## **🧪 Methodology for Estimating PPR Vaccine Needs and Costs Using VADEMOS**

This methodology outlines the approach used to estimate the number of PPR vaccine doses required per country and subnational region in Africa, based on livestock population forecasts and density distributions.

### **1. Data Sources**

* **Population Data**: National livestock population figures were sourced from FAOSTAT (FAO, 2024).
* **Livestock Density Data**: Subnational livestock distribution was derived from Gridded Livestock of the World (GLW4) (2020), which provides species-specific density maps at 10 km resolution.
* **Forecasting Model**: VADEMOS uses an automated machine learning algorithm to predict future livestock populations. When model predictions are unavailable, the most recent FAOSTAT data is used. Users may also manually input more accurate national figures if available. Link to [VADEMOS](https://eufmd.shinyapps.io/VADEMOS/)

### **2. Population Forecasting**

* The analysis uses **2025 livestock population predictions** for sheep and goats. These forecasts represent national-level targets for vaccination planning.

### **3. Density Calculation and Regional Distribution**

* Livestock density data from GLW4 is processed using GIS tools to calculate the **percentage share of each species** within administrative regions (ADM1).
* These percentages are used to proportionally allocate the national forecasted population to each subregion:
  + 100%\_Coverage = (Density / 100) × Forecasted Value
  + 80%\_Coverage = 0.8 × 100%\_Coverage

This ensures that vaccine needs are estimated based on actual livestock concentrations, supporting both prophylactic and emergency vaccination strategies.

### **4. Vaccination Schedule Logic**

* The vaccination strategy includes:
  + **First-round vaccination**: Targeting 100% or 80% of the forecasted population.
  + **Second-year newborns**: Estimating the number of animals born in the following year that would require vaccination.

### **5. Newborn Estimation**

* Based on average reproductive rates in African small ruminant systems:
  + **Goats**: 60% of the vaccinated population is expected to be newborns in the second year.
  + **Sheep**: 40% of the vaccinated population is expected to be newborns in the second year.
* These estimates are applied to the 100%\_Coverage values:
  + 2nd\_year\_newborns = 0.6 × 100%\_Coverage for goats
  + 2nd\_year\_newborns = 0.4 × 100%\_Coverage for sheep

### **6. Cost Estimation**

The cost of PPR vaccination per animal varies significantly across countries and production systems, reflecting differences in delivery channels, logistics, and scale of operations. Reported vaccine prices range from approximately USD 0.06 to USD 0.30 per dose, while the total vaccination service cost (including logistics, personnel, and delivery) can reach between USD 0.18 and USD 2.00 per animal. Key cost drivers include whether vaccination is delivered through public campaigns, which often incur higher fixed and operational expenses, or through private channels, which may be more variable but sometimes lower. Pastoral and agropastoral systems also influence delivery costs due to differences in accessibility and farmer involvement. Economies of scale, as observed in large campaigns such as in Somalia, can reduce per-animal costs, whereas vaccine wastage—ranging from 10–33% in some cases—tends to increase overall expenditure. These factors must be considered alongside vaccine demand estimates to provide realistic and context-specific cost projections