying. The **Sequential Aerosol Technique** (SAT) is a ULV spray drift technique that applies minute amounts of insecticide from aerosol generators fixed to low flying aircraft or helicopters. The aerosols are applied from dusk to dawn in gentle winds and takes advantage of the temperature inversion to keep the droplets in the canopy. Endosulphan and deltamethrin are the current insecticides of choice. Spray application is very precise and is managed and monitored by on-board computers coupled to satellite navigation systems. Spraying is repeated up to 4-5 times over a dry season at intervals of about 10-15 days between sprays.

Discriminative ground-spraying is a residual (leaves residues lasting up to three months) but discriminative technique that selectively treats about 20% of woodland vegetation. Selective application of deltamethrin to tsetse resting sites (right) reduces the dose rate to 12g ha^{-1}. Ground-spraying requires exacting preparation and experienced spray teams trained to recognize tsetse resting sites and refuges. Few tsetse control or veterinary departments are now able to support such operations.

Sterile Insect Technique (SIT) takes advantage of females mating only once with sterilized males released of a wide area using aircraft. The technique requires large facilities to rear and sterilize male flies – up to 10m a week if the area or numbers of wild flies remaining after suppression (by other techniques) are significant. Ratios of 50:1 sterile males to wild population are required.

48. ***Tsetse Traps***. The visual and/or olfactory stimuli used to attract tsetse flies will also attract and kill non-target species, notably other biting and nuisance flies of livestock (Table 2). Their effectiveness at trapping target and non-target species is enhanced by the use of colors and baits (cattle urine or synthetic bait). Some traps contain insecticide strips to knock-down/kill alighting flies which also increase the mortality of ants and other accidental "tourists" (beetles and grasshoppers) to the trap. Persistent use of traps (as expected) could significantly reduce local populations of flies (stomixids, tabanids and muscids) associated with livestock and game.

49. ***Odour Baited Targets***. Insecticide-treated, odour-baited targets provide efficient tsetse control with negligible side-effects on non-target fauna. The insecticide group of choice is the pyrethroids. Like traps, Odour Baited targets attract a small range of non-target species to the insecticide treated cloth. The baits employed are usually synthetic, which will tend to decrease the local populations of biting flies more effectively. Thus, long term exposure to targets deployed over wide areas could suppress populations of *Stomoxyinae* and *Tabanidae*. Incidental contact of other flying or crawling species will not put the species at risk. Cumulative impacts associated with Odour Baited Targets reside in the potential importance of *tabanid* mortality to ecosystems given their role as pollinators of trees and shrubs. Any specialization by tabanids as a sole pollinator of a flowering species may have

implications for the fruiting of that species and other animals that use the fruit as a food resource such as birds and bats. The density of targets required over wide areas increases the need for new roads and tracks for their installation and maintenance (Table 2). Soil erosion in wet season and vegetation loss are direct consequences. Associated cumulative impacts result from the fact that the roads and tracts may provide access to protected areas that facilitates encroachment and illegal activities (poaching, gathering of wood, medicinal plants etc) are among the more important impacts of target deployment.

50. ***Impregnated nets***. A relatively new technique (not in widespread use) that is employed to protect herds at night or under zero grazing is the erection of an impregnated net as a fence around the cattle enclosure. The fence acts in many respects as an odour-baited target, as flies encounter the nets on their way to the visual and olfactory stimuli of the cattle. Like some mosquito bed nets, the insecticide is incorporated into the net polymer and provides it with exceptional longevity. It is likely that the ecological impacts will mirror those for traps and targets – involving mortality of biting and nuisance flies. A positive benefit of nets in areas where livestock biting mosquitoes also transmit malaria to humans is protection of families residing nearby or within the enclosures.

Table 2. Summary of direct and cumulative impacts associated with traps, targets and nets

METHOD and associated activities	DIRECT IMPACT	CUMULATIVE IMPACT	EFFECT ON
Traps Targets Nets Associated Need for roads and Tracks	Effect on Non target species	Suppression of pollinators insects and depleted specific fruiting	Other fauna (bats, birds) Biodiversity
	Soil erosion		Vegetation, future land use
		Increased access to protected areas or to new resources	Increased illegal activities (poaching) or increased and unsustainable or conflictual use of resources (e.g. wood) Social cohesion

51. ***Insecticide treated cattle (Cattle dipping; "Pour-on" and spraying).*** These three live-bait techniques are effective against tsetse and other biting flies of cattle (stable flies, horse flies, mosquitoes and possibly black-fly). Cattle dipping for tick control proved highly effective against tsetse and were subsequently adapted for both purposes. Repeated use of pyrethroids can result in resistance of ticks to the whole family of pyrethroid agents (cross resistance). Continued exposure of tsetse to pyrethroids could also lead to resistance, but the veterinary concern is that pyrethroid control of tsetse may increase tick-bourne diseases as a result of ticks acquiring resistance. Positive impacts are the reduction of other haematophagous flies that can reduce milk/meat production.

52. Application of insecticides by any method to cattle inevitably leads to the contamination of dung with pyrethroid residues (licking irritated skin, grooming behavior, direct contact with faeces). These residues can kill dung fauna and seriously affect dung dispersal and burial by beetles and termites, with knock-on effects for soil nutrient recycling. Regular use of the techniques over wide areas would be expected to deplete dung fauna and processing. These negative impacts can be mitigated by the restrictive application of "pour-on" and spray to the legs, belly (harder to lick) and by treating only the most attractive animals within a herd. Dips offer no such options. Plunge dips are also a potential source of contamination to surrounding soil and water. Dip tanks require large quantities of water for their operation and are therefore constructed close to rivers or other sources of water. The hazards posed by animal dipping arise from three activities: a) treated animals crossing the river to get home; b) pumping out dips to change the dipping agent; c) removing and dumping soil accumulated in the dip tank.

53. The high throughput of cattle at dip tanks can soon degrade the vegetation in the immediate vicinity (waiting for dip) and lead to track development. On steep gradients, surface water run-off can

turn tracks into rivulets and result in gulley erosion, loss of topsoil and clogging of rivers. The chance of erosion on steep slopes is greater where vegetation has been removed by overgrazing or through natural causes such as drought, flood and fire. There are also pesticide storage and health and safety issues for the operators of dip tanks.

Table 3. Summary of direct and cumulative impacts associated with treated cattle methods

METHOD and associated activities	DIRECT IMPACT	CUMULATIVE IMPACT	EFFECT ON
Cattle dipping Pour on Spraying	(Repeated use of...)		Decreased level of resistance to tick borne diseases
	Contamination of dung	Suppression of dung fauna Effects on beetles and termites	Soil nutrient recycling
Plunge dip pools	Potential direct contamination of water and soil		Water and soil
	Track development	Soil erosion	Gulley erosion
Pesticide storage			Health and Safety Issues

54. ***Aerial spraying - Sequential Aerosol Technique (SAT).*** Spraying of any description increases the risk of exposure of non-target organisms (wildlife and humans) to insecticide droplets or aerosols compared with pesticides that are immobilized on cloth or impregnated in nets. The SAT currently relies on low doses of either endosulfan or deltamethrin delivered in low volumes and makes up for the lack of residual action by repeating the treatments at 10-15 day intervals. As such, the application represents a series of 4-5 acute exposures rather than a chronic or sustained exposure of the sort that characterized the residual techniques employed in the '60s. The risk of harm is significantly reduced as a result. Insecticide characteristics and several biophysical factors such as temperature, soil type, dissolved oxygen concentration, pH all influence the risks of pesticide impacts on the receiving environment. But more important than all of these is the quality of the control operation. Environmental damage limitation begins with a well planned, equipped and effected operation.

55. The negative impacts of both insecticides (endosulfan or deltamethrin) are characterized by acute toxic effects on a wide range of terrestrial and aquatic invertebrates in woodlands and wetlands (Table 4). Populations of sensitive species are depressed for the duration of spraying and most recover within weeks or months. Those species with weaker powers of reproduction or dispersal may take one or two years to recover. Endosulfan is more likely to cause temporary behavioral effects or even mortalities of juvenile fish in shallow waters whereas deltamethrin is particularly toxic to aquatic beetles and crustaceans such as shrimps and prawns. Birds, reptiles, bats and small mammals are not directly affected by SAT although their diet (insectivorous) may be temporarily depleted, and low flying aircraft may cause disruption to nesting birds. Key soil processes are unaffected by SAT. Positive impacts reside in the fact that large scale operations will achieve rapid, area-wide reductions in tsetse populations with concomitant falls in the incidences of trypanosomiasis (human and livestock).

56. ***Discriminative ground-spraying***. The huge operation (vehicles, bulldozers, planners, co-coordinators, skilled spray operators etc) required by tsetse/veterinary departments to implement this area-wide technique means that most tsetse affected countries would be unable to mount effective ground-spraying programmes. Residual doses of insecticide required to control tsetse for long periods are applied to about 20% of the vegetation (tree trunks, shrubs and hollows) in savanna woodlands. Pyrethroids are the insecticides of choice to replace DDT for ground-spraying. Pyrethroids are broad spectrum insecticides and when applied as residual doses to vegetation (tree trunks) are acutely toxic to many terrestrial invertebrates. Populations of susceptible species such as spiders, planthoppers,

silverfish and arboreal grasshoppers will take months to recover. The risk of spray-drift and run-off into rivers and streams adjacent to ground-sprayed areas is low (with well managed spray-teams) but pyrethroids are toxic to aquatic invertebrates, especially mayflies, crustaceans and surface dwelling insects. The movement (aquatic drift) of invertebrates downstream may be significantly increased for several days but residual populations are rarely impoverished and quickly recover. Food species of insectivorous species of birds, bats and reptiles may also be temporarily depleted causing a temporary shift in their populations as they move their feeding territory. On the positive side, residual sprays protect the areas for considerable periods (size dependent) and reduce the long-term costs of maintenance and management.

57. ***Sterile Insect Technique (SIT).*** Taken at face value, the SIT is the most environmentally benign of the tsetse control technologies. Control is species specific and the natural enemies of tsetse are able to assist in the process. Sterile insects cannot become established or gene abnormalities (from irradiation) be passed on. The SIT *per se* has no negative impacts on other fauna or flora while being highly effective in mopping up flies. The technique has been proven for tsetse eradication in southern Burkina Faso as early as 1981, in central Nigeria, and in Zanzibar in 1991 to 1994. However, the technique is only feasible once the tsetse populations have been suppressed by using one or more of the insecticide-based means. By association, the cumulative ecotoxicological impact is the same as the techniques used to suppress the population in the first place.

58. ***Insectaries.*** Large, local facilities, known as insectaries, are required to rear and process the sterile flies. The waste products may be hazardous or cause pollution if managed inappropriately. There is a radiation hazard but the risks to staff close to the radiation source are negligible in a well managed facility. IAEA approved safety procedures and protocols for the use of radiation sources and production of sterile male insects must be implemented and subsequently monitored by the IAEA or designated authorities. This will ensure that no fertile and/or trypanosome infected male flies are released. Other potential hazards include allergic reactions to ox blood, the accidental release of flies from the rearing facility, and the contamination of blood and reared flies. These hazards are manageable if appropriate protocols are followed and present no outstanding health risks.

Table 4. Summary of direct and cumulative impacts associated with aerial (SAT) or ground spraying, and with the use of the Sterile Insect Technique (SIT)

METHOD and associated activities	**DIRECT IMPACT**	**CUMULATIVE IMPACT**	**EFFECT ON**
SAT	From Exposure to insecticide Acute toxic effects on non Target species Water and soil contamination		Fish and aquatic invertebrates
		Possibly same as for traps and targets	All insectivorous
	From low flying aircrafts		
Ground spraying	Same as SAT		
Pesticide applications and storage			Health and Safety Issues
SIT		All impacts associated with suppression methods selected prior	

		to SIT	
Associated insectaries			Health and Safety Issue

Assessment of Direct Impacts

59. ***Toxicity of insecticides: Acute and chronic effects.*** Exposure of humans and non-target organisms to tsetse insecticides is dependent upon the type of control method(s) employed and, for the former, the occupation of the individual. Night-time fishermen will be more at risk from acute exposure to insecticides used for SAT than a planter, just as a cattle boy is at more risk from pour-ons than the local miller. Someone handling dip insecticide or impregnated targets is at greater risk of chronic exposure than a pastoralist. Under normal operating circumstances, the magnitude of acute exposure incidents for humans will be minimal and toxicologically insignificant because of the low doses involved (see Box 2 relating to Acceptable Daily Intake -ADIs). To put this in context, exposure to similar pyrethroids used in mosquito control or in crop sprays pose far greater risks to householders and occupational users as a result of regular use and dosages (e.g., 10,000 times higher than SAT per hectare in flowers/arable crops; 100,000 times greater in cotton).

Box 3. Key toxicological parameters of two most commonly used insecticides in tsetse control

Endosulfan is a chlorinated hydrocarbon pesticide classified by WHO as a Class II compound (moderately hazardous) and by the EPA as Class I (highly toxic). The technical product is a mixture of two stereo-isomers, alpha and beta- endosulfan isomers, both of which have low solubility in water but less affinity for lipids than DDT. Endosulfan is not readily accumulated or persistent in tissues, being rapidly metabolized and excreted as the sulfate and diol. Its environmental fate and speed of degradation in soil and water is highly dependent on local conditions. In Botswana, residues in shallow pools disappeared within 5 days, deeper lagoons and rivers in 20 days but both were dependent on the amount of silt and vegetation present. Evaporation rates from aluminium foil are high even at night, 80-90% of the endosulfan in the formulated product volatilizing in 8 h. It is more persistent in soils average half life of 50 d. Endosulfan (both isomers and to a lesser extent, the sulfate) is highly toxic to fish in the low ppb range (24h LC_{50} Barbus 1.2 ppb ; Aplocheilichthys 2.6 ppb; Synodontis 5.6 ppb; Schilbe 5.1ppb; Tilapia 7.3 ppb. Human health: EPA recommends concentrations in the aquatic environment should not exceed 74 ppb or 2ppm in food. Not carcinogenic. Endosulfan is on the Prior Informed Consent list of most UN states.

Deltamethrin is a pyrethroid insecticide with very broad spectrum control and the most powerful of the pyrethroids. Contact and stomach poison action. EPA unallocated toxicity class. Available as EC, WP, ULV and granule formulations. Sparingly soluble in water and not volatile. Environmental fate: stable in air and sunlight; degradation in soil 1-2 weeks, in water it's rapidly absorbed onto dissolved, particulate solids and sediment. Ecological effects: highly toxic to crustaceans and many aquatic invertebrates; toxic to fish under laboratory condition but rarely in the field (absorption onto sediment and suspended matter). More toxic at low temperatures. Highly active against Dipterans, Hymenoptera (bees) Coleoptera and Hemiptera. Human health: ADI 0.01 mg/kg/day. Not carcinogenic, teratogenic or mutagenic.

WHO Environmental Health Criteria (1984) V 40 Endosulfan; and (1990) V 97 for deltamethrin. (http://www.inchem.org/documents/ehc/ehc/ehc97.htm) for deltamethrin and (http://www.inchem.org/documents/ehc/ehc/ehc40.htm) for endosulfan. .

60. By the same token, exposure to deltamethrin aerosols (SAT) by non-target organisms such as night-flying insects is much more likely than exposure for bees or subterranean insects. Insects attracted to baited targets are going to suffer higher mortality than other flying or cursorial insects, for which contact with targets is incidental. Fish in hot, shallow pools may succumb to poisoning more easily than those in a colder, deeper pool, and so on. The magnitude of the impact will depend on the

scale of operations: SAT poses the greatest risk on the basis of scale but immigration of susceptible species readily occurs from outside the treated area (provided a whole biome is not treated in one year). Overall, the use of insecticides that have minimal or no effects on vertebrates (i.e. at non-residual doses) and have low persistence in the environment will decrease the risks to non-target organisms including people. The limiting of applications to specific areas and timing of applications for aerial spraying, as practised in SAT, further reduces the risks to non-target organisms.

61. ***Ecosystem effects***. Beneficial ecosystem processes that rely on invertebrates for services such as pollination, biocontrol (by arthropod agents) and soil nutrient recycling are at minimal risk from well planned and executed interventions. Casualties of some non-target organisms are inevitable, particularly of susceptible arthropod invertebrates, but they are ephemeral and limited in magnitude. Vacant ecological niches are quickly filled by competing species (the exception being exotic biocontrol agents introduced for a specific beneficial purpose). According to Ramberg (2005), based on recovery monitoring of the effects of SAT in the Okavanago Delta of Botswana[12] in 2001 and 2002, whilst aerial applications of deltamethrin decreases the abundance of insect and shifts compositions, this effect is short lived. Still according to Ramberg (2005), abundance and composition recover within one year and less than 10% of the less abundant morphospecies in sensitive taxa may become locally depleted and take longer to recover. These minor effects can be put in context but remembering that the mortality of invertebrate (and some vertebrate) wildlife in savanna and woodland areas is enormous as regular bush fires sweep through huge tracts of land. In aquatic biomes, fish and invertebrate mortality is also high as rivers and shallow wetland pools dry up every year. With sensible management and good communication, spraying of whole areas that are employing arthropod biocontrol techniques can be avoided.

62. With SAT, the significance of 'rolling out' a series of contiguous, area wide tsetse control operations would be of some concern as ecosystem and biodiversity recovery could be impaired. The reason that recovery from acute exposure is so rapid is partly because the surrounding area contains a reservoir of the species from which immigration takes place. If the reservoir is also treated then the process of recovery might be prejudiced. Spraying of a whole wetland, watershed or woodland biome should be avoided - or managed to ensure that spray blocks in the biome are staggered in time to allow ecosystem recovery pathways.

63. ***Pollution and chemical hazards to humans and livestock***. Insecticide pollution incidents are very rare but when they have occurred (e.g., an emergency aerial dump of insecticide over a watering hole) they are very serious. The risk is negligible when competent contractors are employed. The risks to humans of exposure through handling insecticides are present with all insecticide-based methods. Extensive training in storage, handling and disposal procedures together with the provision of suitable protective clothing and masks reduces the risks to operators and to third parties, as the opportunities to re-use insecticide containers will have disappeared.

64. ***Physical impacts. Land degradation: Erosion and gullying***. Direct physical impacts, such as soil erosion resulting from poorly cut tracks in hilly terrain to access targets and traps are rare occurrences and generally, tracks soon regain their vegetation. As discussed, gullying may also result from inappropriately located dip installations. The type and magnitude of erosion encountered in marginal areas and poorly managed cropping systems far exceeds anything caused by tsetse methodology. However, when possible, extensive clearings or creation of new tracks for the installation of various traps or targets or fences should be kept to a minimum, and dip tanks location should be carefully selected to avoid erosion, gullying and contamination as much as possible.

[12] There are many such examples. Reference to Okavanago Delta is made as this is a site and a monitoring team that was visited by the present mission. See Annex 4.

65. ***Social Impacts***. There are hardly any direct negative social impacts associated with any one technique. According to preponderance of genders for specific activities, such as pour-ons, or handling insecticides, health impacts may differ according to genders. Similarly, women and children might be more severely affected by water contamination. Such gender issues might be adequately addressed only at project levels EIAs as they will be largely dependant upon preponderant social and cultural habits in the project areas. Aesthetics might be an issue in some instances where the presence of traps or targets may be viewed as a nuisance by some.

66. ***Social cohesion***. While being fundamentally an operation that thrives to increase agro-pastoral resources, a positive impact, eradication of the fly may have accessory negative impacts on other resources. Where target deployment, for instance for setting up and maintaining barriers from re-invasion, the development of new tracts and small roads which are required may facilitate encroachment and illegal activities (poaching, gathering of wood, medicinal plants etc) leading possibly to unsustainable or conflictual use of resources. Social cohesion issues may arise from encroachments or illegal activities into the area as a result of increased access. Impacts to resources would presumably be even greater in instances when the operation is carried into or near to protected areas, or wildlife preserve areas.

67. ***Other Cumulative Impacts.*** The application of Sterile Insect technique in an area, while being relatively benign environmentally, carries with it the cumulative effects of all the techniques which must have been applied in order to suppress the population of flies at levels where SIT can be effectively applied. In addition, the selection of this technique in a given area does carry all the eventual impacts associated with the maintenance of large insect rearing facilities, even if those are located outside the project area. These cumulative and associated impacts must be included in the project's EIAs where applicable. Cumulative effects could result from concurrent unfolding of the projects with other projects impacting the biota or people at the same time and at the same or in neighboring locations. It is impossible to generate a framework for such a spectrum of potential situations and these would have to be examined at the phase-or national-level SEA or at the project level EIA.

68. ***Mitigation of direct impacts.*** Most of the direct impacts associated with control and eradication of tsetse fly are either small or manageable through proper mitigation measures, as shown in Table 5. In addition to specific mitigation measures or precautions, and not shown in the Table, are framework measures to reduce or control the overall impacts of the projects, namely the Environmental Assessment (ESIA) prior to the unfolding of any projects, and the Environmental Monitoring and Management Plans that will need to be developed for each project.

Table 5. Mitigation of direct impacts

Issue	METHOD	MITIGATION
Acute and toxic effects of Pesticides	SAT and Ground Spraying	Avoid spraying of whole biomes Use competent operator and adequate equipment
	Dip tanks	Limit spraying to certain body parts
		Careful siting for installations
All issues associated with ecosystem Effects		Limit the creation of tracks
Health and Safety Issues		Health and Safety Rules and regulations on Pesticide Handling and Storage Ensure proper training and equipment Ensure full capacity to implement Health and Safety Rules and regulation on Radiation Hazards (IAEA protocols)

69. ***Conclusive remarks.*** While insecticide-based tsetse control methods are inherently hazardous they do not present outstanding significant risks to human or ecosystem health when they are properly planned and managed by competent operators / contractors. For some environmentalists, any risk from pesticide use can never be worth it. Anyone in doubt should talk to a rural farmer for enlightenment on the substantial benefits of a tsetse and trypanosomiasis environment: reduced livestock mortality, morbidity and treatment costs, and improved calving and productivity, improved use of grazing resources and greater carrying capacity, increased cultivation, crop productivity and extended farming systems and increased access to land resources where disease challenge is otherwise constraining. Most negative impacts associated with tsetse methodology can be avoided and mitigated with good planning, training, monitoring and management practices. **Country level EIAs will always be expected to investigate and predict the hazards and risks of exposure to wildlife and humans and advise the government on best practice.**

Indirect Impacts

70. Indirect impacts refer to the environmental and social impacts caused by humans after the clearance of tsetse fly and trypanosomiasis.

71. One of the biggest arguments against widespread tsetse control is that it can lead to **uncontrolled human settlement and degradation of land** through a process of clearance of woodlands, agricultural expansion and increases in livestock density above carrying capacity. Such activities can give rise to inappropriate use of marginal areas for crops or grazing and could result in land degradation, loss of soil or soil fertility and undesirable changes in ground cover, wildlife or beneficial species with a host of social and economic consequences.

72. Compared with the output of research invested on the assessment of direct impacts, the amount of information and knowledge about indirect impacts is limited. This is because measurements of such impacts are both difficult and complex and have been confounded by arguments over cause and effect – often fanned by political, environmental and local development issues. With these limitations, the measurable impacts, which can only be quantified well after the intervention, have often been augmented by misleading anecdotal 'evidence'. In addition, social and economic issues associated with these changes, while numerous, are even less well known and not very adequately predictable. Although there is evidence to support arguments of significant land use changes with negative effects (Swallow, 2000), a lot of the observed impacts were the result of poor land husbandry, and not, *sensu strictu*, the result of tsetse clearance. Besides, there are examples where tsetse eradication did not lead to such detrimental results. The clearance of tsetse (*G. pallidipes*) from large areas in South Africa including the Kruger National Park between 1946 and 1952 did not lead to overpopulation and overstocking of the cleared areas. More recently, the clearance of tsetse from the Okavango Delta in Botswana during 2001-2002 did not result in increased human settlement around the delta (K. Motshwega & P. Kgori, pers. comm., this report, Annex 4). So that one may already conclude, in advance, that most negative indirect effects can possibly be avoided through proper advance planning, adequate land husbandry, and obviously, means and capacity to implement the planning and assist the proper usage of the cleared land.

73. Based on the many years of tsetse control so far in Africa, the negative indirect environmental and social issues often cited in connection with tsetse control are the consequences of: 1) land use and land use changes; 2) uncontrolled settlement; 3) livestock density and overgrazing; 4) loss of biodiversity; 5) loss of trypanotolerance in wildlife and 6) land degradation. Social issues are transversal and are commonly associated to all of these effects.

74. ***Land use issues and changes***. Historically, the integrated planning of tsetse and trypanosomiasis control and land-use development has been haphazard and varied - from the *laissez-faire* attitudes to the meticulously planned and controlled. The many examples of ensuing loss of resources and degradation associated with both spontaneous and planned development continues to fuel land-use concerns. What is often forgotten or ignored are the examples where both extremes of planning policy have resulted in sustained land-use, considerable economic benefits and substantially improved livelihoods. The potentially negative impacts of land use change tend to be emphasized more than the positive outcomes. There is some evidence to support both but attributing either to one cause – tsetse and trypanosomiasis control – is a tenuous exercise. A balanced perspective may be hard to visualize given the paucity of hard evidence: yet the negative aspects must be weighed against the positive development goals: a) Increased rangeland use and carrying capacity; more balanced overall range use, better use of dry season grazing , and greater productivity; b) Increased productivity from larger areas under cultivation; c) Intensified farming systems; d) Use of draught animals, use of manure, inclusion of forage crops and legumes in farm systems; e) Increased access to land resources: forest, wildlife and water.

75. The experience in most of Africa's fly belts is that land-use change was actually the *raison d'être* for tsetse clearance, opening up areas for agriculture, livestock and resettlement. Thus the loss of inhospitable bush, wildlife and woodland to agriculture and settlements was not viewed as a negative impact by government, farmers or settlers. Conservationists saw things differently and many protected areas in the fly belt owe their existence to these campaigners and their legacy helped to create the persisting rift between development and conservation ideals/sectors. Difficulties experienced in Africa of both establishing and enforcing land use plans has hardened the existing divide between development and conservation goals. Conservationists even saw the tsetse fly as a positive and effective factor in "protecting" wilderness and wildlife[13].

76. ***Uncontrolled Settlement***. There are mounting examples of the negative impacts associated with post-clearance settlement. In parts of Tanzania a demand for farmland led people to settle in tsetse infested areas where the tsetse population was progressively suppressed or even cleared as the land was opened up for farming (J. Daffa, pers. comm., this report, Annex 4). Some of these areas have become degraded as a result of poor farming practices. An uncontrolled migratory influx of people and livestock to the Dande Communal Area of northern Zimbabwe followed tsetse clearance in the mid -late '90s. Growth of cattle numbers since the beginning of the decade was estimated at 21% per annum and stocking densities reached the maximum permitted level by 1998 (DfID-AHP, 2001). In the alluvial soils along the river banks the area cultivated has expanded rapidly and bank access and erosion has become a serious issue (RTTCP 2000) and incidents of wildlife raiding crops are rising. Land use and settlement plans were in place but were not observed by the local authorities, some of which were in conflict with traditional land tenure arrangements.

77. Tsetse clearance from Adamaoua in north Cameroon was accompanied by immigration of pastoralist communities that resulted in environmental degradation due to overgrazing of the grassland (H. Hassan, pers. comm., this report). Similar events have occurred in the Ethiopian lowlands that were cleared of tsetse and subsequently converted to mixed farming and grazing. Swallow (2000) describes various case studies on the impact of tsetse control on grazing patterns, migration and human settlement and concludes that tsetse control in areas that are not settled will attract higher rates of immigration than areas that are already settled. An outbreak of trypanosomiasis in the Ghibe valley of Ethiopia caused a rapid migration of people away from the affected areas leading to changes in land use and land cover but these areas were subsequently re-settled when tsetse was controlled. A study in Burkina Faso found no association between tsetse control and migrants' decision of when and where to settle. The elimination of *G. morsitans* from Northern Nigeria was accompanied by movement of

[13] The experience of Tanzania particularly for the Serengeti National Park and the Ngorongoro Conservation area shows that the presence of tsetse is no protection against encroachment of protected areas nor does it protect wildlife against poaching (J. Daffa & T. Mlengeya, pers. comm., this report).

people into the cleared areas and a more even distribution of livestock in the area. Consequently grazing pressure in the environmentally fragile areas of the Soudano-Sahelian vegetation zone was reduced [14] - but the degradation in this zone was blamed on tsetse clearance! The variability in findings of the impact of tsetse control on land and its influence on land use changes highlight the need for continuous monitoring of the physical and social environment during and after tsetse control programmes.

78. ***Lessons learned***. Settlement and land degradation were also the result of previous campaigns where land was reclaimed. Although in a different context and at a different scale, the Onchocerciasis Control Programme (OCP) which lasted for a period of twenty years in West Africa, from 1974 to 1994, may provide some indications of the set and range of potential negative environmental and social impacts associated with human settlement and development activities (See Box 4).

Box 4. The River Blindness (Onchocerciasis) Control Program (OCP) (1974-1994)

One of the most successful health programs in Africa has been the Onchocerciasis Control Programme (OCP) which lasted for a period of twenty years, from 1974 to 1994. The program has virtually eliminated "River Blindness" as a public health hazard in West Africa. The program was supported by twenty three donor agencies through the World Bank, and was carried out by the governments of eleven countries, including Bénin, Burkina Faso, Côte d'Ivoire, Ghana, Mali, Niger, Togo, Guinea, Guinea-Bissau, Senegal and Sierra Leone. The Program was targeted at a population at risk estimated at thirty million, and as a result of the success of the programme, about 25 million hectares of arable land have been made available for settlement.

The causative agent of *river blindness* is a worm (*Onchocerca volvulus*) spread by blackflies that breed in fast flowing water. The programme aimed at eliminating the vector, and used therefore as combating technique the repeated applications of larvicide to flowing water stretches. In order to monitor the direct impacts of the use of larvicide, a special Ecological Panel, later to become an Ecological Group, was created early in the program for that purpose. The Ecological Group was able to demonstrate that there had been no significant, irreversible or long term disturbances of the aquatic environment of the OCP area. This combined with the successful eradication of the vector assured that the OCP was a complete success.

Yet, soon, problems emerged. These came from the human settlement and development activities that ensued the reclaiming of some of the 25 million hectares made available by the project. Quoting from the Committee of Sponsoring Agencies for the project: **"*Where once the enemy was the blackfly, today it is deforestation, erosion, and extensive cultivation*"** In many locations, accelerated pace of spontaneous settlement outgrew the ability to manage previously established, and carefully thought, management plans! In addition to increased physical impacts to the watersheds, there were associated conflicts over the allocation of the land, grazing, water and forest resources, between settlers and hosts, and between settlers themselves.. Some of these conflicts turned into veritable equity issues as some of National Policies, in attempts to favour or accompany the development, tended to favour some groups over the others.

A detailed Environmental Impact Assessment of the settlement in a sample area in Burkina Faso (Upper Léraba Basin) has shown contamination of the river by pesticides from agricultural practices, a contamination much more severe than the one associated with the use of larvicides during the OCP. GIS based techniques and successive examinations of aerial photography and satellite imagery showed that the OCP resulted in the clearing of about 75% of the original savannah woodland, and the complete destruction of the riverine forests, with signs of visible soil erosion (Baldry et al., 1995). It was sensed that continued land degradation and resource depletion in that sample area, and by extension, in almost the whole of the project area, would threaten the incomes, the social cohesion, and the sustainability of the settlements.

[14] Leak, S.G.A., (1999) Tsetse Biology and Ecology: their Role in the Epidemiology and Control of Trypanosomiasis CAB International, Wallingford, UK

The OCP demonstrated that there may be high environmental, social and economic impacts of unassisted spontaneous settlement of reclaimed land, and that the indirect impacts of a programme may be far more important than the short term, usually manageable, direct impacts. Recognizing this fact, the Committee of Sponsoring Agencies formulated a series of fifteen guiding principles for sustainable settlement. These are discussed elsewhere in the appropriate section of this report.

79. ***Social issues related to settlement.*** Unplanned and uncontrolled migration of people are highly significant events and, with the possible exception of political refugees, are a result of poor planning (if any) and poor cross sectoral communications, weak institutions or lack of resolve to implement environmental policies. Uncontrolled settlement is a potential, if not a sure source of social impacts, with potential conflicts about access to resources and land tenures, between pastoral and agricultural activities, etc. In general, the bigger the resettlement the greater the extent of change in land uses and the concomitant risks of complex social issues. Controlled settlement will also bring about change as intended but the gradual environmental transformation and impacts will be less obvious over time. The risks of unsustainable land use and social impacts are present under both scenarios but their management and mitigation is more likely within the latter. A checklist of potential social impacts associated with uncontrolled settlement can be found for example in the World Bank Safeguard policy on Involuntary Resettlement.

80. ***Loss of Biodiversity.*** The creation of tsetse free zones is for a development purpose - often agricultural - and is expected to be accompanied by an increase in the amount of land under cultivation and mixed farming. Agricultural enterprise may cause changes in the composition and perhaps abundance of biodiversity. Cultivation can introduce and/or enhance pest species populations which would in turn necessitate pest control measures, especially where farming is commercially oriented. Intensive/large scale commercially oriented farming is also often accompanied by changes in soil biodiversity and a simplification of the plant community that in turn supports fewer fauna, including insects. Such simplification in biodiversity over large expanses of land or whole ecosystems often reduces the resilience of the ecosystems to withstand or recover from natural disasters (such as flooding) unless proper measures are taken to minimize their impacts.

81. In the mid-Zambezi valley (Zimbabwe), the consequences of human settlement and agricultural development on wildlife diversity along the Angwa, Manyame and Kadzi rivers was shown to have affected the distribution and abundance of wild species in the river beds and banks. All the major ungulate species decreased with increasing field size and a similar trend was observed for small and medium-sized carnivores, though they were in lower numbers when present[15]. Trade and consumption of bush meat is a concern in Cameroon and DR Congo that already have significant levels of such activity as people penetrate more deeply into forests and thereby increase the pressure on wildlife resources. Tsetse control could facilitate this activity. Conversely the pressure on wildlife to meet the protein requirements of people in these countries could be reduced as it will become possible to rear and keep cattle and other livestock in the tsetse cleared areas. This will depend on the socio-economic drivers (dietary preferences or inability to access meat) that underpin people's use of wildlife as a protein source.

82. **Conservation issues**. Loss of biodiversity poses serious economic and conservation issues as natural resources comes under pressure from development. Flora and fauna of swamps, floodplains, woodlands and grasslands are at risk, and one that increases in severity as the scale of clearance accelerates. These issues require early incorporation into strategic planning in order to achieve a balanced approach to development and conservation. Some countries are not in favour of control or eradication of tsetse flies in wildlife conservation areas, which may be incompatible with the purpose and strategy of the PATTEC as these areas are usually the greatest reserve of fly and trypanosomiasis.

[15] Fritz, H et al. (2003) The effects of agricultural fields and human settlements on the use of rivers by wildlife in the mid-Zambezi valley, Zimbabwe. Landscape Ecology 18: 293 - 302

83. A related concern, a biodiversity issue, is the potential loss of endemic trypanotolerant cattle. Such cattle only occur in those areas where tsetse makes it difficult/impossible to maintain sizeable herds of trypanosomiasis susceptible cattle but they are not as productive as other types of cattle under conditions of no tsetse challenge. For simple economic reasons, it is conceivable that trypanotolerant cattle will eventually disappear after the tsetse fly is eradicated and as other more productive cattle breeds are stocked in the reclaimed areas. A trade-off between maintaining trypanotolerant breeds and introducing higher yielding breeds will have to be made although policies to deliberately maintain stocks of trypanolorant breeds, if desired, could be made.

84. There are numerous other threats to biodiversity from humans and so a strategy for tsetse clearance needs to be considered cumulatively alongside agriculture, irrigation and dam building, forest exploitation, exotic species introductions and so on, so that a holistic approach to biodiversity management is attainable. This way, impacts on biodiversity may be fundamentally cumulative in nature.

85. ***Loss of trypanotolerance***. Loss of trypanotolerance in wildlife is primarily a conservation issue. Without the continuous challenge from trypanosomes, a host's immune system may become compromised. The concern is that area-wide control of tsetse could lead to a loss of resistance such that any resurgence of the disease after many years could lead to mortalities of threatened or endangered species (for instance, black rhino populations). Translocation of black rhino from area at risk from poaching in Kenya and Zimbabwe has generally been from tsetse-infested to tsetse free areas. In the reverse direction the animals would be exposed to the disease and under conditions of stress, a normally latent infection can become patent. Two black rhinos have demonstrated this condition - one of which died. Loss of maternal antibodies, aged or immuno-suppressed animals could be at some risk[16]. Where good transboundary control is hard to achieve or there is a risk of reinvasion from failure in the control technique (see Box 3), re-introductions of the diseases are likely. The overall risk is probably small but will vary with geography, conservation policy and transboundary agreements on tsetse control. The local risk would need special evaluation by an EIA.

86. ***Overstocking and land degradation***. The cost of land degradation is estimated at 29 billions US$ in Africa, with values range from 1 to 10% of the Agricultural Domestic Products in any one country (Requier-Desjardins and Bied-Charreton, 2006). Land degradation is therefore a serious issue with definite economic costs.

87. Production of vegetative biomass in semi-arid pastoral areas, grasslands and bushed grasslands is strongly correlated to rainfall and soil fertility and the continuing ability of these biomes to provide grazing for livestock and wildlife depends upon the way in which the areas are managed. The amount of grass and herbage that can be removed annually from grassland, for example, must not be so great as to leave insufficient reserves for growth the following year. It is not easy to calculate the grazing limits (carrying capacity for grazing) of areas that may form part of a huge system of land use; and it is also another matter to manage stocking and grazing rates to suit derived or planned limits. Short-term exploitation and the increasing use of diminishing grazing resources by expanding human and livestock populations has led to vegetation change. Herd accumulation and stocking densities are determined on a rational basis by herders and farmers and so good seasonal rains and untapped grazing resources may be used to increase the size and structure of herds and govern the rates of off-take. So it is not in the interest of livestock owners to mis-manage the resource. However, overgrazing has affected vegetation on every continent and is a problem often linked to areas of common property, where no sense of ownership or personal investment prevents over-exploitation.

[16] Mihok.S et al (1995) Health implications of translocations of endangered species in Africa. Trypanosomiasis in rhinoceros. *pp* 423-424 in: *Proceedings of a Joint Conference of the American Association of Zoo Veterinarians, Wildlife Disease Association, American Association of Wildlife Veterinarians*

88. It was claimed[17] that tsetse and trypanosomiasis control in West Africa led to the overgrazing by cattle of nomadic herdsmen and contributed to the Sahelian drought through reduction of vegetative ground cover and elevation of albedo (reflectivity) of the region, which mathematical models suggest may reduce rainfall. This was disputed at the time[18] [19]and still there is no evidence to link the drought to mismanagement.

Assessment of Indirect Impacts

89. ***Land use changes***. Any change in rural or communal land use can be expected to elicit environmental consequences. Those considered as negative and most likely in the wake of tsetse clearance were outlined above and an attempt at gauging their significance continues below. If one variable is abundantly clear it is for a realistic, strategic, sustainable land management plan to be agreed before any interventions begin. Despite the difficulties of planning, it is the only way to try to mitigate against the big issues of degradation, settlement of inappropriate areas, overgrazing, land clearing, soil erosion, and the destruction of forest, areas, woodland and wildlife and ensuing social consequences. Sustainable Land Management Plans are essential to tsetse control. They are development plans that must reflect not just national policy but farmer's objectives and constraints. Large scale control should only proceed at a rate that allows effective implementation of the plans, and the monitoring of new system of land use is essential to avoid degradation.

90. The potential negative impacts may be balanced by the positive impacts resulting from increased rangeland use and carrying capacity, more balanced overall range use, better use of dry season grazing, and greater productivity, increased areas cultivated, intensified farming systems: with use of draught animals, use of manure, inclusion of forage crops and legumes in farm systems and finally, increased access to land resources: forest, wildlife and water.

91. ***Uncontrolled settlement*** Unplanned and uncontrolled migration of people are highly significant events and, with the possible exception of political refugees, are a result of poor planning (if any) poor cross sectoral communications, weak institutions or lack of resolve to implement environmental policies. In general, the bigger the resettlement the greater the extent of change in land uses and the concomitant risks to the environment. Controlled settlement will also bring about change as intended but the gradual environmental transformation and impacts will be less obvious over time. The risks of unsustainable land use are present under both scenarios but their management and mitigation is more likely within the latter. However the exact relationship between tsetse clearance and land use change effected by humans is far from clear and much of the evidence would suggest that land pressure from adjacent areas is the impetus for migration of any description. Tsetse and trypanosomiasis control operations could certainly act as a trigger but when population pressure for homesteads, farming or grazing land is high, humans will take the risks of moving their families and cattle to marginal areas including tsetse infested zones. The EIAs executed at national level should spell out the dangers and promote mitigation measures, but the Bank should be aware of the huge potential for uncontrollable settlement as tsetse clearance is rolled-out as envisioned under PATTEC. This needn't lead to land degradation even in marginal agricultural areas, as pointed out below.

92. ***Biodiversity***. It is clear that habitat fragmentation is one result of development in rural and communal areas. The numbers and abundance of plant and animal species will very likely decline in the process and conflicts between large herbivores and arable farmers lead to culling. Reductions in biodiversity are to be taken seriously at all levels of organisation (local to global), since biodiversity

[17] Ormerod W E (1976) Ecological effect of control of African trypanosomiasis, *Science*, 1991, 815-21
[18] Ford J (1971) *The Role of the Trypanosomiases in African Ecology*. Clarendon Press, Oxford.
[19] Putt, S N H., Shaw, A P M., Mathewman, R W., Bourn, D M., Underwood, M., James, A D., Hallam, M J & Ellis, P R (1980) The Social and Economic Implications of Trypanosomiasis Control. *A Study of its Impact on Livestock Production and rural Development in Northern Nigeria.* Veterinary Epidemiology and Economics Research Unit, University of Reading.

provides us with renewable resources (food, wood fibre, energy, etc.) and life supporting services (recycling, purification, gas balance etc). In many large river basins, the species diversity is not even fully described or understood yet. Premature extinctions are to be avoided at all costs. Commitment to conservation is highly variable in practice and usually at odds with development anywhere in the world. There are numerous other threats to biodiversity from humans and so a strategy for tsetse clearance needs to be considered alongside agriculture, irrigation and damn building, burning, exotic species introductions and so on, so that a holistic approach to biodiversity management is attainable. Generally, if small populations of the exploited species remain, the effects of overexploitation are reversible given time and protection.

93. ***Livestock and Overgrazing***. When grassland areas are overgrazed, changes in the composition and cover of grasses, herbage, shrubs and trees occur that lead to the replacement of perennial and annual species with unpalatable ephemeral and nutritionally inadequate xeric vegetation. Successional changes such as these are reversible, but require a management plan of stock control which may be hard to implement if agreement between the users cannot be reached (and these may be cross border issues). Grazing pressure is also indicated by soil factors such as fertility, structure and erosion. Reduction in ground cover exposes soils to the action of wind and rain that can result in the removal of soil and if residues are not sufficient to maintain soil organic matter and aggregates, water infiltration rates and water holding capacity are affected. Compaction of clay soils from trampling can lead to increased run-off and erosion, but modest trampling also serves the function of breaking clods, surface crusts and improving seed germination. An extreme outcome of overgrazing is desertification, an unrecoverable state that can result from the destruction of ground cover and the loss of topsoil.

94. Coping strategies have evolved to accommodate the vagaries of rainfall and nutrient distribution and to stabilize the risks to livelihoods. Human and herd expansion has led to encroachment of increasingly marginal lands for grazing and, in some areas, heavy grazing of private, group- and cooperative ranch, and common property resources. But the image conjured up by the term 'overgrazing' is emotive, and more usually employed to describe a stage towards desertification rather than various degrees of grazing pressure on the succession of vegetation. The difficulties of measuring the effects of grazing pressure on land, particularly over the short term, has led to conflicting assessments over the causes and what is seen as overgrazing. It was claimed[20] that tsetse and trypanosomiasis control in West Africa led to the overgrazing by cattle of nomadic herdsmen and contributed to the Sahelian drought through reduction of vegetative ground cover and elevation of albedo (reflectivity) of the region, which mathematical models suggest may reduce rainfall. This was disputed at the time[21] [22]and still there is no evidence to link the drought to mismanagement.

95. ***Loss of trypanotolerance in wildlife***. Loss of trypanotolerance is a long term, poorly known, risk. The evidence for loss of immunity to trypanosomes in wild hosts is not proven or particularly compelling. However, the possibility exists and in case of failure of the program to completely eradicate the disease, resurgence after a longer period in any one area could cause concerns in wildlife management. The precautionary principle calls upon the obligation to consider this as a potential impact even though its probability of occurrence is poorly known. Alternative precautionary measures such as in the case of the rhino where breeding stocks in conservation areas are being used to recover poached regions in central southern and eastern Africa, would be to ensure that some parks where breeding animals are managed retain a trypanosome challenge (as some governments have through legislation).

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[20] Ormerod W E (1976) Ecological effect of control of African trypanosomiasis, *Science*, 1991, 815-21

[21] Ford J (1971) *The Role of the Trypanosomiases in African Ecology*. Clarendon Press, Oxford.

[22] Putt, S N H., Shaw, A P M., Mathewman, R W., Bourn, D M., Underwood, M., James, A D., Hallam, M J & Ellis, P R (1980) The Social and Economic Implications of Trypanosomiasis Control. *A Study of its Impact on Livestock Production and rural Development in Northern Nigeria.* Veterinary Epidemiology and Economics Research Unit, University of Reading.

96. Land degradation is a serious issue in tsetse freed areas designated for development. The variability in soils and soil fertility in some semi-arid areas has led to their agro-ecosystem designation as fragile or unsuitable for cropping. Thus an argument against control of tsetse and trypanosomiasis is that it may promote inappropriate and unsustainable land use in these fragile environments and lead to degradation. Strong scientific evidence to back up the argument is lacking, and contrary to expectations, a multidisciplinary study in Zimbabwe[23] showed that agropastoralist systems in three agroecological zones of differing 'fragility' had caused, over 20 years, little degradation, and where it had, it was due to poor land husbandry rather than the intrinsic erodability of the soils being cultivated. They concluded that it might not be valid to argue against settlement on the grounds of apparently unsuitable agro-ecological zonation, with the corollary that not all parts of Africa's tsetse infested lands are therefore unsuited to agriculture. But it points to a significant fact that the widespread loss of agricultural extension systems in rural areas must be replaced through agencies such as 'farmer field schools' if better land husbandry is to be attained.

97. **Mitigation of indirect impacts**. All the issues related to pos-project usage of the land, can be properly mitigated by proper Environmental Assessment (or Feasibility Study) and advanced planning for the sustainable management of the cleared land. It is understood that the use of the reclaimed land will be "sustainable", if, at a minimum, it generates increased and stable resources and incomes and does not lead to land degradation, to soil losses, to severe and irreversible alteration to hydrological resources, to permanent loss of natural resources or does not generate land tenure conflict, land usage conflict, gender inequity, loss of social cohesion and ethnic inequity. The most important features of mitigating indirect impact are 1) the need for advanced planning and prior assessment, and 2) the need for post project monitoring and assistance in the implementation of the plans.

Table 6. Mitigation of direct impacts

ISSUES	MITIGATION
Land Use Changes	Need for Sustainable Land Management Plans (SLMP) prior to project
Uncontrolled Settlement	Need to be addressed at ESIA or Feasibility Stage prior to project
Livestock Density and Overgrazing	
Loss of Biodiversity and Conservation Issues	Need to be considered at ESIA or Feasibility Stage in a cumulative and integrated way, together with other on-going or planned projects in the region
Loss of trypanotolerance	Precautionary Principle. Need to plan continent-wide some specific areas (Parks, Breeding areas) where some trypanosomiasis challenge is retained
Land Degradation	Need to be addressed at ESIA or Feasibility Stage prior to project Need for capacity building and assistance to Land Husbandry

98 ***Conclusive remarks.*** Indirect impacts are the most serious potential negative consequences of the PATTEC initiative, particularly those with long term, and possibly irreversible effects, related to land degradation and uncontrolled settlement. The amount of reliable quantitative information and knowledge about indirect impacts is limited because measurements of such impacts are both difficult and complex and have been confounded by arguments over cause and effect In addition, social and economic issues associated with these changes, while numerous, are even less well known and not very adequately predictable. **Most of the potential negative indirect impacts can be mitigated by**

[23] Barrett, J C, Brinn, P and Timberlake J 1991 *Tsetse control, agropastoralism and land degradation: a case study in Chiswiti Communal Land.* Unpublished report of the Tsetse and Trypanosomiasis Control Branch, Department of Veterinary Services: Harare

elaborate sustainable land management planning, together with specific and adequate means of implementation and monitoring.

PART V
THE ENVIRONMENTAL AND SOCIAL MANAGEMENT FRAMEWORK

Introduction

99. An Environmental and Social Management Framework (ESMF) consist of a series of recommendations upstream from projects, aimed at assuring that the program or policy can be managed in a way that is compatible with the principles of sustainable development and entails the least environmental negative impacts or social and economic impairments. It includes provisions for Environmental Assessment (EA) of individual projects or phases and as part of EA, provisions for the establishment of Environmental and Social Management Plans (ESMP), prepared at phase or project level. The latter generally consists of a list of mitigation (or compensation) and monitoring measures, compatible with the anticipated impacts, identified through the project-level assessment, together with plans and budget, capacity building and governance requirements for the successful implementation of those measures.

Levels, types and number of Environmental and Social Assessment Reports

100. It may be useful to clarify the hierarchy of the proposed Campaign and to clearly define what is understood or involved by the terms: Program, Phase and Project. For the purpose of EA, we define:

a) The *Program*: designate the entire PATTEC campaign, as described in Chapter 4, including the choice of techniques for suppression and eradication, and the *area wide approach*. The Program will have several phases.

b) The *Phases*: Phases do not represent evolving successive parts of the program, but rather successive repetition of a group of projects of similar nature. It represents a single funding operation to a number of countries, where projects are to unfold. A phase includes in principles a series of *projects*, each one concentrating on control and eradication in a given region.

c) A *Project:* designate a single field operation in a defined area and in a defined period of time, executed and funded through a Phase of the program. Because of the area wide approach of the Program, a project may be confined within a single country, or may involve two or more countries, when the targeted area overlaps national boundaries. Therefore, Phases will include many instances requiring transboundary coordination, both in the unfolding of the projects and their Environmental Assessment.

101. As the Campaign will unfold, Environmental Assessment will or could be required in a number of instances.

1) **Program-level EA**. Strategic Environmental Assessment, such as the present one, has to be carried out for the whole Program, as required by the Bank's Environmental policy (ESAP).

2) **Phase level EA**. Phase I of the Programme has been classified as Category I for environmental assessment purposes and accordingly an Environmental and Social Impact Assessment was required, following the ESAP of the Bank. The same requirement will apply for subsequent phases of the program. Multinational Environmental Assessment (ESIA) will therefore have to be carried out for each Phase of the Program. If four or five phases are to be operationalized, then four or five multinational ESIA will be required, one for each successive phase.

3) **Country and project level EA**. Every phase will involve a number of countries, each with in-country requirements, laws and regulations regarding environmental impact assessment.

Generally, because most projects will involve the use of insecticides, all of them will, theoretically be screened as subject to EA by country laws. All 37 countries targeted by the program do have such set of rules; although for some, the system may not be entirely functional (see Tables, Annex 4).

102. If EA is required at all levels (Table 7) , and if the Program was presented into five or six phases, then in the end, a total of 42 or 43 Environmental Assessment reports might have to be prepared, one for each country involved, and one for each Phase, in addition to the SEA of the Program. Country level Assessment has been required in another continent-wide program, namely the Africa Stockpile Programme (ASP). However, because PATTEC involves systematically transboundary issues, and clearly has to be approached "regionally" instead of "nationally", contrary to the ESMF of the Africa Stockpile Program, we do not recommend adhering to the requirements of in-country assessments. This would be highly inefficient. In order to avoid multiplication of efforts, reduce the number of EA reports, and still remain efficient, we strongly recommend concentrating the site specific Environmental Assessment at the Phase level (Table 7) inasmuch as the Phase level assessment seems, in addition, to be the best suited for adequately including sustainability and transboundary issues.

Table 7. Levels of EA for PATTEC

Level	Description	EA system
Program level Assessment		Bank's SEA procedures
Phase level Assessment	Multinational. Numerous projects in different countries	Bank's ESIA procedures or equivalent.
	Transboundary assessment	Bank's ESIA procedures -with due diligence to harmonize in-country procedures
Country level Assessment	In country Assessment	*** It is suggested to use the Phase level ESIA as a surrogate for each country level EIAs, which normally would be required by each country in every one phase.

103. The PATTEC's Project Coordination and Management Unit (PCMU) will act as the proponent for the purpose of conducting **Phase level ESIA.** They should be responsible, in cooperation with the countries involved, for the production of the ESIA document for approval by the funding partners (e.g. the Bank) and the affected countries. In other words, the Phase level ESIA, prepared as the Bank's procedures should be the document used for approval by the Bank's for funding the proposed Phase, and for approval by the in-country legal authorities. Because of legal requirement for EA within individual countries, special arrangements may be required to obtain advanced assurance that the format and Terms of reference for the Phase Level ESIA will meet and satisfy both the Bank's multinational ESIA standards and similar requirements in each country.

Terms of Reference for Phase level ESIA

104. A model set of Terms of references is presented as Annex 5, based on and modified from model TORs of the Bank for ESIA. Phase-level Assessment should be broad-based, ranging in focus to site-

specific studies, to larger cross-cutting related to sustainability assurance. The ESIA should discuss and assess site-specific aspects of the various generic impacts and issues discussed in the previous chapters, both direct and indirect. These issues should be brought to site-specific rationale and adapted mitigation measures should be proposed as part of the Environmental and Social Management Plans to accompany the various Phase level ESIAs. The ILRI Manual for impact appraisal which should be available shortly, perhaps by mid-2006 according to their work plan should be a useful tool for that exercise. While the review and approval of Environmental Impact Assessment at country level falls entirely within the country's responsibility, the approval of ESMP should be a condition for disbursement by the Bank. Phase level Assessment is also the appropriate level to insist on broader issues such as conservation of biological diversity or possible effects of climate change on the extent of the fly and the potential reduced efficiency of natural upland barriers, for the potential consequences of land degradation on desertification, and for the cross-cutting issues which are part of the Sustainability Assurance Pack of the Bank. Integration of those is done in the model TORs of Annex 5.

105. Environmental Assessment in transboundary contexts is a special concern. In Europe, where each country has strong EA systems, the Espoo Convention was signed to deal with transboundary impacts and determine some basic rules for their assessment in an efficient and respectful manner. As there are no Espoo convention in Africa, in cases where transboundary effects are anticipated, special procedures might need to be agreed upon by involved parties. The case would apply for instance where a single intervention is planned across political boundaries and where that intervention would be subject to the EA regulation in the two countries. As much as adequate regional coordination of operations and interventions will be critical for the success of the program, adequate consideration of transboundary impacts and issues will also be critical.

106. **Sustainability Assurance.** The Bank's environmental policy calls clearly for the use of environmental assessments (EA) as a tool for sustainability assurance. In addition, sustainability criteria as per the Bank's environmental policy lie in the various issues which are explicitly stressed or emphasized as part of EA. For instance the Bank's environmental policy stresses the need for a greater focus on poverty reduction and pro-poor growth policies and programmes, the integration of Africa in the globalization process and the need for improved governance. The policy also takes into account the ratification of a large number of environmental conventions, agreements and protocols, and the growing recognition of MDGs as measures of development. It does specifically address cross cutting issues such as gender, equity, and governance and specific issues such as the deterioration of the natural resource base, with special attention given to land degradation, the conservation of biological diversity, the destruction of tropical forest, and the loss of cropland. Finally, the Bank's policy favours community involvement, in particular the most marginalized and vulnerable groups, on decisions that affect them and calls for governance structures and institutions which are more responsive to the needs and priorities of affected communities in general, and poor people and vulnerable groups in particular. Presumably public disclosure and transparency of the sustainability assessment would be an integral part of community involvement.

Table 8. Sustainability Assurance Components

Sustainability Assurance	
Use of Environmental Assessment	Direct and Indirect Environmental Impacts
Integration of environmental conventions, agreements and protocols and MDGs as	Particularly MAE- Multilateral Agreement on the Environment Climate Change

measures of development.	Desertification Conservation of Biological Diversity Other Agreements as signed by the countries Ex. Ramsar, Cites, etc.
Integration of Bank's Sustainability Criteria	Poverty reduction Pro-growth Cross Cutting Issues Gender Equity Governance Deterioration of Natural Resource Base
Community involvement and public disclosure	

107. These sustainability assurance elements have been factored into the scoping and terms of reference of the phase-level ESIA (Annex 5).

Environmental and Social Management Plans

108. Phase level ESIA shall include extensive Environmental and Social Management Plans. Standard terms of references for ESMP are shown as Annex 6 to the present report, extracted from the Bank's Environmental Policy (Annex 11). ESMP should include

a) A list of mitigation /enhancement measures and estimated costs; Phase I ESIA has provided a model of mitigation/enhancement measures in table form which may serve as a canvas for future ESIA. It is reproduced for reference as Annex 7 to the present report.

b) Advanced plans for the Sustainable use of cleared land, a Sustainable Land Management Plan, as discussed previously, together with all the governance issues associated with the implementation of the plan

c) A full plan for monitoring the consequences of the projects, and its direct and indirect effects, particularly in the long time range, together with, again, all governance and technical issues associated with the successful implementation and operation of the Monitoring Plan.

109. "Lessons learned" from previous tsetse control programs in Africa stress the importance of advanced planning, monitoring, technical assistance and capacity building into the design of the coming phases and into the ESMP.

Lessons learned from previous tsetse control programmes, RTTCP and FITCA

110. The Regional Tsetse and Trypanosomiasis Control Programme (RTTCP) was designed to eradicate tsetse fly from the Common Fly-Belt of Malawi, Mozambique, Zambia and Zimbabwe. The fly-belt is a contiguous area that covers 322,000 km^2 of tsetse infested land and whose utilisation is largely communal settlement, safari and game concessions and protected areas such as national parks. Operations to clear the fly began in 1986 with funding assistance from the European Union. Under pressure from the EU in the early '90s, the focus on eradication and resettlement gave way to sustainable rural development and a selective approach to interventions based on economically viable control in priority areas was established in 1995. Environmental monitoring by an EU group was extensive in the early eradication phase, but dealt solely with the direct impacts of the area-wide aerial

and target operations that employed endosulfan, and deltamethrin. Ground-spraying of DDT in Zimbabwe (funded by the Zimbabwe government, not the EU) was monitored for its impacts on wildlife by DFID.

111. The indirect environmental impacts of such a large regional programme on land use and its socio-economic implications were not configured into the programme's predominantly technical strategy at the outset, and later attempts to formulate and prioritise regional control, land use plans and an NR strategy were unproductive. In the absence of sound national and regional planning, and unsupported by changes in donor thinking, the EU terminated funding for the programme in 2000. The shift in donor attitude - from one where the responsibility for public pests rested with central government to one where the onus for control fell to the livestock owner - quickly shaped state policy too. One real issue of contention for the EU was the fear of uncontrolled settlement of large areas of land cleared of tsetse and the unsustainable use of land and natural resources in its wake.

112. EU and other donor policy was strongly reflected in the EU's subsequent programme - Farming in Tsetse Controlled Areas (FITCA), another regional programme covering five East African Counties: Kenya, Uganda, Ethiopia, Tanzania and Rwanda but where the emphasis was on farming communities to control tsetse and trypanosomiasis through the application of appropriate control methods - baited traps and targets, insecticide-treated cattle and trypanocidal drugs. Small scale control, cost recovery and community participation were the guiding principles. Local planning was the byword and communities were to be responsible for land management and monitoring, thus overcoming the donor and environmental NGO fears of unchecked settlement and land degradation associated with area-wide control. The strategic lessons to be learnt from the FITCA programme (1996- 2004) will be eagerly awaited, but it is already clear that disease levels in some small areas cleared of tsetse remains unaffected, as the areas are too small to withstand re-invasion pressure from outside (but also including other factors such as animal density, habitat type, commitment of participation etc) and whether the recurrent cost of control and disease protection can be borne by the communities remains to be seen.

113. Whereas FITCA recognised at the outset the need to monitor the indirect impacts of tsetse control on expanded cultivation and livestock density i.e. land use and habitat change and biodiversity, the simple quantitative tools were not readily available and the resort to remote sensed data and GIS mapping of field data, while very effective, is the domain of research institutes and was not transferable for local community use. The capacity of stakeholders to engage in simple monitoring and management of land to enable them to respond proactively to any observed changes was a missed FITCA opportunity (but possibly an unrealistic one anyway). FITCA never consulted the RTTCP for lessons learnt about strategy formulation and planning.

Application to the present Program

114. ***Monitoring***. As shown by the “lessons learned” from previous tsetse control projects, and as shown by the assessment of the indirect impacts, monitoring will always be a very strict requirement for almost all interventions. The bank should reinforce the recipients commitment to monitoring and require that teams are set up (and funds set aside) to collect relevant baseline data and use established indicators of land cover, soil condition, vegetation status and biodiversity to quantify change. The Bank must recognize that socio-economic and environmental information is hard to come by and may need to be researched (along with fly distribution, demographics and current land use), requiring longer time and possibly extra funding.

115. ***Public consultation and Disclosure***. As this aspect is a key element of the Sustainability criteria of the Bank, special attention must be given to the level and effective participation of the public, and the community involvement, both in the assessment, the monitoring, and eventually in the planning of post-clearance stages. Most of in-country EA systems do have provisions for public consultation, but

some do not. Should this occur, the Bank's policy on public consultation and disclosure should be applied across the board, in agreement with the recipient country.

PART V
CONCLUSION AND RECOMMANDATIONS

116. Direct impacts of insecticide-based methods of tsetse control on ecosystems are limited and predictable. They can be monitored and managed to avoid unwanted side-effects. Indirect effects of control concern the environmental impacts of human activities, which are harder to predict, monitor and ascertain until sometime after the intervention. Indirect impacts are the most serious potential negative consequences of the PATTEC initiative, particularly those with long term, and possibly irreversible effects, related to land degradation and uncontrolled settlement. Most of the potential negative indirect impacts can be mitigated by elaborate sustainable land management planning, together with specific and adequate means of implementation and monitoring. Consequently, despite the widespread use of insecticides in wild lands or the longer-term impacts of controlling tsetse and trypanosomiasis on subsequent land use, the present assessment conclude that the overall environmental and social impacts of the Program can be managed, with appropriate planning and means for implementation and monitoring.

Design and operation of the Program

117. Much of the environmental sustainability of the Campaign depends on whether or not the project is successful, and whether or not it is carried in a well coordinated manner, as planned. As discussed earlier, almost all previous national, or even regional programs, failed largely due to re-infestation, as a result of unsustained, uncoordinated efforts or inappropriate approach. PATTEC has deliberately targeted the complete eradication of tsetse, as opposed to control, largely for the purpose of putting the problem to an end, and to avoid the recurrent costs of control. A significant part of the efforts, both in terms of human and financial resources would in a way have been lost if the full benefits of the program are not achieved. Therefore, because of high opportunity costs, the Bank should ensure that the Campaign is carried efficiently through all its planned phases and is successful. There are two key components for this, namely the efficient cooperation between countries to adopt fully the area-wide strategy of PATTEC, and the selection of the set of countries and target belts for the successive phases of the Campaign, a "road map".

118. We strongly recommend that Phase level ESIA incorporate a **Feasibility study**, to help PATTEC to define its role in support of national governments and their projects, to facilitate early strategic planning, identify priorities and means, staffing, land monitoring and management harmonization, socio-economic issues, capacity building training, primary research and data management.

119. In order to ensure full cooperation of countries, as a condition of funding, all recipients of a financial agreement from the Bank should have tsetse and trypanosomiasis control identified as a national priority, with firm commitments from their ministries (livestock/agriculture/public health/planning) to develop strategic plans prior to implementation This means that priority areas for tsetse clearance will have been identified for sound economic and development reasons, while others may be deleted on the basis of unsound economic, social, or environmental grounds.

120. **National planning strategies** cannot be drawn up in isolation where a tsetse distribution lies across a border(s). Their needs and those of their neighbors must be planned in both time and space if a common goal of tsetse control/eradication is to be realized within the region. The Bank and PATTEC should ensure that national strategic plans are integrated with others in a region to ensure cooperation and commitment across borders. Existing conflicts in policy across borders with respect to

institutions (traditional, local and national), control, gazetted land, land use and buffer zones need to be understood. Solutions to transboundary issues that affect Protected Areas may be insurmountable and require alternative control strategies or barriers

121. In cases of direct **transboundary impacts** or interventions, the financing agreement with countries should stipulate that fixed contributions to PATTEC would enable the latter to help to organize or oversee transboundary committees by region to address the environmental issues[24] and more specifically: a) Bring together ministries responsible for planning, tsetse control, public health, environmental protection, national parks and NGOs (such as IUCN or WWF) b) Ensuring that staff with real decision-making powers are co-opted to a Transboundary Coordination Committee (or something similar) and that PATTEC is responsible for timing and co-ordination of meetings ; c) Measures are taken to clearly indicate what sustainable land management plans are being adopted for each country and how the plans will stem uncontrolled exploitation of land and possible degradation of natural resources and d) Identify land use monitoring requirements

122. As part of foreseen **technical assistance**, the Bank strategy should be to recommend that environmental specialists are hired to assist countries in the: 1) identification of land use monitoring requirements from a knowledge of agro-ecological maps, current and projected land-use plans and programme of tsetse clearance.; 2) quality assessment of national plans as they relate to sustainable land affectation; 3) design in and out the planning factors that can mitigate potential environmental problems before they arise; 4) assessment of national and local expertise in monitoring land use change; 5) establishment of a register of experts in the region with competence in EIA, remote sensing, GIS, wildlife ecology, ecological monitoring, land use planning etc. and 6) interpretation of an observed environmental change or degradation in terms of cause and effect

123. The bases for **agreed monitoring and standardized methods** used across boundaries need to be established early in the programme. The more localized the monitoring the harder it is to find staff to undertake/manage and to develop meaningful indicators of change. **Adequate funds** are required to induce local expertise to commit to a monitoring regime and community volunteers can find it hard to perform in the face of other livelihood priorities

The need for a road map

124. Since the Program must be carefully planned, there is a need for a "road map" for planning future Phases. At the time of writing the present report, the Bank had already given the mandate to a different group of experts to provide such a road map to the Bank. Essentially, the purpose is to provide to the Bank and to PATTEC some indications as to which group of countries should be considered for Phase 2, and which other group for Phase 3, and so on, including determining, if need be, how many Phases will be required. The selection of countries for future phases and the determination of the number of Phases that will be required are beyond the scope of the present report, inasmuch as this has been appropriately handed out as a separate mandate. However, some contribution can be made to the nature and importance of the various criteria that can be used for such a selection, based on the present Assessment. This is the purpose of the present section.

125. We propose that there should be three categories of criteria to be used for the selection of the various countries in future phases. These categories are

1) "Readiness" of the country, a criterion of operational capacity;
2) "Coordination capability" of the projects within each phase, a criteria of feasibility and coherence with the overall area-wide and ecosystemic approach of PATTEC, and finally,

[24] These measures assume that countries with a tsetse cluster have already coordinated their tsetse control activities

3) Ensuring "Minimum impacts and maximum benefits", a criteria of optimizing priorities and assuring that the programme overall is compatible with sustainable development.

Readiness of the countries

126. The first criteria obviously have been the main factor in the selection of countries for Phase 1. Phase I has been prepared jointly by representatives from the six participating countries, PATTEC and the ADB. Six countries were selected, namely Ethiopia, Kenya, Uganda, Burkina Faso, Mali, and Ghana. The combined projects cover an area of 180,000 km2 with about 14, 8 million people in the implementation area. The zones targeted cover 13 million hectares that will become tsetse free. According to the documentation on the planning of Phase I, the criteria for selecting the countries included mostly the country's readiness to implement the activities under the program, that is: 1) the level of mobilization behind the commitment to embark on the program, 2) the state of existing expertise and activities relevant to tsetse and trypanosomiasis control; 3) the availability of data and information on the geographical location, spread and intensity of the isolated islands ("foyers") of flies; 4) a country's capability to isolate the flies by establishing control barriers, and 5) knowledge of the species in the country.

127. At the time of the planning, the 37 countries were categorised in three groups of readiness for eradication as follows:

1) Group 1. Eight (8) countries which have human, physical and financial resources ready to eradicate tsetse flies and where implementation of activities to remove flies has actually started , namely Botswana, Burkina Faso, Ethiopia Kenya, Mali, Tanzania, Uganda, Zimbabwe;

2) Group 2. Thirteen (13) countries which have prepared plans to embark on tsetse eradication activities, namely Angola, Cameroon Gambia, Ghana, Guinea, Mozambique, Namibia, Nigeria, Rwanda, ,Sudan, Senegal, South Africa and Zambia;

3) Group 3. Sixteen (16) countries where there are currently no reported arrangements to initiate eradication actions, namely Benin Burundi, Central African Republic ,Chad, Congo Brazzaville, Cote d'Ivoire, DR Congo, Equatorial Guinea, Gabon, Guinea Bissau, Liberia, Malawi, , Niger, Sierra Leone, Somalia and Togo. Phase I countries all come from the first group, with the exception of Ghana, from the second group, which was included on account of sharing a common tsetse belt with Burkina Faso.

128. Consequently, if readiness was the sole criteria, Phase 2 could include the three others group 1 countries not covered in Phase 1, namely Botswana, Tanzania and Zimbabwe, and a selection, or all, of group 2 countries, namely Angola, Cameroon Gambia, Guinea, Mozambique, Namibia, Nigeria, Rwanda, ,Sudan, Senegal, South Africa and Zambia. Phase 3 could include group 3 countries or a selection of those, with the remainder left for a Phase 4.

Coordination capability and area wide approach

129. However, readiness and capacity of the countries selected, while being a critical and essential part of the success of the projects, cannot be the sole criteria. Obviously there is a need to ensure success and efficiency at the coordination and synchronization levels, as discussed above as part of the requirements of a Feasibility Study for each Phase. Conditions for achieving success in the PATTEC regional approach, such as common geographical, entomological and epidemiological features, synchronization and good coordination of suppression activities, sustained funding to carry on the activities, community ownership, sustainable management capacity for the intervention, and other, as dicussed in ¶ 118 to 123, must be factored into a criteria for selecting the various countries as part of future phases. Regional coordination includes provision and procedures to harmonize and successfully manage transboundary issues and synchronize operations in different countries. While the first criteria rest entirely on the assessment of country's capacity and readiness, the second criteria

would rest on country's *willingness* to coordinate and synchronize the operations within their clountry with those of their neighbours.

130. Transboundary issues, and coherence to the area wide approach, were part of Phase I. were present affect five of the six countries. The six countries represent in fact three distinct zones or foci: 1) In East Africa the infested areas selected by the respective Governments are, in Ethiopia an area of 25,000km^2 located in the Southern Rift Valley in the south-west of the country; 2) In Kenya an area of 24000km^2 split between the Lake Victoria Basin-Kyoga belt (8,000km^2) that is shared with Uganda and the North and South Kenya Rift belt (16,000km^2). In Uganda, the project area lies within the Lake Victoria Basin-Kyoga belt (from the southwest of the country to the Kenya border) and has an area of 40,000km^2 of *G.f. fuscipes* and *G. pallidipes*. 3) In West Africa, the project area in Burkina Faso falls within the cotton belt with an area of 72,000km^2. In Mali, the area borders with Burkina Faso and covers an estimated area of 22,000km^2 whilst in Ghana; the project area is estimated to be about 40,0000km^2 and encompasses the northern half of the country that borders Burkina Faso. These areas share a common *G. palpalis gambiensis* population.

131. However, coordination and area-wide approach appears to have been second criteria, while readiness of the countries was the first one. We recommend that the criteria should be inverted for all future phases. If, as a result, a phase include countries with uneven objective capacities, all efforts should be made to provide technical assistance and plan capacity building in order to efficiently include that particular country within a well coordinated and synchronized operation within a given belt of tsetse. The area wide approach has to be the priority criteria, ahead of country's capabilities.

132. According to this criteria, Phase 2 could include any combination of countries from Group 1, Group 2 or Group 3, provided they together represent an adequate coverage of a series of common or possibly contiguous belts of occurrence of tsetse, and provide for a high potential for efficient coordination and synchronization of operations. In other words, instead of selecting countries, belts should be selected first. Examples are : the *G. morsitans centralis* population shared by Botswana, Namibia, Angola and Zambia, the mixed species population spanning Nigeria, Cameroon, Chad, Equatorial Guinea, the *G. swynnertoni* population spanning north-eastern Tanzania and south-eastern Kenya, and the common fly belt of Mozambique, Malawi, Zambia and Zimbabwe.

Ensuring "Minimum impacts and maximum benefits"

133. A third criteria respond to Environmental and Social concerns, and this would call for a deployment a) which minimizes the time and the use of pesticides, b) which immediately increases the social benefits, or alleviate human sufferings, by, for instance, giving priorities to the areas where the human form of the disease prevails or c) where adequate Sustainable Land Management practices can be emplaced. In a way, this is part of sub criteria comparable to the one on readiness, but focussed on the capacity of the countries to ensure the full and successful implementation of the ESMP, including the SLMP and the extended monitoring programs

134. Finally, an unfortunate extraneous criteria might be considered, related to external circumstances, entirely unrelated to anything about the program itself, but which may exercise a detrimental effect to any part of or the entire programme. For instance, armed conflicts or civil unrest may cause a breakdown in surveillance and treatment systems and cause large migrations of people some of whom are already infected. For example, the present increased incidence of sleeping sickness in Burkina Faso is linked to the influx of people fleeing the civil unrest in Cote d'Ivoire where it is more prevalent. Other examples are known from migration of refugees from Sudan and DRC to Uganda. And for nagana, the civil war in Zimbabwe caused massive re-invasion of fly and the disease after years of successful control. Similarly, Somalia will remain a focus of riverine fly for the foreseeable future. Should present or anticipated conflict areas be factored in or out of the program? Certainly the risk of the collapse of the programme at places due to civil or military unsettling must be assessed.

Is the PATTEC Program compatible with Sustainable Development?

135. PATTEC convincingly argues that the potential benefits of the Campaign are outstanding in terms of improved livelihood, alleviation of human sufferings, increased revenues and resources. If the potential negative effects are managed and mitigated by adequate planning and able implementation, following Environmental Assessment, the whole PATTEC Campaign is certainly in line with the Sustainability criteria of the Bank in terms of its focus on poverty reduction and pro-poor growth policies and programmes.

136. The Campaign is considered as an important input for the New Partnership for African Development (NEPAD) programme, with which it shares a regional approach, and specific goals in terms of improvement of health and environment and resource development. In addition, the PATTEC programme has the support of the International Atomic Energy Agency (IAEA), who is responsible for the development of the Sterile Insect Technique, the Food and Agricultural Organization (FAO), concerned with health and livelihood issues in Africa, the United Nations Economic and Social Council (UN ECOSOC) and of the World Health Organization (WHO).

137. Because of its potential benefits, its concordance with the Bank's focus on poverty reduction, pro-growth development, and overall sustainability assurance criteria, and in view of its wide support and manageable environmental and social impacts, the PATTEC initiative is considered an environmentally acceptable endeavor if all measures are taken to ensure its full success and to implement all the related environmental preventive measures recommended here.

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Annex 1.

Terms of reference and the Consultant Team

Terms of Reference

Strategic Environmental (and Social) Assessment of Tsetse and Trypanosomiasis Control and Eradication Program in Africa

Background

In October 2001, the African Heads of State and Government collectively launched the Pan African Tsetse and Trypanosomiasis Eradication Campaign (PATTEC). The Campaign arose from the awareness that Africa's concerted efforts to reduce poverty could come to naught if urgent action was not taken to stem the ravages of trypanosomiasis, among other vector-borne diseases. In accordance with the decision by the African leaders, the Commission of the African Union was assigned the task of initiating and coordinating the activities of PATTEC. Within the framework of this assignment, the Commission of the African Union prepared a Plan of Action to guide the process of eliminating tsetse flies and tsetse-transmitted diseases from Africa, through proper sequencing and coordination of interventions.

The program is based on a comprehensive approach and involves all the 37 countries infested with tsetse flies, on an estimated area of 10 million km2. The focus for the programme is on eradication but procedures for surveillance, diagnosis and treatment of both sleeping sickness cases in humans and *nagana* cases in livestock in the program area, will be introduced. The utilization of land rendered free of tsetse would be initiated through formulation and implementation of appropriate development programs and sustainable exploitation of its natural resources.

According the World Health Organization

1) Countries where sleeping sickness is currently epidemics include: Angola, DRC, Uganda and Sudan.
2) Countries with high levels of endemic include: Cameroon, Congo, Cote d'Ivoire, Central African Republic, Guinea, Mozambique, Tanzania and Chad.
3) Countries with low levels of endemic include: Benin, Burkina Faso, Gabon, Ghana, Equatorial Guinea, Kenya, Mali, Nigeria, Togo and Zambia.
4) Countries in which information on sleeping sickness prevalence is incomplete are: Burundi, Botswana, Ethiopia, Liberia, Namibia, Rwanda, Senegal and Sierra Leone.

Six countries (Mali, Burkina Faso, Ghana, Uganda, Kenya, and Ethiopia) were selected to participate in Phase one program. Ten additional countries (Angola, Cameroon, Tanzania, Chad, Benin, Togo, Zambia, Botswana, Namibia and Rwanda) have been targeted for immediate continuation of the studies.

Overall Objectives of the present SEA

As per its Environmental procedures (2003), the Bank is committed to introduce the Strategic Impact Assessment (SIA) to be used as a systematic process for evaluating the environmental consequences of proposed policy, plan or program initiative in order to ensure they are fully included and appropriately addressed at the early stage of decision making on par with social and economic considerations. The SIA therefore is applied ex-ante at national, regional and local, trans-boundary and international levels, to assess strategic decisions at plan, program and policy levels in key sectors with potentially significant effects such as transport, waste management, health, education, tourism, industry, infrastructure, telecommunications, spatial planning, land use, trade, nature conservation and modern biotechnology.

Strategic Environmental (and Social) Assessment (SEA[25]) is a tool conceived to assist decision-makers and planners in the optimal design of policies, plans and programs in terms of environmental sustainability, and in the assessment of the compliance and coherence of those schemes to their own internal rules. SEA generally considers primarily long term and wide scale environmental consequences of policies, plans and programs, in combination with their economic, social and cultural incidences and in reference to existing environmental,

[25] SEA is synonymous to the expression « Strategic Impact Assessment » in the Bank's terminology

social or economic policies. Finally, SEA provides a rationale and framework plan for the screening and scoping of the various projects which are going to be realized as a result of the unfolding of the program (or plan or policy).

Outputs of SEA generally include significant prospective analysis, consideration of wide scale cumulative impacts, assessment of cross-cutting issues, such as poverty alleviation, gender issues, and others and generally results in the production of a Framework Environmental and Social Management Plan (ESMP) of the (Policy) (Plan) Programme during and after its realization.

The induced environmental effects of the Program are wide scale, and probably of an unprecedented scale in Africa and elsewhere world wide. The progressive "opening", the "désenclavement", of more than 10 millions km2 will lead to remarkable opportunities for enhanced sustainable development, provided pitfalls are avoided. Possible pitfalls might be uncoordinated planning for development, unforeseen and unmanageable impacts or consequences that might appear in ten or more years, or development that might not be sustainable given the particular biophysical or ecosystemic context of opened areas. Opening such large areas of land to possible new development and new vocations, above and beyond agro-pastoral usages, might and will have effects on natural habitats, biodiversity, water, transboundary issues, preservation of wildlife and wilderness, social equity and many other issues.

Given the previous and on-going related Environmental studies, and while reviewing the previous direct impact assessment, specific objectives of the SEA will be to focus on indirect, cumulative and induced effects of the programme and include some degree of review and assessment, or provide guidance for, the various national or multinational development programs that need to be formulated and implemented in the land rendered free of Trypanosomiasis and *nagana*, including non agro-pastoral use, to ensure sustainable and peaceful use of the newly open areas.

The overall objective of the SEA is therefore

1. to assess the compliance and coherence of Tsetse and Trypanosomiasis Eradication program (T&T) in Africa with the Bank's environmental policies and procedures;
2. To prepare a "Framework Environmental (and Social) Management Plan" to guide implementation of the projects in various countries or contexts,;
3. To provide guidance for the authorities responsible for the implementation of the Africa-wide program,
4. To review and assess the various national or multinational development plans for tsetse free zones (TFZ), assess their sustainability and assess the inc-country capacity to monitor sustainability and apply effective Environmental Assessment process for projects within the TFZ, and finally
5. To provide framework guidelines for the Environmental Impact Assessment (ESIA) of the various projects stemming from the T&T once they become defined in the various countries.

Specific Objectives of the present SEA

In order to achieve this, staged and tiered objectives are:

1. To scope and map out the major Sustainability Issues related to the program in SSA.
2. To review the previously completed ESIA with emphasis on direct impacts of eradication and control techniques and methods
3. To build on established contacts in Phase I countries for discussion and consultation on indirect and induced impacts and development plans and to guide on establishing contacts in additional selected countries;
4. To extend and validate conclusions of the ESIA in terms of direct environmental impacts and durability of applied techniques of eradiation and/or control in additional selected countries;
5. To establish close links and collaboration with the on going ILRI Research Team in order to complement and build on the Framework Environmental Management Plan and Guidelines for Environmental Assessment of Projects for tsetse freed zones (TFZ) and to assure compliance of the latter with the Bank's procedures.
6. To assess the capacity and natural resource base within anticipated tsetse freed zone (TFZ) in a number of selected countries in order to provide a sustainability framework for development of those areas.

7. To assess regional and sectoral development policies, as well as Environmental and Monitoring programs and tools, for the TFZ in a number of selected countries.
8. To assess the institutional framework of the Development and Environmental instruments and "dispositifs" in a number of selected countries, in order to prepare or suggest stand alone capacity building framework programmes.
9. To assess regionally and nationally the implications of the T&T programme on Environmental Sensitive Areas and on Transboundary Issues.

Activities and staged objectives

Given the final and staged objectives, the SEA Mission Team:

1) Will review the completed ESIA report, review and list all major environmental issues which need to be further addressed or more extensively reviewed and validate their applicability to a set of selected additional countries;

2) Will establish contacts with the on going ILRI Research Team (and the PATTEC coordination team) and arrange for a working session aimed at focusing the SEA on complementary issues and assure the full use of the ILRI findings in the SEA report;

3) Will prepare a Scoping and Orientation Report (SOR) including a recall of the Bank's policy and methods for SEA, a list of the major and outstanding Environmental and Social Issues related to the T&T program, the list of selected countries, the list of reference material and established contacts with local or regional organization and the field mission plans, and a preliminary set of standards, thresholds and sustainability criteria to be used in the Assessment. The SOR will include the review of the ESIA and the incorporation of the literature review, if provided by ILRI;

4) Will carry on field missions to a number of selected additional countries (to be determined) , visit selected Tsetse infested areas and discuss with relevant Government departments, agencies, NGOs and international organizations in selected countries, in order to:

a) Assess the capacity and natural resource base within anticipated tsetse freed zone (TFZ) in order to provide a sustainability framework for development of those areas

b) Assess regional and sectoral development policies, as well as Environmental and Monitoring programs and tools, for the TFZ those countries.

c) Assess the institutional framework of the Development and Environmental instruments and "dispositifs" in those countries, in order to prepare or suggest stand alone capacity building framework programmes.

The SEA content and level of rigor will follow the African Development Bank Group policies, procedures and guidelines for public sector operations that have been formulated to ensure that adequate attention is given to environmental, natural resource management, social and socio economic issues.

In addition to the specific objectives and parts of the reports on specific activities listed above, the SEA report will:

a) Include reactions, suggestions and objections from stakeholders;
b) Present an overview of the data requirements, quality and data gaps.
c) Identify, analyze and assess the state of the environment and social conditions likely to be significantly affected;
d) Identify, analyze and assess the likely significant effects on the environment and social aspects including cumulative, induced and indirect effects;
e) Contain information on any likely trans-boundary effect on the environment;
f) Identify, analyze and assess the current state of the environment and social aspects and the likely evolution of this state should the provisions of the SIA report not be implemented;
g) analyze and assess measures to prevent, reduce, mitigate or compensate any adverse effects on the environment which may result from the implementation of the strategic decisions in the form of a Framework Environmental and Social Management Plan, or improvements or additions to the one

proposed as a result of the ILRI study, for the usage of the Bank in its lending and support policy of projects stemming form the program;

h) Contain information on the methods envisaged for monitoring the implementation of the SIA report drafted;
i) Contain guidelines for the screening,, scoping and the preparation of the Terms of reference of ESIA of projects stemming form the program
j) Contain recommendations for institutional strengthening and public consultation and
k) Include an Executive Summary in non-technical language.

The consultant will address cumulative impacts and as best as possible describe the contribution that the impact will have to the overall cumulative effect. To determine this, the consultant will require general knowledge of other activities contributing to the cumulative impacts and activities and program s planned for the future that could also contribute to the cumulative effect. The consultant will describe the overall residual impacts that can be expected following mitigation as described in the environmental management plan, predict and assess the program 's likely positive and negative impacts in quantitative terms, to the extent possible; identifies mitigation measures and any residual negative impacts that can not be mitigated. He shall explore opportunities for environmental enhancement, reveal key data gaps, and specify topics that do not require further attention. In this task the consultant may examine with great details the African Stockpile Program (ASP) and harmonize the impact of using pesticides in Tsetse control with the results of the ASP.

Outputs and Deliverables

The consultant will prepare an SEA report that will be presented in draft and final versions to the Bank. Number of copies of each will be determined during negotiations with the consultant.

The consultant will also provide a stand alone Executive Summary at the draft final and final stage. Number of copies will be decided upon between the consultant and the Bank. The stand alone Executive Summary of the SEA, in English, will be used primarily by senior management to get informed about the environmental situation vis-à-vis the Program. It will be the main document, along with the Program Appraisal document, upon which the Bank would make a decision for Program support.

Three reports make up the deliverables of this consultancy

1) a Scoping and Orientation report (approximately 20 pages)
2) the main SEA report (approximately 100 pages)
3) the stand alone Executive Summary of the SEA (approximately 20 pages)

Inputs and General Qualifications required

To conduct a Strategic Impact Assessment (SIA), the consultancy will require the hiring of the following specialists with a minimum Master's Degree level specialization and at least 15 years of practical experience in related fields:

a) One or more Environmental assessment specialist including the Team leader
b) One Entomologist
c) One Ecotoxicologist

It is noted here that the inputs of the different specialists will not be equal and that the team leader will be responsible for the SEA production and technical content. The Annex to the present provides broad individualized specifications for the contribution from the various Team members.

The members of the Study Team will have strong analytical skills, writing proficiency and have some background in cross cutting, social and gender analysis;

A major part of their working experience should be in developing countries with that of the Africa Region being an advantage; and

- be fluent in English or French and have a working knowledge of either;

- Have the ability to work in a team environment of different cultures and nationalities, and
- Have competence in the use of standard word processing and spreadsheet software applications.

Duration of the study

Thirty-five working days (35) including ten (10) days at the headquarters in Tunis and twenty-five (25) days field mission.

The Mission Team was composed of

1. Dr Michel A. Bouchard, acting as Strategic Environmental Specialist and Team Leader
2. Dr Ian Grant, acting as resource specialist in Ecotoxicology
3. Dr Anna M. Akol, acting as resource specialist in Entomology
4. Mr. Rachid Nafti, acting as an expert in Environmental Assessment and Environmental Management Plan

In addition, the Team was accompanied, or partly completed by two Environmental specialists from the Bank, namely, Dr Modibo Traoré, from OCAR, and Mr. Louis-Philippe Mousseau, from ONAR.

Annex 2

SCOPING AND ORIENTATION REPORT

1. Strategic Environmental Assessment requires careful planning to be successfully carried out. Because this is an emerging and growing field of Environmental Assessment, the initial steps of scoping and orientation are critical. In the present case, given the will of the Bank to proceed quickly and given that the project was to be executed in a short period of time, the need to properly devise a balanced and functional work plan was enhanced, and the critical character of the scoping and orientation phase was increased.

2. A work plan was prepared in conformity to the Terms of References for the Project. In addition to the purpose of securing the successful operation of the Study, the work plan was intended to optimize the efficiency of the field work, and the return on the consultation operations to be included in the process. The work plan is summarized in the following table

PHASE 1	STEP 1	PREPARATORY FIELD MISSION	TEAM LEADER BANK OFFICER	ETHIOPIA (PATTEC) KENYA (ILRI)
	STEP 2	PREPARATION OF THE SCOPING AND ORIENTATION REPORT (SOR)	TEAM	no travelling

PHASE 2	STEP 1	FIELD MISSIONS	TEAM BANK OFFICER	ETHIOPIA BOTSWANA TANZANIA CAMEROON and DRC
	STEP 2	PREPARATION OF THE FINAL REPORT	TEAM	no travelling (Tunis)

3. As part of the scoping for this mandate, previous and on-going environmental assessment exercises or closely related to such were examined thoroughly. Two significant environmental assessments have been completed or are on-going, namely 1) The Environmental and Social Impact Assessment of the Phase I of the Program (the Bank) and 2) the "Framework for the Identification of Environmental and Socio-economic consequences of the Program" carried out by the International Livestock Research Institute (ILRI), based in Nairobi.

Impact study (ESIA)

4. The "impact study" (ESIA) of the "Multinational Programme of Eradication of Tsetse and Trypanosomiasis in Sub-Saharan Africa" was carried out in 2004, as a Bank's project under Phase I loan agreement and under the African Development Fund. Phase I of the Programme has been classified as Category I for environmental assessment purposes and accordingly a comprehensive Environmental and Social Impact Assessment (ESIA) has been carried out in order to: a) identify the direct environmental and social impacts that integrated tsetse fly eradication activities would have on the biophysical and social environment in the six countries; b) assess the risks associated with such activities; and c) formulate appropriate mitigation measures for inclusion in the design and execution of the project. A multidisciplinary consultant team comprised of an environmentalist, an entomologist

and an ecologist was contracted to carry out the ESIA. A mission was undertaken to the six countries selected for participation in the Phase I project of PATTEC, namely Burkina Faso, Mali, Ghana, Ethiopia, Uganda, and Kenya. During the field visits, extensive consultations were carried out with government representatives including those responsible for agriculture, livestock and environment. Interviews with officers responsible for tsetse control programme in each country, researchers and others concerned with trypanosomiasis and tsetse control as well as meetings with farmers in infested areas in each of the countries.

5. The ESIA provides a substantial information and data base for the direct impacts of the eradication techniques and the sickness control techniques. Some considerations were given to the indirect and induced effects, namely in the opening up of lands previously restricted, but the perspective has been mainly to examine expansion of agro-pastoral activities and little has been examined in terms of other uses for the lands rendered free of tsetse.

Framework Study (ILRI)

6. A framework study for the "Identification and Management of Environmental and Socio-Economic Consequences of Tsetse and Trypanosomiasis Control and Eradication" was mandated by the PATTEC to the International Livestock Research Institute (ILRI) under financing by USAID as of March 2005. The study is being carried out in collaboration with the United States State Department Office, the PATTEC Coordination office in the African Union and the arm of the African Union responsible for activities related to livestock development in Africa (AU-IBAR). Part of the objectives of the Framework Study is to include the indirect and induced effects of the Program through the opening and development of the land rendered free of the disease both in humans and in livestock. While not being an SEA for the purpose of the Bank, the purpose and scope of the Framework Study range partly over the previous ESIA and the present SEA. Consequently close ties have been established with the ILRI research team and a meeting was arranged (see annex to this report)

7. Some specific objectives of the ILRI study are:

To synthesize information on methodologies used and results obtained on relevant studies of environmental and socio-economic impacts of tsetse and trypanosomiasis interventions

To develop a framework that will provide guidelines on methodology for evaluating and monitoring environmental and socio-economic impacts & results of tsetse & trypanosomiasis interventions (both in terms of early warnings system & timely evaluation of environmental & socio-economic impacts of project activities).

Identify best practices for key indicators for socio-economic & environmental impact assessments (minimum data set & ways of measuring the indicators) for tsetse & trypanosomiasis interventions.

To develop (advice on) communication & dissemination strategy – outreach.

8. In addition to those meetings and readings, a quick literature search, and consultation was carried amongst African Bank Environmental specialists, to determine: a) the appropriate form of SEA to adopt, b) whether or not there was some previous examples of large scale disease vector eradication programs in Africa, that could be used as a model and c) whether or not there were other continent-wide programs of different natures but for which Environment and Social Management Framework had been formulated, that could also be used as models and finally d) evaluate at first hand the level of complementarity to other wide scale development project or sustainable development initiatives in Africa.

9. As a result of the various planning and meeting at the stage of the scoping and orientation, of consultation and literature search, some orientation was taken for the present SEA:

a. The present SEA would be mostly streamlined as a Sustainability Test for the Campaign

b. A clear distinction would be made between impacts associated with the Techniques used to combat the vector and those impacts that would be associated or induced by the occupation or re-occupation of the land rendered free of tsetse.
c. “Lessons learned” from the previous program of eradication of Onchocerciasis (river blindness) from 1974 to 1994 would be used extensively
d. Environmental and sustainable development Guidelines from the Africa Stockpile Program would be examined closely for possible use as models;
e. Duplications with ILRI deliverables would be avoided as much as possible, and reference for possible future usage of the Guidelines being developed under this initiative would be recommended

TRYPANOSOMIASIS AND TSETSE SEA TEAM STUDY
MEETING WITH ILRI TEAM

Date: January 6th 2006, 11h00 to 15h30
Location: Nairobi, Kenya
Object: Meeting with ILRI Team on Tsetse and Trypanosomiasis Control and Eradication.

Participants: Joseph Maitima, Ade Freeman, and John McDermott, for ILRI
Michel A. Bouchard, SEA Team
Louis-Philippe Mousseau, AfDB

Context

The overall purpose of the meeting was to establish formal contact and seek full collaboration between the SEA team and the ILRI Team.

The specific objectives were 1) to understand the range of the expected outputs from the ILRI team, and their possible commonality with the tools to be developed by the present Team in order to avoid duplication; 2) to assess the timing of the delivery of the various tools by ILRI in comparison with the time line of the present Team; 3) to assess the usefulness in terms of Environmental Impact Assessment.

Background

A framework study for the "Identification and Management of Environmental and Socio-Economic Consequences of Tsetse and Trypanosomiasis Control and Eradication" was mandated by the PATTEC to the International Livestock Research Institute (ILRI) under financing by USAID as of March 2005. Some specific objectives of the ILRI study are:

> *To synthesize information on methodologies used and results obtained on relevant studies of environmental and socio-economic impacts of tsetse and trypanosomiasis interventions*
>
> *To develop a framework that will provide guidelines on methodology for evaluating and monitoring environmental and socio-economic impacts & results of tsetse & trypanosomiasis interventions (both in terms of early warnings system & timely evaluation of environmental & socio-economic impacts of project activities).*
>
> *Identify best practices for key indicators for socio-economic & environmental impact assessments (minimum data set & ways of measuring the indicators) for tsetse & trypanosomiasis interventions.*
>
> *To develop (advice on) communication & dissemination strategy – outreach.*

The study is being carried out in collaboration with the United States State Department Office, the PATTEC Coordination office in the African Union and the arm of the African Union responsible for activities related to livestock development in Africa (AU-IBAR)

Part of the objectives of the Framework Study is to include the indirect and induced effects of the Program through the opening and development of the land rendered free of the disease both in humans

and in livestock.

Presentation

DR Bouchard introduced himself and in abstentia the Study Team, and its mandate, together with the purpose of the visit. Mr. Mousseau introduced the Bank's interest. Dr Freeman introduced the ILRI personnel. He then invited Dr Maitima to make a presentation, which is summarized below.

ILRI is preparing : *A Methodological Guide For The Identification And Management Of Environmental And Socio-Economic Consequences Of Tsetse And Trypanosomiasis Control And Eradication*

With the main goal : To develop a methodological guide to support decision making processes for monitoring & assessing environmental & social economic impacts, and for mitigating negative impacts of Tsetse &Trypanosomiasis interventions

And the following objectives: 1) To synthesize information on methodologies for assessing environmental and socio-economic impacts of tsetse and trypanosomiasis interventions 2) To Identify indicators for measuring socio-economics and environmental impacts of tsetse & trypanosomiasis interventions 3) To develop guidelines given inform of a manual for evaluating and monitoring environmental and socio-economic impacts of Tsetse &Trypanosomiasis interventions and 4) To disseminate the guidelines or manual to stakeholders including policy makers and project managers

They held a Stakeholder Workshop, on Feb14-14, 2005 : The purposes for the workshop were 1)Get feed back from stakeholders on the feasibility of the project in addressing their needs 2)Identify the needs of country projects in environmental and social economic impact assessments 3) Discuss how the project should be designed to meet the needs

Needs identified were : 1) Need for standard methodological guide for environmental impact assessments 2) Urgent need for tools to analyze and demonstrate socio-economic impacts and outcomes of tsetse control interventions and 3) A framework for monitoring of environmental and socio-economic changes to serve as a an early warning system for short term and long term impacts

Key observations and decisions: 1) It was noted that the problems reported by different countries are general enough to be replicated. 2) Indicators – both social and environmental all should look at tradeoffs in welfare, natural resources, socioeconomics, and livelihoods. It was decided to focus efforts: a) to synthesize methodologies used in the assessment of environmental and social impacts of tsetse eradication b) In consultation with subject specialists develop indicators of environmental, social and economic changes in tsetse eradication areas

Their project activities include

- Conduct literature reviews, and synthesis
- Develop a methodological guideline for evaluation and monitoring of environmental and social economic impacts of tsetse & trypanosomiasis interventions
- Hold an experts' workshop to discuss preliminary versions of the guideline
- Prepare final versions of the review paper, and methodological guidelines
- Hold a policy workshop for policy makers and project implementers
- Prepare final report of the dissemination activities

Project deliverables will be: 1) A literature review of methodologies to assess the social economic and environmental impacts of tsetse and trypanosomiasis interventions 2) A methodological guide in the

form of a manual to inform tsetse control and eradication project implementers on how to assess impacts and 3) a Final report on dissemination activities

Present status:

Stakeholder meeting was held Feb 2005
Conceptual framework was developed
Survey on published literature done
Country experts working on unpublished records
Field visit to West Africa planned for February 2006
Draft framework April 2006
Expert reviews May 2006
Final workshop June 2006

Discussions

Discussion successively tackled the following topics:

1) On decision making: questions and discussions centered on the timing of these studies in relation to the technical decision of the Campaign and whether or not there was still room for optimizing the program on environmental grounds.

2) On the complexity of site specifics methods: It was agreed that site specific factors were so numerous and varied that it would be impossible to list them all; strategic level studies were best confined to generic types of impacts associated with broad classes of interventions

3) On alternatives: Discussion was raised as to whether or not there were alternatives to PATTEC, given nationally-driven or local-driven plans were not really viable. While there may be various administrative or coordinating alternatives, there is none for the Campaign, except of course, the No Project alternative. This raises the fundamental question of the desirability of the whole Initiative and the prospective analysis of a future without continent-wide attempt to eradicate the tsetse.

4) On public consultation. Methods and level of consultation were discussed and experiences shared. What should be the appropriate level of public consultation for the various phases, the various national initiatives and the various local projects?

5) On Guidelines. Question was raised for calling the deliverable of ILRI a Manual as this is fundamentally a Guidelines? Answer was that Manual was a thoughtful title reflecting the kind of "Guidelines" they are producing, inasmuch as they intend to include substantial guiding in the form of "how to", for impact assessment and monitoring.

6) On Land Use and Land Use Changes. The matter is of crucial importance, as largely emphasized in the Bank's SEA Team TORs. ILRI is planning to extend their study (and seek the appropriate mandate) to the phase of Sustainable Land Management.

7) On time lines. See above.

8) On significance of direct impacts. Discussion centered on common agreement that direct impacts associated with the various techniques were relatively environmentally benign. Some specifics were discussed.

Complementarities of mandates and areas of collaborations

The TORs of the present SEA Team were made available and explained to the ILRI Team. It was realized that there is significant differences and substantial complementarity.

The literature review (published and unpublished) will be an extremely valid contribution, and will be referred to in the present SEA Team report as a tool to be expected. We agree however that it will not substantially change the present orientations concerning the fact that direct impacts of modern methods are relatively benign and that considerable attention must be given to indirect, induced, impacts to tsetse freed zone and adjoining areas.

Future collaborations

Communications channels were established, between Dr Maitima and Dr Bouchard.
The SEA Team suggested to ILRI that their coming workshop for expert reviews or disseminations might be organized in Tunis.
Some documentation was exchanged, but no draft version of the Manual or of the Literature Review was available on hand.

Summary for Scoping and Orientation Purposes

1) **focus on indirect is desirable and correct, as this will not be the focus of ILRI Framework Study**
2) **not focus on building check list or guidelines for impact assessment as this will be the focus of ILRI Framework Study and would be a duplication effort from the present SEA Team**

ANNEX 3

List of persons met
List of meetings and field visits
Field and Meetings Summary notes

List of persons met

Dr Jean Tenaguem, Médecin Chef, Hôpital de Campo, District de Kribi, Cameroon, February 1st'
Prof. Angwafo III Fru, Secretary General, Ministry of Public Heath of Cameroon, Yaoundé, January 31
Dr Nsom Mba Charles, Deputy Director, Direction de la Lutte contre la Maladie, Ministry of Public Heath of Cameroon, Yaoundé, January 31'
Dr Aboubacar Oumarou, Ministre de l'Élevage, de la Pêche et des Industries Animales, Yaoundé, January 31
Dr Vincent Ebo'o Eyenga, Coordonnateur du Programme National de la Lutte contre la Trypanosomiase Humaine Africaine ; Chef de Bureau Suivi/Évaluation au Service de la Lutte contre le Paludisme, Ministère de la Santé Publique, Direction de la Lutte contre la Maladie, Yaoundé, January 30
Dr Hamadama Hassen, Vétérinaire biochimiste, Chef de Mission; Mission Spéciale d'Éradication des Glossines; Ministère de l'Élevage, des Pêches et des Industries Animales, District de Gnaoundéré, Yaoundé, January 30
Mr Samuel N. Marwa, Senior Finance Officer, External Finance Department, Ministry of Finance, Dar Es Salaam, Tanzania
Dr Joyce W.S. Daffa, Principal TseTse Control Officer, Division of Veterinary Services, Ministry of Water and Livestock Development, Tanzania
Dr Metchilda Byamungu, Acting Director, Tanzanian Tse Tse Research Institute (TTRI), Tanga, Tanzania
Dr Jackson Ukule, Tanzanian Tse Tse Research Institute (TTRI) , Tanga, Tanzania
Dr Imira Malili Tanzanian Tse Tse Research Institute (TTRI) , Tanga, Tanzani
Dr J. Ole Ngotee Mollel, Assistant Director Veterinary, Public Health, Ministry of Water and Livestock Development ,Dar Es Salaam, Tanzania
Dr Abraham. M. Nyanda, Director General, Tanzania Atomic Energy Commission ,Arusha, Tanzania
Mr Allan J.H. Kijazi, Director of Planning, Development Projects and Tourism Services, Tanzania National Parks Arusha, Tanzania
Dr Inyasi A.V. Lejora, Manager, Ecological Monitoring Department, Tanzania National Park Arusha, Tanzania
Dr Titus Kamani Mlengeya, Chief, veterinary Officer. Serengeti National Park, Tanzania National Park (Meeting no 13), Serengeti, Tanzania
Prof Lars Ramberg, Director, HOORC, University of Botswana,
Xxxxx, prêté par UICN
Mr Sekwoga S. Motsumi, Public Education /Information Officer, ODMP, Department of Environmental Affairs, Ministry of Environment, Botswana, (Meeting no 6)
Mrs Portia Segomelo, Project Coordinator, ODMP, Department of Environmental Affairs, Ministry of Environment, Botswana,
Dr Motshwega, Acting Head of Tse Control Division (TTCD)
Dr Gezahegn, STEP Program (014316320)
Mrs Nina Okajube, Officer in Charge, African Development Bank, Ethiopia Country Office
Mr Hailemariam Hailemeskel, Agricultural Economist, African Development Bank, Ethiopia Country Office
Mr Levi Uche Madueke, PATTEC Assistant Coordinator, African Union Commission, Addis Ababa, Ethiopia
Dr Joseph Maitima, ILRI
Dr John McDermott, ILRI
Dr Abe Freeman, ILRI

List and summary of meetings and field visits

Maun, Botswana, January 19, Tse Tse Control Unit
Maun, Botswana, January 20, Harry Oppenheimer Okavanago Delta Research Station, University of Botswana
Dar Es Salaam, Tanzania, January 23, Department of Veterinary Services Offices
Dar Es Salaam, Tanzania, January 23, Ministry of Finances
Tanga, Tanzania, January 24, TTRI Insectary
Arusha, Tanzania, January 25, Tanzanian Atomic Energy Commission
Arusha, Tanzania, January 25, Tanzanian National Parks
Serengeti, Tanzania, January 23, Chief Veterinary Office
Dar Es Salaam, Tanzania, January 24, Stakeholders Workshop
Yaoundé, Cameroon, January 30, PATTEC Focal Point
Yaoundé, Cameroon, January 31, Minister of Livestock, Fisheries and Animal Industries
Yaoundé, Cameroon, January 31, Minister of Livestock, Fisheries and Animal Industries
Campo/Mabioto, Cameroon, February 1, Médecin Chef, Hôpital de Campo, District de Kribi
Yaoundé, Cameroon, February 2, Minister of the Environment and of the Protection of Nature

VISITS AND NOTES OF MEETINGS

ETHIOPIA

Addis Ababa, Ethiopia, PATTEC offices Monday 16th January 2006.

Met the Assistant Coordinator for PATTEC, Mr **Levi Uche Madueke,** at the AU office in Addis Ababa in the morning who reported on the achievements of PATTEC to-date. The PATTEC Coordinator Dr. John P. Kabayo was away in Sudan on another mission. Were present, for the SEA team, Dr Bouchard, Dr Grant and Dr Akol. Accompanying was Mr. Traoré from ADB-Tunis.

Notes from the meeting

1. The countries of the Phase I Project are at various stages of satisfying the conditions for receiving the grant/loan from the ADB to be used in implementing the project. It was concluded that the Phase I Project has not yet actually started in any of the six countries. PATTEC role is really to coordinate the efforts of various countries, to raise the program as a priority issues and to intervene towards donors in attempts to mobilize funding.
2. On the funding issue, PATTEC does not have yet core funding for the whole Campaign. Both formal and informal approaches to various multilateral donors that include the World Bank, the Bill Gates Foundation, JICA, and DFID to support the PATTEC initiative have been and are being made. Some bilateral donors have raised the priority issue and expressed concerns about the opportunity cost of the Campaign.

3. In addition to the ADB, financial commitments had been received from the IAEA and the US government.
4. Their coordination role is viewed as the most important added value to the campaign. Examples of trans-boundary problems are discussed, and the importance of getting the countries to work together is stressed.

Visit no 2. Addis Ababa, Ethiopia, ADB Country office, Monday 16th January 2006.

Met **Mrs Nina Okajube,** Officer in Charge, African Development Bank, Ethiopia Country Office and **Mr Hailemariam Hailemeskel,** Agricultural Economist. Were present, for the SEA team, Dr Bouchard, Dr Grant and Dr Akol. Accompanying was Mr. Traoré from ADB-Tunis. After a summary of the mission's goals and the nature of the SEA, some ideas were exchanged, particularly in regard of the situation in Ethiopia. Arrangements are coordinated from this office for a visit to the Kaliti Insectary and the technical staff involved in the STEP program.

(Field) Visit no 3. Kaliti Insectary, Ethiopia, Monday 16th January 2006.

A visit was made to the Tsetse Insectary at Kaliti on the outskirts of Addis Ababa. The mission was received by the manager of the facility, **Dr. Gezahegn** and his technical staff. Dr Gezahegn gave an overview of the rearing activities.

Notes from the meetings

1. The purpose of the facility is to provide sterile male tsetse for use in the proposed SIT programme for the STEP project area (Awassa) in the Southern Rift Valley of Ethiopia. Using a combination of targets and pour-ons over a three year period, the tsetse population in 10,000km^2 of the Awassa has been suppressed by 90% and is now ready for the release of sterile male for achieving eradication.
2. The zone is protected from re-infestation the natural barrier of high plateaus and a range of land at altitudes where the fly does not occur. The potential influence of climate changes in the coming century on such natural barriers was evoked and discussed as a factor to be considered.
3. Financial and technical support for the Insectary has been received from the International Atomic Energy Agency. Additional support for the facility has also been received from the Ethiopian government.

Summary

In Ethiopia, tsetse flies have progressively invaded productive agricultural areas in the West, South and Southwest parts of the country. Consequently, it is estimated that a total area of 150,000 km2 is currently believed to be infested with different species of tsetse flies. There are five economically important animal trypanosome species in Ethiopia. These are T. *congolense*, T. *vivax*, T. *brucei brucei*, T. *evansi* and T. *equiperdum*. However, sleeping sickness is of negligible public health importance in the country. As far as the vector is concerned, there are five species of tsetse flies distributed along the lowlands of western, southern and south-western parts of the country Glossina *morsitans submorsitans*, G. *pallidipe*s, G. *fuscipes fuscipes* and G. *tachinoides* are the most important tsetse flies whilst G. *longipenis* is of minor economic importance. The problem of tsetse-borne animal trypanosomiasis is the main cause for the decline in the number of cattle and particularly draft oxen in tsetse-affected areas of Ethiopia. The loss of draft oxen, generally, causes a dramatic decline in farm size and crop production. As a result, farmers always shift from cultivating the higher valued "teff" to maize, as the latter requires less ploughing.

Two main projects have been implemented in Ethiopia, namely: i) the Farming In Tsetse Controlled Area (FITCA) financed up to December 2004 by the European Union and implemented by the Ministry of Agriculture and Rural Development; and ii) the Southern Tsetse Eradication Project (STEP) initiated in 1997 for a ten years period and implemented by the Commission for Sciences and Technology. The total cost of the STEP project was initially estimated at US$ 43.8 million. It is presently financed by the Government of Ethiopia (40%) and the International Atomic Energy Agency (IAEA) for around US$ 1.6 million. To co finance this project, the Government has prepared a request amounting US$ 12.650 million. The STEP target area is 25,000 km2 covering the valley in the Southern Rift Valley. This area was chosen because it is not only one of the most tsetse-affected areas but it also is sufficiently isolated, being surrounded by high escarpments and arid land with minimum risk of reinfestation from other infested areas. Moreover, only one species of tsetse fly, *G. pallidipes*, is believed to inhabit the area.

BOTSWANA[26]

Visit no 4. Maun, Botswana, TseTse Control center, Thursday, 19th January 2006.

The mission met **Dr Motshwega,** Acting Head of TseTse Control Center (TTC) and **Dr Patrick Kgori**, Entomologist. TTC is part of the Division of Animal Wealth within the Ministry of Environment, Wildlife and Tourism. The meeting is aimed at examining in some details the case study of the Okavanago delta operation and the reasons for its success.

Notes from the meeting

1. Tsetse Control in the Okavango Delta, Botswana – initiated in 2001 to safeguard tourism in the delta and livestock outside the delta area. Sequential area spraying (SAT) was carried out in 2001 and 2002 and successfully cleared tsetse from an area totalling 16000km^2. Post-spray monitoring for tsetse has not yielded a single record of the fly. Eradication was achieved without resorting to SIT. Subsequently a land use management plan, the Okavango Delta Management Plan (ODMP) was developed and implemented for the purpose of integrated resource management in the delta.
2. Serious environmental concerns were raised prior to the initiation of the project, mostly by international NGOs, mostly IUCN, with fears on the potential negative effects of the use of insecticide in wildlife protected areas and Ramsar sites, with potential impacts on the loss of biological diversity.
3. An EIA was carried in preparation for the first (2001) phase, suggesting a series of mitigation measures and suggesting the monitoring of the direct impacts. Monitoring was carried for the second phase (2002) with careful examination in selected sample areas of pre-spraying condition, and monitoring subsequently and up to a year after spraying in the same areas. Monitoring was carried by researchers from the Harry Oppenheimer Okavanago Research Center of the University of Botswana and was reported to a Stakeholder Committee. It showed that the direct impacts are relatively small, short-termed and can be mitigated with the appropriate use of the techniques.
4. While eradication is successful, re-invasion from adjoining areas is feared if the neighbouring areas of Lynianti (Namibia) and Caprivi (partly Zimbabwe) are not successfully cleared as well. ; Re-invasion is presently prevented by the use of target

[26] Visits and meeting in Botswana were technical in nature and targeted scientists and technical personnel involved in the operation of tsetse control; these visits were not official and were not organized by the Government of Botswana

barriers. They contend that this is a clear case where a regional and trans-boundary approach is critical and a clear example where PATTEC's role of coordination is crucial.

5. They conclude that the eradication of tsetse in the Okavango delta did not lead so far to any uncontrolled development but, on the contrary, based on its positive impacts on tourism and livestock around the park, may be a basis for sustainable development of this region.

Visit no 5. Maun, Botswana, Okavango Delta Management Plan Office (ODMP), Friday 20th January 2006.

The mission met the officials of the Okavango Delta Management Plan (ODMP) Project in Maun, specifically **Mrs Portia Segomelo,** Project Coordinator, ODMP, from the Department of Environmental Affairs, Ministry of Environment, **Mr. Comfort Molosiwa**, Project Facilitator, from IUCN, and **Mr Sekwoga S. Motsumi,** Public Education /Information Officer, from the Department of Environmental Affairs, Ministry of Environment.

Notes from the meeting

1. The ODMP is a Government of Botswana funded project for the integrated management of the Okavango Delta, and also receives financial support from DANIDA, SIDA, DDE (German Development Service), IUCN. The project started in 2003 and is funded through 2006 with approximately 7 M$.
2. The project integrates various policies and regulatory tools from numerous government departments, namely Land and Housing, Environment Wildlife and Tourism, Mineral and Water resources, Commerce and Industry, etc, and local governments as well. In addition to integrating regional development protocols (including the OkaCon-Okavango Convention, 1994, joint agreement between Angola, Namibia and Botswana for the integrated water management of the Okavanago System) and national policies, it does attempt to integrate into the management of the delta, the issues raised in all Multinational Agreements on the Environment, particularly the conservation of Biological Diversity.
3. The primary objective is to exercise integrated planning and target cross sectoral issues including conservation of biodiversity and management of the Ramsar sites, land use and allocations (land tenure system designate tribal land, free land, private land and state land), fisheries conflict, human health, human-elephant conflicts, etc.
4. Public consultation and community involvement is a key component of ODMP.
5. Impacts associated with Tsetse control have not been and are not currently a major concern. They are confident in the results of the monitoring of the direct impacts of the use of insecticide that was done after spraying, which showed only minor and short-terms effects.

Visit no 6. Maun, Botswana, Harry Openheimer Okavango Research Centre (HOORC), Friday 20th January 2006.

The mission met with **Prof Lars Ramberg,** Director, HOORC, University of Botswana, and a number of associate researchers, including **Dr Marsallilla**, GIS specialist, and other specialists in data management

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Notes from the meeting

1. Professor Ramberg led the team that carried the post-spraying monitoring in the delta in 2003. He explains that in fact monitoring started already in 2002 on experimental stations in the delta. The monitoring was carried to full scale in 2003, but was not continued after. They are preparing a 5 year study project on monitoring the biological diversity in the delta, starting in

2006 or 2007. The results of the 2003 monitoring were published as a report, which is available from the HOORC and was made available for the mission. Professor Ramberg and recorded some short-term impacts on birds and fish, and on invertebrates. He concurs with the conclusion that overall, direct impacts from SAT are relatively small. There was a reduction in the number of species and populations of some invertebrates but the communities had recovered to their former levels within one year

2. In addition to monitoring, HOORC has developed the Okavango Delta Information System (ODIS) for ODMP; the data base contains among others, demographic and socio-economic data. They also manage a second data base, the Okavanago Data Base, under OkaCon.

Summary and comments-

Tsetse Control in the Okavango Delta, Botswana – initiated in 2001 to safeguard tourism in the delta and livestock outside the delta area. Sequential area spraying was carried out in 2001 and 2002 and successfully cleared tsetse from an area totaling 16000km^2. Post-spray monitoring for tsetse has not yielded a single record of the fly. Subsequently a land use management plan, the Okavango Delta Management Plan (ODMP) was developed and implemented to integrate resource management in the delta. The success of the tsetse control effort was due to the availability of considerable financial resources and political will from the government of Botswana, the presence of only one species of tsetse (*Glossina morsitans centralis*), and a state-of-the art control technology (SAT) that was ideally suited to the flat terrain of the delta. Direct impacts are conclusively demonstrated to be rather small and short-termed. There were no significant indirect impacts possibly due to well defined vocation of the land, as a national and Wildlife Park, and the implementation of a land use management plan, the Okavango Delta Management Plan (ODMP), a cross-sectoral and multi-stakeholder organization developed for the purpose of implementing integrated resource management in the delta.

TANZANIA

Visit no 7. Dar Es Salam, Tanzania, Directory of Veterinary Services, Ministry of Livestock Development, Monday, 23rd January 2006.

The mission met **Dr Motshwega,** Acting Head of TseTse Control Center (TTC) and **Dr Patrick Kgori**, Entomologist. TTC is part of the Division of Animal Wealth within the Ministry of Environment, Wildlife and Tourism. The meeting is aimed at examining in some details the case study of the Okavanago delta operation and the reasons for its success.

Monday 23rd January 2006. Meeting with Directorate of Veterinary services in the Ministry of Livestock Development. Discussions with the Director of Veterinary services (Dr. P. Njau) and the Principal Tsetse Control Officer (Mrs. Joyce Daffa) who gave a brief on the status of the tsetse and trypanosomiasis situation in Tanzania. Left for the Tsetse and Trypanosomiasis Research Institute (TTRI) at Tanga in the afternoon.

Tuesday 24th January 2006. Meeting with officials of TTRI, the Acting Director (Mrs. M. Byamungu), an entomologist (Dr. I. Malele) and an ecologist (Mr. Jackson Ukuli). The Tanga insectary is well equipped and has the expertise and experience to handle the mass rearing of several million flies, including simultaneous rearing of different tsetse species. Travelled to Arusha in the afternoon

Wednesday 25th January 2006. Meeting with the Director General (Mr. Abraham Nyanda) of the Tanzania Atomic Energy Commission (TAEC) who outlined the potential role of TAEC in

the SIT component of the PATTEC programme for the region. Later met the Director of Planning, Development Projects and Tourism (Mr. Allan Kijazi) and the Manager of the Ecological Monitoring Unit (Mr. Nyazi Lejora) of the Tanzania National Parks (TANAPA). While they expressed concern about the impacts of some of the techniques proposed for creation of tsetse free zones they affirmed TANAPA's willingness to cooperate and provide support in the PATTEC programme for Tanzania. The institutional linkages governing protected areas and were described and include the Tanzania wildlife research institute (TAWIRI). Also mentioned the need for enhancement of technical capacity. Left for Serengeti National Park later in the morning.

Met the Chief Veterinary Officer of Serengeti National Park (Dr. Titus Mlengeya) later in the evening who described the history of tsetse control in the Ngorongoro Conservation area and Serengeti National Park. The Parks are committed to the PATTEC programme to safeguard tourism and the health of park staff.

Friday 27th January 2006. Stakeholders workshop at the Travertine Hotel to inform stakeholders of the issues that were being pursued in the SEA study and gather opinion on the PATTEC programme. List of participants is the following:

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CAMEROON

In Cameroon, the mission met with two Ministers (Livestock and Environment) and one secretary-general (Health). A field visit was organized to Campo, 80 km from Kribi in he southeastern part of the country where screening and treatment of sleeping sickness are taking place. The infested area of Cameroon spreads along the borders with neighboring Equatorial Guinea, Gabon and Central African Republic. That shows that the fight against trypanosomiasis should be pursued in a sustainable manner by synchronizing interventions alongside borders.

Monday 30th January 2006. Set up meetings with officers of the Ministries of Livestock and Animal Industries (Dr. Hamadama Hassan) and of Public Health (Dr. Vincent Ebo'o Eyenga).

Tuesday 31st January 2006. Meetings with Dr. Hassan and Dr. Ebo'o who described the tsetse and trypanosomiasis situation in Cameroon. Sleeping sickness only present in the southern half of the country and animal trypanosomiasis in the northern half. Reservations on the success of the PATTEC initiative were expressed because of the critical role of barrier systems to prevent reinvasion. Regional collaboration will be essential to the success of the programme.

Wednesday 1st February 2006. Travelled to Campo in the south; Campo is a sleeping sickness foci. Met Dr. Jean M, a medical doctor working in the villages and visited a village (Mabiogo) that was practically abandoned due to the scourge of sleeping sickness. Only eight cases of sleeping sickness had been recorded at the hospital in the past 2 years although it is suspected that the number of infected persons could be higher. Active surveillance for sleeping sickness is constrained by the lack of logistical support. Treatment of sleeping sickness was difficult because of the limited number of drugs available (Arsobal and Pentamidine), toxicity of the drugs (Arsobal) and the necessity for hospitalisation of patients.

DR CONGO

The mission met **Dr. Claude Sese,** Médecin Directeur Adjoint du PNL THA, **Dr. Philémon Mansinsa**, Entomologiste du projet, Mr. **Jean Burana**, Infirmier traitant, Responsable des études et recherches, Maluku, Dr. **Constantin Miaka Mia Bilenge**, Secrétaire général Ministère de la Santé, **Dr. Simon Van Nieuwenhove**, Medical Officer, WHO Office in Kinshasa, Dr. **Vim Van der Velen**, Chef de Projet and **Mr. Fiory Fraipont**, CTB, Responsable régional des services internationaux.

Summary and Comments

In DR Congo, there is a "*Programme national de lutte contre la trypanosomiase humaine africiane (PNL THA)*" sponsored by the WHO with support from CTB the Belgian Cooperation. It is a 5-year project ending in 2008. WHO provides Trypanocides free of charge. The disease is endemic in central Africa: Congo, CAR, and Cameroon. Within the PATTEC framework, a request has been sent to the Bank.

In DRCongo, 9 out of 11 provinces are infested; however, hot spots of the disease are the Bandundu and Kasai which are the most affected districts. Mobile screening teams are deployed throughout the country; with running costs nearing 80 000 USD per year per team. Also, some tsetse control activity has been associated with the disease treatment activity. It involves use of simple traps at community level where training is also provided.

The group of flies which have been identified as vectors of the parasite (*Trypanosoma Gambiense*) in DRC are *Glossina morsitans centralis*, *G. Palpalis palpalis* (in Bas-Congo, and nearby Congo and Angola), G. fuscipes (Province orientale et Equateur),*G. pallidipes* and *G. fuscipes fuscipes* (Maniema and Kivu). Most of them dwell into the forest galleries located along the rivers and streams. The Swiss Institute of Tropical Medicine is conducting research on new drug molecules with funding from the Bill Gates Foundation.

The mission had the opportunity to visit a screening and treatment center in Maluku (120 Km from Kinshasa) and noticed that most of the patients had ages ranging from 18 to 35 mostly women. That shows that it is the most active portion of the population in rural areas that develops the disease because they are frequently in contact with the vectors (flies) during the course of their normal production activities.

The best procedure of managing this risk is the ability to detect, very early, the presence of the disease in the population. This would be done by the provision of preliminary diagnostic facilities in all hospitals in the sleeping sickness endemic areas so that diagnosis could be done at the same time as malaria. In addition, diagnostic facilities in the sleeping sickness referral centres should be upgraded and training programmes aimed at upgrading the knowledge of medical personnel should be initiated. Furthermore, the twin strategies of active and passive surveillance should be carried out in the communities with greater emphasis on active surveillance.

The mission benefited from the kind cooperation and courtesies of DRC Government officials Ministry of Health and the Belgian Cooperation (CTB), in particular, the staff of PNL THA Project, who coordinated the meetings and provided logistical support and other valuable assistance to the mission.

ANNEX 4

Country's EIA system

Country's system of EIA

Country	Enabling legislation	Specific legislation / regulations	General and specific guidelines	SEA provision	Formal provisions for public participation	Main administrative body
Sudan	¿	×	×		×	√
Benin	√		√		√	√
Gambia	√	¿	√		√	√
Ghana	√	√	√		√	√
Niger	√	√	√		¿	√
Nigeria	√	√	√			√
Cameroon	√	¿	×		×	√
Congo	√	√	¿		¿	√
Gabon						
Burundi	×	×	×		×	√
Ethiopia	√	√	√	√	√	√
Kenya	√	√	¿	√		√
Tanzania	×	×	¿		×	√
Uganda	√	√	√		√	√
Lesotho	√	√	√		¿	√
Mozambique	√	√	¿		√	√
Namibia	¿	×	√	√	¿	√
South Africa	√	√	√	√	√	√
Zambia	√	√	√		√	√

¿ In draft ; √ Already Established ; × Not Established

The following tables summarize the status Review of the application of Environmental Impact Assessment (EIA) in selected African countries:

West Africa

	Nigeria	**Benin**	**Ghana**	**Gambia**	**Niger**
Enabling legislation	Yes, 1992	Yes, 1999	Yes, 1994	Yes, 1994	Yes, 1998
Specific legislation / regulations	Yes, 1992	Yes, 2001	Yes, 1999	Final draft	Yes, 1997
General and specific guidelines	Yes, 1995	Yes, 1997 & 2000	Yes, 1995 & 1999	Yes, 1999	Yes, 1997
Formal provisions for public participation	No	Yes (through guidelines)	Yes, 1999	Yes, 1994, 1999	Under draft
Main administrative body / bodies	The federal environmental protection agency(FEPA) , 1988	Benin Environment agency (BEA), 1995	Ghana Environmental protection agency, 1994	The Gambia national environment agency, 1994	Environmental Assessment and impact studies bureau, 1997; Ministry of environment and desertification
Information Source	Echefu N. & Akpofure E. 2003; Akpafure, EA & Ojile, M, 2003	BEA official source, January 2005	EPA, March, 2004	NEA, March 2004	UNDP/UNEP/GEF, 2001; Almeida, K., 2001

Central Africa

	Cameroon	Congo	Gabon
Enabling legislation	Yes, 1996	Yes, 1991, Rev. 1997	Yes, 1979
Specific legislation / regulations	Draft	Yes, 1986	Yes, 1979
General and specific guidelines	No	Under draft	
Formal provisions for public participation	No	Included in draft procedures	
Main administrative body / bodies	The Ministry of Environment and Forestry	General Directorate of the Environment under the Ministry of Industry, mining and the Environment. The National Agency for Environmental Protection is under creation	General Directorate of the Environment under the Ministry of Environment and nature protection, 1985
Information Source	Bitondo, D., 2000 Tekeu, J-C., 2004	D'Almeida, K., 2001	D'Almeida, K., 2001

Eastern Africa

	Tanzania	**Ethiopia**	**Uganda**	**Kenya**	**Burundi**
Enabling legislation	No	Yes, 1995	Yes, 1995	Yes, 1999	No
Specific legislation / regulations	No	Yes, 2002	Yes, 1998	Yes, 2003	No
General and specific guidelines	In draft	Yes, 2000	Yes, 1995	In draft	Yes, 1997
Formal provisions for public participation		Yes, 2002	Yes, 1995		
Main administrative body / bodies	National Environment Management Council, 1983	Environmental Protection Agency, 1995	National Environment Management Agency (NEMA), 1995	Natioanl Environment Management Authority (NEMA)	Ministry of National & Regional Development & the Environment
Information Source	Katima, JHY, 2003 Kibassa, J, 2003	IUCN, 2001, Tekelemichael, Y,2003 EPA, March, 2004	NEMA, 2004	NEMA, 2004	D'Almeida, K, 2001

Southern Africa

	Mozambique	**Namibia**	**South Africa**	**Zambia**	**Lesotho**
Enabling legislation	Yes, 1997	In draft	Yes, 1989	Yes, 1990	Yes, 2001(to be gazetted)
Specific legislation / regulations	Yes, 1998	No	Yes, 1997	Yes, 1997	Yes, 2003 (to be gazetted)
General and specific guidelines	Under draft	Yes	Yes, 1997	Yes, general in 1997. Specific, yet to be adopted, 2000-2001	Yes, under the 2001 Act
Formal provisions for public participation	Yes, (EIA regulations)	Draft bill	Implied under review clause	Yes (Eia regulations)	Under draft
Main administrative body / bodies	Ministerio para a coordenacao da accao Ambienta	Directorate of Environmental Affairs	Department of Environmental Affairs & Tourism	Environment Council of Zambia (ECZ)	National Environment Secretariat
Information Source	SAIEA, 2003	DEA,March, 2004	SAIEA, 2003a	NECZ, March, 2004	SAIEA, 2003

ANNEX 5
TERMS OF REFERENCE FOR PHASE LEVEL ESIA

Extracted and modified from AfDB Environmental Policies and Procedures, Annex 10

GENERIC CONTENTS OF TERMS OF REFERENCE AND TYPICAL CONTENTS OF AN ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT REPORT

Part A of this Annex presents the generic contents of the Terms of Reference (TOR) to carry out an Environmental and Social Impact Assessment (ESIA), as required for Category 1 projects at the AfDB.

Part B of this Annex presents the typical contents of an ESIA Report, as it shall be presented to the Bank for review and approval.

PART A: GENERIC CONTENTS OF TERMS OF REFERENCE FOR AN ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT

1. INTRODUCTION

This first section of the TOR indicates the purpose of the TOR, identifies the project sponsor which is normally a governmental institution, briefly describes the project to be assessed and explains the arrangements made at this stage to undertake the ESIA, such as the invitation to tender.

2. CONTEXT

This section explains the institutional, geographical, environmental, social and economic context in which the project is to take place. Moreover, it provides sufficient information on the objectives and components of the project, as well as on the study area, so that any person interested in the project can understand the situation and constraints surrounding the project and the ESIA to be carried out. Also, it shall mention any source of information (documents such as Country Environmental Profiles and Poverty Reduction Strategy Papers) that could be useful for the completion of the ESIA.

3. REQUIREMENTS

This section indicates which policies and guidelines must be followed in carrying out the ESIA. Among others, those can include:

- AfDB's environmental and social policies;
- AfDB's environmental and social guidelines;
- AfDB's Environmental and Social Assessment Procedures;

- ADB's Cross cutting issues and Sustainability Assurance tools.
- National legislation and regulations regarding environmental and social assessment;
- All existing national legislation regarding pesticide usage and storage
- All existing national legislation regarding radioactive products usage and low level radioactive waste disposal.
- International environmental/social agreements signed by the borrowing country;
- Co-financier requirements regarding environmental and social assessment.

4. OBJECTIVES AND SCOPE OF WORK

This section defines the objectives of the ESIA and summarises the scope of work to carry out, by indicating the key tasks to undertake during the study. The scope and level of work involve in the preparation of the ESIA shall be proportional to the project's potential impacts. For instance, an ESIA for a project that would likely have major adverse impacts on social components but limited impacts on the environment should focus mainly on the affected social components.

Major tasks that shall be highlighted in this section because of their importance in the preparation of an ESIA include:

- Describing the proposed project or projects by providing a synthetic description of the project relevant components and presenting plans, maps, figures and tables.

- Identifying the policy, legal and administrative framework relevant to the project in each country.

- Defining and justifying the project study area for the assessment of environmental and social impacts.

- Describing and analysing the physical, biological and human environment conditions in the study area before project implementation. This analysis shall include the interrelations between environmental and social components and the importance that the society and local populations attach to these components, in order to identify the environmental and social components of high value or presenting a particular interest.

- Presenting and analysing alternatives to the proposed project, including the "without project" option, by identifying and comparing the alternatives on the basis of technical, economic, environmental and social criteria.

- For the selected alternative, identifying and assessing potential importance of beneficial and adverse environmental and social, direct and indirect, short and long-term, temporary and permanent impacts, on the basis of a rigorous method. The list of impacts to be discussed must follow the generic impacts inventoried at the SEA level for PATTEC and must include direct impacts, from the methods used in tsetse fly suppression and eradication, and potential indirect impacts, associated with land clearing.

- Defining appropriate mitigation/enhancement measures to prevent, minimise, mitigate, or compensate for adverse impacts or to enhance the project environmental and social benefits, including responsibilities and associated costs.

- Addressing potential cumulative effects taking into account other initiatives planned in the study area.

- Addressing potential transboundary issues and potential impacts, with coordinated plans for mitigation and monitoring

- Addressing the issues of integration of environmental conventions, agreements and protocols and MDGs as measures of development. Special attention must be given to compliance to and effects on MAE- Multilateral Agreement on the Environment on Climate Change, Desertification and Conservation of Biological Diversity. Consideration must also be given to other Agreements signed by the countries (Ex. Ramsar, Cites, etc.), and adherence or not to the Africa Stockpile Program.

- Addressing the integration of Bank's Sustainability Criteria and assess impacts or consequences on the various cross-cutting issues, such as Poverty reduction, Pro-growth effects, Gender issues, Equity issues, and finally Governance issues

- Developing an environmental and social monitoring program (ESMP), including indicators, institutional responsibilities and associated costs. The ESMP must include a Sustainable Land Management Plan for the sustainable use of cleared land. In turn, the SLMP must include clear indications and pathways for Community Involvement.

- As appropriate, preparing an environmental hazard plan including an analysis of the risk of accident, the identification of appropriate security measures and the development of a preliminary contingency plan.

- Identifying institutional responsibilities and needs for capacity building if necessary to implement the recommendations of the environmental and social assessment.

- Carrying out consultations with primary and secondary stakeholders in order to obtain their views on and preoccupations about the project. These consultations shall occur during the preparation of the ESIA Report to identify key environmental and social issues and impacts, and after completion of the draft ESIA Report to obtain comments from stakeholders on the proposed mitigation/enhancement measures.

- Preparing the ESIA Report according to the generic contents presented in Part B hereafter.

- Preparing an Environmental and Social Management Plan (ESMP), including a SLMP, as a distinct document from the ESIA Report.

- For the purpose of supporting the Monitoring Plan, provide for relevant baseline data and determine indicators of land cover, soil condition, vegetation status and biodiversity to quantify change

5. SCHEDULE

This section specifies deadlines for presenting the ESIA preliminary (draft) and final reports to the project sponsor, as well as other significant events and dates. The schedule shall be

realistic to allow the completion of the ESIA Report within the specified deadlines. Depending on the nature and magnitude of the project and its potential impacts, the period of time required to complete an ESIA may vary between 6 and 24 months.

6. TEAM OF EXPERTS AND LEVEL OF EFFORT

This section identifies the types of experts required to carry out the ESIA and indicates, if possible, the level of effort estimated for each expert. A multidisciplinary team including experts in the environmental and social fields shall be favoured. The expertise requirements shall be defined as precisely as possible to ensure that key issues for project assessment are handled by appropriate specialists, such as a gender specialist when gender issues are determinant or a hydrologist when water management is central to the project success.

7. REPORTING

The ESIA Report shall be presented in a clear and concise manner and focus on relevant and significant environmental and social issues that assist in understanding the project and its impacts. The scope and level of details of the Report shall be proportional to the project's potential impacts.

The ESIA Report shall describe the scientific approach adopted to carry out the studies. In particular, the models, methods and criteria used in the studies shall be presented and explained. The Report shall also include maps and drawings at the appropriate scale and refer to all consulted documents.

The detailed ESIA Report can be prepared in English or French. The ESIA Executive Summary needs however to be written in English and French and in a dominant local language if necessary. To be useful for consultations, the ESIA Executive Summary shall be concise and written in a non-technical language.

PART B: TYPICAL CONTENTS OF AN ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT REPORT

The typical contents of an ESIA Report are presented hereafter. It shall be noted that the presentation of the Report may be adapted pending on the nature and specific requirements of the project.

Executive Summary

This section shall present in a non-technical language a concise summary of the ESIA Report with a particular attention on the processes and procedures used; baseline conditions; the alternatives considered; mitigation/enhancement measures; monitoring program; consultations with stakeholders; capabilities of environmental and social units and actions to strengthen those capacities; and cost implications. This Executive Summary shall be written in English, French and a local language, if necessary for public consultations.

Introduction

The Introduction shall indicate the purpose of the ESIA, present an overview of the proposed project to be assessed, as well as the project's purpose and needs. This section identifies the project sponsor and the consultant assigned to carry out the ESIA. It shall also briefly mention the contents of the ESIA Report and the methods adopted to complete the assessment.

i. Policy, Legal and Administrative Framework

This chapter concerns the policy, legal and administrative framework within which the ESIA is carried out. It presents the relevant environmental and social policies of the Bank and borrowing country, as well as the national legal requirements and related constraints (e.g. practices that may discriminate or exclude any stakeholder group) relevant to the project. It provides information on the environmental requirements of any co-financiers, and identifies relevant international environmental/social agreements to which the country is a signatory.

ii. Project Description and Justification

The first part of this chapter shall describe the proposed projects and their geographic, ecological, social, economic and temporal context:

This section shall describe the choice of techniques, the exact nature of their use and details of their operation, including full disclosure of insecticides to be used, names and qualifications of operators, identify national authorities and organisations or individuals that will be associated and responsible for the each projects.

The project justification should be based on combined economic, environmental and social assessments. To this end, this chapter shall describe the current situation in the sector, explain the problems or the needs to be satisfied by the project and present the constraints associated with the project implementation.

iii. Description of the Project Environment

This chapter shall first determine the limits of the study area that shall be defined in order to encompass all project direct and indirect impacts. The description and analysis of the physical, biological and human conditions shall address relevant environmental and social issues within this area, including any changes anticipated before project implementation.

Within the human environment, key issues that shall be considered include population characteristics and trends, revenue disparities, gender differences, health problems, natural resource access and ownership, land use patterns and civil society organisation level.

It shall also address the interrelations between the environmental and social components and the importance (value) that the society and local populations attach to these components, in order to identify the environmental and social components of high value or presenting a particular interest. A particular attention shall be given to the rare, threatened, sensitive or valorised environmental and social components.

The information presented shall be relevant to decisions about project location, design, operations as well as environmental and social management. Maps, figures and tables shall be included in this chapter to better illustrate the various environmental and social components.

iv. Project Alternatives

This part of the ESIA Report consists in analysing the various feasible alternatives of the project, including the "without project" option. It normally comprises two sections. The first section identifies and describes the potential feasible alternatives that would allow to reach the project objectives. The second section presents a comparison of the potential alternatives on the basis of technical, economic, environmental and social criteria, as well as of public views and concerns.

The alternative comparison shall address the proposed project site, technology, design, and operation, in terms of their potential environmental and social impacts and the feasibility of mitigating these impacts. For each of the alternatives, the environmental and social impacts shall be quantified as possible, including their economic values where feasible. The selected alternative shall be the most environmentally and socially sustainable, taking into account the technical and economical feasibility.

v. Potential Impacts and Mitigation/Enhancement Measures

This chapter presents a detailed analysis of beneficial and adverse impacts of various components of the selected project alternative on the physical, biological and human (social, cultural and economic) environments. The methodology of assessment, based on a rigorous scientific method, shall be first presented. Then all environmental and social, direct and indirect, short and long-term, temporary and permanent impacts shall be described and assessed, indicating their importance level and their probability of occurrence.

The generic impacts as identified in the Program SEA shall all be discussed and assessed, both direct and indirect impacts.

Appropriate mitigation measures shall be identified to prevent, minimise, mitigate or compensate for adverse environmental and/or social impacts. Moreover, enhancement measures shall be developed in order to improve project environmental and social performance. Roles and responsibilities to implement measures shall be clearly defined. The cost of the measures shall be estimated, including the cost for environmental and social capacity building and gender mainstreaming, if necessary. Residual impacts shall be presented.

vi. Environmental Hazard Management

Whenever relevant, this chapter shall describe the security measures and propose a preliminary contingency plan for the construction and operation phases of the project (possible contingency situations, major actions to properly react to accidents, responsibilities and means of communications), particularly with regards to Pesticide Management and Storage and to Radioactive Hazards related to SIT, even though Insectaries may lie outside the project area.

vii. Environmental and Social Monitoring Program

The first section of this chapter shall describe the surveillance measures aiming at ensuring that the proposed mitigation and enhancement measures are effectively implemented during the implementation phase. The second section concerns the environmental and social monitoring activities designed to measure and evaluate the project impacts on some key environmental and social components of concern and to implement remedial measures, if necessary. Indicators, roles and responsibilities shall be clearly defined. The cost of the program shall be estimated, including the cost for environmental and social capacity building if necessary.

viii. Public Consultations

This chapter shall summarise the actions undertaken to consult the groups affected by the project, as well as other concerned key stakeholders including Civil Society Organisations. The detailed record of the consultation meetings shall be presented in annex to the ESIA Report.

ix. Conclusion

The Conclusion shall specify the environmental and social acceptability of the project, taking into account the impacts and measures identified during the assessment process. It shall also identify any other condition or external requirement for ensuring the success of the project.

x. Annexes

- List of the professionals and organizations having contributed to the preparation of the ESIA Report.
- List of consulted documents, including project-related reports.
- Baseline data referred to in the Report.
- Record of consultation meetings with primary and secondary stakeholders.

ANNEX 6

STANDARD CONTENT OF ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

Extracted and modifiED from AfDB Environmental Policies and Procedures, Annex 11

GENERIC CONTENTS OF AN ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

An Environmental and Social Management Plan (ESMP) is required for all Category 1 and 2 projects financed by the Bank. Since the phases of the PATTEC Program are considered Category 1, ESMP is mandatory for each Phase level Assessment. The purpose of the ESMP is to define and reach an agreement with convened between PATTEC and individual countries concerning mitigation/enhancement, monitoring, consultative and institutional strengthening measures to be undertaken during project implementation and operations.

The ESMP format shall be flexible to ensure the integration of project specific mitigating, enhancing and monitoring requirements. For instance, the ESMP shall integrate or at least refer to any initiatives, such as resettlement plans, that contribute to enhance the project environmental or social performance but may be prepared separately or as part of the ESIA Report. In addition, the ESMP format shall permit adjustments and revisions to reflect new developments and findings along project implementation and operations.

The ESMP shall be prepared by the proponent, namely PATTEC. The ESMP's scope and level of details shall be proportional to the number and complexity of the measures required to ensure the project's environmental and social sustainability. Any change to the ESMP shall be approved by the Bank and also, if necessary, by the appropriate local and/or national regulatory authorities.

The following components constitute the minimal contents of an ESMP:

1. General Information

- Project Number
- Starting date of implementation
- Project completion date
- Date of operation
- Period covered by the plan

2. Objectives of the ESMP

This section shall specify that the ESMP aims to bring the project into compliance with applicable national environmental and social legal requirements and the African Development Bank's environmental and social policies. Other objective of the ESMP is to outline the mitigating/enhancing, monitoring, consultative and institutional measures required to prevent, minimise, mitigate or compensate for adverse environmental and social impacts, or to

enhance the project beneficial impacts. It shall also address capacity building requirements to strengthen the Borrower's environmental and social capacities if necessary.

3. Context

The ESMP shall briefly describe project activities and major environmental and social components that will likely be affected positively or negatively by the project. The information provided shall be concise for Category 1 projects, as the ESIA Report covers in detail this topic. In fact, for this section, cross-references to the ESIA Report are recommended.

4. Beneficial and Adverse Impacts

This section shall focus on beneficial impacts that can be enhanced to improve the project environmental and social performance as well as on adverse impacts that require mitigation measures to be minimised or compensated. For Category 1 projects, the impact description in the ESMP shall be brief and refer to the ESIA Report for further details. For Category 2 projects, the ESMP shall clearly defined the impacts and indicate their level of importance.

5. Enhancement and Mitigation Program

This section shall propose feasible and cost effective measures to address the impacts previously defined, in order to accrue project benefits (enhancement measures) or to reduce potentially adverse environmental and social impacts to acceptable levels (mitigation measures). Each measure shall be described in detail, providing all technical information required for its implementation (design, equipment description and operating procedures, as appropriate).

6. Monitoring Program

A monitoring program aims to ensure that mitigation and enhancement measures are implemented, that they generate intended results and that they are modified, ceased or replaced when inappropriate. Moreover, it allows assessing compliance with national environmental and social policies and standards as well as with the Bank's policies and guidelines. A monitoring program shall include two parts: surveillance and monitoring activities.

Surveillance activities

The surveillance aims to ensure that the proposed mitigation and enhancement measures are effectively implemented during the construction phase.

Monitoring activities

These activities consist in measuring and evaluating the project impacts on some environmental and social components of concern and to implement remedial measures, if necessary.

The program shall define as clearly as possible the indicators to be used to monitor the mitigation and enhancement measures that need to be assessed during project implementation and/or operation. The monitoring program shall also provide technical details on monitoring activities such as methods to be used, sampling locations, frequency of measurements, detection limits, and definition of thresholds that will signal the need for corrective actions.

7. Consultations

The implementation and monitoring of some mitigation or enhancement measures may require that consultative mechanisms be used. In such cases, the ESMP shall first identify for which measures consultations will be undertaken as well as the goals and expected outcomes of these consultations. Then the ESMP shall specify the target groups, appropriate consultative processes, consultation frequency, reporting methods and result disclosure procedures.

8. Complementary Initiatives

The ESMP shall integrate or at least refer to all initiatives that are proposed to improve the project environmental or social performance. As the ESIA Report completed for Category 1 projects may include such initiatives, these shall be briefly presented in this section. Moreover, these complementary initiatives shall be taken into account in determining the responsibilities, institutional arrangements, cost estimates and implementation schedule.

9. Responsibilities and Institutional Arrangements

The implementation of enhancement and mitigation measures as well as the completion of the monitoring program requires to clearly establishing responsibilities among the various organizations involved in project implementation and operation. Ultimately PATTEC and individual countries are responsible for monitoring and reporting on achieved results.

Consequently, the ESMP shall identify the responsibilities of the Bank, the Borrower, the implementing agencies and other stakeholders in applying the ESMP, particularly the monitoring program. In addition, the ESMP shall propose support to the organisations that may have insufficient capacities to fulfil their obligations. This support could be provided through various means including technical assistance, training and/or procurement.

10. Estimated Cost

This section estimates the capital and recurrent cost associated with the various proposed measures (enhancement and mitigation), the monitoring program, consultations, complementary initiatives and institutional arrangements. Although financing for implementing the ESMP shall be part of project financing, it might not always be possible. In such cases, this section shall discuss potential sources of funding.

11. Implementation Schedule and Reporting

The ESMP shall include an implementation schedule taking into account all activities related to the proposed measures (enhancement and mitigation), the monitoring program, consultations, complementary initiatives and institutional arrangements. Moreover, the implementation schedule shall be developed by phases and in co-ordination with the overall project implementation plan.

To ensure early detection of critical environmental and social conditions and to provide information on the mitigation progress and results, reporting deadlines shall be specified in the implementation schedule and reporting procedures shall be presented in this section.

ANNEX 7

Table of Mitigation/Enhancement Measures from PHASE 1 ESIA

Impact	Mitigation Measure/Enhancement	Responsibility for implementation (within the project organisational framework)	Schedule	Cost Estimate (UA)
Negative environmental impacts of insecticide-based control methods	Environmental Monitoring	Environmental Monitoring Unit	At the start of project and for the duration of the project	1,600,000
Ensure compliance with environmental regulations	EIA study	Authorised company or expert/Environmental Monitoring Unit	At least 6 months the start of the project (estimated duration of study:3 months)	120,000
	Annual environmental audits	Authorised company/ Environmental Monitoring Unit	Second year of project and annually thereafter	80,000
	Capacity building for National Environmental Authorities	Environmental Monitoring Unit	During first and second years of the project	120,00
	Adaptive Research to develop environmental friendly control methods	Environmental Monitoring Unit/Outsourced to Research Institutes	At the start of project and for the duration of the project	600,000
Adverse impacts on human health	Provision of safety equipment, adequate storage and application facilities, training	Environmental Monitoring Unit/PCMU/	At the start of suppression operations and for the duration of the operations	300,000
Potential hazards of SIT	External audit to tsetse rearing facility and Radiation Protection Authority	Environmental Monitoring Unit/Service provider/	Before the start of the project and once again during Phase 1 Project	16,000
Adverse impacts on land use Enhancement of project benefits	Creating Linkages with decentralised Natural Resources Management Organisations (training, equipment and support to development of natural resources management plans)	Environmental Monitoring Unit/ Decentralised Natural Resources Management Organisations	At the start of project and for the duration of the project	200,000
	Supporting rural development initiatives identified by NROs	Environmental Monitoring Unit/PCMU	At the start of project and for the duration of the project	200,000
Gender imbalance	Support women organisations	Environmental Monitoring Unit/PCMU	At the start of project and for the duration of the project	200,000
Risk of project failure	External auditing of project	Environmental Monitoring Unit/Service provider/Donors/ PATTEC	Once during Phase I	50,000
Risk of Disease resurgence	Supporting diagnosis and treatment of the disease	Environmental Monitoring Unit	At the start of project and for the duration of the project	1,000,000
TOTAL				**4,486,000**