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PPR surveillance in vaccinated & unvaccinated populations

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GF-TADs

GLOBAL FRAMEWORK FOR THE
PROGRESSIVE CONTROL OF
TRANSBOUNDARY ANIMAL DISEASES



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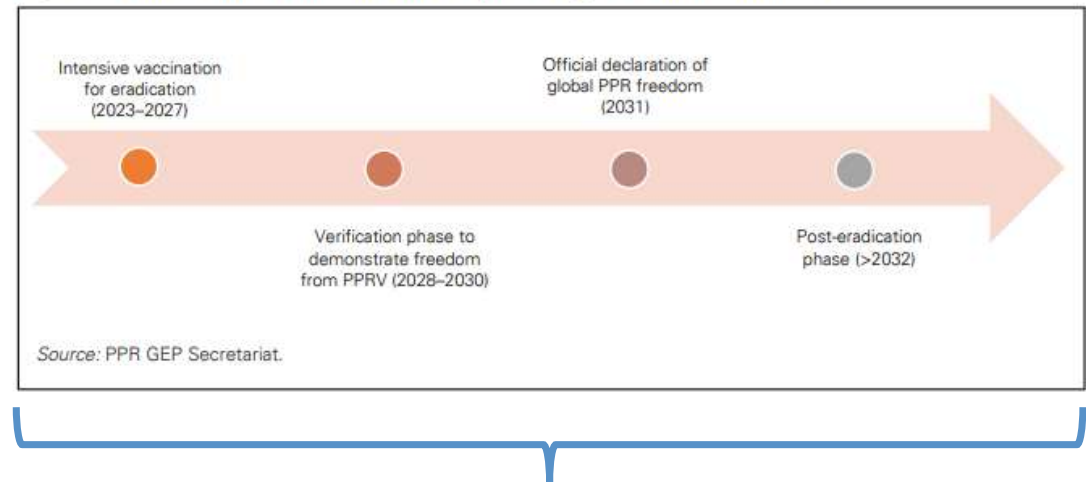
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PPR surveillance along the pathway to eradication

Gradual transition between three surveillance contexts:

- Infection present / vaccination phase
- Post-vaccination verification phase
- Declaration of freedom and maintenance phase

Figure 2: Phases and milestones in the pathway of Global Eradication



Gradual transition between three surveillance contexts that correspond to stages of the Global Strategy

Basis for aligning surveillance with epidemiological stage

Shifting focus of PPR surveillance: from detecting cases to verifying absence

- **Surveillance objectives evolve:**

Countries progress: control → elimination → freedom.

Focus shifts: outbreak detection → demonstration of absence.

- **Risk-based surveillance:**

Encouraged to ensure resources target subpopulations most likely to maintain or re-introduce infection.

- **Evidence for freedom:**

must combine post-vaccination evaluation and ongoing passive and active surveillance.

- **Surveillance must include:**

high-risk groups and zones, particularly along borders and in transboundary episystems.

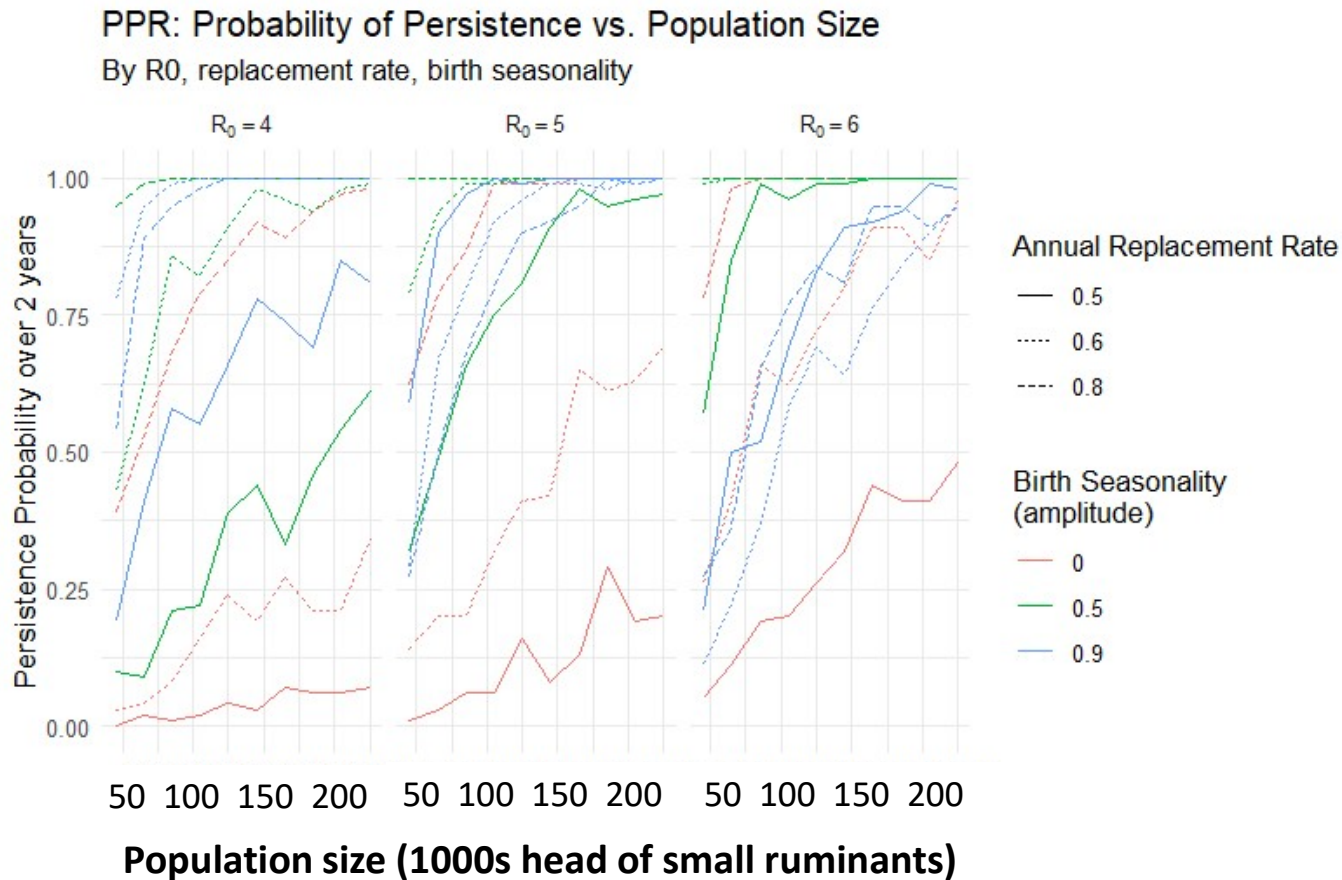


Surveillance challenges

- Limited resources
- Heterogeneous risk (high risks “subpopulations”)
- Mobile populations
- Administrative boundaries \neq epidemiological boundaries

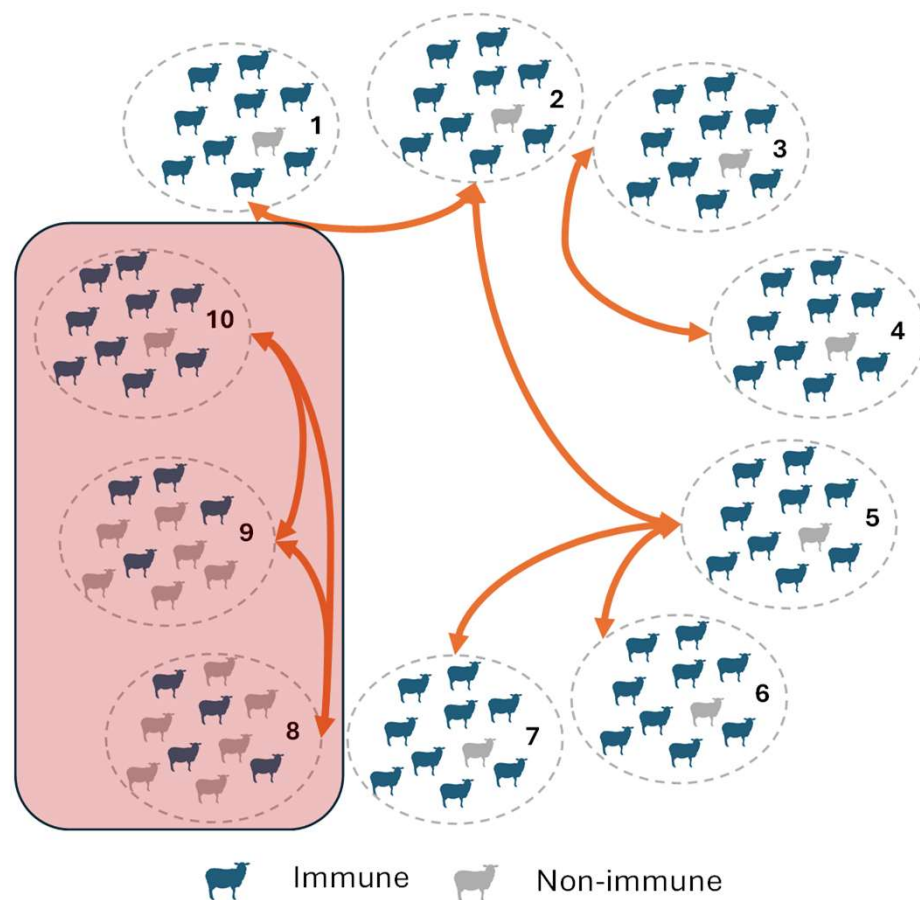


PPRV persistence: the critical community size



Simulation-based exploration of PPR virus persistence across a range of values for R_0 , replacement rate, and birth seasonality. Results are based on simplified stochastic models in isolated populations and should not be interpreted as calibrated to real-world settings. The purpose is to illustrate how demographic and epidemiological parameters influence persistence likelihood.

From geographically-based to epidemiologically-based surveillance and control



*Illustration of how interconnected subpopulations can form an episystem capable of sustaining infection despite high overall immunity. In this example, **the overall proportion of immune animals across all subpopulations is 80%**, but two subpopulations (8 and 9) have only 40% of immune animals. Individually, these low-immunity subpopulations may not meet the threshold population size to maintain transmission. However, **their connectivity with a third subpopulation (10) creates a combined group (8+9+10) with only 57% immunity, which is below the level needed to stop virus spread and that now may be large enough to sustain transmission as a connected community.***

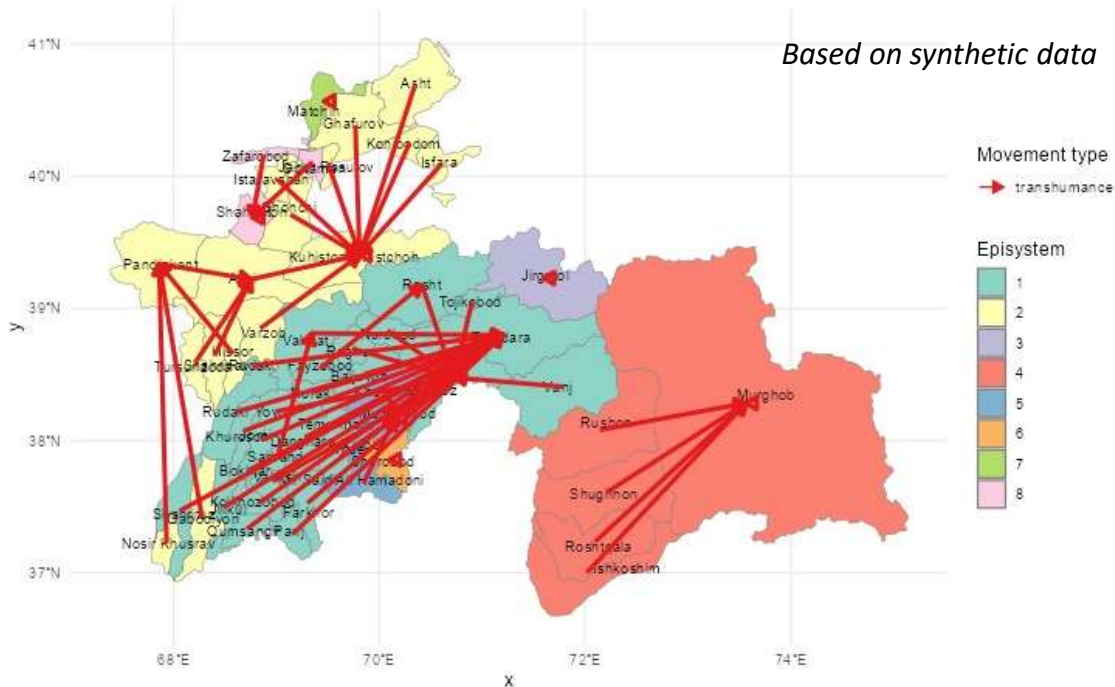
How the episystem approach can guide surveillance at different stages of the eradication pathway

“episystems approach”: critical for rinderpest eradication, it should inform PPR surveillance & control.

Epidemiological setting	Main purpose of surveillance	Recommended approach	Role of the episystem
Infected areas	Guide control through timely detection and confirmation of outbreaks.	Emphasise clinical and participatory surveillance; investigate suspected outbreaks quickly.	Identify maintenance episystems where virus is likely to persist and target control and investigation there.
Vaccinated areas	Verify that vaccination has interrupted virus circulation and detect any residual infection	Combine post-vaccination evaluation with syndromic surveillance in non-vaccinated subpopulations.	Focus on episystems with low immunity or high connectivity to ensure effective coverage and detect possible residual foci.
Unvaccinated free areas	Provide assurance of freedom and early warning of reintroduction.	Rely on passive surveillance and zero-reporting by frontline actors; periodic checks in risk zones.	Monitor border episystems and cross-border movement links for early warning and evidence of vigilance.

Episystem toolkit

Toolkit developed for initial characterization of episystems based on small ruminant demographics and movements – 1 step is integration of phylogenetic data.



Neighbor-joining tree constructed using partial N gene sequences of peste des petits ruminants virus (PPRV), showing relationships among the PPRV lineage IV isolates circulating in Africa. Source: Mulumba-Mfumu, et al (2021). <https://doi.org/10.3390/v13122373>

Qualitatively assessing risk of PPRV presence in different subpopulations

Guideline for Qualitative Risk Assessment of Peste des Petits Ruminants (PPR) Virus Presence in the Post-Vaccination Period

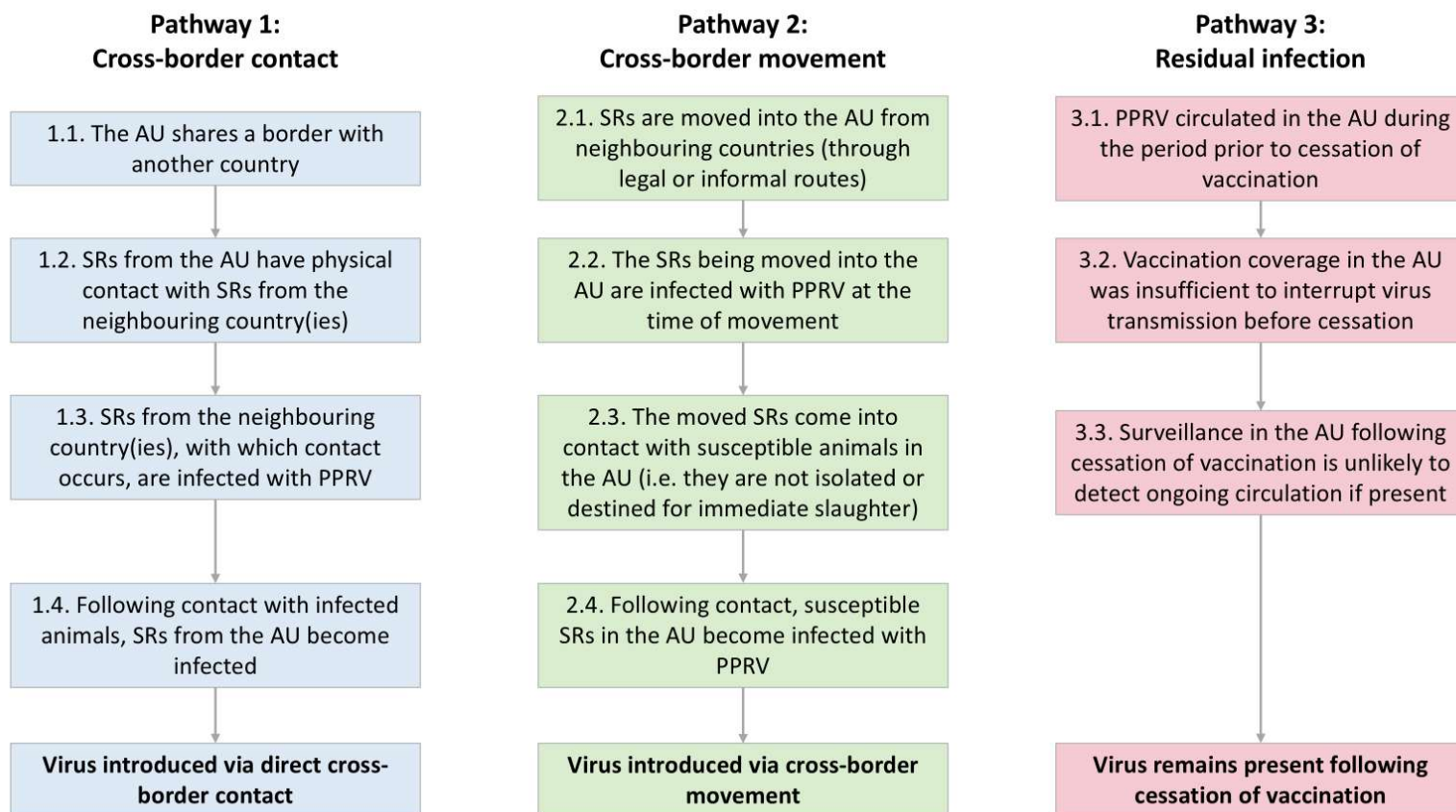
Scenario tree-based framework for assessing risk by administrative unit

3 pathways that can lead to PPRV presence in an area / subpopulation:

- Cross-border contact
- Cross-border movement
- Residual presence following cessation of vaccination

} Applied at the level of administrative units (operational units) but taking into account connectivity.

Qualitatively assessing risk of PPRV presence in different subpopulations



Qualitatively assessing risk of PPRV presence in different subpopulations

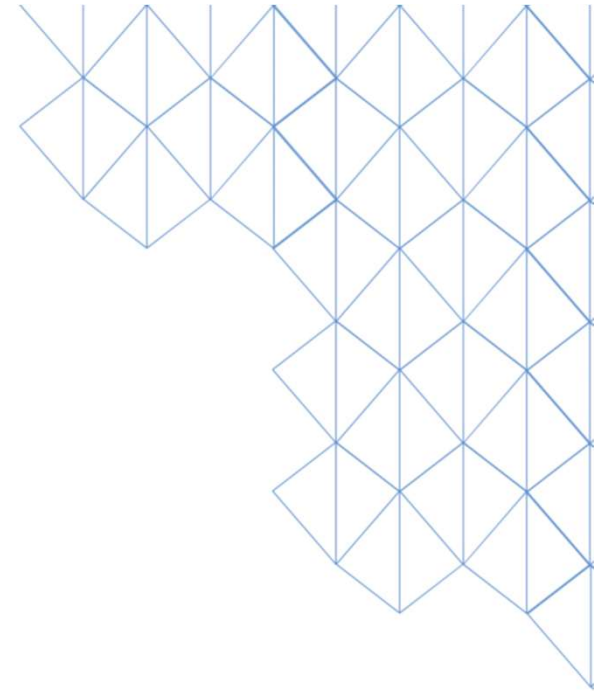
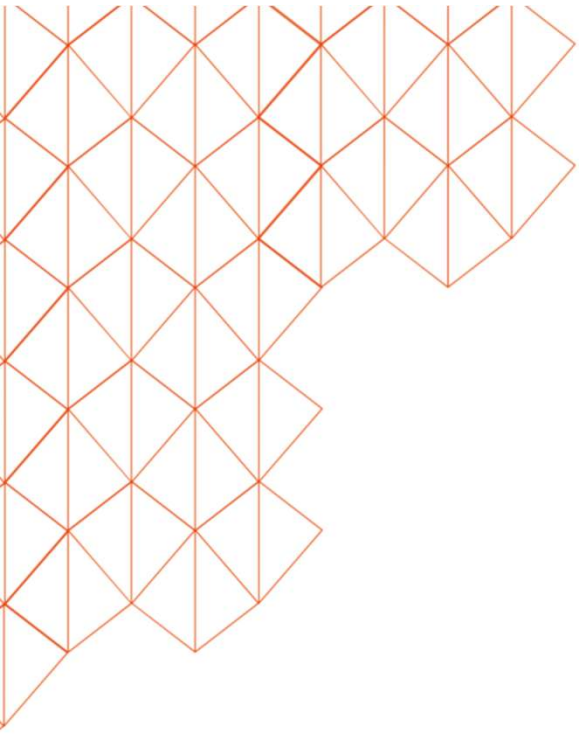
Name of AU	Pathway 1 – Cross-border contact							
	1.1. Does the AU share a land border with one or more neighbouring countries?	1.2. (Likelihood) How likely is it that small ruminants in the AU have direct physical contact with small ruminants from neighbouring countries?	1.2 (Uncertainty) Confidence in Step 1.2 score (Low/Medium/High)	1.3. (Likelihood) How likely is it that small ruminants from neighbouring countries, with which animals in the AU may have physical contact, are infected with PPR virus?	1.3 (Uncertainty) Confidence in Step 1.2 score (Low/Medium/High)	1.4. (Likelihood) How likely is it that such contact with infected small ruminants from neighbouring countries, if it occurs, would result in transmission to small ruminants in the AU?	1.4 (Uncertainty) Confidence in Step 1.2 score (Low/Medium/High)	P1 interim (1.1 gate → 1.2)
AU1	Yes	Very High	Low	Low	Medium	High	Low	Very High
AU2	Yes	Very Low	Low	<div style="border: 1px solid black; padding: 2px;"> Negligible Very Low Low High Very High </div>				Very Low

Name of AU	Results summary			
	Likelihood via cross-border contact (P1)	Likelihood via cross-border movement (P2)	Likelihood via residual infection (P3)	Overall (highest pathway likelihood)
AU1	Negligible	Low	Low	Low
AU2	Very Low	Very Low	Very Low	Very Low
AU3	High	Very Low	Very Low	High
AU4	Negligible	Low	Very Low	Low
AU5	Very Low	Low	Low	Low



Key messages

- Surveillance **objectives evolve** along the eradication pathway.
- The **episystem approach** helps identify and target interconnected populations where the virus is most likely to persist or re-emerge.
- **Sustained vigilance in cross-border episystems** is essential to detect re-introduction early and to maintain confidence in freedom.
- **Episystem toolkit**: A practical starting point to map and characterise episystems using available data.
- **Qualitative risk assessment framework**: supports prioritisation of areas for surveillance in the post-vaccination period.



Thankyou!