



position paper

SUPPORTING LIVELIHOODS AND
BUILDING RESILIENCE THROUGH
PESTE DES PETITS RUMINANTS (PPR)
AND SMALL RUMINANT
DISEASES CONTROL

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Background

Peste des petits ruminants (PPR) is a widespread, virulent and devastating animal disease of domestic and wild small ruminants. Also referred to as goat plague, it is caused by a morbillivirus closely related to rinderpest virus.

It can have significant economic, food security and livelihood impacts. The disease was first described in 1942 in Côte d'Ivoire (West Africa) and subsequently confirmed in other regions.¹ To date, the presence of the virus has been confirmed in large areas of Asia, the Middle East and Africa, and is spreading to new countries, affecting and threatening an increasing number of small ruminant and livestock keepers.

From the late 1970s onwards, sub-Saharan Africa, then the Middle East and Asia experienced severe epidemics. The process of expansion into new, uninfected territories continued, particularly from 2004 to 2012,² when the virus extended its range southwards in Africa as far as the southern part of the United Republic of Tanzania in 2008 and, in 2012, to the Democratic Republic of Congo and Angola (Cabinda Province). It also advanced into North Africa to Tunisia in 2006 (Ayari-Fakhfakh *et al.*, 2001) and reports made to the World Organisation of Animal Health (OIE) indicate it had spread to Morocco in 2008 and Algeria in 2011. Outbreaks occurred in the Central Asian Republics from 1990,³ China (Tibet Autonomous Region) in 2007,⁴ the Maldives in 2009,⁵ and Bhutan and the Comoros in 2010.⁶ It is unclear what factors have favoured the spread of the disease, but many millions of small ruminants in southern Africa, central Asia, Southeast Asia, China, Turkey and southern Europe must now be considered at high risk of PPR virus incursion.

The relentless spread of the disease in affected countries and the subsequent threat imposed on PPR-free African countries further south of the current endemic area have resulted in an increased recognition of the urgent need to embark on regional and global programmes for controlling this disease.

Above all and urgently, the international community must join forces against PPR: i) in order to stop the rapid spread of the disease in already affected countries and at-risk regions with a special focus on immediately threatened Southern African Development Communities (SADC), Caucasus and European countries; ii) because of the key role sheep and goats play in national food and nutritional security, income security and livelihood resilience in countries across the world and the damage the disease causes to livelihoods in the least economically developed nations; and iii) to sustain the momentum created by the eradication of rinderpest that

¹ The disease likely has its origins in central Asia.

² The dates indicated in this paragraph either refer to the detection of the first outbreak of the disease or to the first report of the presence of positive serological samples.

³ See evidence of outbreak in 1990 in Handistatus II: http://web.oie.int/hs2/sit_pays_mald_pl.asp?c_pays=31&c_mald=6

⁴ See http://www.oie.int/wahis_2/public/wahid.php/Reviewreport/Review?page_refer=MapFullEventReport&reportid=12742 and http://www.oie.int/wahis_2/public/wahid.php/Reviewreport/semestrial/review?year=2010&semester=0&wild=0&country=COM&this_country_code=COM&detailed=1

⁵ See http://www.oie.int/wahis_2/public/wahid.php/Reviewreport/semestrial/review?year=2009&semester=0&wild=0&country=MDV&this_country_code=MDV&detailed=1

⁶ See http://www.oie.int/wahis_2/public/wahid.php/Reviewreport/Review?page_refer=MapFullEventReport&reportid=12742 and http://www.oie.int/wahis_2/public/wahid.php/Reviewreport/semestrial/review?year=2010&semester=0&wild=0&country=COM&this_country_code=COM&detailed=1

resulted in a growing interest among the international community to address PPR at a regional and global scale.

This present document is intended to share the Food and Agriculture Organization of the United Nations' (FAO's) position on PPR and small ruminant disease control and to outline the preliminary steps necessary for initiating regional approaches and later global initiatives while identifying appropriate partnerships to drive and implement the required activities.

The role of small ruminants in food security and livelihood resilience

There are compelling reasons to start an immediate concerted effort on PPR, among which are the need to stop the spread of the disease in already affected countries and at-risk regions and to mitigate the economic impact of the disease on people relying on small ruminants for subsistence.

Indeed, eliminating PPR is seen as key to poverty reduction in the world's most vulnerable pastoral/agropastoralist communities and will, therefore, directly benefit the livelihoods of millions of livestock farmers and smallholders in affected countries. In addition, halting the introduction and spread of the disease in countries at immediate risk today such as Botswana, Mozambique and Zambia in Africa or those uninfected countries in Asia is key for protecting the assets of smallholders who depend on the raising of small ruminants for their daily subsistence.

Goat and sheep breeds are numerous and are found in a variety of livestock production systems. The majority can be found in extensive pastoralist and agropastoralist systems, in part because of the adaptability of the animals to the agro-ecology, which is often harsh and remote. While the majority of small ruminants are produced in extensive production systems, the majority of people involved in small ruminant production can be found in mixed farming systems. Uganda has 15.9 million goats and sheep, with households owning on average between 6 to 36 sheep and goats (Bourdin, 1983). In the highlands of East Africa, increased population pressure and land fragmentation are leading to increased demand for more intensive dairy and meat goat systems. The growth rate within these systems is estimated at 12.5 percent (Peacock, 1996).



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PPR is of particular interest to FAO and other development agencies because of the important role small ruminants play in food security and livelihood resilience. Small ruminants provide their owners with a vast range of products and services. They can supply milk, meat, skins and wool throughout the year. Compared with large ruminants, they are cheaper to buy, their reproduction rate is relatively fast and they can easily be sold for cash or exchanged for other staples. For farmers in cropping areas, they are often used as insurance against crop failure.

Income generated from goats is used to purchase cattle (for draught power and milk) and donkeys (for transport of firewood and water) while sale of goats protects depletion of large ruminants in times of food and economic crisis. Milk production through goats can be very important in pastoralist communities, as demonstrated in a recent study of a pastoralist community in Somali region of Ethiopia where, with limited inputs into goats, milk offtake could increase by 550 percent (Sadler *et al.*, 2012).

Households in many parts of the world depend on sheep and goat production to feed and educate their families. Women often have access to and control over small ruminants making it an important resource for them. However, when they lose their small ruminants, they fall out of livestock production and are led to migrate to the cities where they experience peri-urban poverty, overcrowding and sedentary lifestyles. As a result, they contribute to environmental degradation and unsustainable land use as they turn to the selling of firewood, grass and charcoal.

At a regional level, the greater Horn of Africa collectively exports several million live animals annually to the Arabian Peninsula (3 million in 2011). In West Africa, goat meat and mutton account for about 25 percent of all meat produced in 2010 (FAO, 2010). In countries in Africa with large small ruminant populations, such as Mali and Nigeria, goat meat and mutton constitute about one third of the national meat production. Along with geographical distribution, there is a marked increase in demand for mutton meat. In sub-Saharan Africa it is predicted that from 2000 to 2030 there will be an increase of consumption of mutton by 137 percent. For low income countries, mutton has a predicted increase of 177 percent, second only to poultry (Figure 2), making it an important livelihood and food security asset that needs to be maintained and protected globally.

The above-mentioned dynamics mean that small ruminants play a vital role in rural areas. The entry or presence of any small ruminant disease within these settings can be devastating for the livelihoods and resilience of these communities. PPR can result in huge losses due to mortality in susceptible flocks from 10 to 100 percent and morbidity from 50 to 100 percent (Bourdin, 1983; Roeder, 2012). Morbidity losses include severe weight loss, reduced reproductive capability and reduced milk production. Other losses associated with the disease are the costs to bring the disease under control at both national and household levels.

Opportunities and challenges

As was the case with rinderpest, several technical factors favour the prospect of achieving global eradication of PPR virus. These include: the existence of the virus as a single serotype; the absence of a carrier state; the lack of any reservoir of infection outside of the small ruminant population; the availability of live attenuated vaccines which confer lifelong immunity after a single dose and are robust, safe and relatively cheap to produce; the availability of diagnostic tests for sero-monitoring of vaccination programmes and detection of virus circulation; as well as a growing political support for eradication. Furthermore, the memory of the success of rinderpest eradication is still present in the minds of farmers and animal health personnel resulting in positive perceptions and attitudes to the generation of a new eradication programme. Recent experience with mass pulsed vaccination in southern Ethiopia has demonstrated the feasibility of rapid area-wide clearance of PPR virus infection (Roeder, 2012). Lessons learned from the rinderpest eradication campaign will, therefore, be of paramount importance in any new PPR campaign and their application may result in less time taken to achieve similar success.

In addition, the international community has a clear and growing interest for such a campaign, as was observed during the Global Rinderpest Eradication Programme (GREP) Symposium (October 2010) in Rome, marking the end of rinderpest, where government ministers and experts raised concerns about the major spread of PPR. Experts there recommended that “international and regional organizations and all stakeholders should apply the lessons learned from the eradication of rinderpest to other diseases, in particular the progressive control and eventual eradication of PPR”. This recommendation was further stressed during the three regional workshops organized by the GREP Secretariat in Asia, Africa and the



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Middle East and, again, in the global declaration made in June 2011 by heads of states, heads of governments, ministers, CVOs and other participants at the 37th FAO Conference. As a result, FAO was requested: “to initiate, in collaboration with global, regional and national partners, appropriate programmes for the control and eradication of *peste des petits ruminants* within the framework of improved ruminant health” (FAO, 2012).

Conversely, the control of transboundary animal diseases (TADs) such as PPR also poses a series of challenges that need to be systematically addressed. One of the major challenges of PPR control is small ruminant production. Small ruminants are often found in marginalized extensive production systems and/or are produced by people with limited access to services, such as women and pastoralists. For these people, small ruminants are often their most important asset. At the national level, small ruminant lobbies often have limited access to political will or resources, reducing the attention given to PPR (and small ruminant health). Another challenge facing small ruminant production is the short nature of the cycle of reproduction which leads farmers to resist investment in animal health or vaccines because, compared to large ruminants, there seems to be no significant return on such outlay. Therefore, it is important that any strategy engages small ruminant owners to improve their own systems and enhances private sector service delivery channels (FAO, 2012; Njeumi and Rossiter, 2012). In this respect, FAO has extensive multidisciplinary experience and a commitment to work within rural and smallholder settings, integrating production and animal health along with social and economic issues either in livestock only or in mixed farming systems. Ultimately, while there is no major technical complexity for controlling PPR, most of the challenges ahead for achieving regional and global eradication of the disease lie in capacity to comprehend the specifics of small ruminant production systems in order to develop a phased and targeted approach.

A phased strategic framework for controlling PPR: a mosaic of targeted approaches

GENERAL CONSIDERATIONS

Given the heterogeneous socioecological characteristics, the extensive nature of the production systems and the mixture of small ruminant production and PPR disease scenarios, it will be necessary to develop a mosaic of fit for purpose approaches for controlling the disease in different agro- and socioecological settings. This model will provide the building blocks for a phased approach to move from a local to a global control of PPR.

Protecting the small ruminant assets of livestock keepers will likewise be an important aspect of any strategy. A focused or targeted approach is vital given lessons learned from rinderpest eradication and the limitations of resources. In other words, any focused animal health protection approach will need to seek complementarities between:

- veterinary technological advances in PPR diagnostics and vaccines;
- the needs of smallholders and the demands of regulatory bodies;
- existing tools and novel delivery mechanisms.

Globally and locally, four issues need appropriate attention:

- the development and delivery of existing and new technologies, including access to effective, affordable quality assured, thermo-stable PPR vaccine, including bivalent/trivalent options; health communication for awareness raising also needs to be considered;



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- an increased understanding of epidemiology and socioecology of PPR and other small ruminant diseases is needed since PPR is a dynamic disease, and only an enhanced active understanding will enable improved targeting of interventions;
- the need to develop synergies between different portfolios of small ruminant diseases and to recognize the importance of a broader food security umbrella. In certain situations, PPR might be a clear entry point, while in others a combination of diseases or the food security agenda might be more palatable for delivery;
- the development of “using and supporting” existing delivery mechanisms and, where required, establishing community-based animal health delivery systems or others systems.

ELEMENTS OF A STRATEGIC FRAMEWORK

This strategic framework has been formulated to provide a common vision for PPR prevention and control. This common vision makes possible a consistent, cohesive and coordinated response focused on the following overall objective:

To eliminate the threat posed by small ruminant diseases (with a special focus on PPR) to the livelihoods, food security and health of people nationally, regionally and globally.

The overall goal of the strategy would be to progressively control and eradicate PPR from the small ruminant sector in Asia and Africa, and to prevent further introduction of the disease to non-infected countries, thereby i) promoting viable small ruminant production and ii) improving the livelihood of all small ruminant stakeholders, especially the poor.

The strategy would have two underlying guiding principles:

- The approaches used for controlling PPR should be based on the best available epidemiological knowledge and an optimal preparedness to prevent the further spread of the disease.
- The approaches will be livelihood-centred and tailored to address country-specific and sector-specific epidemiological scenarios.

The purpose of the strategic framework is to contribute to the overall objective by:

- i. providing robust country-specific and sector-specific technical options for prevention and control of PPR and other diseases in small ruminants;
- ii. building the capacity to implement and maintain these technical options;
- iii. supplying analytical and logistical support to ensure that the technical options can be implemented in ways that are sustainable, technically sound and socially equitable.

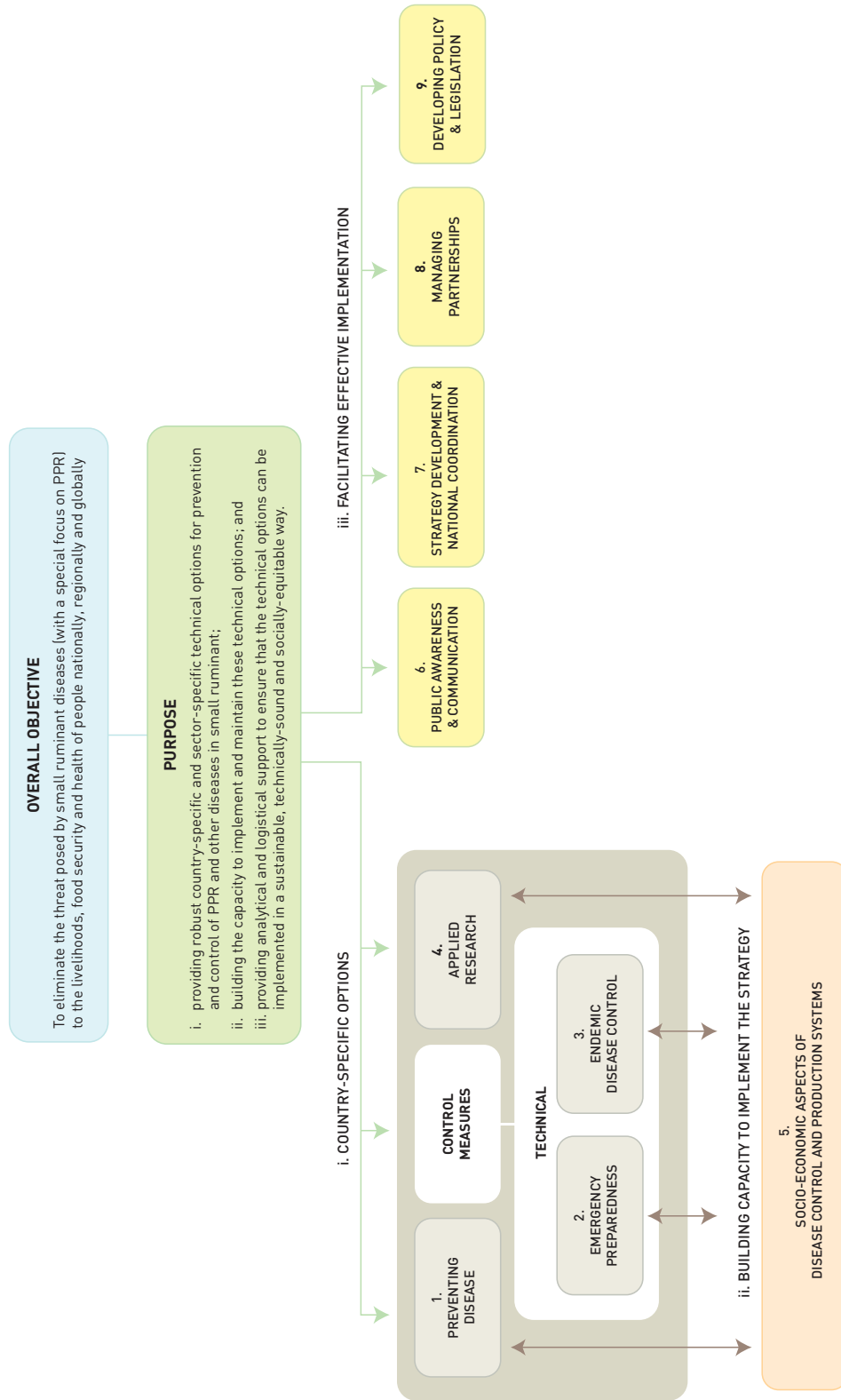
The strategic framework identifies nine interlinked components that constitute a comprehensive response to PPR (see Figure 1):

Component 1: strategy development and national coordination

Component 2: preventing incursion of disease through emergency preparedness and rapid response capability

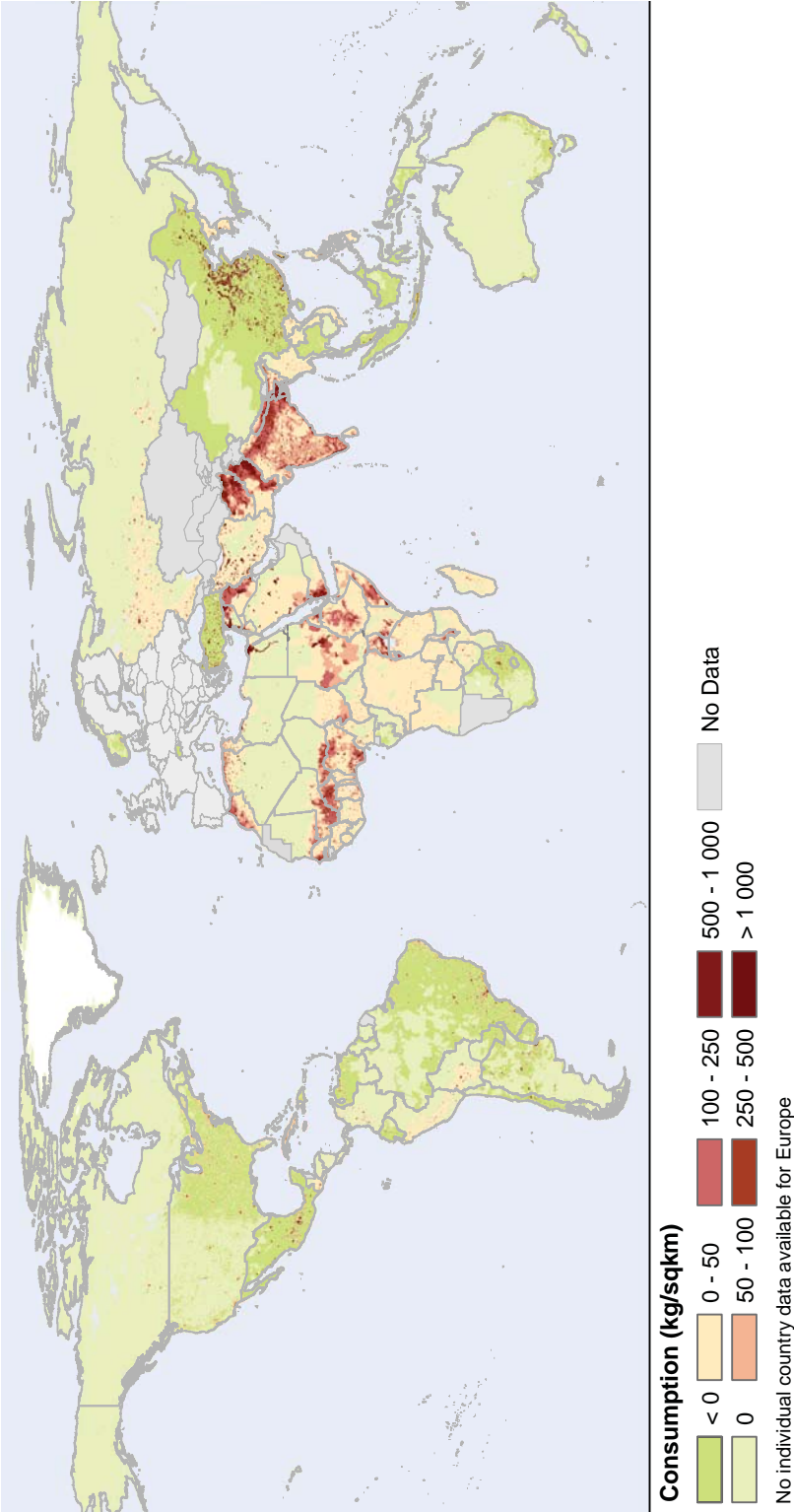
Component 3: endemic disease control

Figure 1. Strategic framework for PPR prevention and control in Asia and Africa



Note: Adapted from the strategic framework for controlling HPAI in South East Asia

Figure 2. Growth in demand for mutton from 2000 to 2030



Source: FAO, 2011. Mapping supply and demand for animal-source foods to 2030, by T.P. Robinson & F. Pozzi. Animal Production and Health Working Paper, No. 2. Rome.

- Component 4: research and development
- Component 5: socio-economic aspects of disease control and production systems
- Component 6: public awareness and communication
- Component 7: strategy development and national coordination
- Component 8: managing partnerships and regional coordination
- Component 9: developing policy and legislation

Five of these components contribute directly to point (ii) of the purpose of the strategic framework and are the primary focus of capacity-building, while the other four components contribute towards point (iii) (Figure 1).

The relative priorities placed on the different components in individual countries will vary depending on the epidemiological scenarios for each country, the amount of progress already made with national strategies, and the capacity to implement the different technical options and approaches for PPR prevention and control. Those countries that are currently not infected will give higher priority to components 1 and 2, whereas countries where the disease is already endemic will give higher priority to components 2 and 3. Countries with a limited research capacity may give a lower priority to component 4. There is an important role for components 5 through 9 in all countries.

A PHASED APPROACH

An understanding of the anticipated phases for the global strategy (Njeumi and Rossiter, 2012) is described below, as well as the elements needed to implement the specific phases:

Phase I: improved epidemiological understanding and establishment of progressive control

This phase is based on the specificity of the country or agro- and socioecology. It builds on the need to initiate work on risk-based priority areas and the ability to target interventions efficiently. Therefore, in order to reduce the losses due to PPR and other small ruminant diseases such as sheep and goat pox and/or contagious caprine pleuropneumonia (CCPP), it is critical that initial vaccination campaigns focus on epidemiologically important areas rather than attempt uniform coverage. This part of the programme will contribute directly to building the resilience of the poorer pastoralists, but the following requirements are needed:

- improved knowledge of the epidemiology and socioecology of these and other small ruminant diseases through improved disease surveillance, investigation and reporting;
- better targeting versus blanket interventions against PPR and other diseases based on their situation on the ground (e.g. endemic, free or buffer zones);
- improved tools including the development of affordable thermo-stable vaccines, pen-side diagnostic tests, DIVA vaccines and related serological tests or multidiseases tests;
- increased experience with progressive control strategies, the possibilities for focused vaccination programmes, cost recovery, use of thermo-stable vaccines, etc.;
- the ability to combine with other activities such as vaccination against sheep and goat pox and/or CCPP; provision of therapeutic services for the control of

ecto- and endoparasites and other endemic diseases impacting on small ruminant production and productivity, to increase efficiency, broaden impact and encourage fuller participation. The other activities to be combined with PPR will be determined by countries based on their local priorities and epidemiological considerations.

Prerequisites for implementing the above-mentioned strategy (further developed in the Annex) include:

- a) strong well-trained teams in countries which are able to conduct disease surveillance;
- b) a strong quality vaccine delivery network and infrastructure (with transport and immediately available operational budget at national and regional state/provincial levels);
- c) the establishment of improved animal health delivery systems, if and where required;
- d) development of the capacity to conduct surveys that verify the absence of clinical disease as well as the sero-surveillance capacity to prove the absence of antibodies.

Considering the complexity and variation in disease prevalence in provinces, countries and subregions along with the different levels of control applied, there may be areas where one could consider PPR (and other small ruminant diseases) vaccination against cost recovery. Vaccination would be especially desirable in the initial phase, in areas where disease is widely present and where there is a culture of paying for it, provided that the established animal health delivery system can provide it efficiently upon owner request. Such a strategy requires either existing capacity in the field or the capacity to re-establish a suitable animal health delivery system quickly. The programme also depends on the availability of thermo-stable vaccines for the relevant small ruminant diseases and a government policy in place to charge pastoralists in those areas where there is an established cost recovery system for vaccination. This approach may considerably reduce the initial cost of the control programme and would allow time to establish the disease surveillance and laboratory capacity.

There are many additional advantages to a targeted approach. Progress can be achieved in relatively short periods of time as was shown during the rinderpest eradication campaign in Ethiopia. It took only three years for example to clear the Afar ecosystem from rinderpest, though it should be noted that verification of its absence took longer. As small ruminants replace at a faster rate than cattle, the verification of absence of PPR will take less time than that for rinderpest. In a targeted approach, too, vaccine quantities and operational costs are relatively low, veterinarians can evolve into disease control strategists and links between regional/provincial and central veterinary services are strengthened. The outreach role of community-based animal health workers (CAHWs) in such a programme is also cost-effective. Growth in the number of good quality samples collected from the field also contributes to the overall increased epidemiological understanding. With such clear benefits, a targeted approach will convince governments and donors to continue expanding the control programme beyond the cleared areas (FAO, 2012; Roeder, 2012).

Phase II: the progressive control phase

By the start of phase 2, a comprehensive knowledge of PPR epidemiology will have been generated together with evidence for significant progress in PPR control.

During the progressive control phase, the geographical coverage of the programme will expand to a subregional, if not a continental level. Mass vaccination of assumed high-risk populations will be progressively replaced by focused vaccination as more epidemiological information becomes available. During phase 2 and beyond, the intention will be to channel resources and efforts into detecting, containing and removing reservoirs of infection. This approach should be similar to the rinderpest “seek-confirm-eliminate” method.

If possible, a vaccine and serological test (DIVA) that can distinguish vaccine antibodies from field virus antibodies will be developed during this stage, greatly improving the possibility for eradication. Likewise, a sample collection/transport method without cold chain that can be used for sample dispatch will reduce costs and challenges in biological specimen shipments significantly.

Phase III: the final eradication and verification phase

Assuming that phase II makes progress towards significant levels of control, countries should gradually reduce their levels of vaccination (if they have not already done so) to increasingly smaller focused and strategic campaigns. Surveillance will be maintained and even increased in view of the risks posed to populations where vaccination has been withdrawn. In addition, other aspects of disease management should continue such as: identification and traceability of animals, quarantine and movement control along the trade routes, biosecurity measures and slaughterhouse. Reinfections back into disease-free populations are expected due to the large numbers of sheep and goat present in these ecosystems and their movement within and between them. Therefore, to achieve eradication it is important to target statistically significant numbers of the whole population. Clear operational plans must be in place together with sufficiently well-trained and empowered veterinarians, who have the financial and operational capacity to respond immediately and to control any foci of disease. The risk for reinfection of PPR and sheep and goat pox (and any other small ruminant disease targeted by the programme) should be assessed and evaluated continuously.

When surveillance shows no disease, then individual countries and regions will begin to enter the pathway for PPR progressive control and eradication. This pathway is under consideration and might take the form of a progressive control pathway (PCP) approach for PPR. It is also understood that OIE in collaboration with FAO will develop guidelines for surveillance and accreditation of PPR freedom through its PPR ad hoc group, much as it did for rinderpest eradication. This group would make recommendations to the OIE Scientific Commission for Animal Diseases.

To achieve this targeted approach, it will be necessary to support the strengthening of veterinary services and the establishment of sustainable animal health delivery systems that will be dealing with a wider scope of animal health and production issues. A key element of the proposed strategy is to involve all veterinary actors in the field (including CAHWs and livestock farmers’ schools). National and pro-

vincial/regional level structures will need to be created to oversee the implementation of the national and subregional strategies. These structures will ensure flexible implementation and control budgets for disease surveillance and vaccination.

ELEMENTS NEEDED FOR THE PHASED APPROACH: COORDINATION AND PARTNERSHIPS

One of the lessons learned from the global eradication of rinderpest (Njeumi and Rossiter, 2012) was that effective coordination is instrumental for successful implementation of a disease control/eradication programme. The targeted progressive control strategy will rely on strong coordination mechanisms between the countries in the region. A control coordination committee could be set up to guide the process and provide oversight for the programme. Members of the committee would include the regional economic commissions, member states, international organizations and other relevant partners.

The coordination committee could have the following duties and responsibilities:

- 1) provide strategic guidance to the control programme and oversee and harmonize implementation of the subregional and national programmes;
- 2) monitor the programme progress and execution;
- 3) highlight achievements, identify constraints and formulate recommendations for the way forward;
- 4) identify existing initiatives on PPR and other TADs and high-impact animal diseases and follow up for information sharing and synergy building;
- 5) initiate resource mobilization strategy and actions to support the control programme;
- 6) provide leadership and strategic guidance in the development of appropriate information, communication and knowledge management strategies.

The programme will be linked with FAO and OIE world reference laboratories, regional and subregional (disease specific) networks and will include a research component on the epidemiology of PPR in camels, wildlife, the efficiency of vaccine delivery systems as well as the socio-economic impact of the disease.

Key research areas (Njeumi and Rossiter, 2012; Roeder, 2012) that will ensure success include:

- development and technology transfer of an efficacious thermo-stable vaccine against PPR (and sheep and goat pox) in the short term;
- development of improved diagnostics tools like pen-side tests, robust antigen/RNA detection tests, robust serological tests (DIVA) in the long term;
- epidemiological research which will include antibody/virus dynamics in populations, estimation of the basic reproductive rate, virus virulence determinants and an understanding of wildlife/livestock interactions;
- cost effectiveness of progressive control and control options along with incentives for economic contribution and participation. It should also include development of guidelines for methodology to understand the socio-economics of PPR and other small ruminant diseases.

Conclusion

FAO believes in reducing the impact of TADs on livelihoods by tackling PPR through support to countries in their development of PPR strategies for eradication which are sustainable, realistic and implementable. It understands the important role healthy small ruminants play in reducing vulnerabilities faced by smallholders, and sees smallholders as an integral part of disease management and control. FAO proposes a livelihood-centred response which is twin track in its focus on both immediate and medium-term goals to protect the assets of small ruminant keepers.

The immediate response will be based on clear epidemiologically-defined targeted surveillance and vaccinations, and enhanced capacities for early warning and response. This response will be complemented by a medium- to long-term strategy to enhance the capacities of communities and small ruminant owners so that their assets are protected through improved integrated activities targeting small ruminant health and productivity.

While country level progressive control of PPR and other small ruminant diseases is possible, better synergies and coordinated interventions may become beneficial through subregional strategies which take into account country-specific realities and requirements over stand-alone and uncoordinated approaches. Hence, this global framework serves as a guideline to formulate subregional or regional strategies for the progressive control and eradication of PPR which support livelihoods and build the resilience of rural poor dependent on small ruminants.



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PREREQUISITES FOR IMPLEMENTING THE STRATEGY INCLUDE:

strong well-trained teams in countries that are able to conduct disease surveillance through the ability to:

- conduct disease history surveys for clinical disease using participatory epidemiological approaches (PE);
- perform active disease search;
- develop a thorough understanding of the livestock husbandry systems in their operational area;
- map areas free of clinical disease for at least two years;
- identify reservoirs of infection;
- collect, preserve and forward samples for laboratory diagnosis in a timely manner;
- directly contact the vaccination coordination office and teams to initiate an immediate response.

strong vaccine delivery and infrastructure (with transport and immediately available operational budget at national and regional/provincial levels). Each country will need strong organization in their veterinary field services that:

- include national veterinary service representation in the regions/provinces, empowered to implement immediate actions;
- have a thorough understanding of the livestock keeping systems including the livestock movement patterns in their operational area;
- include district staff, private sector veterinarians and CAHW vaccination teams,
- have access to sufficient quantities of quality certified (thermo-stable) vaccine at all times;
- have access to cold chain transport, vaccination equipment and materials (including identification mechanisms), etc.;
- are facilitated to report any suspected clinical cases to disease surveillance teams (including, through the use of new technologies such as sms, email, etc., when available).

establishment of improved animal health delivery systems where required, and particularly in remote and/or insecure pastoralist areas. These systems will include some of the following activities:

- training of field staff, private sector workers and CAHWs in disease surveillance and reporting, sample collection, preservation and forwarding, vaccination techniques and veterinary extension;
- planning of sustainable retraining of CAHWs; establishment of clear line method of communication between remote CAHWs and coordinators which

should be functional even without a project (i.e. must be easy, less time consuming and economically feasible);

- provision of inputs such as sampling materials and pen-side tests (when available), vaccination equipment and thermo-stable vaccine;
- support private veterinary drugs supply systems and agree on payment systems for service delivery (cost recovery) or receive operational costs from the government;
- award of sanitary mandate to the private sector through contractual arrangements to implement the PPR vaccination; government monitoring and regulation to ensure quality and effectiveness of the service provided;
- enhancement of community participation in disease surveillance/vaccination where relevant and possible through:
 - raising awareness of the need to report major small ruminant diseases;
 - understanding disincentives to reporting and the negative impact of control measures such as movement control;
- national agreement on reporting methods, including reporting zero cases/suspicions to be reviewed every year (i.e. as part of an annual contingency plan review) so that adjustments can be made to methods and to changing conditions.

development of the capacity to conduct surveys that verify the absence of clinical disease as well as the sero-surveillance capacity to prove absence of virus circulation, which includes the following activities:

- train field and laboratory staff in clinical disease surveillance and sample collection, preservation and forwarding;
- provide inputs such as sample collection materials and equipment along with pen-side tests (when they become available);
- list the needs on calibration or quality control of laboratory equipment;
- set up and implement daily temperature control procedures of refrigerators/freezers including the record on duration of power cuts;
- provide laboratory testing kits and train laboratory staff in antigen and antibody detection tests;
- strengthen laboratory networks to standardize diagnostic tests that allow data to be compared with confidence across diverse ecological zones and production systems.