Advancing Animal Trypanosomosis Control: Innovations and Progress from the COMBAT Project

Horizon2020
European Union Funding
for Research & Innovation

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Project coordinator

cirad
LA RECHERCHE AGRONOMIQUE POUR LE DÉVELOPPEMENT

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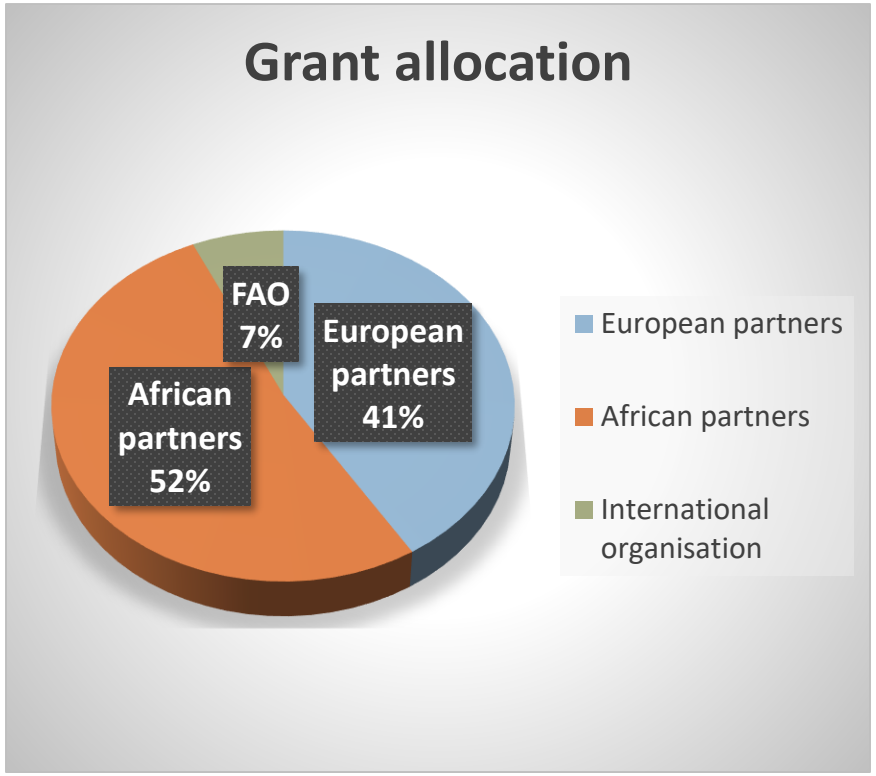
37th ISCTRC meeting – Mombasa, Kenya

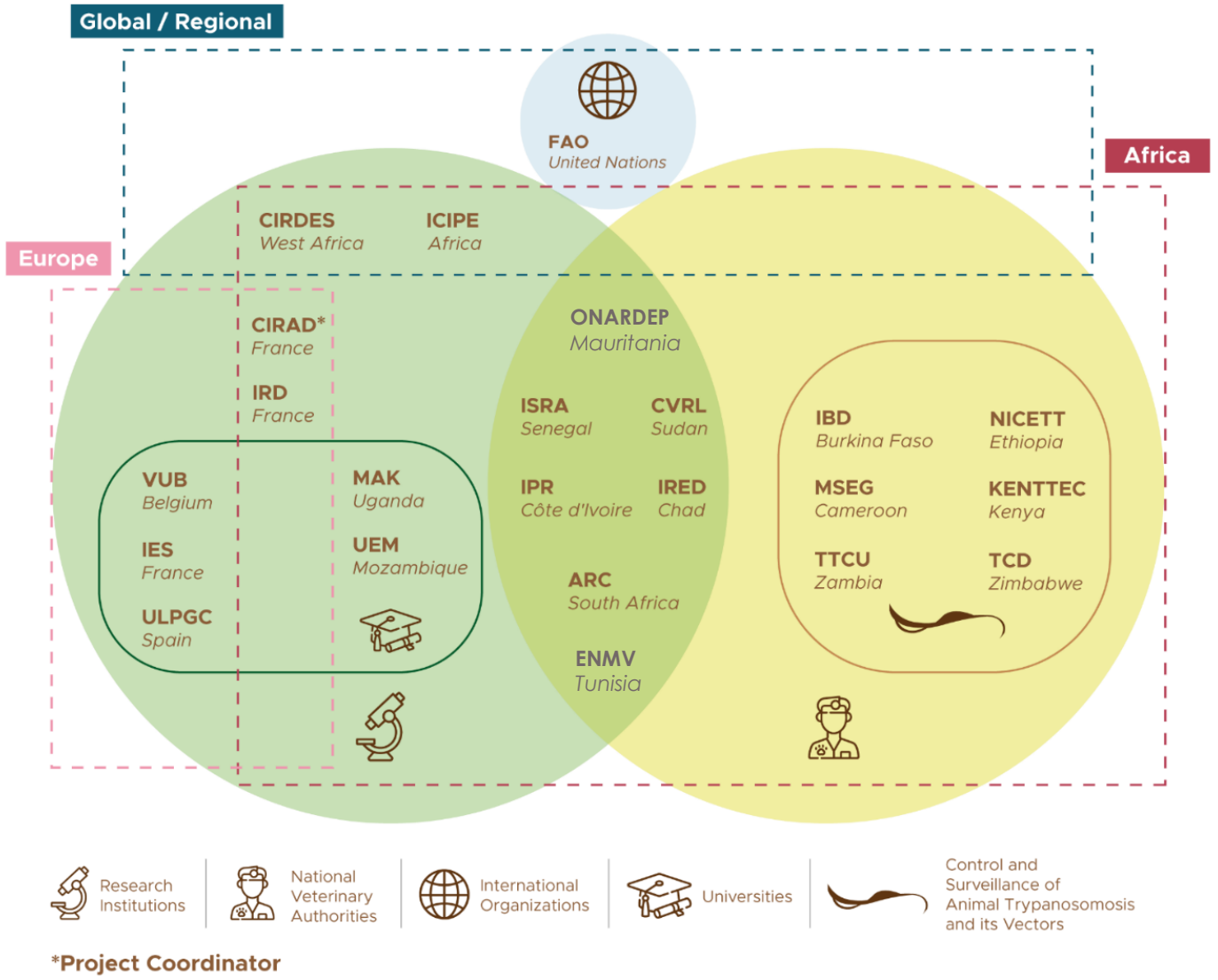


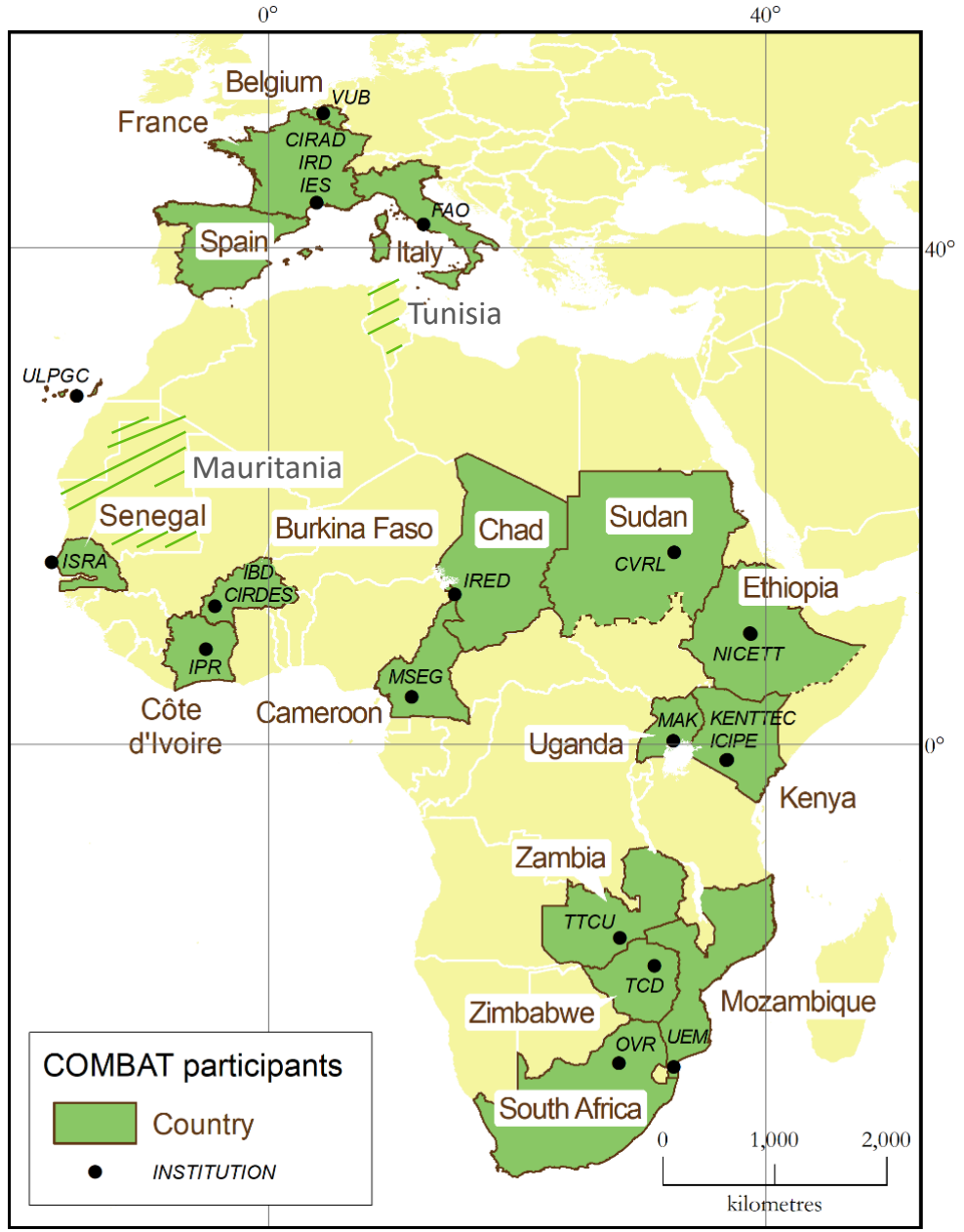
5 years- Sept 2021 to August 2026

Budget: 5.9 M €

Aim: to reduce the burden of animal trypanosomosis (AT) in Africa



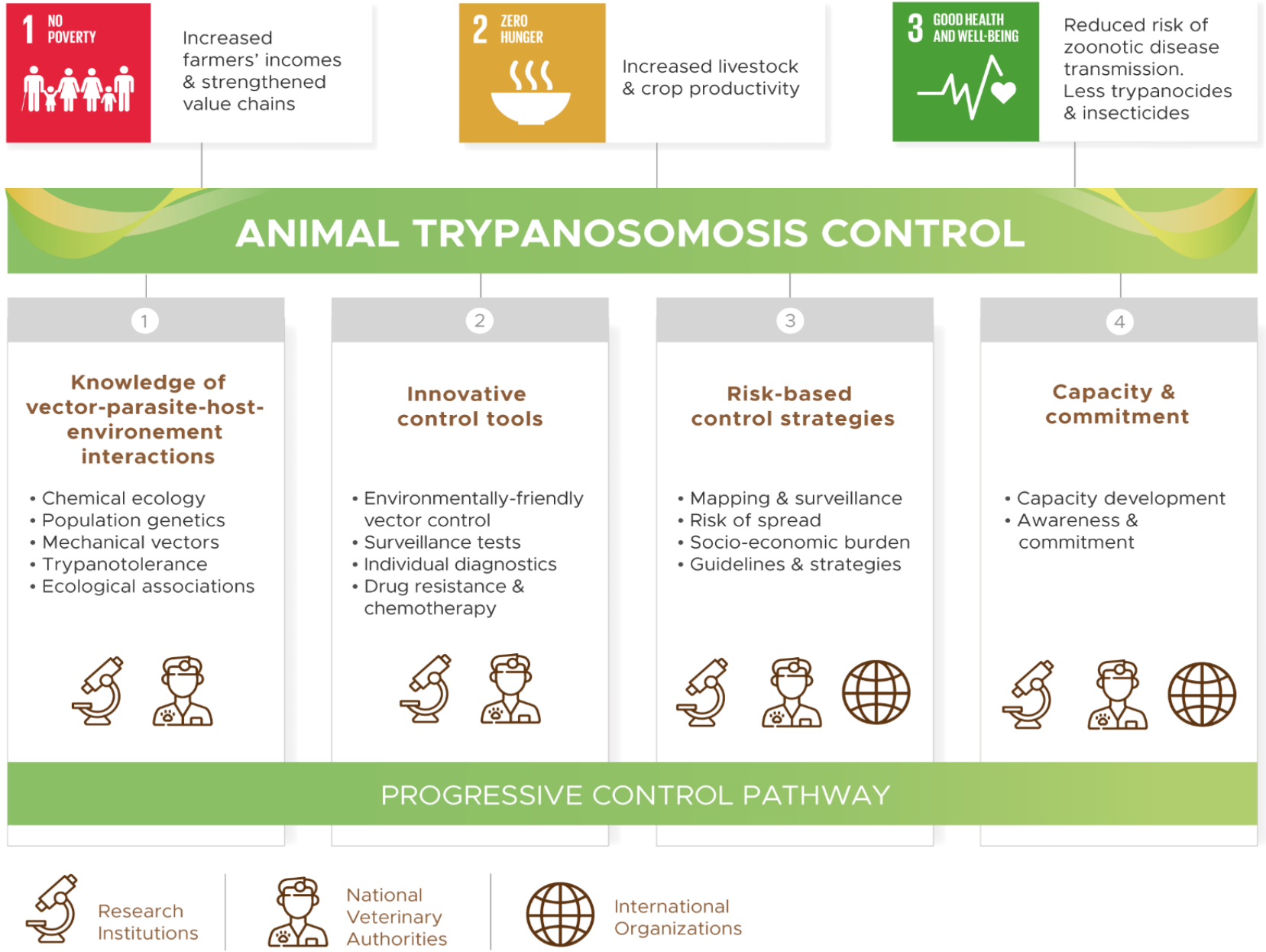




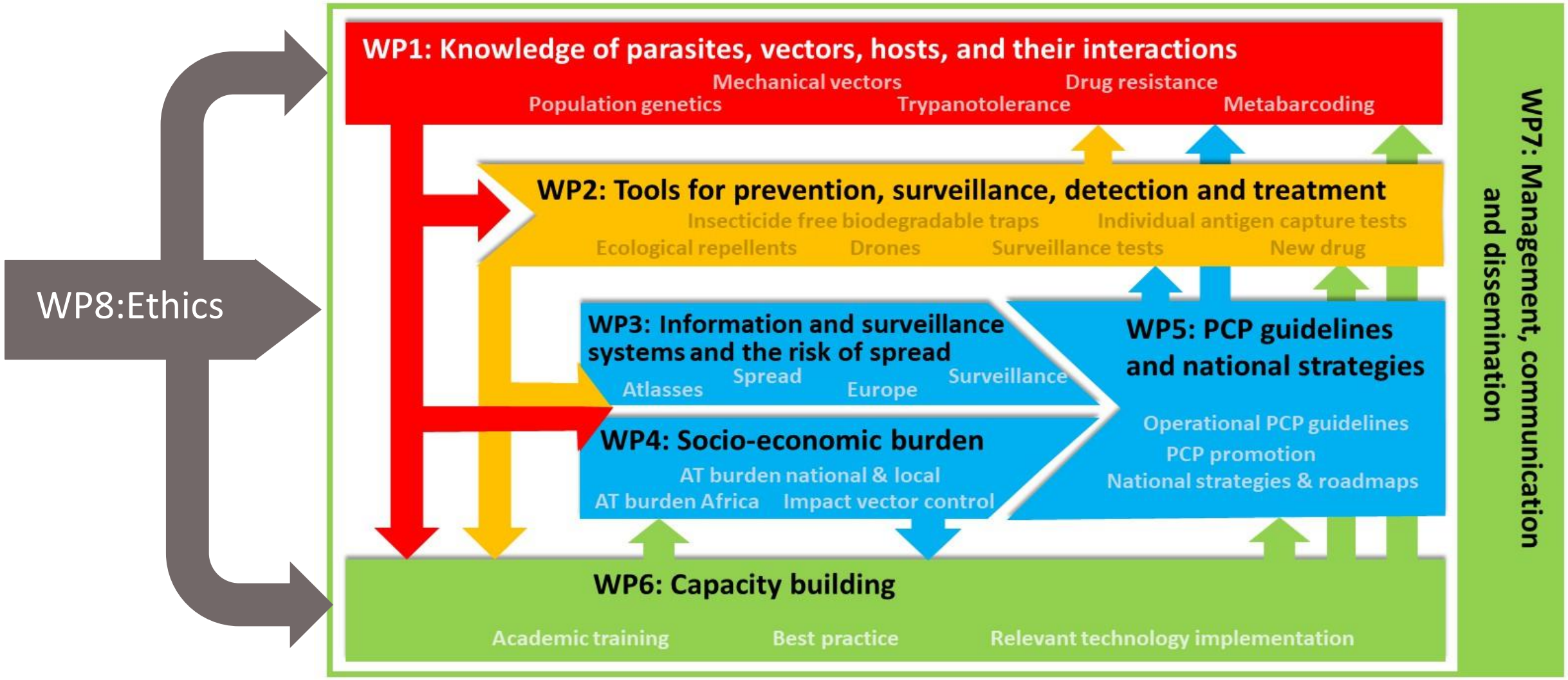
Boulangé *et al.*, 2022

Project pillars

All the activities of COMBAT feed the PCP



Workpackages





Pillar I (WP1): Knowledge on parasites, vectors, hosts, environment and their interactions



Vectors

- Chemical ecology
- Population genetics
- Mechanical vectors
- Competence/capacity

Chemical ecology

Identify pheromones of tsetse flies and Stomoxys involved in reproductive behaviour to use them as attractants to improve traps: mating pheromones, larviposition/oviposition pheromone

Methodology:

- Solvent extraction
- Gas chromatography, mass spectrometry
- Identification of pheromones
- Behavioural evaluation in lab and field

Results:

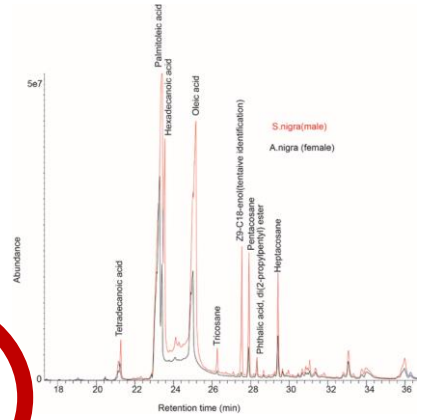


- Tsetse:
  - Mating pheromones: 6 attractive to males, 2 increase mating,
  - Larviposition pheromones: 8 compounds attract gravid females
- Stomoxys:



  - Mating pheromone: complexe mix of body semiochemicals are being analysed in the lab
  - Larviposition pheromones: Optimization of a nanopolymer dispenser for the behavioral evaluation of the p-cresol + carvone, an oviposition stimulant,









Genetic isolation of *Glossina brevipalpis* in Mozambique

Microsatellite analysis revealed significant genetic subdivision between the *G. brevipalpis* populations of Gorongosa and Maputo National Parks

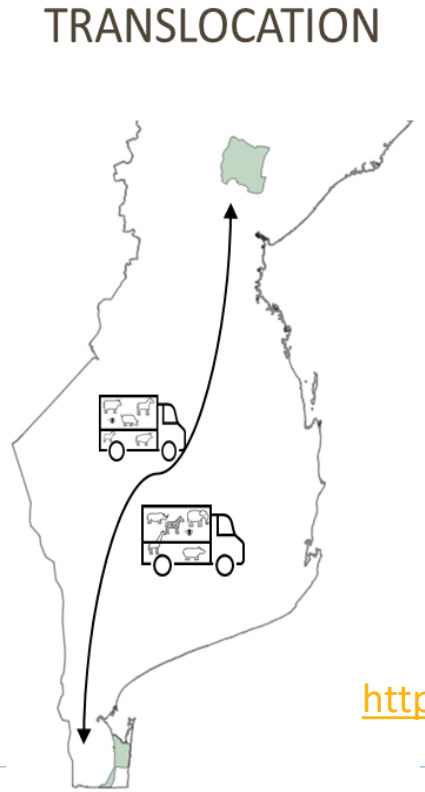
Bayesian clustering indicates rare exchange of individuals (two flies per year).

Passive dispersals most likely facilitated by motorised transport during wildlife and livestock translocation,

Overturns the assumption of total isolation and informs targeted tsetse control strategies.



Mozambique



May exist similar cases elsewhere, relevant to control strategies

Unravelling genetic differentiation between *Glossina brevipalpis* populations from two distant National Parks in Mozambique

Denise R.A. Brito, Adeline Ségard, Fernando C. Mulandane, Nióbio Cossa, Hermógenes N. Mucache, Sophie Ravel, Thierry De Meeûs, Luis Neves

doi: https://doi.org/10.1101/2025.02.28.640735

Now published in *PLOS Neglected Tropical Diseases* doi: 10.1371/journal.pntd.0012953

https://www.biorxiv.org/content/10.1101/2025.02.28.640735v1

Ecology of mechanical vectors

Extensive biting flies density survey in several location of 8 countries, coupled with testing of traps:

- **South Western France** (Gers): 1 million flies, **75% stomoxys**, **0,4% tabanids**, *Musca* 7%, other 8%. Annual variations unpredictable
- **Canary Islands**: **24,000 Stomoxys**, **1 tabanid**. No significant link with most parameters (climate, altitude, trap type). High temperature had a small negative effect on density. Flies present year-round, density varies seasonally.
- **Senegal**: 1000 flies captured in 3 areas in two seasons **Stomoxys spp. & Tabanids** abundant in rainy season. Stomoxys carry *T. vivax* and *T. evansi*.
- **Kenya:**
  - **ICIPE** surveyed 9 tsetse-free and infested areas. Six **Stomoxys** species identified. Widespread and present year-round across various ecological settings, including urban areas. Established that they feed on many animal species including humans. Field flies showed **5% infected with *T. vivax*** and **3% with *T. evansi*.**
  - **KENTTEC** undertook field surveys in four counties in North-Eastern Kenya. **24,000 flies** captured. Large predominance of **Tabanids (97,7%)** vs **Stomoxys (2,3%)**. Analyses ongoing.
- **Tchad:** Surveyed three zones. 1010 flies captured, predominantly **tabanids** (**71%** 6 species) and **Stomoxys** (**27%** 2 species), Could not complete the task because of political unrest.

- Ongoing in **Côte d'Ivoire, Mauritania** and **Tunisia**



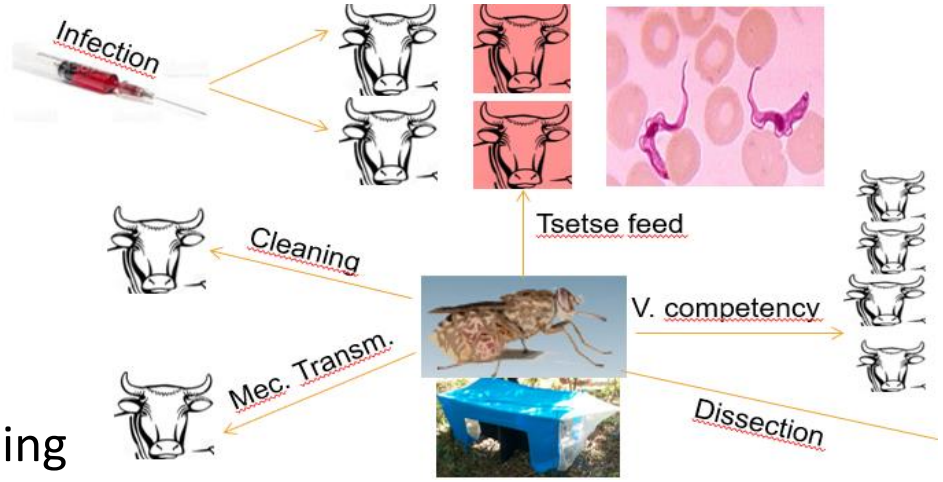
These flies play a key role in maintaining AT
Control strategies must consider their ecology and seasonal dynamics

Competence/capacity of AT vectors

Assessment of vector competence of *G. brevipalpis*

Transmission of *T. congolense* at a field station in Mozambique

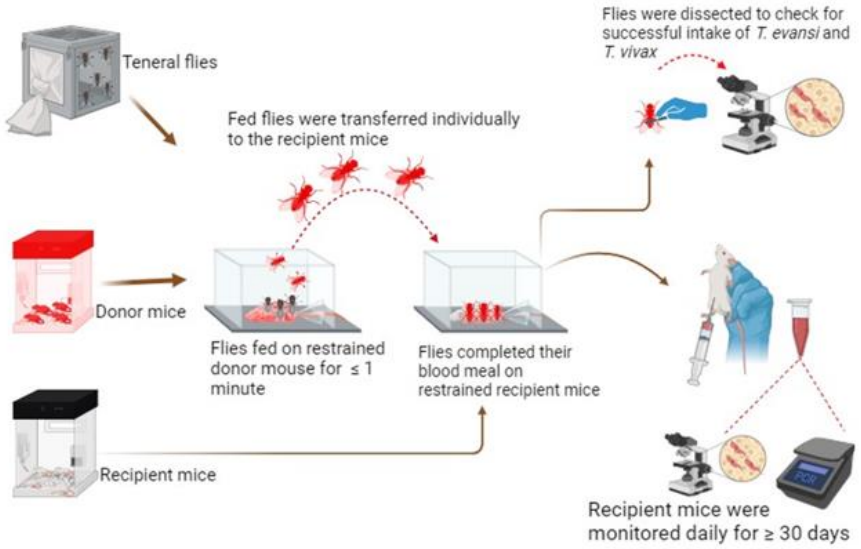
The experiment demonstrated that *G. brevipalpis* easily acquires infection by *T. congolense* by feeding on infected cattle, and becomes efficient to transmit it to clean animals.



Study vector competence of *Stomoxys*

Transmission of *T. evansi* and *T. vivax* at ICIPE

- 30% of *Stomoxys* showed proboscis infection after immediate feeding disruption.
- 80% of the infected mice-fed flies showed positive infection in their crop and gut after immediate feeding disruption
- *T. evansi* survived up to 6 hrs and *T. vivax* for 16 hours in the gut of *Stomoxys*
- *Stomoxys* transmitted *T. evansi* and *T.vivax in vivo* with 8.3% and 30% success rate, respectively



RESEARCH ARTICLE

Stomoxys flies (Diptera, Muscidae) are competent vectors of _Trypanosoma evansi_, _Trypanosoma vivax_, and other livestock hemopathogens

Julia W. Muita[1,2], Joel L. Bargul[2], JohnMark O. Makwatta[1], Ernest M. Ngatia[1,2], Simon K. Tawich[1], Daniel K. Masiga[1], Merid N. Getahun[1]*

1 International Centre of Insect Physiology and Ecology (icipe), Nairobi, Kenya, 2 Department of Biochemistry, Jomo Kenyatta University of Agriculture and Technology (JKUAT), Nairobi, Kenya

Evaluation of the vectorial competence of _Glossina brevipalpis_ in the transmission of _Trypanosoma congolense_-savannah type, in the Matutuíne District, Maputo Province, Mozambique

Nióbio V. Cossa, Fernando C. Mulandane, Denise R.A. Brito, Hermogénes Mucache, Moeti O. Taioe, Alain Boulangé, Geoffrey Gimonneau, Johan Esterhuizen, Marc Desquesnes, Luís C. B. Neves

doi: https://doi.org/10.1101/2025.07.24.666565



Hosts

- Population genetics
- Trypanotolerance

Comparison of cattle breeds differing in their tolerance to AT

Increase knowledge on AT ***pathological processes in cattle***, and identify variables related to ***immune and metabolic response discriminating tolerant from susceptible animals***

- **Compare the immune response and the metabolic profiles in trypanotolerant and susceptible breeds**
- Experimental *T. congolense* infection of trypanosusceptible & trypanotolerant cattle
  - **Burkina:** 24 animals: 7 N'Dama, 8 cross-bred: Zebu X European taurine, 9 Zebu
  - **Uganda:** Comparing Ankole cows with a Karamoja breed suspected of tolerance





Trypanotolerance : parasitemia and anemia control + leukocytosis + cholesterol level

- Test if **tsetse flies** have the same **probability to acquire trypanosomes** by feeding on experimentally infected **tolerant or susceptible cattle**
  - 5 sessions of tsetse flies feeding on infected cattle
  - Dissection of live flies: 15 to 19 days post-feeding on cattle







No evidence of effect of breeds on the tsetse fly infection rate but influence of parasitaemia

Identification of vector ecological associations that shape transmission cycles through a metabarcoding approach

METABARCODING ON AT VECTORS

Identification of tsetse host blood meals at the interface between agricultural and protected areas (UEM Mozambique, ARC South Africa)



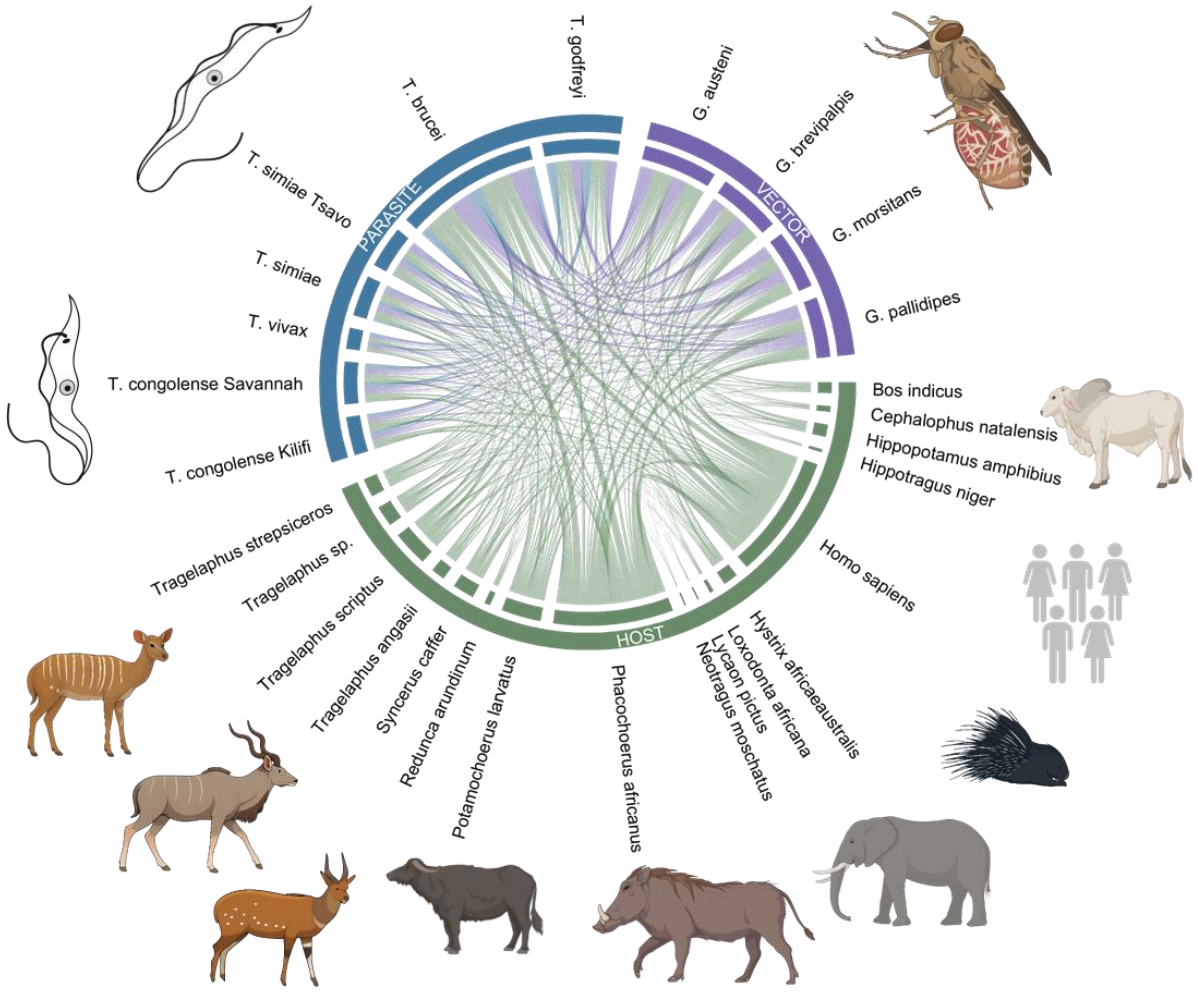


Spread of AT out of the tsetse belt through livestock commercial roads

Risk for Europe through high added-value animal trade

Senegal, Mauritania, Tunisia

Identification of tsetse host blood meals at the interface between agricultural and protected areas



Mozambique, Maputo and Gorongosa National Parks, and their respective buffer zones

Metabarcoding uncovered a **high diversity** of **trypanosomes**, **vertebrate** hosts (including **human**) and bacterial **symbionts** within individual flies.

Host, parasite and microbiome **diversity** was mainly determined by circulating **tsetse species**.

Parks and their buffer zones appeared as a single, **porous epidemiological landscape** in both location. Risk of **AAT spillover** to livestock and potentially **HAT to humans**

Using tsetse-based **metabarcoding** as a routine **surveillance tool** for early detection of emerging AAT threats should be considered.

COMBAT



Pillar II (WP2): Tools for prevention, surveillance, detection and treatment



Integrated control

Alternative ecologically-sound **vector control compounds**

Efficacy of **impregnated screens** including polyethylen Flyscreens

Efficacy of **biodegradable fly-trapping** device

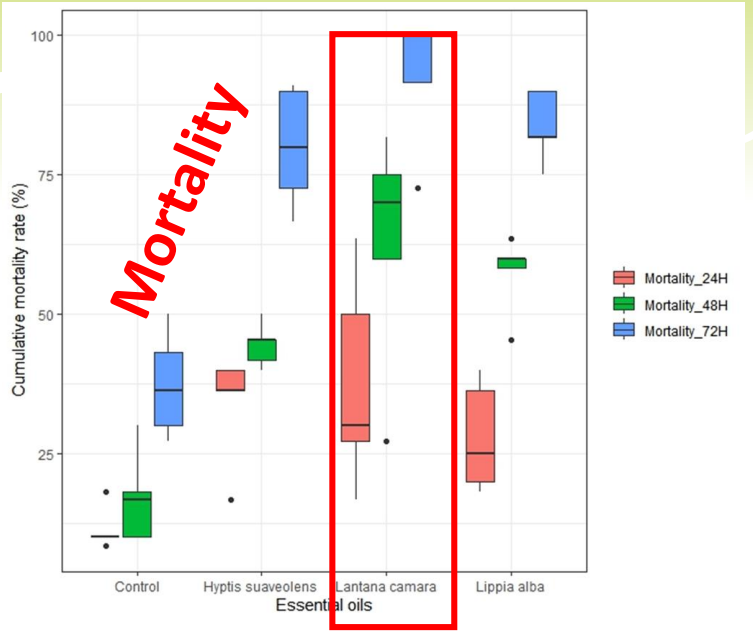
Drones for tsetse monitoring

Alternative ecologically-sound vector control compounds

Plant extracts used to assess repulsive and/or insecticide effect on tsetse flies:

- **Insecticidal effects:** knock down rate at 1 h and mortality at 24 h, 48h and 72h after tarsal contact with an impregnated support for 10 seconds)
- **Repellent effects:** Feeding rate after blood-feeding during 30 minutes using a feeders enclosed with impregnated membrane
- Positive control: deltametrin screen, negative control DMSO

- Burkina Faso: *Cymbopogon citratus*; *Mentha piperita*; Cc/Mp
- Senegal: *Hyptis suaveolens*, *Lantana camara*, and *Lippia alba*







- ***L. camara*** exhibited the greatest efficacy in terms of knock-down, mortality, and repellency, supporting its potential application as a biopesticide
- ***M. piperita*** could be used as an insecticide against tsetse flies when applied to animals or impregnated into inert baits
- ***C. citratus*** could be used as a natural repellent when applied to livestock skin or sprayed on livestock resting areas

Efficacy of impregnated screens including new Flyscreens

Activity implemented in 6 countries: with **East African Tiny Target** (EATT), **West African Tiny Target** (WATT), **Full Blue FlyScreen** (FBF) and **White and Blue FlyScreen** (WBF) using transparent sticky film for a comparative evaluation of their attractivity to hematophagous flies



EATT



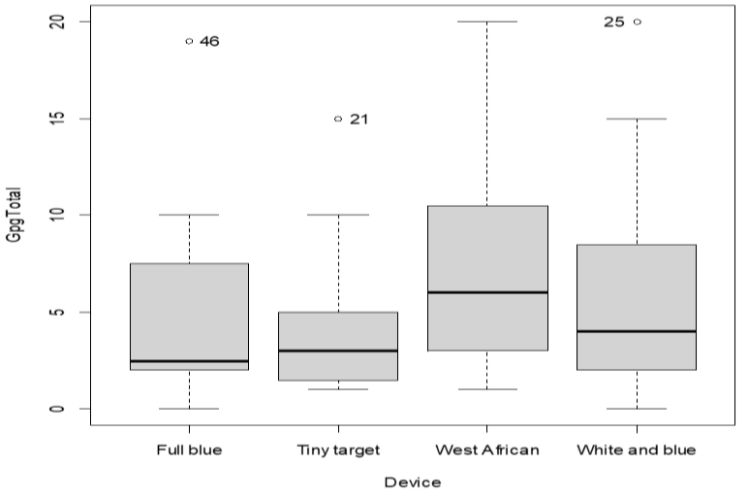
WATT



FBF



WBF



Cameroon (*Stomoxys* and Tabanids): EATT < **WATT**, WBF and **FBF**
Côte d'Ivoire (tsetse) : EATT and WBF < **WATT** and **FBF**
Tchad (*Stomoxys* and Tabanids): EATT < WBF and **FBF** < **WATT**
Burkina Faso (tsetse) : no differences between screens
Mozambique and **South Africa**: Activity still ongoing

So far, in most cases, WATT and **FBF** are the most attractive screens and not significantly different (except Chad); so **FBF** seems promising

Efficacy of biodegradable fly-trapping device



Protypes evaluated under Latin squares in **9 countries**; in most cases the BioflyTraps performances were lower than reference traps (Vavoua and Nzi), especially for *Stomoxys calcitrans* which affinity for Vavoua trap is very high
However, when considering all hematophagous flies , results are contrasted from a country to another



Nzi



P23+



P38



Vavoua



P23



P32

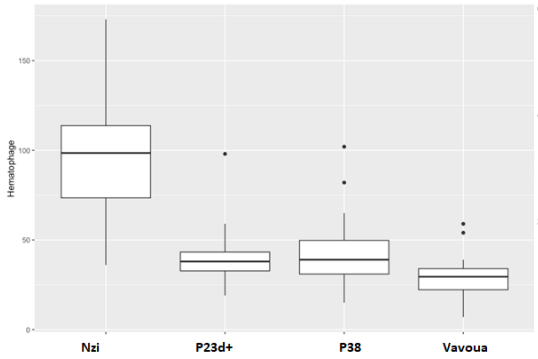


P33

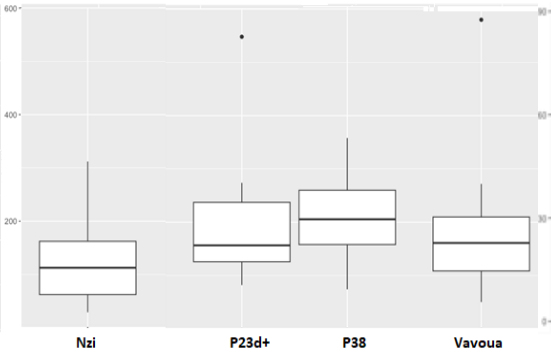
Tchad (Stomoxys and Tabanids):
Vavoua < P23+ and P38 < Nzi

Burkina Faso (tsetse) :
Nzi < P23+, P38, Vavoua

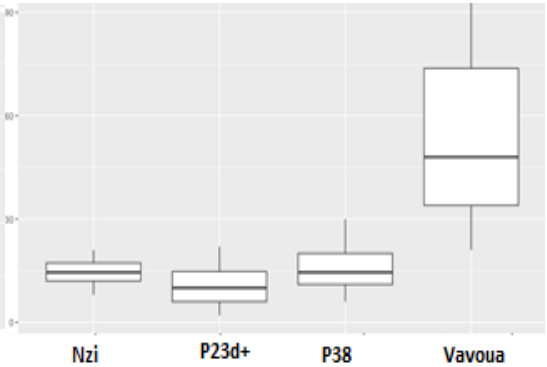
Canaries Islands (Stomoxys):
Nzi, P23+, P38 < Vavoua



Chad

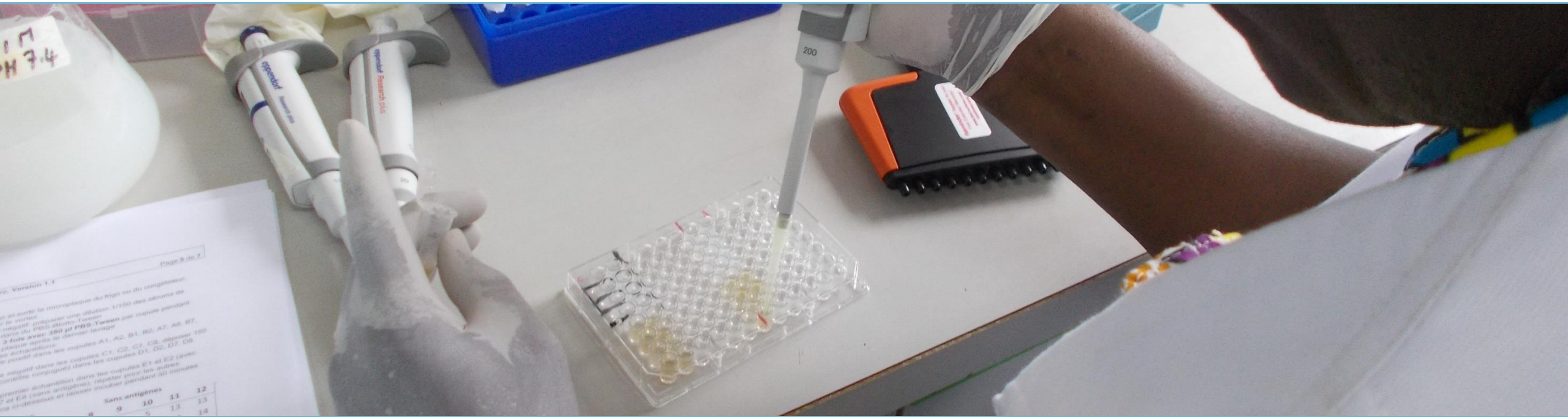


Burkina Faso



Canary Island

Ongoing in **Côte d'Ivoire**, **Mozambique**, **South Africa**, **Senegal**
Planed for the coming year in **Tunisia** and **Mauritania**



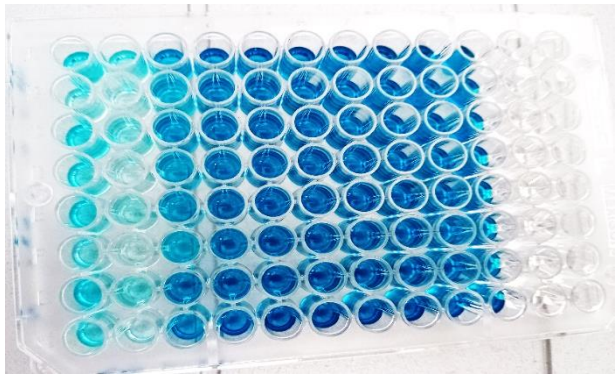
Diagnosis

- **Tsetse saliva** antibody detection ELISA
- Improved Ab detection **ELISA based on trypanosome lysates**
- AT antibody detection **ELISA based on recombinant antigens**
- **RFID capture tests**
- **cMDH capture test**

Diagnostic tests

- **Anti-tsetse saliva antibody detection**
  - Did not work at all
  - Abandonned

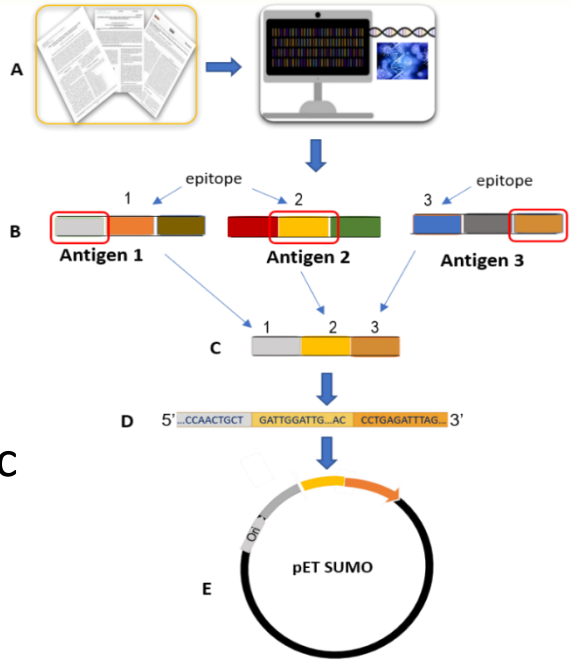
- **Antibody detection**
  - Whole tryp lysate based:
    - Improved using **lyophilised** antigen and reference sera
    - Improved using **in vitro-cultured** trypanosomes
    - In vitro cultured ***T. evansi*** can be used as **pan-tryp** test
  - Recombinant antigens-based (**chimeras**)

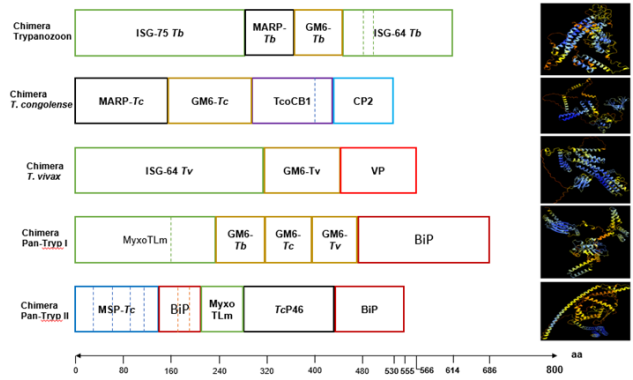


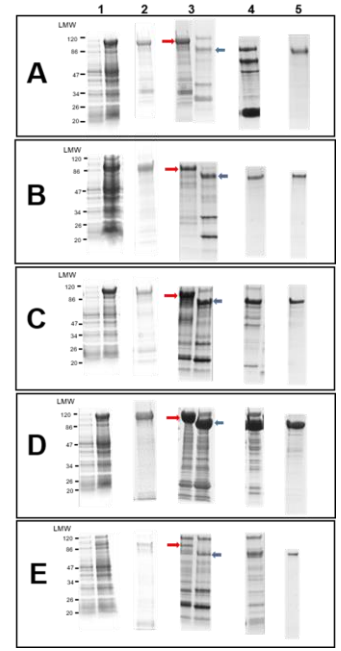
- **Antigen-capture tests**
  - cMDH-based (detection by colorymetric assay)
    - Good results with polyclonal, nothing with monoclonals
    - Showed a potential also for antibody detection
  - RFID-detection test

Innovative approach using multivalent chimeric recombinant antigens

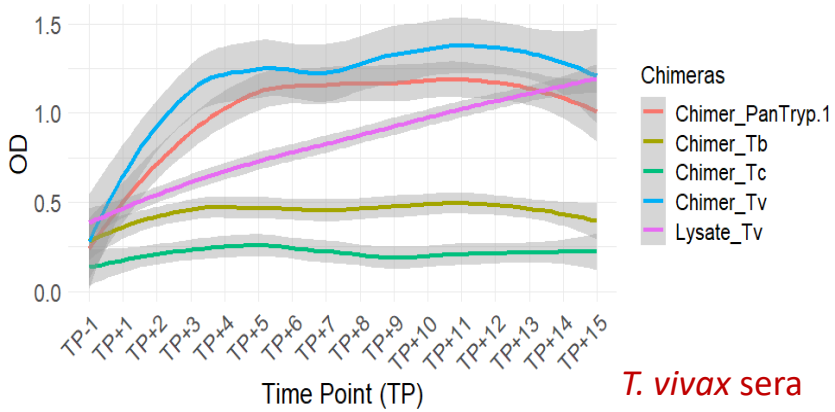
- Multiepitope proteins (chimeras) designed from known immunodominant antigens
  - Three species specific *Tb, Tc, Tv*
  - Two pan-trypanosome
- Recombinant expression/purification successful
  - One pan-tryp works very well, not the other
  - Chimer-Tc and chimer-Tv work very well, not Chimer-Tc
  - Compare favorably with lysate-based ELISA
  - Species-specific *congo* and *vivax*



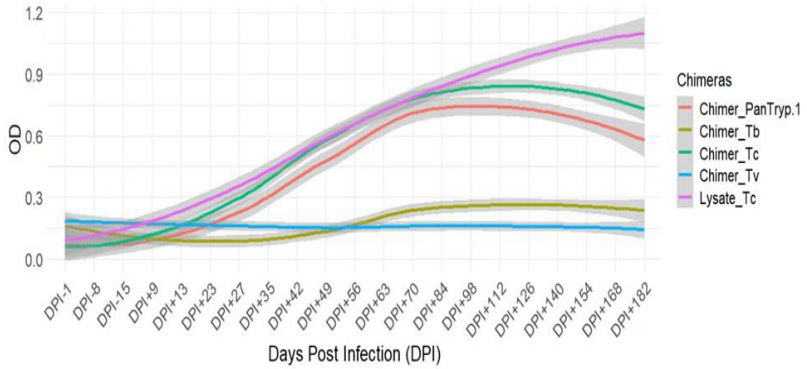




Need further extensive evaluation beyond COMBAT



T. vivax sera

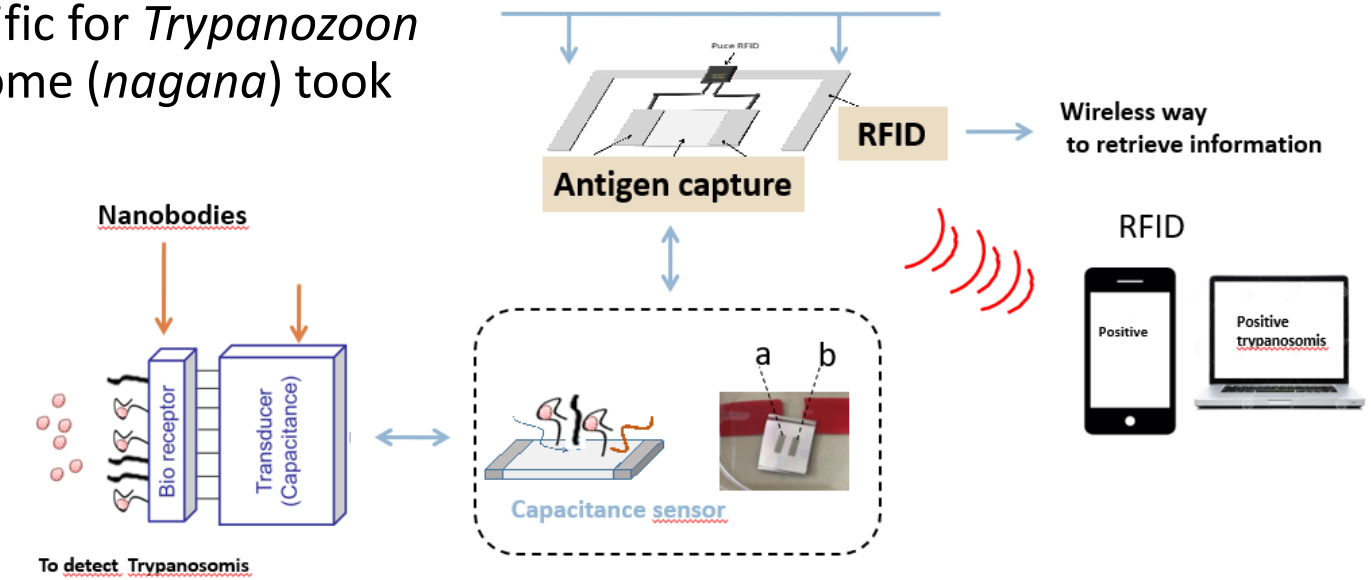


T. congo sera

Develop antigen RFID capture test

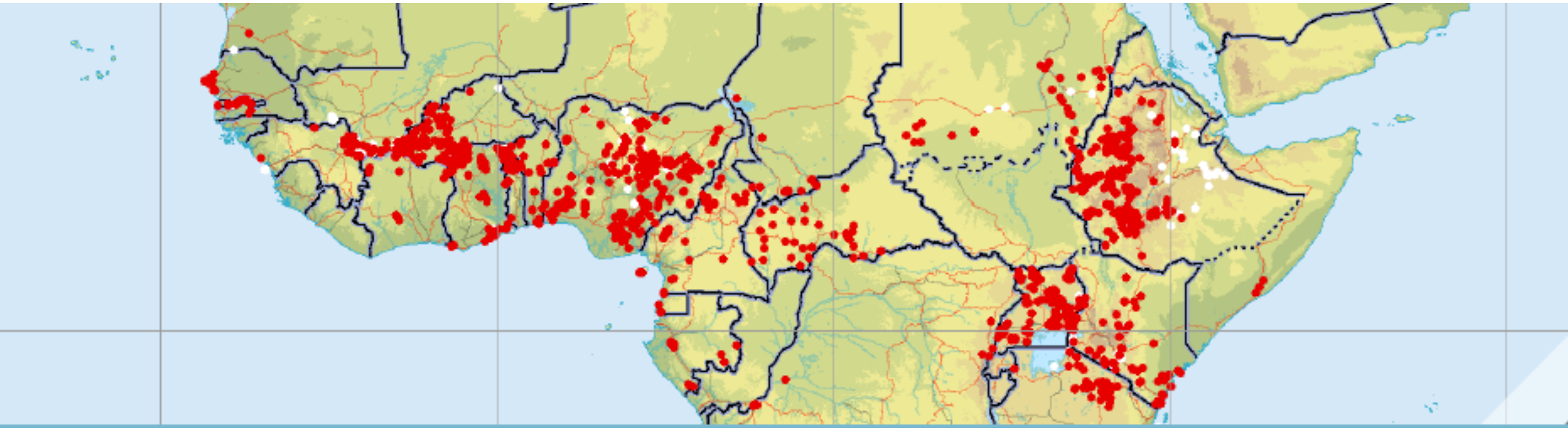
- Aim: Develop a RFID sensor based antigen capture test for rHAT, *surra* and *nagana*.
  - Principle: Capture of trypanosome antigen on the sensor changes its electrical properties, and is detectable with a radio frequency reader
- Results:
  - Failure to develop a functional RFID sensor
  - Identification of nanobodies specific for *Trypanozoon* (rHAT & *surra*) and pan-trypanosome (*nagana*) took more time than expected

- Perspectives:
  - Characterisation of recently identified nanobody pairs for antigen detection by ELISA or RDT





Pillar III – Risk-based control strategies



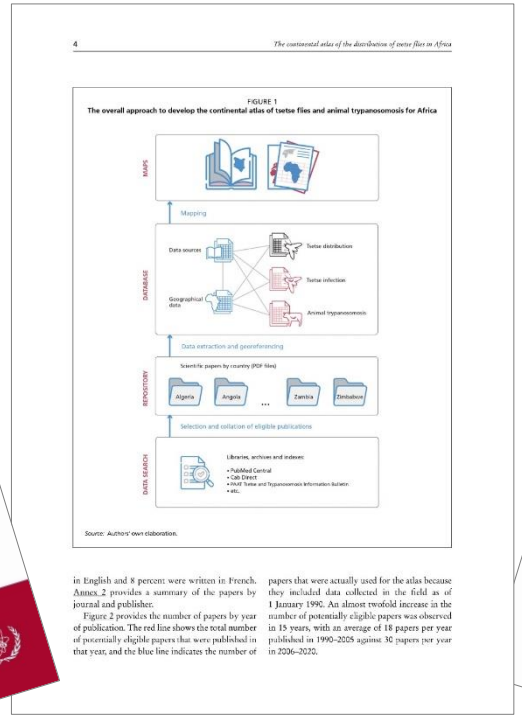
Information and surveillance system and the risk of spread (WP3)

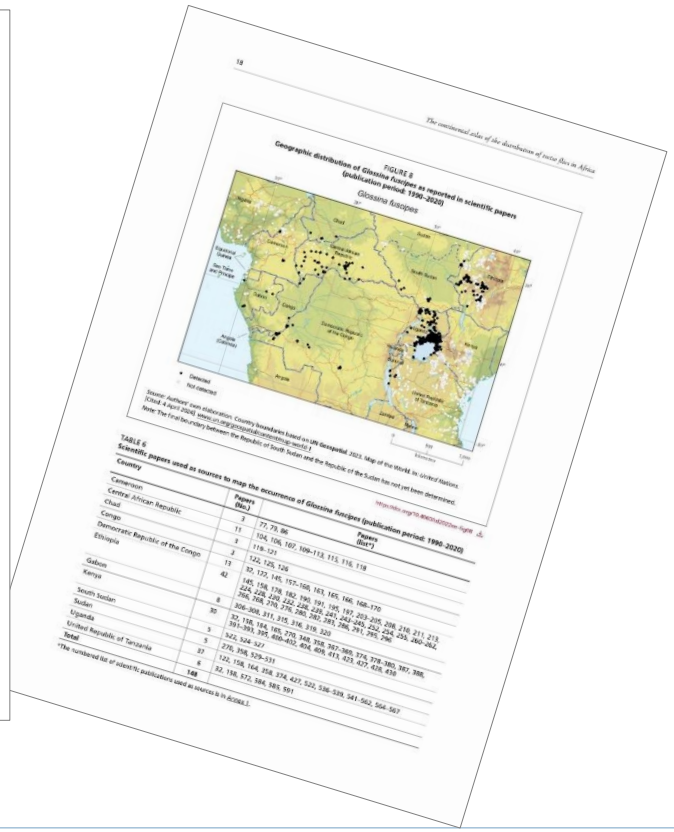
- To develop/update information systems/atlases of AT and vectors
  - Continental atlas
  - National atlases
- To strengthen national surveillance systems/networks
- To develop geospatial models to map disease risk
- To assess and model the risk of AT entry into Europe

Continental Atlas of Tsetse flies

- Continental atlas of tsetse flies and animal trypanosomosis completed for 1990-2020
  - Tsetse distribution component published
  - Animal trypanosomosis component to be published in 2026
  - Open access and open data policy adopted (freely downloadable datasets)

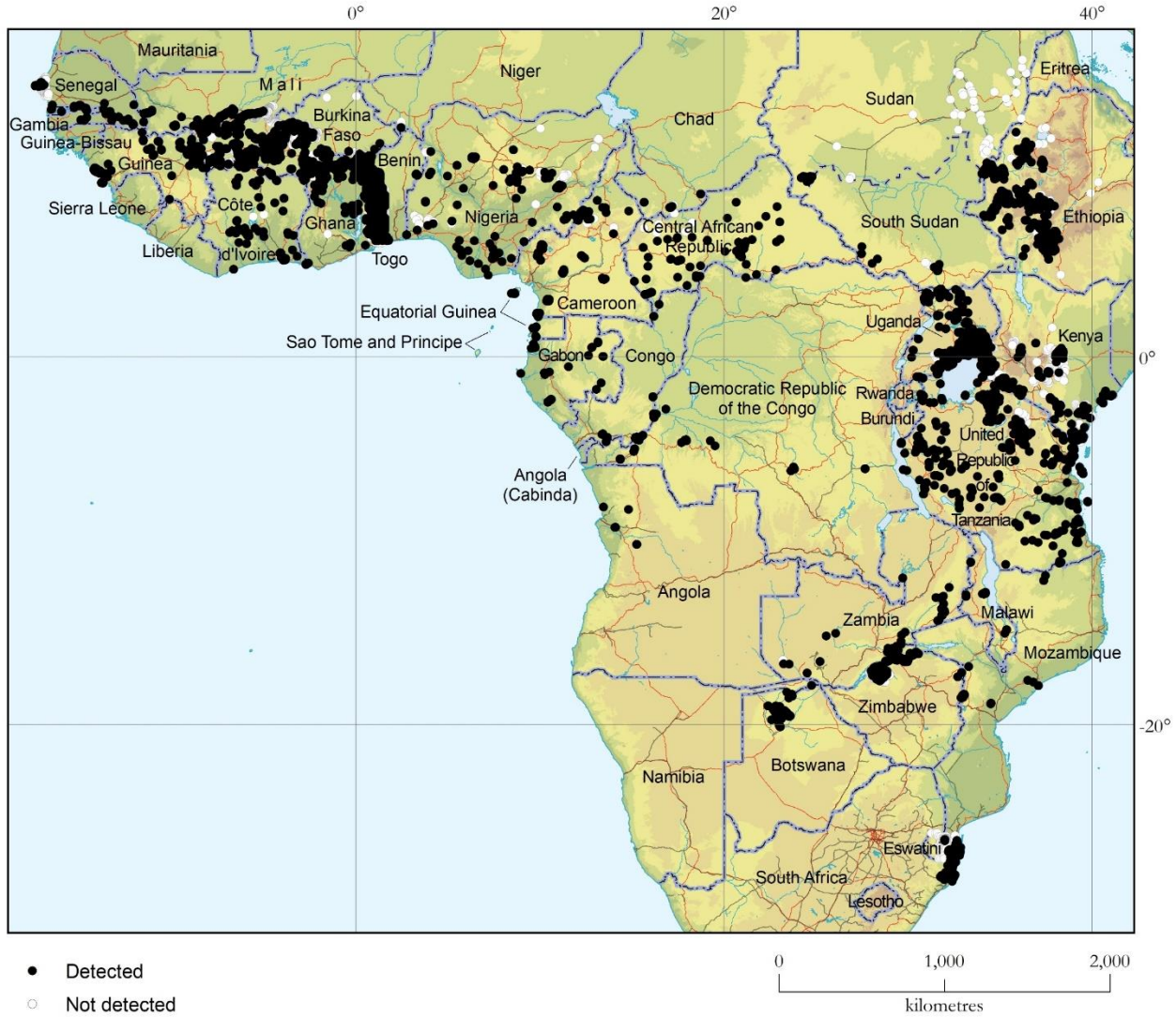






Food and Agriculture Organization of the United Nations

Tsetse flies (*Glossina*)



Geographic distribution of tsetse flies (genus *Glossina*) as reported in scientific papers (publication period: 1990–2020).

Source: Cecchi, G., Paone, M., de Gier, J. and Zhao, W. 2024. *The continental atlas of the distribution of tsetse flies in Africa.* PAAT Technical and Scientific Series, No. 12. Rome, FAO. https://doi.org/10.4060/cd2022en

Disclaimer: The boundaries and names shown and the designations used on this map do not imply the expression of any opinion whatsoever on the part of FAO concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers and boundaries. Dashed lines on maps represent approximate border lines for which there may not yet be full agreement. The final boundary between the Republic of South Sudan and the Republic of the Sudan has not yet been determined.

https://doi.org/10.4060/cd2022en-fig03

National Atlases

- National atlases of AT and its vectors
  - 8 new atlases developed
    - Cameroon, Chad, Côte d'Ivoire, Mozambique, Senegal, South Africa, Spain, Zambia
  - 4 previously existing atlases enhanced and updated
    - Burkina Faso, Ethiopia, Kenya, Zimbabwe
  - Publications
    - Spain
      - AT: https://doi.org/10.3390/ani14020243
      - Vectors: https://doi.org/10.1186/s13071-025-06922-9
    - Zambia
      - Submitted
    - Others
      - Under preparation

National Atlases



National atlases (progress status)

- Not initiated
- Initiated
- Developed
- Developed and published
- Developed, published and updated



National atlases (COMBAT countries)

- New atlas developed
- Existing atlas enahnced and updated

COMBAT contributed substantially to the development of national atlases

Risk of spread

- Models of AT and vector distribution and risk
  - Tsetse distribution modelled in Kenya and Côte d'Ivoire
    - Kenya paper accepted for publication: https://doi.org/10.1186/s13071-025-06938-1
    - Côte d'Ivoire drafted
- Risk of introduction and exposure of AT in continental Europe assessed
  - Low risk overall (Almost zero to very weak", i.e. 1 to 4 on a maximum scale of 9)





Socio-economic Burden (WP4)

- Continental level
- National level
- Priority areas
- Zone under HAT control

Socio-economic Burden (WP4)

Objectives of WP4

- ✓ **Complement the work done by the other WPs** with information about the cost of this disease
- ✓ **Help policy makers understand the importance of AT** in different settings and to **prioritise funding** accordingly.

Structure

- ✓ **Four levels:** 1) continental 2) national 3) local and 4) impact of specific interventions.
- ✓ Includes **9 COMBAT countries**

Task 4.1: Continental burden

- ➢ **Review of the literature on disease impacts** 

  Papers range from longitudinal monitoring of T+/T- livestock to cross-sectional surveys comparing areas **with/without** the disease or tsetse control or **before/after** tsetse control. They give evidence of disease impact on **mortality, calving rates, milk yields** and **animal traction**.

	With	Without
Before	✓	✓
After	✓	✓

- ➢ **Calculation of the cost of the disease** to livestock keepers is being linked to AT continental atlas and modelled so as to give upper and lower values. Although a single quotable monetary figure is what people look for, a more **nuanced estimate** is required to be both **realistic** and **credible**.

Task 4.2: National burden

Combines aspects of the methodology of Task 4.1, with the practical and country-specific information collected in Task 4.3 and the prevalence and other data collected by countries in national atlases.

Task 4.3: Burden of AT in priority areas for intervention

By the end of 2024, nearly 2000 in-depth livestock keeper interviews had been done. These examined farmers' perceptions of the disease, animal productivity and disease costs in areas with different prevalence levels/tsetse control situations.

Country	Zones	Interviews
Burkina Faso	12	322
Chad	3	253
Cameroon	3	77
Côte d'Ivoire	2	134
Kenya	2	430
Senegal	3	480
South Africa	7	68
Sudan	2	78
Uganda	2	192

Cameroon and South Africa joined WP4 later in the project with more limited funding and are undertaking more interviews.

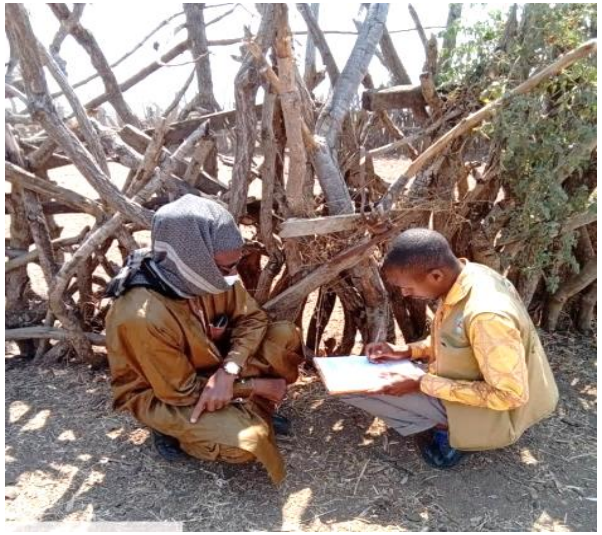


Impact on AAT from vector control undertaken to control HAT



Chad

Looked at 3 similar areas, 2 with tsetse control. Found important differences between areas and before/after tsetse control, in terms of riverine land use, agricultural cultivation and use of work oxen.



Côte d'Ivoire

Looked at 2 similar areas with tsetse control. Cattle keepers described improvements in overall animal and human health and reduced calf mortality and expenditure on trypanocides



Guidelines and national strategies in line with the PCP

WP5 - Objectives

- To develop and publish operational **guidelines** for the PCP for AT
- To hold regional **workshops** to create awareness, improve understanding and promote the use of the PCP approach in national strategies and policies.
- To develop national **strategies** and **roadmaps** for AT control in line with the PCP

PCP guidelines



- Drafts of PCP guidelines completed (2). Publication planned in 2026.
  - General
    - The progressive control pathway for African animal trypanosomosis: Operational guidelines
  - Thematic
    - Guidelines on animal trypanosomosis treatment and the management of drug resistance

PAAT TECHNICAL AND SCIENTIFIC SERIES 13

The progressive control pathway for African animal trypanosomosis
Operational guidelines

DRAFT

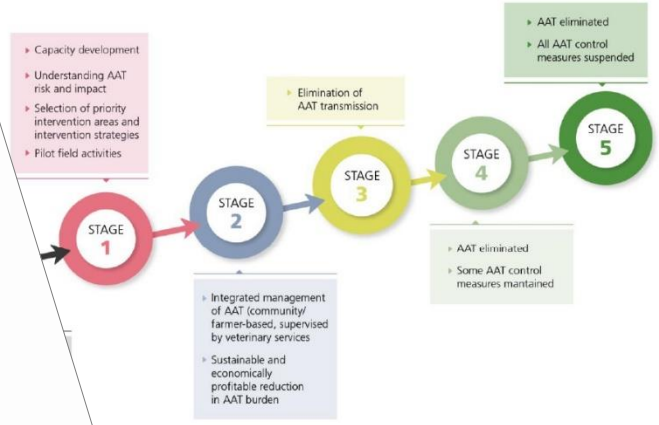
Published by
FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS
Rome, 2026

Chapter 4

PCP STAGES

The PCP-AAT is constituted by five stages, plus a pre-entry level (Below Stage 1). The self-declaration of free-status to the WOAH (WOAH, 2024b) (WOAH, 2025) could be considered as an additional stage (a "Stage 5+").

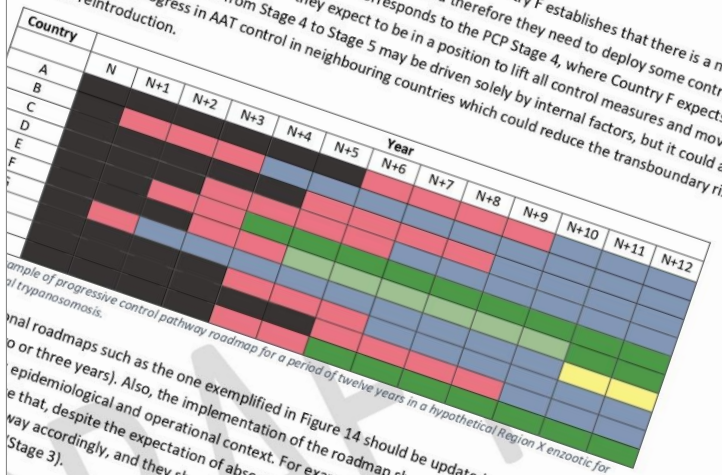
ure 4 shows the pathway in its basic form, with a stepwise progression from 'Below Stage 1' to 'Stage 5'. sible substages for stage 1 and 2 as well as possible fast-tracking options are not shown in Figure 4, but are described in the corresponding section of Chapter 5.



thway for African animal trypanosomosis. Adapted from Diall et al. 2017.

is chapter we outline, for each stage, the main objective, specific outcomes ctivities.

risk and that therefore they can move to Stage 5; by contrast, Country F establishes that there is a non-negligible risk of AAT reintroduction or re-emergence, and therefore they need to deploy some control measures to minimize this risk. This situation corresponds to the PCP Stage 4, where Country F expects to remain for six years, following which they expect to be in a position to lift all control measures and move to Stage 5. This last transition from Stage 4 to Stage 5 may be driven solely by internal factors, but it could also be enabled by progress in AAT control in neighbouring countries which could reduce the transboundary risk of AAT reintroduction.



ample of progressive control pathway roadmap for a period of twelve years in a hypothetical Region X enzootic for al trypanosomosis.

nal roadmaps such as the one exemplified in Figure 14 should be updated at regular intervals o or three years). Also, the implementation of the roadmap should be continuously adjusted epidemiological and operational context. For example, should Stage 1 surveys in countries E e that, despite the expectation of absence, AAT is in fact present, these countries should way accordingly, and they should plan as the next step either a reduction (Stage 2) or an (Stage 3).

y in a geographically explicit manner five snapshot of the roadmap in Figure 14. This n, whilst conceptually identical to the one in Figure 14, is more useful to appreciate ension of AAT control. Arguably, such as dimension is particularly important when ted, as reinvasion of tsetse flies or reintroduction of AAT from neighbouring the progress made in a given country. However, the roadmap in Figure 14 and staging at the country level, which blurs differences within countries and here the transboundary dimension of AAT may play a bigger role. A better ould be gained by developing PCP roadmaps at the subnational level and al level.

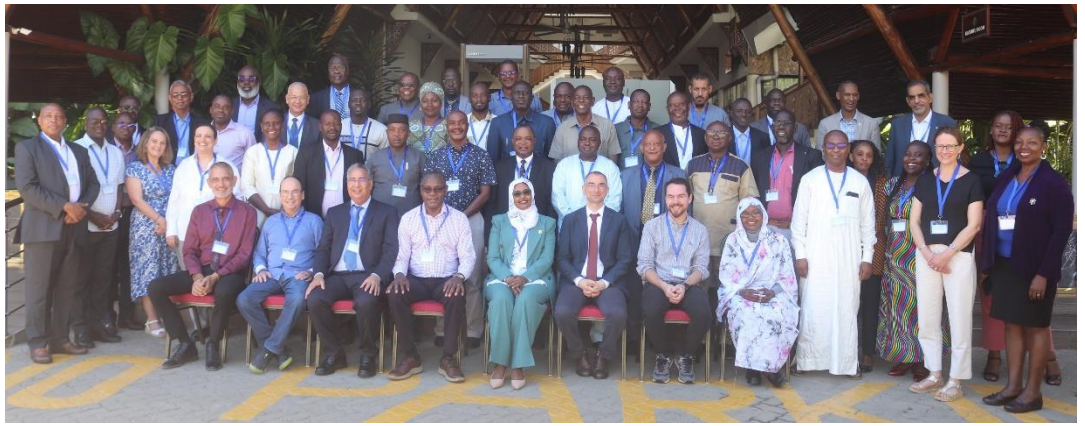


Regional workshops

- Regional/multi-national/multi-stakeholders workshops held (3)
  - 22–23 September 2022
    - CIRAD/IRD, Montpellier, France. Participants: **36**
  - 4–6 June 2024
    - FAO Headquarters, Rome, Italy. Participants: **29**
  - 24–26 March 2025
    - AU-IBAR organized, Mombasa, Kenya. Participants: **57**







National workshops (with FAO)

- Kenya
  - May 2021



- Chad
  - October 2022



- Côte d'Ivoire
  - August 2023



- Cameroon
  - March 2023



- South Africa
  - 17 April 2023



- Mozambique
  - 19 April 2023



- Zambia
  - November 2023



- Senegal
  - March 2024



- Zimbabwe
  - November 2023



- Burkina Faso
  - May 2024



National workshops (without FAO)

- Kenya
  - March 2023
  - January 2024
  - March 2024







- Ethiopia
  - 26-31 January 2024
  - 28 March – 11 April 2024





- Zambia
  - Two workshops



Strategies developed

- National strategies
  - 12 countries developed national strategies in line with the PCP. Finalization and endorsement ongoing.
    - Cameroon, Chad, Côte d'Ivoire, Mozambique, Senegal, South Africa, Spain, Zambia, Burkina Faso, Ethiopia, Kenya, Zimbabwe
- Continental strategies
  - AU-IBAR initiated the development of a continental strategy in line with the PCP.



Pillar IV- Capacity and commitment

Overview



- Enhance academic qualifications (MSc and PhD students, and post-docs)
- Training for best practice in AT control
- National trainings organised by each partner
  - Capacity building
  - stakeholder awareness-raising activities
  - Advocacy towards policy-makers
- Reinforcing AT research and control infrastructure

Higher training

- 22 Msc
- 2 DVM
- 21 PhD
- 4 Post-docs



Training for best practice in AT control

Genotyping, population genetics and data analysis. Two workshops organized in Senegal and Côte d'Ivoire. M36

Metabarcoding. Three workshops organised in Senegal (ISRA), Canary Islands (ULPGC) and Mozambique (UEM) M19-M36

Trapping and identification of AT vectors. Two workshops, one for French- (Burkina Faso, CIRDES) and one for English-speaking (Kenya, ICIPE) project partners. M13-M24

Bioinformatics. One workshop organised in Mozambique (UEM). M25-M36

Data analysis using R software. One workshop for 20 people organised in Senegal (ISRA). M25-M36

AT diagnosis (parasitology, ELISA, lateral flow, PCR). Two workshops, one for French- (Burkina Faso, CIRDES) and one for English-speaking (Mozambique, UEM) partners M18

Regional level GIS training. Two workshops, one for French- (Senegal, ISRA) and one for English-speaking (Kenya, ICIPE) project partners. M36

Basic principles of AT burden assessment. E-learning courses with practical exercises, in both English and French. M7-M12

Methods to discriminate between sterile tsetse flies and wild tsetse flies in the context of SIT-based tsetse elimination programmes. One training organised in Senegal (ISRA). M48

Comparison of attracting devices for the control of tsetse flies. Six trainings organised in Côte d'Ivoire, Canary Islands, Sudan, South Africa, Mozambique and Chad M24

Training on the state-of-the-art techniques RFID and others AT diagnostics developed in the course of COMBAT. Three trainings in Côte d'Ivoire (IPR), Mozambique (UEM), Sudan (CVRL) M37-M42

One scientist of **CIRDES specialized in entomology will realise two missions to support IRED** activities in Chad, particularly pertaining flies collection in the North and data handling M12-M48

Qualitative risk assessment. One training in the Canary Islands M48

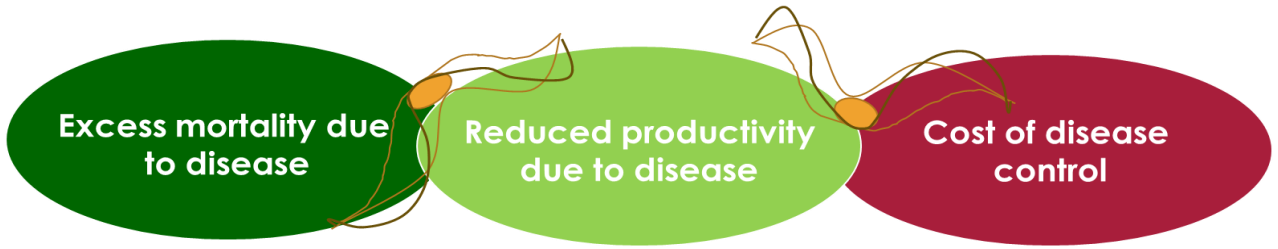
Development of national atlases of AT and its vectors. Nine trainings in Cameroon, Chad, Côte d'Ivoire, Mozambique, Senegal, Sudan, Ethiopia, Zambia and Kenya M1-M36

Twelve one week individual focused training on data management, quality assurance, documentation (WP3) at FAO (Rome) for partners involved in the creation of atlases M1-M36

Online course “Basic principles of Animal Trypanosomosis burden assessment”

- Held over 5-week period, Nov/Dec 2022, 1 – 2 days of work per week
- 34 participants registered, including all 15 COMBAT countries, half were able to fully participate
- Bilingual, with course materials, exercises and lectures in both French and English
- Also, speakers from within and outside COMBAT talked about their fieldwork on this topic

- Alexandra Shaw



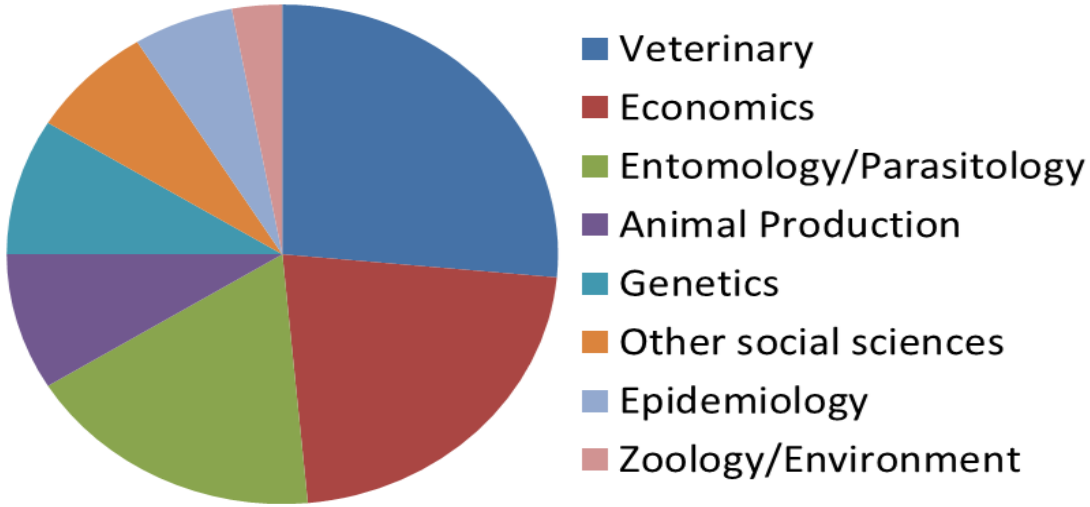


Fig. 1 – Participants’ academic backgrounds

Training Workshop on Mechanical Vectors



- **Objective:** To provide comprehensive training on the main insect vectors of trypanosomes and the setting of traps
- **Methodology:** The workshop combined theoretical sessions, hands-on field activities, and practical sessions for two weeks
- M. Desquesnes & G. Gimmoneau (CIRAD)



ULPGC/Spain 16-20 May 2022 (Canary Islands)
IPR/Côte d'Ivoire, from 7 to 11 November 2022
UEM/Mozambique June 5-13, 2023: 6 scientists and students
ARC/South Africa April 5-12, 2024, 11 participants from
ENMV/Tunisia July 17-23, 2024, 4 participants



ONARDEP/Mauritania, October 1-12, 2024, 6 participants
ENMV/Tunisia, November 15-30, 2025, 12 participants

Workshops on the development of the national atlas of animal trypanosomosis (AT) and its vectors

Giuliano Cecchi (FAO)

- **KENTTEC/Kenya**: 15-22 May 2022, 30 participants
- **IRED/Chad**: 8-16 October 2022, 16 participants
- **AHI Ethiopia**: 4-10 December 2022, 15 participants
- **MSEG/Cameroon**: March 14-15, 2023, 33 participants
- **ARC/South Africa**: April 11-13, 2023 4 participants
- **UEM/Mozambique**: April 17-18, 2023 8 participants
- **IPR/Côte d'Ivoire**: August 22-23, 2023 14 participants
- **TTCU/Zambia**: November 15-16, 2023 12 participants
- **TCD/Zimbabwe**: November 21-22, 2023 11 participants
- **ISRA/Senegal**: March 26-27, 2024 11 participants
- **DGELMA/Burkina Faso**: May 13-14, 2024 10 participants
- **ENMV/Tunisia**: March 2025
- **AHI/Ethiopia**: July 2025















Communication, dissemination, exploitation

OPEN LETTER

Open Research Europe 2022, 2:67 Last updated: 15 AUG 2022

Check for updates

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OPEN LETTER

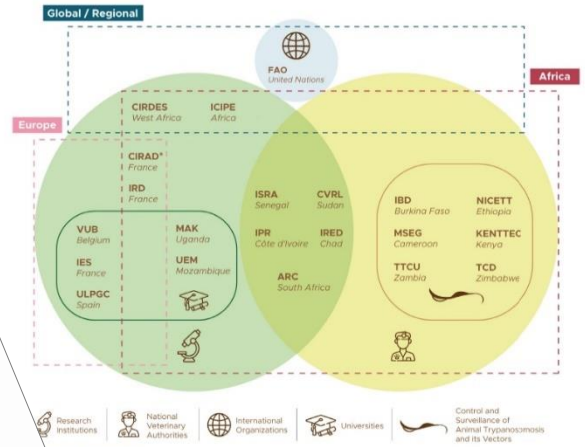
REVISED

The COMBAT project: controlling and progressively minimizing the burden of vector-borne animal trypanosomosis in Africa [version 2; peer review: 3 approved]

Alain Boulangé[1,2*], Veerle Lejon[3*], David Berthier[2,4], Sophie Thévenon[2,4], Geoffrey Gimonneau[2,5], Marc Desquesnes[2,6], Samuel Abah[7], Prudencième Agboho[8], Kalinga Chilongo[9], Tsegaye Gebre[10], Assane Gueye Fall[11], Dramane Kaba[12], Stefan Magez[13], Daniel Masiga[14], Enock Matovu[15], Aldjibert Moukhtar[16], Luis Neves[17,18], Pamela A. Olet[19], Soumaïla Pagabeleguem[20], William Shereni[21], Brice Sorli[22], Moeti O. Taioe[23], María Teresa Tejedor Junco[24], Rehab Yagi[25], Philippe Solano[3], Giuliano Cecchi[26*]

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* Equal contributors



oject Coordinator

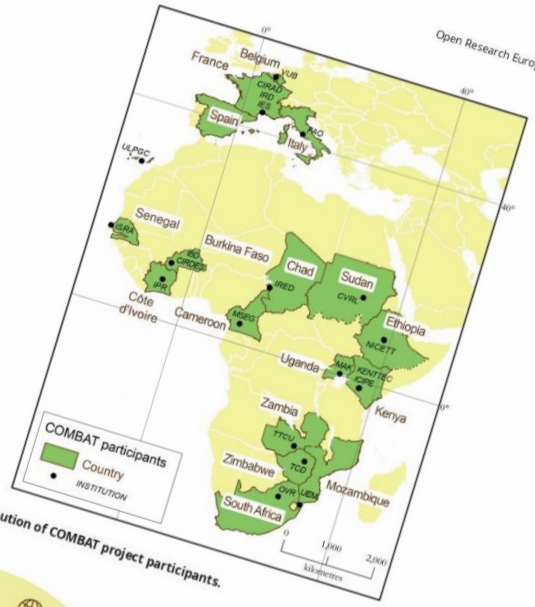
roject consortium. The list of acronyms is in Table 1.

m interventions against bovine
ca were estimated at approxi-
20-year period, at an average of
of affected area (Shaw *et al.*,

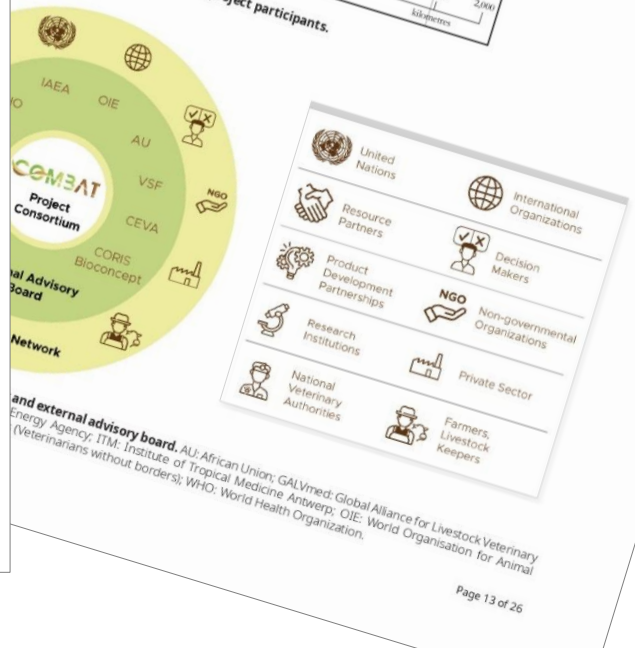
million people (52% of the
e to severe food insecu-
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increased meat and
d mortality, improved
of soils) (Swallow,
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the control tools
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of meat by
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rica, COMBAT will
e, thus decreasing the need

As to SDG3, the project will contribute to good health and well-being through new vector control tools and improved diagnostics, which will support the ongoing HAT elimination initiatives. At a time when the COVID-19 pandemic has drawn the world's attention to zoonoses, the control of African trypanosomoses provides an example of the need for and potential of the One-Health approach.

While the project main impacts will be on SGDs 1, 2 and 3, COMBAT will also contribute to other SDGs. For example, increased income will benefit smallholder households, not least women and children (SDG 4 and 5). Increased livestock production will strengthen value-chains, for instance by boosting the dairy sector (Swallow, 2000), creating employment in food industries (SDG8) and decreasing reliance on food imports. Healthier, disease-free animals can also contribute to climate change mitigation and adaptation (SDG13) (FAO, 2020a), because AT-free animals have lower emissions intensity (i.e. lower emissions per unit of product) (MacLeod *et al.*, 2018), whilst at the same time they enhance the resilience of communities. COMBAT will also increase knowledge of local animal genetic resources and shed light on how certain livestock species and breeds cope better with AT (FAO, 2020b). This will contribute to raising awareness of livestock biodiversity, inform the conservation of animal genetic resources (SDG 15), and provide data for the development of livestock genomics. Finally, with its large consortium of participants and broad external



graphical distribution of COMBAT project participants.

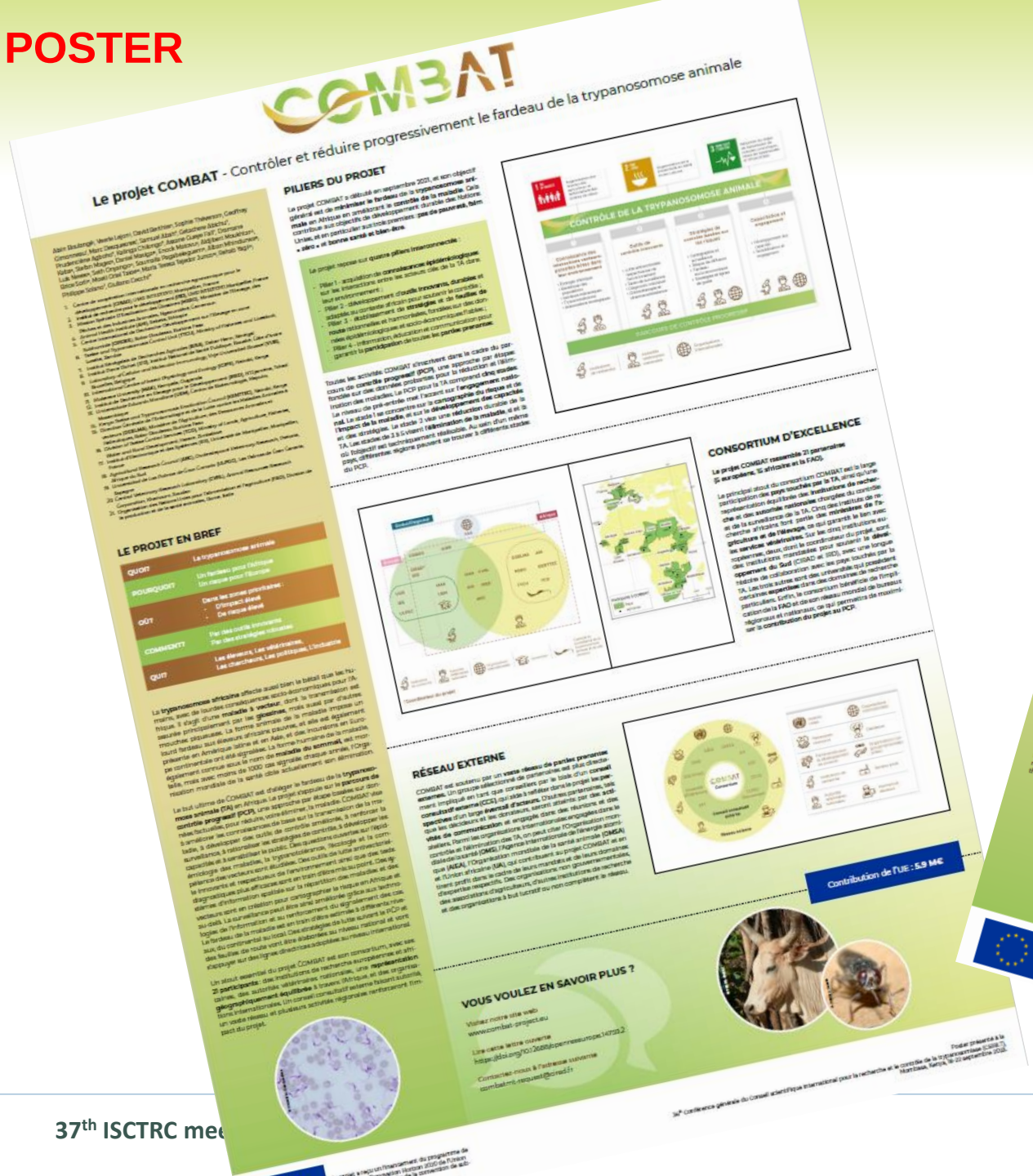


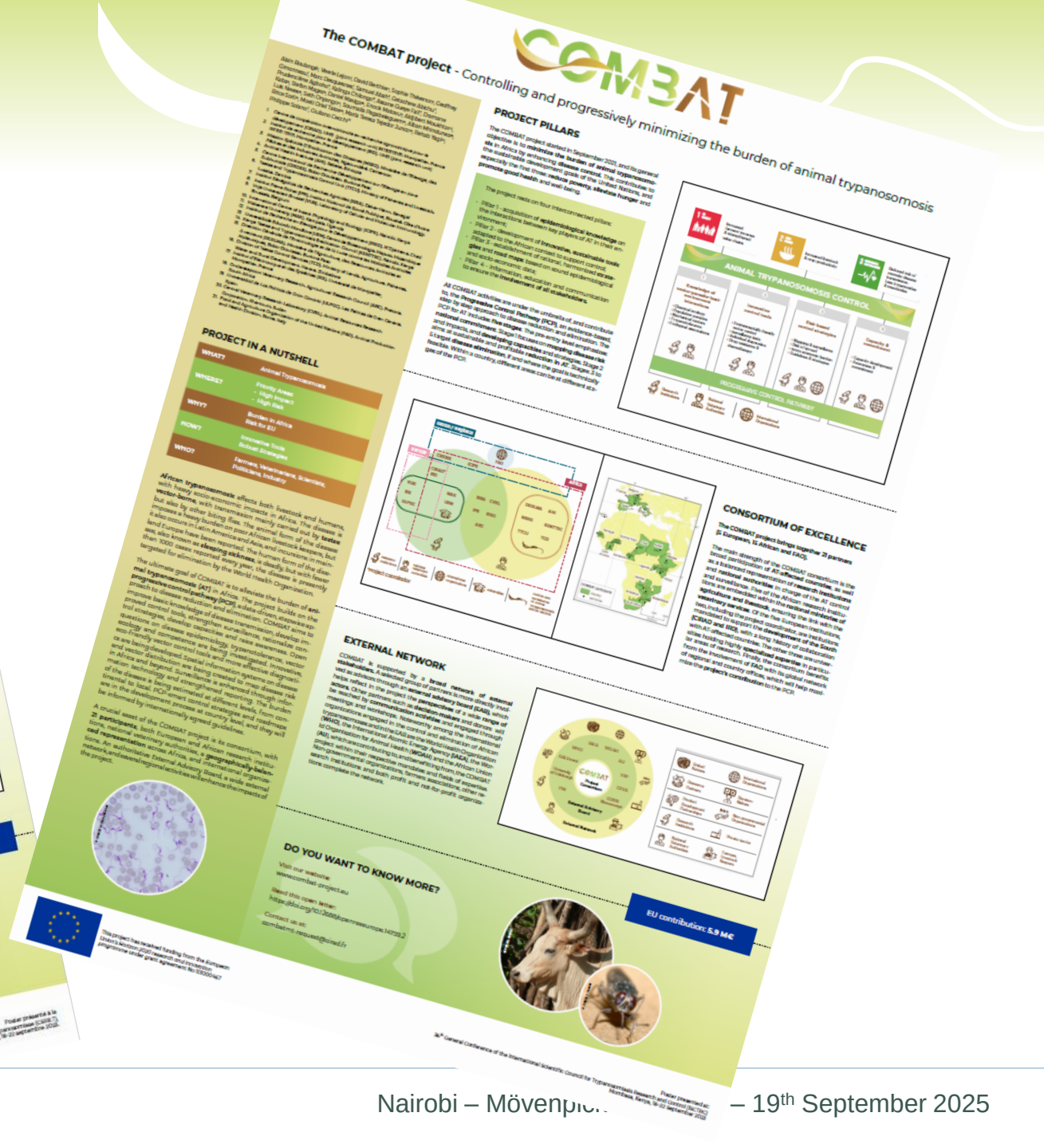
and external advisory board. AU: African Union; GALVmed: Global Alliance for Livestock Veterinary
Energy Agency; ITM: Institute of Tropical Medicine Antwerp; OIE: World Organisation for Animal
(Veterinarians without borders); WHO: World Health Organization.

https://doi.org/10.12688/openreseurope.14759.2

Boulangé *et al.*, 2022

POSTER


COMBAT
Le projet COMBAT - Contrôler et réduire progressivement le fardeau de la trypanosomose animale
PILIERS DU PROJET
CONTRÔLE DE LA TRYPANOSOMOSE ANIMALE
LE PROJET EN BREF
CONSORTIUM D'EXCELLENCE
RÉSEAU EXTERNE
Contribution de l'UE : 5.9 M€
VOUS VOULEZ EN SAVOIR PLUS ?


COMBAT
The COMBAT project - Controlling and progressively minimizing the burden of animal trypanosomosis
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ANIMAL TRYPANOSOMOSIS CONTROL
PROJECT IN A NUTSHELL
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EU contribution: 5.9 M€

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COMBAT

COntrolling and progressively Minimizing the Burden of Animal Trypanosomosis

PROJECT | OBJECTIVES | EPIDEMIOLOGICAL KNOWLEDGE | INNOVATIVE CONTROL TOOLS | RISK-BASED CONTROL STRATEGIES | CAPACITIES / INSTITUTIONS | IMPACT | RESOURCES



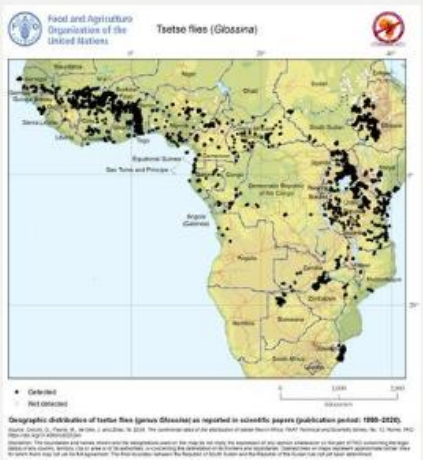
News



COMBAT support training course "Unveiling the Secrets of the Tsetse Fly: A Deep Dive into Metabarcoding", held in Maputo, Mozambique

07/01/2025

Within the framework of the COMBAT project, a training course on metabarcoding



FAO released the new continental atlas of the geographic distribution of tsetse flies (genus Glossina) for Africa

08/10/2024



September 16th-20th - COMBAT's Third Annual Meeting takes place in Côte d'Ivoire: Shaping the Future of AT control

19/08/2024

COMBAT partners are convening in Grand-Bassam, Côte d'Ivoire, for their annual progress meeting. After three years of...

www.combat-project.eu/

Conferences



36th ISCTRC Mombasa: 10 presentations, 10 posters



37th ISCTRC Nairobi: 18 presentations, 6 posters

Key achievements

- Set of pheromones from tsetse and *Stomoxys* identified to improve traps
- Better knowledge of vector competence
- Extensive epidemiological data on tsetse, mechanical vectors, trypanosome species present
- Insights into the determinism of trypanotolerance
- Development of biodegradable traps, assessment of efficacy of flyscreens
- Ab-ELISA: Improvement of accessibility of WTL, promising new test based on chimeras

- Continental atlas of tsetse flies published
- 8 national atlas developped, 4 enhanced
- Extensive socio-economic data collected at a range of scale
- PCP guideline drafted
- Advanced high-level PCP-advocacy campains conducted

- Training and awaness activities touching > 1000 people realised for all stakeholders
- 15 scientific papers published, 5 accepted, many in preparation

Last year of the project

- Continue collecting epidemiological data
- Compare Ab-ELISA test (WTL vs recombinant)
- Complete a study on genetic diversity of livestock at risk of trypanosomosis
- Complete the assessment of biodegradable traps

- Get insight into the determinism of drug resistance through whole genome sequencing
- Attempt to develop a drug-resistance molecular test
- Test a new trypanocide (GALVmed)

- Publish the continental atlas of animal trypanosomosis
- Publish the cost of animal trypanosomosis at a range of scale
- Publish the PCP operational guidelines
- Continue publishing the outputs of COMBAT, aim >40 publications in the project time-frame

- Find a way to continue the COMBAT

Horizon2020
European Union Funding
for Research & Innovation

Asante kwa usikivu wenu
Merci de votre attention
Thanks for your attention

Funded by the European Union