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GF-TADs

Foot and Mouth Disease

Risk Assessment Training Workshop

Johannesburg, South Africa 19-21 September 2023



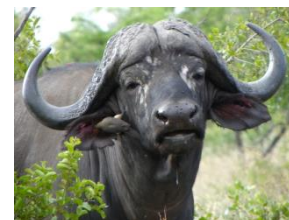
Outline

- 1 FMDV transmission
- 2 Veterinary fence
- 3 Surveillance
- 4 Movement control
- 5 Vaccination
- 6 Summary



Foot-and-mouth disease

- Foot and mouth disease (FMD) is a transboundary animal disease (TAD) that affects cloven-hoofed livestock and wildlife
- FMD was the first animal disease to be identified as a filterable agent (virus) in 1897
- A contagious viral disease that causes severe economic impacts due to reduced production and as a barrier to free trade
- Seven serotypes – SAT1-3, O, A, Asia-1, C
- African buffalo is the only confirmed wildlife reservoir of SAT serotypes

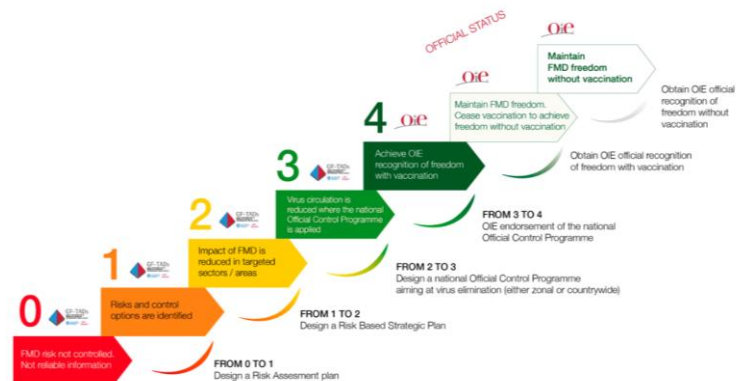


FMD control



<https://www.getsurrey.co.uk/news/surrey-news/pirbright-research-clinic-fined-after-7063314>

- FMD control is performed in effort to reduce the number of adequate (high-risk) contacts and/or the susceptible population
- The appropriate control strategy will vary from country to country depending on the epidemiological situation



Farm-level FMD control

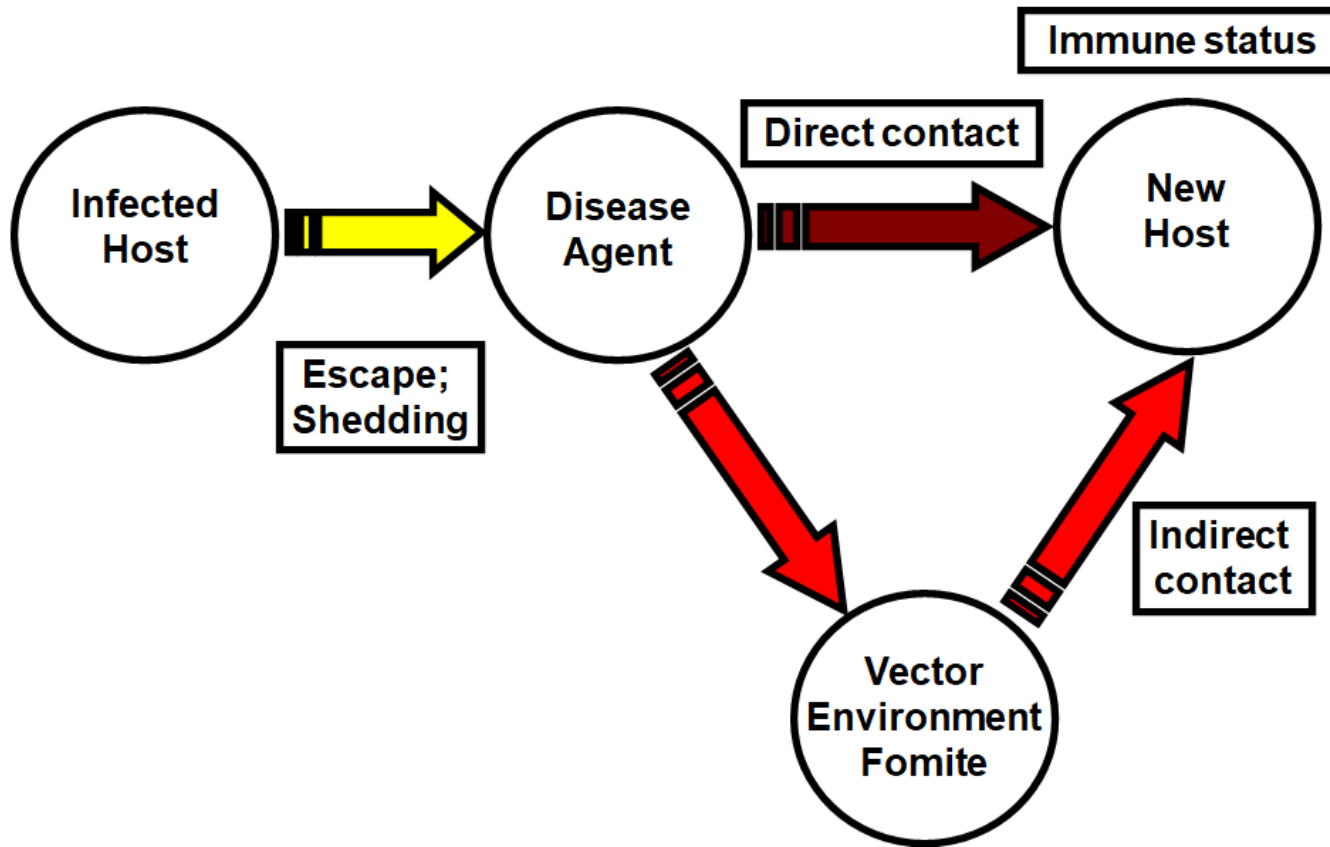


<https://www.technologynetworks.com/immunology/articles/biosecurity-from-the-horses-mouth-328509>



- Biosecurity is the fundamental concept to reduce high-risk contacts (introduction and spread)
 - Closed herd; all-in, all-out management
 - Testing and quarantining herd introductions; only add low-risk animals
 - Controlled access to people and equipment
 - Disinfection of entries when high-risk
 - Cleaning and disinfecting livestock pens and equipment
 - Animal health examinations and record keeping
 - Appropriate disposal of manure and carcasses

FMD virus transmission



- FMD is highly infectious and contagious
 - Spread by direct contact
 - Typically via respiratory route
- Indirect contact also important
 - Contaminated products
 - Fomites
 - (Long-distance aerosols)

FMD Virus transmission

- Incubation period is highly variable (2-14 days) and depends upon many factors including route of exposure, exposure dose, species, breed, immunological status
- Duration of infectiousness
 - Cattle – 2 days (0-5)
 - Swine – 7 days (1-10)
 - Sheep – 3 days
 - Goats – 5 days
- Carrier – cattle up to 3 years, sheep 9 months, goats 4 months, African buffalo 5 years
- R_0 – estimated to be about 20 during the 2001 UK FMD epidemic but approximately 2 in other field studies and via indirect contact

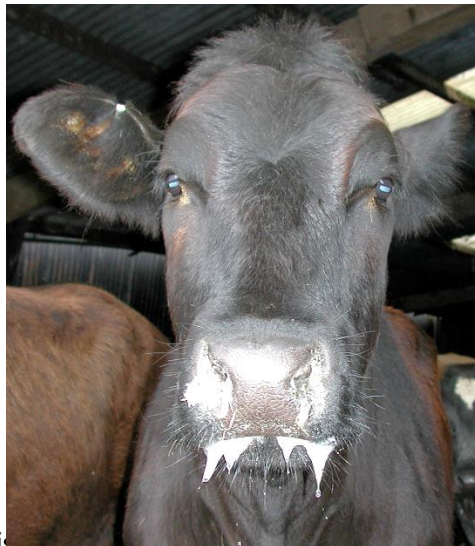


Animal to animal transmission



- FMD virus can be detected in all excretions and secretions
- Aerosolised virus can infect other animals via the respiratory route
- Respiratory droplets can infect animals by the respiratory or oral routes
- Shedding in milk can infect calves
- Contaminated semen can cause infection during breeding
- Virus can be shed prior to clinically apparent signs

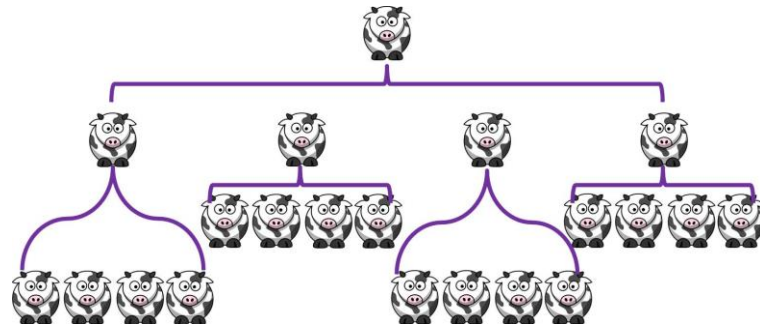
<https://www.nadis.org.uk/disease-a-z/cattle/foot-and-mouth-disease/>



FMD Virus transmission

- Rate of transmission (transmissibility) \sim rate of adequate contact x duration of infectiousness
- $R_0 = 1$: endemic disease state
- $R_0 > 1$: increasing number of cases, epidemic if the population is susceptible to infection
- $R_0 < 1$: disease will not be maintained in the population
- Proportion required to be immunized (protected) to prevent an outbreak

- $(R_0 - 1) / R_0$
- $(20 - 1) / 20 = 95\%$
- $(2 - 1) / 2 = 50\%$
- $(5 - 1) / 5 = 80\%$



Pillars of FMD control

1. Disease control fences

- a) Separation of domestic animals from wildlife reservoirs

2. Surveillance

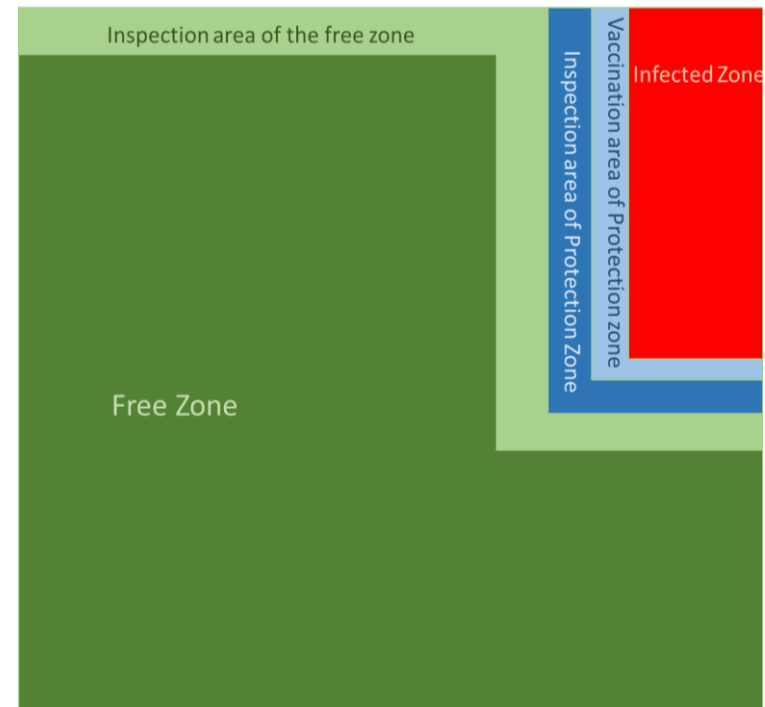
- a) Clinical surveillance
- b) Serological surveillance

3. Movement restrictions

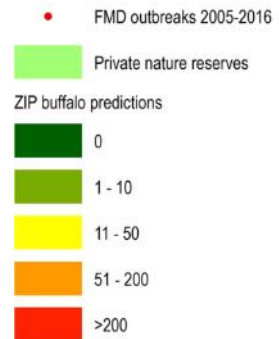
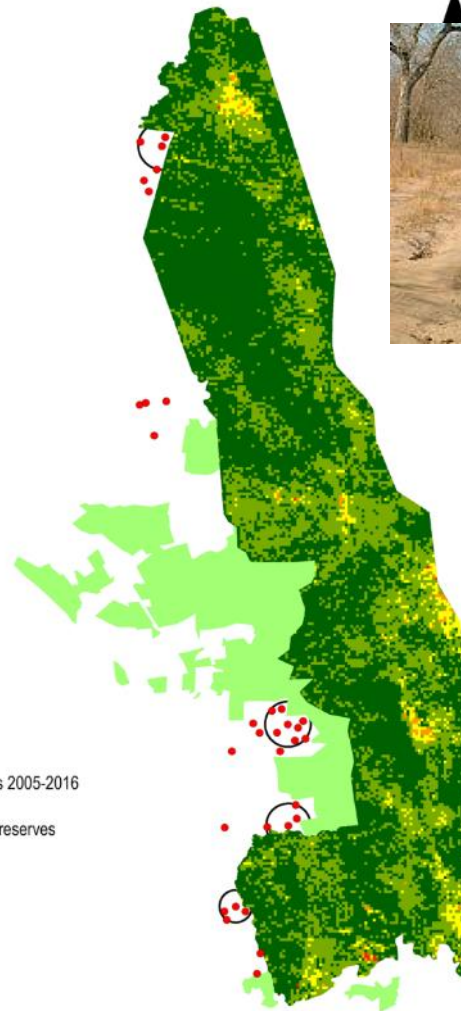
- a) FMD zoning
- b) Permit system

4. Vaccination of cattle

- a) Appropriate vaccine – matching
- b) Vaccination proportion
- c) Vaccination interval



Disease control fences

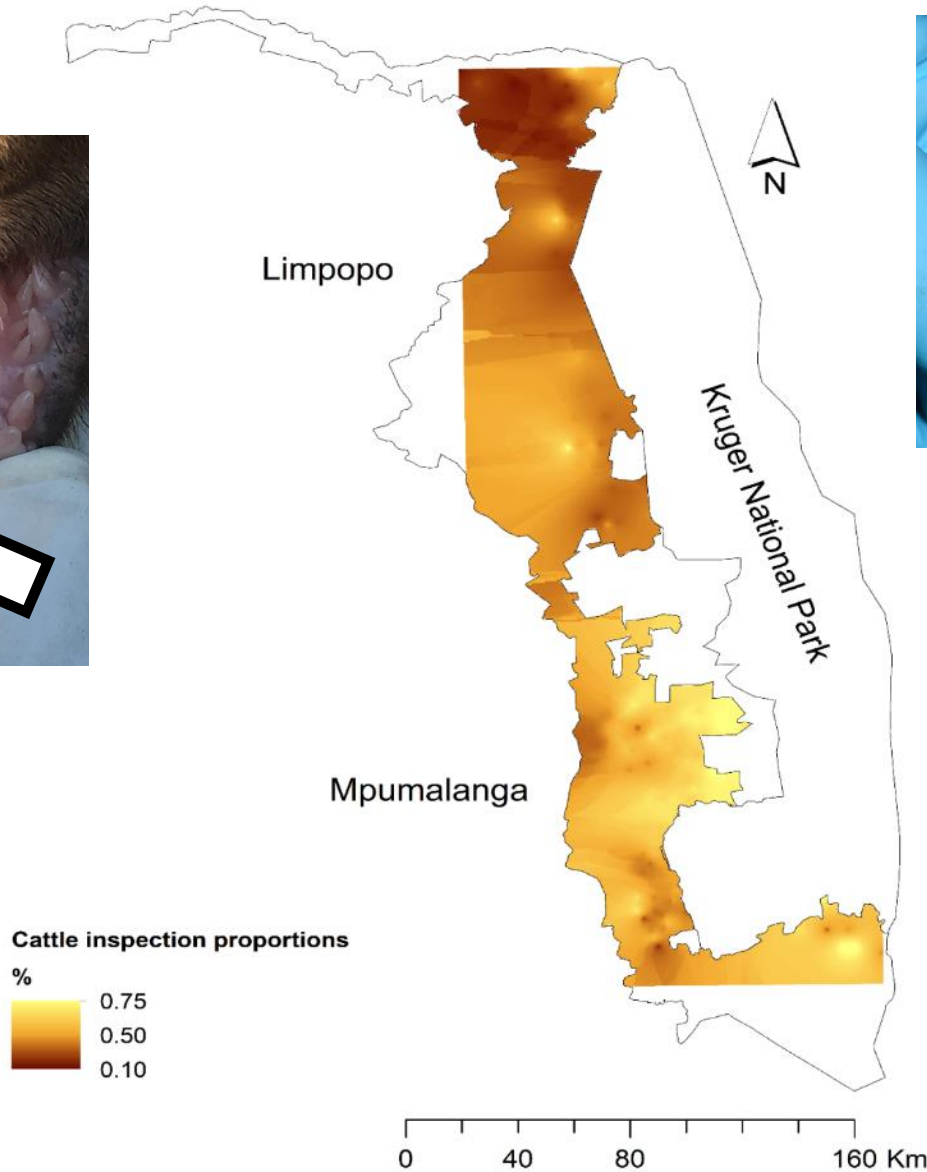


Clinical surveillance

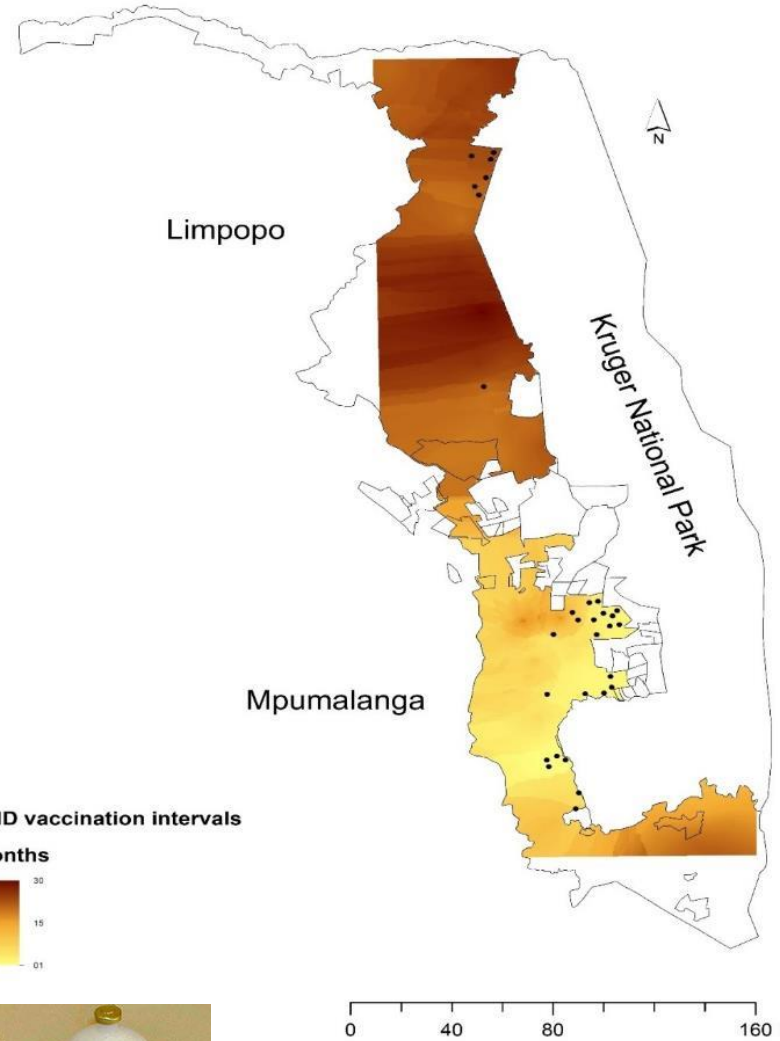
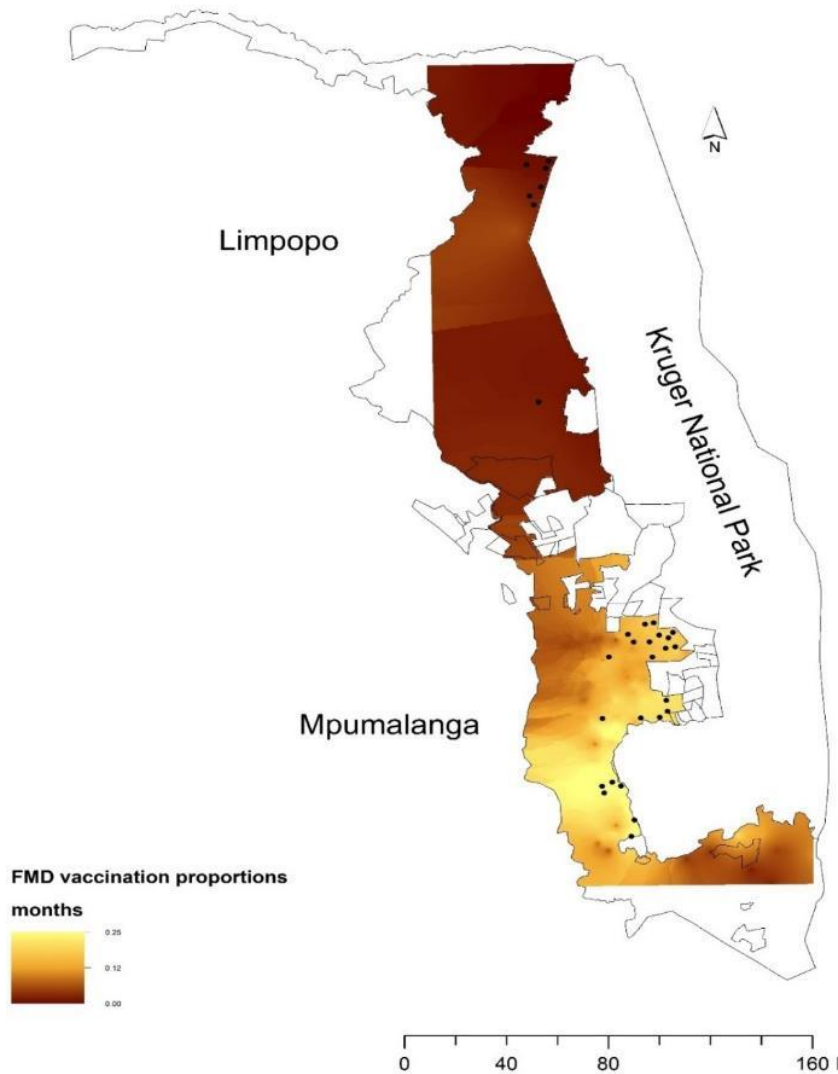


- Typical clinical signs are the development of fever and subsequently vesicles on the nose, inside the oral cavity, on the feet, and on the teats
- Ruptured blisters can cause lameness and reluctance to move or eat
- Lesions typically heal within 7 days but secondary bacterial infections can occur

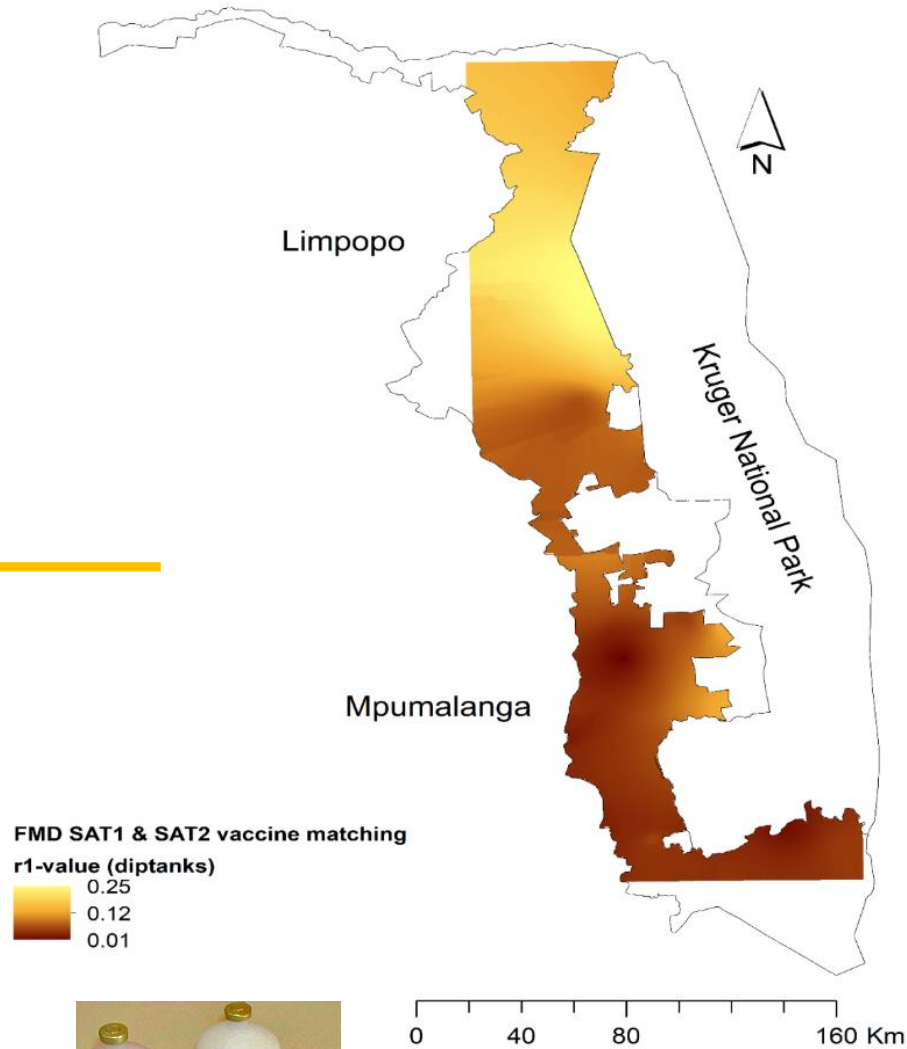
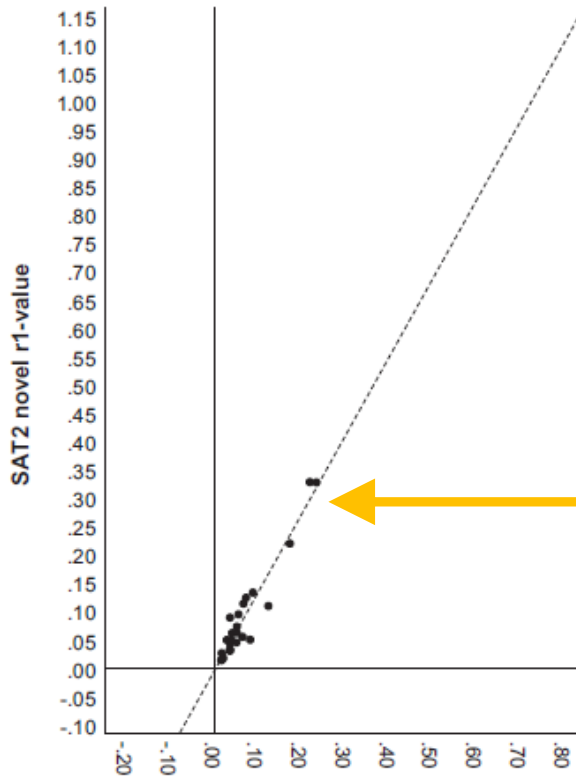
Clinical Surveillance



Vaccination



Vaccination



Country-level FMD control

- Contingency planning for potential outbreaks including farmer compensation, carcass disposal, disinfection and vaccination protocols
- Desk-top outbreak simulation exercises for the coordination of all stakeholders involved in outbreak control including movement restrictions
- Regular clinical and laboratory surveillance in susceptible species
- Livestock movement data base with ability for contact tracing
- Disease control fencing (wildlife contacts)
- Vaccination
 - Antigen bank for rapid emergency vaccination
 - Routine vaccine matching
 - Post-vaccination serological monitoring

Summary

- FMD is difficult to control due to the large number of susceptible hosts, multiple transmission routes, and subclinical transmission
- Control efforts should give the highest priority to preventing direct transmission events
- Animals will and do move out of control areas due to market forces
- Vaccines should be matched to locally relevant viruses
- Field vaccination must target a high proportion of susceptible animals and be performed at appropriate intervals





Thank you



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