RESEARCH PROGRAM ON Livestock

CGIAR

More meat, milk and eggs by and for the poor

Epidemiology and Control of Peste des Petits Ruminants (ECo-PPR) Study Design and Toolbox

A suite of tools toward understanding epidemiology and socio-economic impact of peste des petits ruminants

Barbara Wieland[1], Michel Dione[2], Bryony A. Jones[3], Zoë Campbell[4], Guy Ilboudo[5], Pacem Kotchofa[2], Erick Rutto[4], Edward Okoth[4], Nicoline de Haan[4] and Karl Rich[2]

[1]International Livestock Research Institute, Addis Ababa, Ethiopia

[2]International Livestock Research Institute, Dakar, Senegal

[3]Royal Veterinary College, University of London, UK

[4]International Livestock Research Institute, Nairobi, Kenya

[5]International Livestock Research Institute, Ouagadougou, Burkina Faso

Supported by IFAD through funding of the European Commission

CGIAR is a global partnership that unites organizations engaged in research for a food-secure future. The CGIAR Research Program on Livestock provides research-based solutions to help smallholder farmers, pastoralists and agro-pastoralists transition to sustainable, resilient livelihoods and to productive enterprises that will help feed future generations. It aims to increase the productivity and profitability of livestock agri-food systems in sustainable ways, making meat, milk and eggs more available and affordable across the developing world. The Program brings together five core partners: the International Livestock Research Institute (ILRI) with a mandate on livestock; the International Center for Tropical Agriculture (CIAT), which works on forages; the International Center for Research in the Dry Areas (ICARDA), which works on small ruminants and dryland systems; the Swedish University of Agricultural Sciences (SLU) with expertise particularly in animal health and genetics and the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) which connects research into development and innovation and scaling processes.

The Program thanks all donors and organizations who globally support its work through their contributions to the **CGIAR Trust Fund**.

1. Background on Eco-PPR project

Small ruminants are often important assets for livestock keepers in developing countries. They provide readily available cash when needed, are regarded as medium-term assets and sources of livelihood, are rich sources of protein and they fulfil socio-cultural functions. However, the multifunctional role of small ruminants is threatened by a high burden of disease, such as peste des petits ruminants (PPR). The control of PPR in endemic settings poses a series of challenges that need to be systematically addressed. The International Livestock Research Institute (ILRI), is implementing the Epidemiology and Control of Peste des Petits Ruminants (Eco-PPR) research project to support ongoing global PPR control and eradication efforts spearheaded by the PPR Secretariat of the FAO and OIE (OIE & FAO, 2015). The project focuses on existing research gaps and aims to provide research support to ongoing PPR control and eradication efforts in East (Kenya, Tanzania and Ethiopia) and West Africa (Senegal, Mali and Burkina Faso). The project will generate evidence to support surveillance and control actions in selected countries with emphasis on high risk areas that are difficult to reach with vaccination campaigns and may become pockets of infection (ILRI, 2019b).

The objectives of the project are to:

- Generate evidence on disease epidemiology, social networks and gendered disease impact.
- Develop frameworks to assess disease risk and feasibility of eradication under different control scenarios in remote high-risk areas.
- Validate and test vaccines and gender sensitive vaccine delivery models for specific epidemiological and geographical situations.
- Improve surveillance capacity and coordination at national and regional levels.

To fully understand the socioeconomic impact of PPR and challenges for control, an interdisciplinary approach that brings together social and biosciences should be followed. A collaborative effort was made to harmonize data collection across countries and partners. As a result, a study design and toolkit consisting of different methods and types of data collection tools was developed. Each tool addresses a specific set of data needs and when combined they

will provide in-depth understanding of the PPR situation of the country under research, which will help to identify entry points for evidence-based control of PPR.

2. Project inception workshop

A project inception workshop was organized to better shape the objectives and activities and put them into context according to research priorities set by local partners in respective countries. During the inception workshop held in June 2019 in Ouagadougou, Burkina Faso, the project research questions and activities were discussed and validated with key project partners and stakeholders and possible synergies with similar existing research and development projects in Africa identified (ILRI, 2019a). The project was re-organized into four research components:

- Epidemiology, socioeconomic impact and gender to fill existing knowledge gaps.
- Modelling PPR control to assess effectiveness of different control scenarios.
- Gendered vaccine delivery models and diagnostics to improve access to vaccines by livestock keepers.
- Capacity development and surveillance to provide an adequate enabling environment for control efforts.

Figure 1: Eco-PPR inception workshop in West Africa, 25th – 27th June 2019, Ouagadougou, Burkina Faso (photo credit: Michel Dione, ILRI)

3. Process development of the research methods

3.1. Main research questions

A list of research questions was generated by the project team. These informed the content and targeting of tools for various value chain actors.

The following questions were prioritized:

- ***What is the local knowledge of PPR?***
    - What are the common sheep and goat disease problems – local names, characteristics?
    - Do livestock keepers clearly characterize PPR disease?
    - Do men and women characterize PPR disease differently?
    - What is the awareness of vaccine among livestock keepers? What is their experience of using it? Does this vary by gender?
- ***What is the pattern of PPR occurrence?***
    - What is the history of PPR occurrence in this area – when, where, action taken? History of vaccination in the area?
    - Are there any current or recent outbreaks? – when, where, action taken?
    - PPRV disease occurrence during the study period
        - phylogeography and links to movement networks?
    - What are the higher and lower PPR risk "areas"? ("area" could be at multiple scales – village, group of villages, grazing area, district, part of country, ecosystem including cross-border)
- ***What are the factors influencing PPR occurrence?***
    - What are the patterns and drivers of sheep and goat movements in this area – when, where, how?
        - Flock movements – daily, seasonal?
        - Animals entering/leaving flock – trade, social exchange, religious festivity?
        - Trading practices and market network?

- Cross-border movements?

- What are the characteristics of the small ruminant production system in this area?
  - Livelihood system – relative importance of livestock, sheep & goats – contribution to livelihood?
  - Availability of resources?
    - Water - main sources of water for domestic use and for animals, do they pay for it?
    - Pasture?
    - Access to credit?
    - Access to markets?
    - Does access to these resources vary by gender?
  - Production challenges
    - What are the usual (past or predicted) natural disasters that affect small ruminants (drought, flood, etc.)?
    - Do investment priorities in small ruminants vary by gender?
    - How are the costs and benefits of increased or decreased production distributed between men and women? Do women benefit proportionally to their labor contributions?
  - Outputs – milk, meat, multi-purpose
    - Who controls outputs for household use? Who controls profits if sold?
  - What are the characteristics of small ruminant flocks - size, flock structure (species, sex, age)?
  - Housing and husbandry practices?
  - Control of breeding – seasonality of reproduction?
  - Who plays what role (men, women, young people) in small ruminant management and decision-making?
  - Disease prevention measures – use of vaccines, anthelmintics, ecto-parasiticides, etc? Gender roles in making decisions and acting?

        - Action if animals get sick – where do they seek advice, obtain treatments and vaccine? (Gender roles)

- ***What is the impact of PPR disease in this area?***
    - Direct – mortality, morbidity, milk production, body condition/growth, reproduction, market value, treatment/control etc.?
    - Indirect – livelihoods, income, social, education, dietary?
    - Does the impact of PPR disease vary by gender?
- ***How can PPR control be improved in this area?***
    - Who are the people/actors/stakeholders with a role in PPR control?
        - What is gender break-down for various roles? (eg: Paravets, Extension workers)
    - What is the animal health service capacity?
        - Personnel, resources, communications, transport, etc. ?
        - Surveillance system
            - Outbreak reporting/surveillance – including lab diagnostics/early warning?
        - Disease control measures
    - Movement control – role of, pros and cons, perceptions of?
    - Any differences in movement patterns for female controlled animals?
- ***How are vaccines delivered along the vaccine chains?***
    - What are the factors affecting quality of services?
    - Willingness of farmers to vaccinate and to pay for vaccinations?
    - Cost of vaccines and perceptions of farmers?
    - Is there a difference in attitudes and perceptions by gender group?
- ***What is the vaccination strategy?***
    - Knowledge, perception of livestock keepers/vets etc.?
    - Seasonality – farmer's preferred time for vaccination?
    - Identification of vaccinated animals – attitude, willingness, preference?
    - Involvement of different gender groups?
    - Coordination – transboundary?

  - Methods for advocacy for PPR control and vaccination (e.g. games, communication strategy)?
  - Vaccine delivery models?
- ***How does gender influence PPR control and how can we improve PPR vaccine delivery to be gender-sensitive?***
  - How do production goals differ?
  - Investment priorities in small ruminants?
  - Perceptions of roles of livestock?
  - Workload for livestock?
  - Preferences for trainings and extension opportunities?
  - How are small ruminants transferred when household structure changes? (death, divorce, marriage)
  - How can extension and vaccine services better meet the needs and priorities of women?
  - How do women's roles and priorities change with climate change, urban migration, commercialization, access to credit, market access, extension opportunities designed for women, at different life stages?

3.2. Data collection tools

For each type of study, a suitable data collection tool was developed (Table 1).

Table 1: Study methods

Data collection tool	Target group	Method	Number	Main research topics addressed
Desk review	All published and non-published reports	Desk work	Not applicable	What is the existing knowledge about PPR control
Key informant interviews	Veterinarians, policy makers, community leaders, veterinary input suppliers within the research areas	Semi-structured interview	One or more as required to obtain overview for each study area	Animal health service capacity Main disease problems PPR interventions Vaccine value chain

				Main markets and trade routes
Community meeting representing the area	Livestock keepers	Semi-structured group interview – men, women and youth *(separate groups if appropriate)*	One or more meetings depending on the size of the study area	Common diseases History of PPR and current disease Control measures Impact Management Livestock movement and trade
Household survey	Livestock-keeping households	Structured interview – *with head of household and other male and female household members*	Random sample of 150 households from each study area	Small ruminant production system, management Livestock movements Common diseases PPR impact and control measures Vaccination strategy
Market survey	Individuals who are buying and/or selling sheep and/or goats in live animal markets.	Structured questionnaire	Minimum of 20 people or 10% of the people buying and/or selling in the market, whichever is greater, depending on the size of the market	Trading practices and market networks
Participatory disease surveillance	Livestock farmers Small ruminant herds	Identify high risk areas during community meeting and HH interviews, visit more areas as identified during PDS and carry out key informant and group interviews, flock observation	At least five high risk areas per country	Common diseases History of PPR and current disease – detection and confirmation of PPR disease Control measures Management Livestock movement and trade
Outbreak investigation	Livestock keepers Small ruminant herds	Structured interview, clinical examination, Rapid test and sample collection	If PPR-like cases detected during PDS, household survey or passive surveillance	Characteristics of PPR disease, confirm diagnosis, samples for sequencing
PPR-like disease reporting (passive surveillance)	Veterinary officers Livestock farmers Small ruminant herds	Rumour register – set up with veterinary officer if not already in place	As many as possible!	Ongoing disease occurrence, identify outbreaks for investigation
Sero-monitoring	Small ruminant herds	Random selection and blood sampling	In specific sites only, linked to vaccination	To evaluate impact of vaccination

			campaigns – no. flocks and animals per flock to be determined for each site.	
Flock dynamic recording	Small ruminant herds	Monthly herd recording	70 farms per country	Document animal entry and exit at farm level, the value of this and to estimate the disease mortality and morbidity over time
Gender studies	Livestock-keeping households	How does gender influence the control of PPR?	Qualitative and quantitative surveys	Ownership and management of small ruminants, Gendered impact of disease, Participation of women in PPR control, Role of women in small ruminant trade, etc.
Knowledge Attitude and Practices (KAP) interview	Vaccinators (veterinarians and para-veterinarians)	Structured interview	Vaccinators (The number will depend on how many are available to respond to the interview)	Vaccine handling and processing. Identification of constraints and weaknesses Quality of vaccines in the field Factors affecting the quality of vaccines.
Vaccine preferences	Livestock-keeping households	Structured interview	Same number of farmers with household survey (150 per country)	Willingness of farmers to vaccinate and to pay for vaccination
Participatory disease modelling	Small ruminant value chains actors and stakeholders	National workshops	3 to 5 workshops	Ex ante assessment of PPR control options
Risk mapping	Small ruminant value chains actors and stakeholders	Regional workshops	Three regional workshops per sub-region	Livestock marketing and seasonal movements Multiple-criteria decision-making mapping
Sample collection guideline	Small ruminant herds	Serum Swabs (conjunctival, nasal swab and oral)	Up to 6 clinical cases per herd, during outbreak investigation	Laboratory analysis
Autopsy (post-mortem)	Small ruminant herds	Tissue samples from dead animal (mediastinal lymph node and spleen)	Dead animals identified during outbreak investigation	Laboratory analysis, virus isolation

Estimating age by dentition	Small ruminant herds	Examination of incisor teeth.	During clinical examination and sample collection.	Determine the age of animals

It is important that for each data collection tool and method, both men and women can participate. This means ensuring that both men and women are given the opportunity to contribute in group meetings and household interviews, and directing key questions to specific gender groups, and/or having separate meetings and/or interviews for men and women. For each tool, we identified which types of data need to be gender disaggregated and made this explicit in the tool. Where necessary, people involved with data collection will be trained in use of the tools and methods in order to ensure good quality data and standardization across the study areas. This is part of the capacity-building component of the project e.g. training in data collection and Participatory Disease Surveillance (PDS).

3.3. Toolbox development

The development of the toolbox followed the steps below:

Expert consultation: a group of researchers (epidemiologists, laboratory experts, gender and socio-economists and disease modelers) developed the concept to guide the inclusion of study types in the research toolbox to be used across countries in West and East Africa. Three versions of the tools were circulated among the group for feedback and review.

Workshop for toolkit validation: In November 2019, a workshop was held at ILRI Nairobi campus among project partners from West and East Africa to further scrutinize the tools and to ensure they captured context specific issues. Partners from West Africa included the Centre de Coopération Internationale en Recherche Agronomique pour le Développement (CIRAD), Centre International de recherche-développement sur l'élevage en zone subhumide (CIRDES), Institiut Sénégalais de Recherches Agricoles (ISRA), Laboratoire Central Vétérinare (LCV) and those from East Africa included Directorate of Veterinary Services of Kenya and Tanzania. The meeting also promoted interaction among the researchers involved in the project to better shape research protocols.

Figure 2: Workshop on tool validation on 12th November 2010 at ILRI, Nairobi, Kenya (Photo credit: Michel Dione, ILRI)

The resulting data collection framework included tools to 1) capture baseline and context data, 2) facilitate longitudinal follow up, 3) complementary studies, and 4) integrated studies which will lead to decision making tools (Figure 3). Specific technical tools were developed such as sample collection guideline, autopsy (post-mortem) and estimating age by dentition based on previous field work in the region. The procedure for obtaining informed consent was developed, including project information sheets and consent forms. A Field Researcher Manual was prepared that provided guidance to researchers and data collectors on how to use the tools.

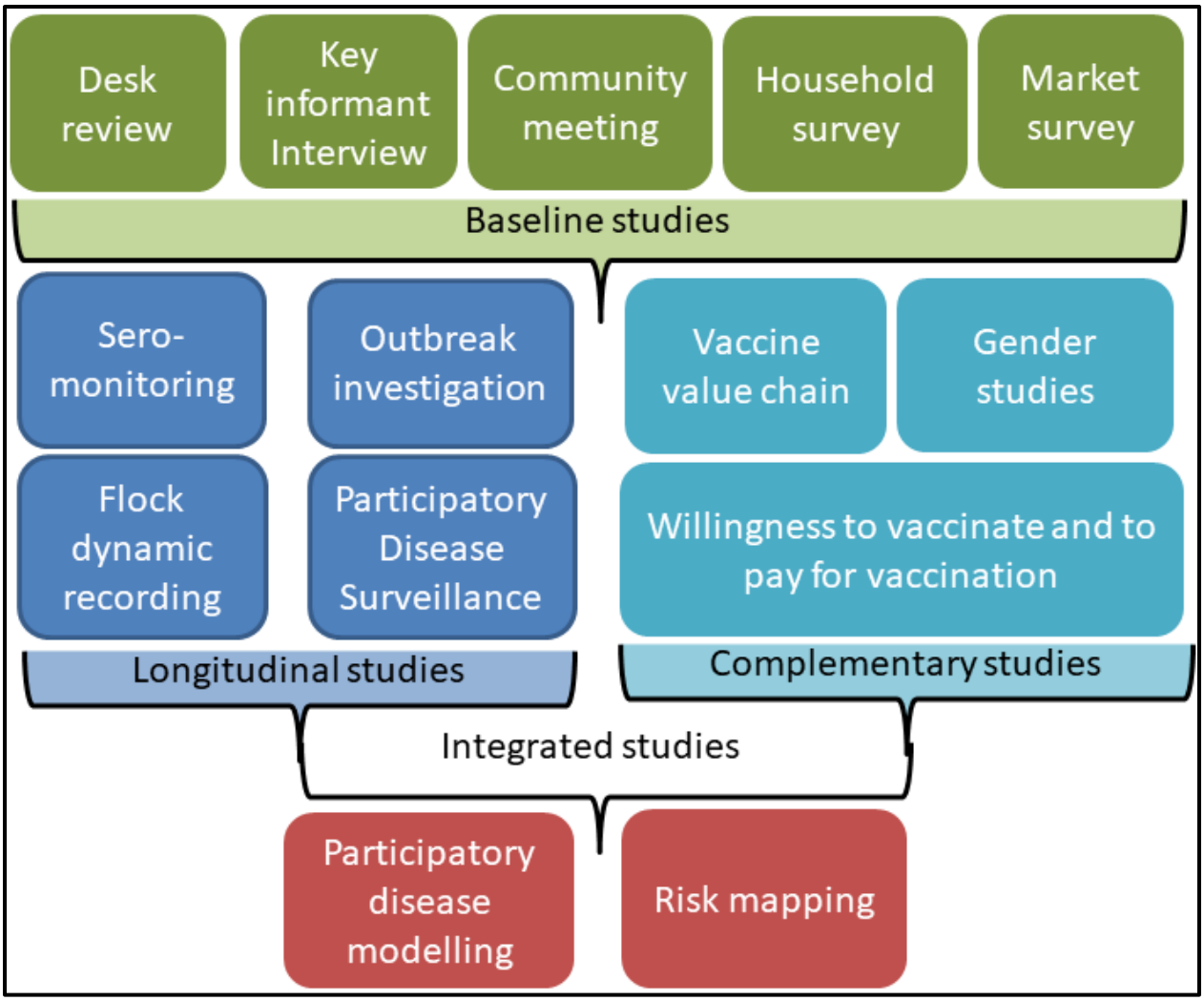

Figure 3: Data collection framework

4. Design of Digital Data Collection Platform Open Data Kit (ODK)

The digital data collection platform Open Data Kit (ODK) was selected for collection of structured data in this project. Open Data Kit (ODK) is a free and open source set of tools which help organizations to author, field and manage mobile data collection solutions. ODK provides an out-of-box solution for users to; build, collect and aggregate (opendatakit.org). Once data is collected in the field with ODK Collect, it can be uploaded and managed with ODK Aggregate. Aggregate is the intermediary server storage platform that accepts the data and can send it on

external applications, if desired. ODK Aggregate also allows datasets to be downloaded in aggregated formats such as CSV files (Managing your Data with ODK Aggregate).

5. Regional Field testing

From 17th February to 21st February 2020, a workshop was organized to field test the Eco-PPR research tools and train partners in Dakar, Senegal. The workshop was attended by representatives of partners institutions in West Africa mainly Laboratoire Central Vétérinaires (LCV), Institut Sénégalais de Recherches Agricoles (ISRA), Centre International de Recherche-Développement sur l'Elevage en zone Subhumide (CIRDES) and the French Agricultural Research Centre for International Development is a French agricultural (CIRAD). Field testing of the data collection tools was carried out in Vélingara, Saint Louis region. This pilot testing enables us to navigate through the tools and gain better understanding about their implementation in the field.

Figure 4: Training on pen-side rapid diagnostic test for PPR at ISRA/LNERV, Dakar, Senegal (Photo credit: Michel Dione, ILRI)

Figure 5: Community meeting with livestock farmers at Linguère, Senegal (Photo credit: Michel Dione, ILRI)

Figure 6: Group photo with project partners during training workshop at ISRA/LNERV, Dakar, Senegal (photo credit: Michel Dione, ILRI)

6. Review of toolbox

After the field testing of tools and feedback from partners on toolbox, the Eco-PPR scientists revised the data collections tools to address relevant comments. The final tools were reviewed and ODK formats developed. A field training manual was developed for enumerators to facilitate data collection harmonization across countries.

7. Field researcher manuals

Epidemiology and Control of Peste des Petits Ruminants (ECo-PPR): Field researcher manual

https://hdl.handle.net/10568/109076

Epidémiologie et Contrôle de la Peste des Petits Ruminants (ECo-PPR) : Manuel du chercheur de terrain

https://hdl.handle.net/10568/109077

8. References

ILRI. (2019a). Epidemiology and control of peste des petits ruminants (ECo-PPR) inception workshop for West Africa. ILRI Workshop Report. Nairobi, Kenya: ILRI. https://hdl.handle.net/10568/105444.

ILRI. (2019b). Epidemiology and control of Peste des Petits Ruminants in East and West Africa. ILRI Project Profile. Nairobi, Kenya: ILRI. https://hdl.handle.net/10568/101634

OIE, & FAO. (2015). Global Strategy for the Control and Eradication of PPR. http://www.fao.org/3/a-i4460e.pdf

9. Project partners

West Africa: Centre de Coopération Internationale en Recherche Agronomique pour le Développement (CIRAD); Institut Sénégalais de Recherches Agricoles (ISRA); Laboratoire Central Vétérinaire (LCV), Mali; Centre International de Recherche-Développement sur l'Elevage en Zone Subhumide (CIRDES), Burkina Faso, Veterinary Services of Senegal, Mali and Burkina Faso.

East Africa: Government of Kenya, Ministry of Agriculture, Livestock, Fisheries and Irrigation, State Department of Livestock; Directorate of Veterinary Services, Ministry of Livestock and Fisheries, United Republic of Tanzania; Government of Ethiopia, Ministry of Agriculture, Tanzania Wildlife Research Institute (TAWIRI)

Other: Royal Veterinary College, University of London, UK