An easy-to-use computer program to help plan farmer-friendly tsetse control

RIU

Validated RNRRS Output.

A range of new information is now available to make people aware that effective farmer-friendly control methods do exist for tsetse fly, and to help them plan better ways of putting them into practice effectively. Examples include an easy-to-use program called 'Tsetse Plan', which helps users design and implement tsetse control using bait techniques like insecticide-treated cattle and odour-baited traps. A range of other information is also available, including slide shows (demonstrating how technologies like traps can be built) and the www.tsetse.org website, which contains a wealth of information. These resources are now being used across many countries, including Ethiopia, Kenya, South Africa, Tanzania, Uganda, Zambia and Zimbabwe. However, tremendous scope still exists to extend this coverage.

Project Ref: **AHP05:**
Topic: **2. Better Lives for Livestock Keepers: Improved Livestock & Fodder**
Lead Organisation: **Natural Resources Institute (NRI), UK**
Source: **Animal Health Programme**

Document Contents:

Description

AHP05

Research into Use
NR International
Park House
Bradbourne Lane
Aylesford
Kent
ME20 6SN
UK

Geographical regions included:

Botswana, Burkina Faso, Cote d'Ivoire, Ethiopia, Kenya, Malawi, Mozambique, South Africa, Tanzania, Uganda, Zambia, Zimbabwe,

Target Audiences for this content:

Livestock farmers,

A. Description of the research output(s)

1. Working title of output or cluster of outputs.

Tsetse plan, an interactive computer program that provides expert assistance to help NGOs and farmers groups plan tsetse control campaigns

Alternative title:-

TSETSE PLAN: A Decision tool to support community-based interventions against tsetse

2. Name of relevant RNRRS Programme(s) commissioning supporting research and also indicate other funding sources, if applicable.

The research projects that contributed to the development of this output were supported by: DFID's Animal Health (AHP) and Livestock Production (LPP) programmes, the EU-supported Farming in Tsetse-Controlled Areas project and the Zimbabwe Department of Veterinary Services.

3. Provide relevant R numbers (and/or programme development/dissemination reference numbers covering supporting research) along with the institutional partners (with individual contact persons (if appropriate)) involved in the project activities.

Funding agency	***Project no.***	***Project title***
AHP	R7987	Message in a bottle: disseminating tsetse control technologies.
LPP	ZC0254	General model for predicting the effect of insecticide-treated cattle on tsetse populations.

Project Partners (contact person):

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4. Describe the RNRRS output or cluster of outputs being proposed and when was it produced? ***(max. 400 words)****. This requires a clear and concise description of the output(s) and the problem the output(s) aimed to address. Please incorporate and highlight (in bold) key words that would/could be used to select your output when held in a database.*

Tsetse-borne **trypanosomiasis** is a severe constraint to the livelihoods of poor **livestock** owners across ~10 million square kilometres of **sub-Saharan Africa**. The control of tsetse now relies largely on the resources of livestock keepers, mainly because the capacity of the government-supported institutions that formerly undertook this task has declined. This shift was made feasible by the development of **bait methods** (**insecticide-treated cattle**; **odour-baited traps** and **targets**) that, in contrast to the **insecticide-spraying** methods used in the past, could be applied by farmers. However, while effective, **farmer-friendly** methods to control tsetse exist, few **livestock keepers**, or the **NGO**s and institutions that advise them, are aware of **best practice**. Consequently, the scant resources of poor livestock keepers are frequently squandered on interventions that are poorly planned and implemented and, hence, ineffective.

This output addresses the problem by providing a computer-based package including:-

- an interactive computer programme ('*Tsetse Plan*') to help users design and implement tsetse control using bait methods;

- **slideshows** on the manufacture and use of the technologies (eg, **traps**, **targets**, **odour dispensers**) commonly used to control tsetse and;

- general information on **tsetse** biology and control, including *ca*. 140 pages providing answers to frequently-asked questions, a **socio-economic** module and hyperlinks to supporting technical papers.

These three elements synthesize knowledge from 25 years of research and experience relating to the use of baits to control tsetse. By employing a **user-friendly interface**, non-specialists can assess the general feasibility of controlling tsetse in their area and then, if appropriate, develop a control strategy, identify appropriate methods of control and produce a shopping list and itemised budget for the operation.

'Tsetse Plan' and the supporting information were developed between 2000 and 2005 in collaboration with scientists and institutions undertaking tsetse control operations in **Botswana**, **Ethiopia**, **South Africa**, **Tanzania** and **Zimbabwe**. 'Tsetse Plan' and the associated information is available via the **World Wide Web** (**www.tsetse.org**) or in **CD-ROM** format.

The African Union's Pan-African Tsetse and Trypanosomiasis Eradication Campaign (**PATTEC**) has initiated **area-wide** operations to eliminate tsetse from areas of **Angola**, **Botswana**, **Burkina Faso**, **Ethiopia**, **Ghana**, **Kenya**, **Mali**, **Uganda** and **Zambia**. These operations will use a variety of tsetse control methods, including baits deployed by local communities. Smaller-scale interventions, based on the use of baits, are also being promoted by NGOs and government agencies in most tsetse-affected countries. The widespread use of Tsetse Plan and the associated information available at www.tsetse.org will improve the cost-effectiveness of these interventions.

5. What is the type of output(s) being described here?
Please tick one or more of the following options.

Product	***Technology***	***Service***	***Process or Methodology***	***Policy***	***Other Please specify***
X			**X**		Decision support tool

6. What is the main commodity (ies) upon which the output(s) focussed? Could this output be applied to other commodities, if so, please comment

The use of Tsetse Plan to design cost-effective interventions against tsetse-borne trypanosomiasis will improve the health of livestock, including not only the cattle themselves but also pigs, goats, sheep, donkeys, horses and camels.

Humans also suffer trypanosomiasis, in the form of sleeping sickness, and hence tsetse control will improve human health in areas where sleeping sickness is endemic (eg, Uganda, Angola, the Sudan).

Improved health and productivity of draught animals – particularly cattle – will also have indirect benefits for the productivity of mixed crop-livestock systems. In Ethiopia, the absence of draft animals due, for example, to trypanosomiasis leads to delayed planting, lower crop yields and higher costs of production. Crops likely to be particularly affected by the improvements in the health, productivity and availability of draught animals include maize, cotton and sorghum.

7. What production system(s) does/could the output(s) focus upon?
Please tick one or more of the following options. Leave blank if not applicable

Semi-Arid	***High potential***	***Hillsides***	***Forest-Agriculture***	***Peri-urban***	***Land water***	***Tropical moist forest***	***Cross-cutting***
X	**X**			**X**			

8. What farming system(s) does the output(s) focus upon?
Please tick one or more of the following options (see Annex B for definitions).
Leave blank if not applicable

Smallholder rainfed humid	***Irrigated***	***Wetland rice based***	***Smallholder rainfed highland***	***Smallholder rainfed dry/cold***	***Dualistic***	***Coastal artisanal fishing***
X				**X**	**X**	

*9. How could value be added to the output or additional constraints faced by poor people addressed by clustering this output with research outputs from other sources (RNRRS and non RNRRS)? (**max. 300 words**).*

Please specify what other outputs your output(s) could be clustered. At this point you should make reference to the circulated list of RNRRS outputs for which proformas are currently being prepared.

The two main factors preventing farmers from controlling tsetse effectively are (i) inadequate technical information and (ii) the relatively high cost of control, especially for poor farmers. This output and the related **Tsetse Muse** output address the first constraint, while the RNNRS output '**Tsetse control through restricted application of insecticide to cattle**' addresses the second by providing a safe and effective means of controlling tsetse for ca. $2/animal/year.

Tsetse also transmit human African trypanosomiasis (sleeping sickness) and results from various countries (eg, Uganda, Angola, Ivory Coast) show that bait technologies can contribute significantly to the control of this disease. Grouping this output with the outputs '**Diagnostics that can identify human-infective trypanosomes in cattle blood**' and '**Treatment of cattle to eliminate the animal reservoir of *T. b. rhodesiense***' would therefore contribute to the effective control of sleeping sickness.

Trypanosomiasis is only one of several diseases affecting the health and productivity of African livestock and thus there are synergistic links between this output and '**Simple decision tools for diagnosis of endemic diseases in Africa**' which includes tools to improve the diagnosis and management of trypanosomiasis and other vector-borne diseases.

Livestock are an integral part of mixed farming systems in sub-Saharan Africa and improving the health and productivity of humans and their livestock has an impact on crop production. Accordingly, this output also links to the CPP and LPP outputs concerned with '**Draught animal power**' and '**Draught animal toolbox**'.

Lecturers and students from several universities have used Tsetse Plan or elements of the tsetse.org website as a training resource. Hence, this output links to those concerned with the training and professional development of animal health specialists (AHP outputs: '**AUVEC'; Creation of a common … African veterinary network**).

Validation

B. Validation of the research output(s)

*10**. How** were the output(s) validated and **who** validated them?*

*Please provide brief description of method(s) used and consider application, replication, adaptation and/or adoption in the context of any partner organisation and user groups involved. In addressing the "who" component detail which group(s) did the validation e.g. end users, intermediary organisation, government department, aid organisation, private company etc... This section should also be used to detail, if applicable, to which social group, gender, income category the validation was applied and any increases in productivity observed during validation **(max. 500 words)**.*

1. The simulation models of tsetse populations underpinning the programme 'Tsetse Plan' (available at

http://www.nri.org/tsetse/Plan/index.html) were developed and validated by comparison of the simulations with the observed impact of tsetse control in Kenya, Tanzania, Malawi, Zambia, and Zimbabwe. The results of these comparisons are reported in various peer-reviewed papers (eg, Hargrove, 2000, 2003ab; Hargrove et al., 2003; Vale & Torr, 2004).

2. The impact of bait technologies on tsetse populations predicted by Tsetse Plan are validated by field studies of the performance of insecticides (eg, Mangwiro *et al*., 1999; Vale *et al*., 1999), attractants (eg, Torr *et al*., 1997), traps (eg, Laveissière & Grebaut, 1990; Mihok, 2002) and targets (eg, Vale *et al*., 1988).

3. The 140 pages addressing frequently-asked-questions on various aspects of tsetse biology and control are validated by numerous peer-reviewed papers. For each FAQ page on the tsetse.org website (www.tsetse.org), the answer is followed by a list of supporting references. For an example of one such page, see http://www.nri.org/tsetse/FAQ/bestins.html.

4. The slideshows illustrating the use various bait technologies were produced by experienced personnel. For example, staff from the Botswana Tsetse Control Division are shown using the type of tsetse trap commonly employed in Botswana.
(see http://www.nri.org/tsetse/Technol/Botswana trap/sld001.htm).

5. Prototype versions of 'Tsetse Plan' were used in the planning of tsetse control operations undertaken by the Farming Tsetse Controlled Areas project in Tanzania (FITCA-Tanga) and the Southern Tsetse Eradication Project (STEP) in Ethiopia.

6. The www.tsetse.org website was made public on October 2003 and during the last year of the project (2004-05) the average number of pages viewed per month exceeded 3000. The most visited pages, excluding index pages, were those concerned with answers to frequently-asked-questions such as the chemical properties of attractants (961 visits). During the project, there were 277 requests for the 'Tsetse Plan' or 'Tsetse Muse' programs, >600 downloads of the slideshows and >3800 downloads of documents (pdf files).

*11. **Where and when** have the output(s) been validated?*

*Please indicate the places(s) and country(ies), any particular social group targeted and also indicate in which production system and farming system, using the options provided in questions 7 and 8 respectively, above **(max 300 words)**.*

1. Simulation models of tsetse populations were validated by scientists working in Zimbabwe and the UK between 1999 and 2005, using field data from Kenya, South Africa, Tanzania, Malawi, Zambia and Zimbabwe.

2. Studies of the performance of bait technologies were undertaken between ~1980 and 2004 in many countries including Burkina Faso, Ivory Coast, Kenya, South Africa and Zimbabwe.

3. Research validating the FAQ pages of tsetse.org was performed over the past ca. 25 years in many

African countries, particularly Kenya, South Africa, Tanzania, Zimbabwe and the UK.

4. The slideshows were validated by tsetse control personnel conducting control operations or carrying out tsetse research in Botswana (Ngamiland), Tanzania (Tanga) and Zimbabwe (Mashonaland) during 2001-2005.

5. Prototype versions of 'Tsetse Plan' were used to design tsetse control operations implemented in the Tanga region of Tanzania (2003-05) and regions of Ethiopia, (2001-05). The users included a private consulting company (CCL, Tanga), government veterinary officers (Ethiopia, Malawi, Mozambique and South Africa) and an NGO (FARM Africa) that were promoting community-based projects for the benefit of pastorialists (Handeni, Tanzania), mixed crop-livestock keepers (Konso and Deme Valley, Ethiopia) and landless livestock keepers (Pangani, Tanzania).

6. The www.tsetse.org website was made public on October 2003 and statistics on the use of the tsetse.org website were gathered automatically by the University of Greenwich server which hosted the site. We have little information on the use of the >500 CD-ROMs distributed to users across Africa, apart from reports that the CD-ROM is being used as a training tool in Ethiopia (University of Addis Ababa), Tanzania (National Tsetse Control Office) and Zimbabwe (Department of Veterinary Services).

Current Situation

C. Current situation

12. ***How and by whom*** *are the outputs currently being used? Please give a brief description* ***(max. 250 words****).*

1. *Tsetse.org* website. The University of Greenwich has continued to host the tsetse.org website following the conclusion of those DFID projects that developed 'Tsetse Plan' and the tsetse.org website. Use has continued to increase and is currently averaging 9000 pages viewed/month. A wide range of pages providing answers to frequently-asked-questions are being viewed and various documents (pdf files), Powerpoint slideshows and programmes, including Tsetse Plan, are being downloaded. In 2006, Tsetse Plan has been downloaded 330 times. Users of the website included unidentified users in many tsetse-affected countries (eg, Ethiopia, Kenya, South Africa, Tanzania, Uganda, Zambia and Zimbabwe) and identifiable academic institutions from Europe (London School of Hygiene and Tropical Medicine, University of Edinburgh) and North America (Stanford, Trent).

2. *Academic users*. The Tsetse.org CD and its models are being used as a teaching resource at the University of Addis Ababa and 'Tsetse Plan' is being used as a research and teaching tool by students and lecturers from European and North American and universities.

3. *Tsetse control practitioners*. Use of Tsetse Plan or the tsetse.org CD by people directly concerned with bait technologies to control tsetse is limited. In Zimbabwe, the Tsetse Control Branch is using the CD

and Tsetse Plan has a training tool for its entomologists. Cawood Beef Ltd is using the FAQ and Tsetse Plan to assess the feasibility of controlling tsetse in 2000 km^2 near Tete in Mozambique.

*13. **Where** are the outputs currently being used? As with Question 11 please indicate place(s) and countries where the outputs are being used **(max. 250 words).***

1. Users of the tsetse.org website appear to be from a wide range of countries, including those directly affected by tsetse and trypanosomiasis (eg, Ethiopia, Kenya, South Africa, Tanzania, Uganda, Zambia and Zimbabwe), developed countries that support tsetse control (eg, UK, France, Belgium, the Netherlands) and countries that have no obvious connection (eg, Kazakhstan, Uruguay).

2. Academic users are from Ethiopia, Zimbabwe, UK, Canada and USA.

3. The tsetse.org CD is being used in Kenya, South Africa, Tanzania and Zimbabwe

*14. What is the scale of current use? Indicating how quickly use was established and whether usage is still spreading **(max 250 words).***

The tsetse.org website was established in October 2003. The mean number of pages viewed per month has doubled each year since then, rising from ca. 1000 pages/month in 2003 (October-December), 2000 pages/ month in 2004, 3500 pages/month in 2005 and 8000 pages/month in 2006 (Jan-Sep).

Tsetse Plan is currently being used by academics at universities in Ethiopia, Kenya, Canada and the UK and by Cawood Beef Ltd to assess the feasibility of controlling tsetse in 2000 km^2 near Tete in Mozambique. The programme has been downloaded 330 times in 2006.

*15. In your experience what programmes, platforms, policy, institutional structures exist that have assisted with the promotion and/or adoption of the output(s) proposed here and in terms of capacity strengthening what do you see as the key facts of success? **(max 350 words).***

The use of computer-based systems to assist in the planning of tsetse control is likely to be affected by the following:-

1. *IT infrastructure and literacy*. As with all computer-based systems, the underlying IT infrastructure has a profound effect on the uptake of Tsetse Plan and the tsetse.org computer package. The crucial factors in this are: availability and reliability of electricity, availability of suitable computers (<5 years old) and software (MS Office 2000 and above) and basic computer literacy (familiarity with MS Office and Explorer). While there are minimum requirements for using Tsetse Plan/tsetse.org, performance is better with more recent computers and software. Consequently, users in well supported institutions in major cities are more likely to use the software than, say, a government veterinarian working in a remote area. The Tsetse Plan/tsetse.org package is written in English and thus uptake is generally greater in Anglophone countries rather than those where French, Portuguese or African languages predominate (eg, kiSwahalii in Tanzania; Amharic in Ethiopia).

2. *Demand.* Uptake is also greater with users who are actively engaged in designing and/or implementing tsetse control.

3. *Education*. The use of Tsetse Plan/tsetse.org by some universities confirms a demand for the material by educational institutions concerned with the training and continuing professional development of veterinarians.

4. *Commercial links*. Many of the materials used in tsetse control (insecticides, attractants, traps) are supplied by private companies. Distributing CD-ROMs of tsetse.org and advertising the existence of the tsetse.org website by companies providing materials for tsetse control increases awareness of the information and appropriate use of the materials.

5. *Website design* The Tsetse.org website as currently designed satisfies several criteria recognised as key to production of websites for development purposes (Taylor 2001): accessibility (download times, compatibility with popularly available software), appearance (attractiveness, absence of distracting features), clarity of purpose, interactivity, readability, marketing (appearance on search engines), navigability, content quality, authority and relevance, readability and timeliness of updates. The website was evaluated against a modified version of these criteria with seven users in Ethiopia and Tanzania with scorings of 1 and 2 (the highest ratings on a scale 1-5) for nearly all the criteria (Morton 2005).

Environmental Impact

H. Environmental impact

24. What are the direct and indirect environmental benefits related to the output(s) and their outcome(s)? ***(max 300 words)***

This could include direct benefits from the application of the technology or policy action with local governments or multinational agencies to create environmentally sound policies or programmes. Any supporting and appropriate evidence can be provided in the form of an annex.

All tsetse control methods have two potential types of impact on the environment. One is related to the direct impact of the technique and the second is related to the consequences of improving the health and productivity of livestock.

The bait methods promoted by Tsetse Plan have less environmental impact than some of the current practices. For instance, the restricted application method of treating cattle (Torr et al., 2007) was developed, in part, as a consequence of concerns regarding the environmental impact of the standard (whole body) method of treating cattle with insecticide. The new method reduces the amount of insecticide used and hence the impact on non-target organisms. Information contained within the tsetse.org website also advises users on the safe use and disposal of insecticides and attractants.

With effective land-use planning and implementation, the use of bait methods to control tsetse can alleviate environmental-degradation associated with the concentration of people and livestock into areas naturally free of tsetse.

25. Are there any adverse environmental impacts related to the output(s) and their outcome(s)? ***(max 100 words)***

Bait methods does not have any significant direct impact on the environment. Without effective land-use planning and implementation, the use of insecticide-treated cattle to control tsetse could lead to environmental-degradation arising from inappropriate land-use.

26. Do the outputs increase the capacity of poor people to cope with the effects of climate change, reduce the risks of natural disasters and increase their resilience? ***(max 200 words)***

Predictive models of climate change suggest that there will be shifts in the areas suitable for pastoral and mixed system and in the distribution of tsetse (ILRI, 2000; Thornton et al., 2006). For the morsitans group of tsetse, which includes the major vectors of animal trypanosomiasis, there will be a decrease in suitable habitat along the northern margin of the west African belt and over a large area of southern Sudan and southern Zambia, and an increase along the southern edge of the west African belt and scattered parts of Kenya, Uganda and Ethiopia. Bait methods can play an important role in controlling tsetse in current and predicted areas of infestation.

More generally, livestock are important in reducing vulnerability to natural and man-made disasters (see Q21). Bait methods are particularly useful in this role since the treatment is applied to cattle whereas other methods of control (eg, insecticide spraying, SIT) are geographically fixed. Hence, livestock keepers fleeing a war zone can move with their treated cattle and expect to achieve some measure of control. By contrast, if the area had been controlled by, say, aerial spraying the benefits would be lost.

Annex

Appendix 1: References

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