Risk Assessment as a Tool for the Control and Prevention of Rift Valley Fever Outbreaks

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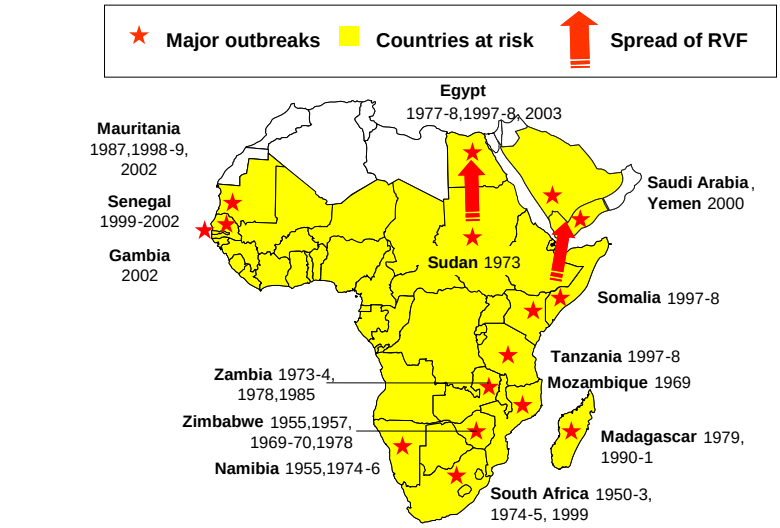
Outline

- background
  - Rift Valley fever
  - risk analysis
- Rift Valley fever risk assessments for following scenarios
  - endemically infected
  - free from infection
- conclusion

Rift Valley fever (RVF)

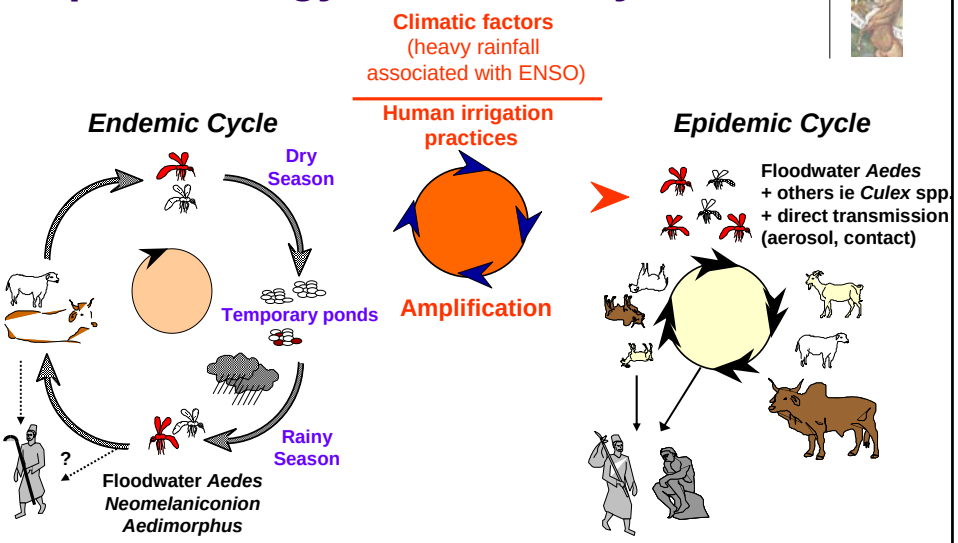
- *Phlebovirus* genus within family *Bunyaviridae*
- vector-borne infection
  - wide range of arthropod species
- domestic ruminant species
  - peracute and acute disease in domestic ruminant species
  - high mortality among new-born animals
  - abortion in adult females
- humans
  - influenza-like illness
  - fatalities occur

Reported RVF Outbreaks in Africa and Arabian Peninsula



From: EFSA RVF risk assessment report 2005

Epidemiology of Rift Valley Fever

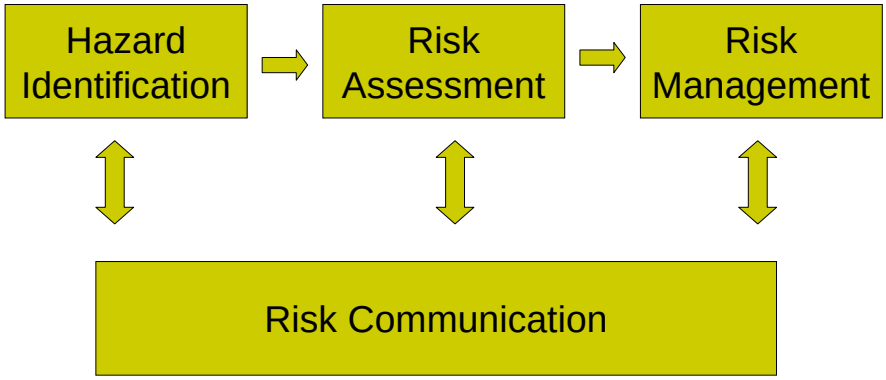


From: EFSA RVF risk assessment report 2005

Risk Analysis

- science-based and transparent approach to risk management
- estimate, evaluate and discuss risk of adverse events and their mitigation
  - structured approach
- contains several components
- qualitative and/or quantitative approach
- *express and communicate risk as well as uncertainty!!!*

Risk Analysis Components

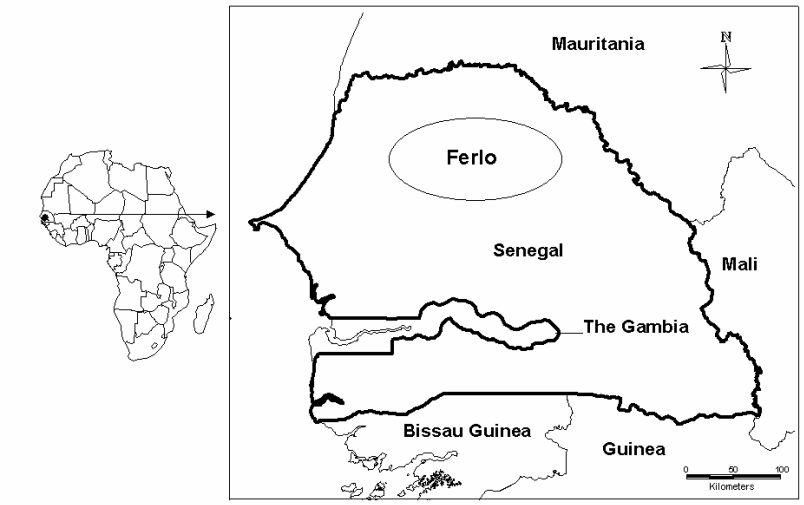


after OIE Animal Health Code

Risk Assessment Models

- risk pathway diagrams
  - release, exposure and consequence assessment
- model implementation
  - qualitative or quantitative
  - data- or knowledge driven
    - statistical models derived from empirical data
    - static or dynamic models
      - based on expert opinion and published information

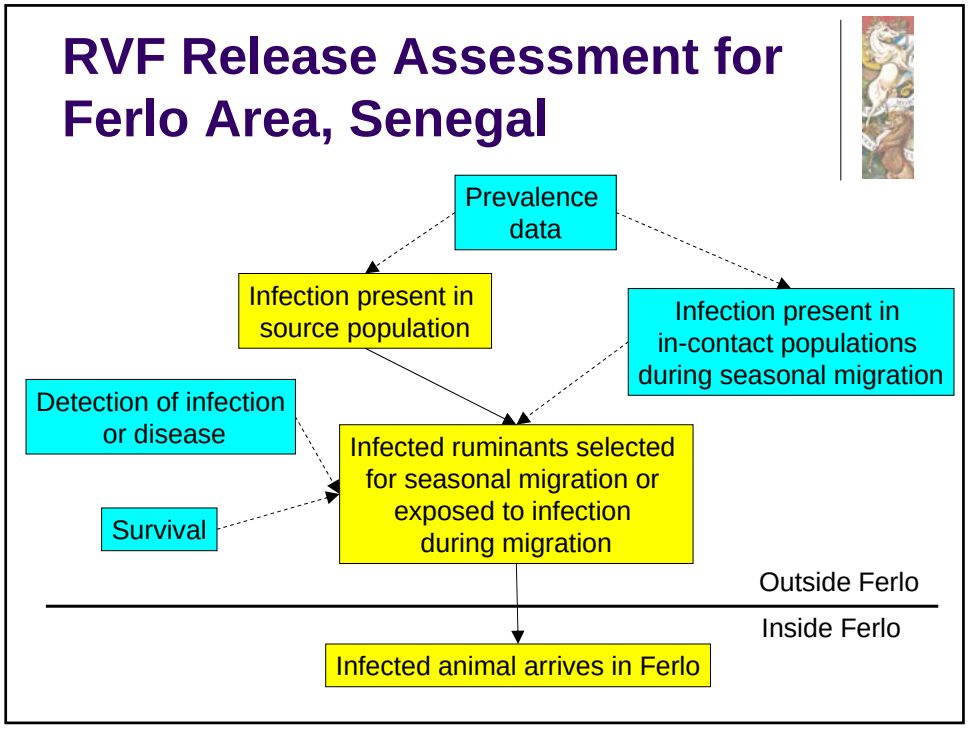
RVF Risk Assessment in Country with Endemic Infection: Senegal

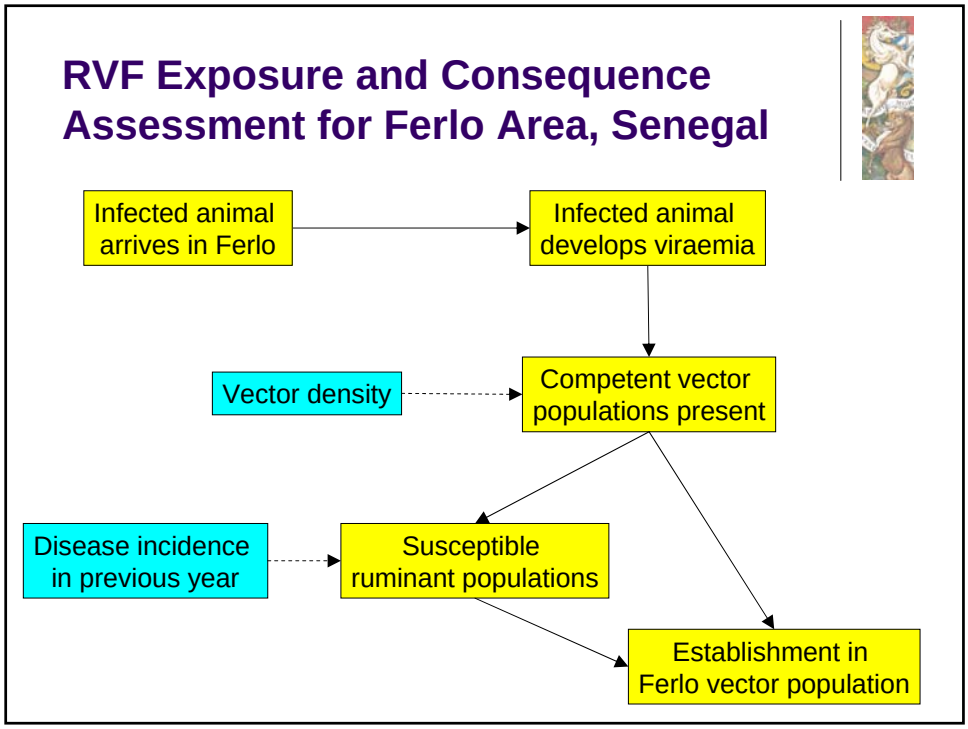


RVF in Ferlo Area of Senegal

- Sahelian climate
- temporary pond system
  - *Aedes vexans*
  - *Culex poicilipes*
- massive movement of nomadic herds during rainy season into Ferlo
- endemic RVF infection
  - no mosquitoes during dry season

=> maintenance mechanisms?


RVF Release Assessment for Ferlo Area, Senegal
Prevalence data
Infection present in source population
Infection present in in-contact populations during seasonal migration
Detection of infection or disease
Infected ruminants selected for seasonal migration or exposed to infection during migration
Survival
Outside Ferlo
Inside Ferlo
Infected animal arrives in Ferlo


RVF Exposure and Consequence Assessment for Ferlo Area, Senegal
Infected animal arrives in Ferlo
Infected animal develops viraemia
Vector density
Competent vector populations present
Disease incidence in previous year
Susceptible ruminant populations
Establishment in Ferlo vector population

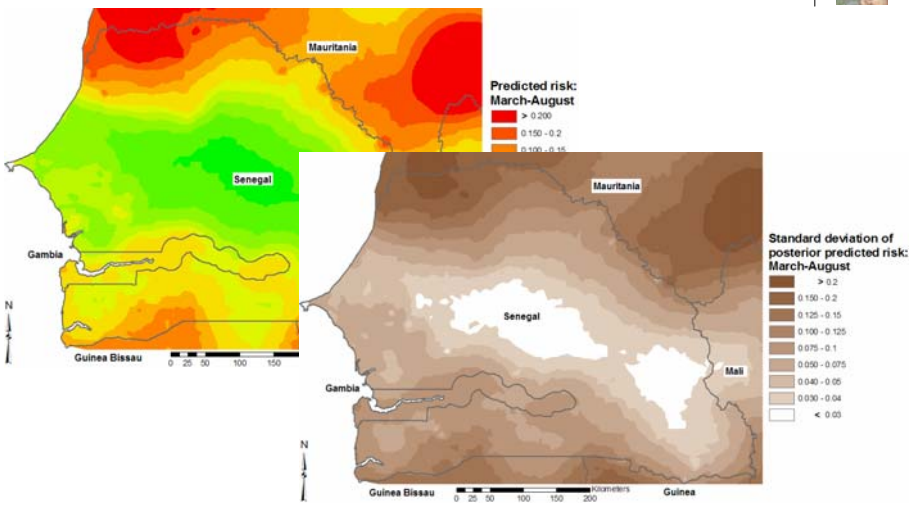
Conclusions from Risk Assessment for Ferlo Area, Senegal

- low risk of release through nomadic animal movements
- high risk of maintenance through trans-ovarial transmission amongst vectors
  - mosquito density heterogeneous in space and time
    - pond type
    - vegetation cover
    - rainfall rhythm

Recommendations from Risk Assessment for Ferlo Area, Senegal

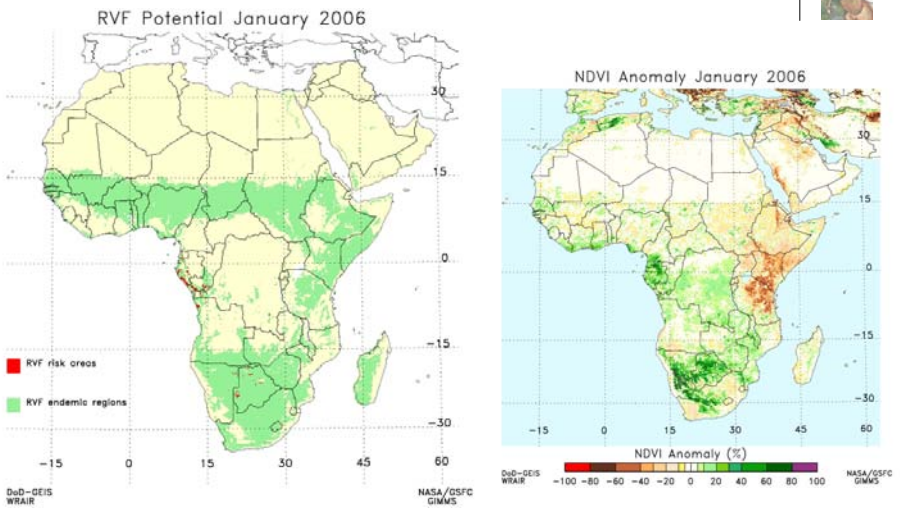
- risk management
  - larvicides and/or artificial ponds
- research
  - validate results
  - quantify key parameters such as vector capacity
  - assess linkages between ecological factors and mosquito densities

Data-Driven Model: RVF Risk in March-August



From: Clements 2005

RVF Risk Prediction by DoD-GEIS

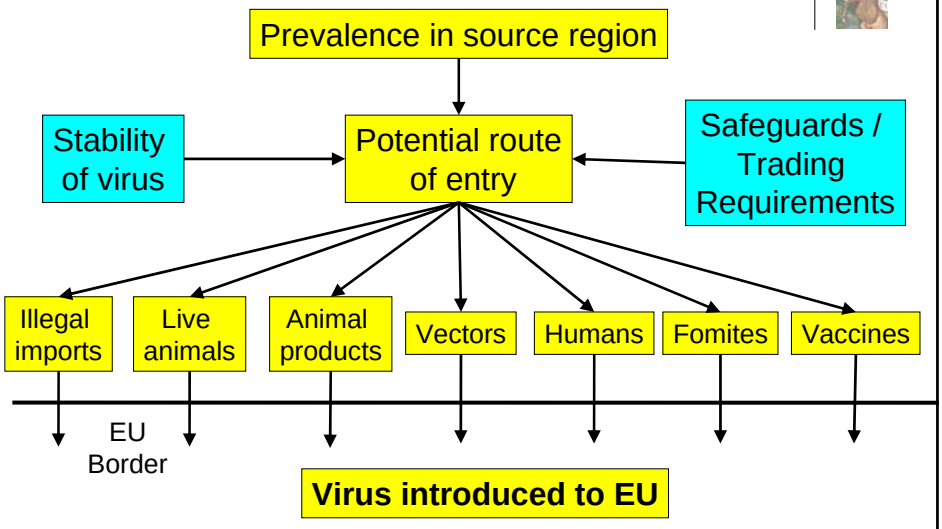


from: Department of Defense Global Emerging Infections Surveillance and Response System

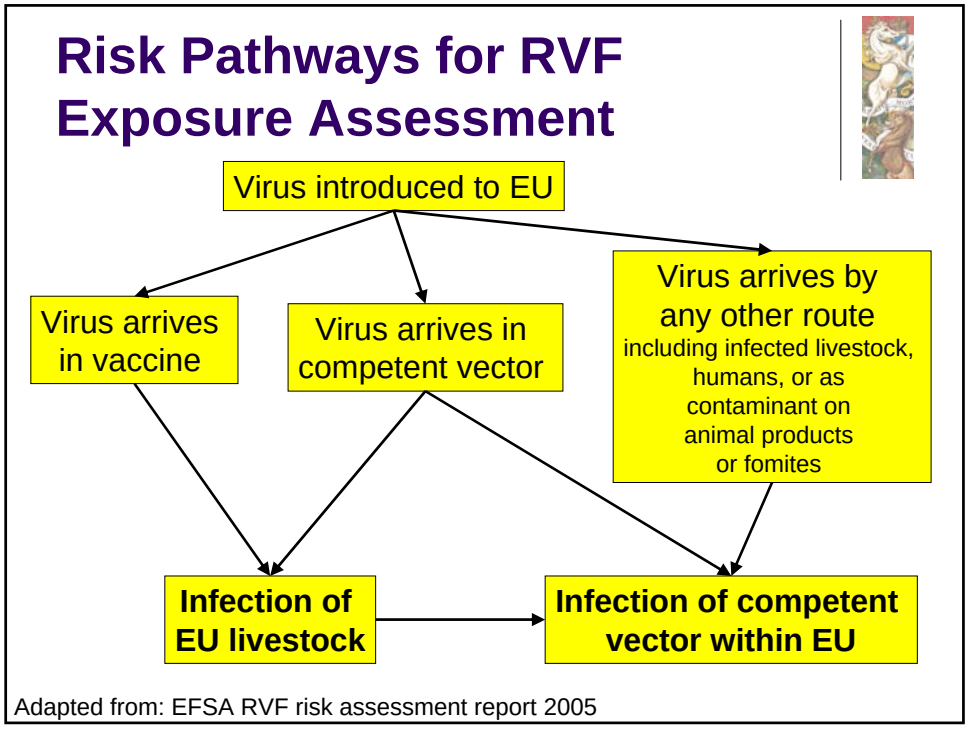
Risk of RVF Introduction to European Union

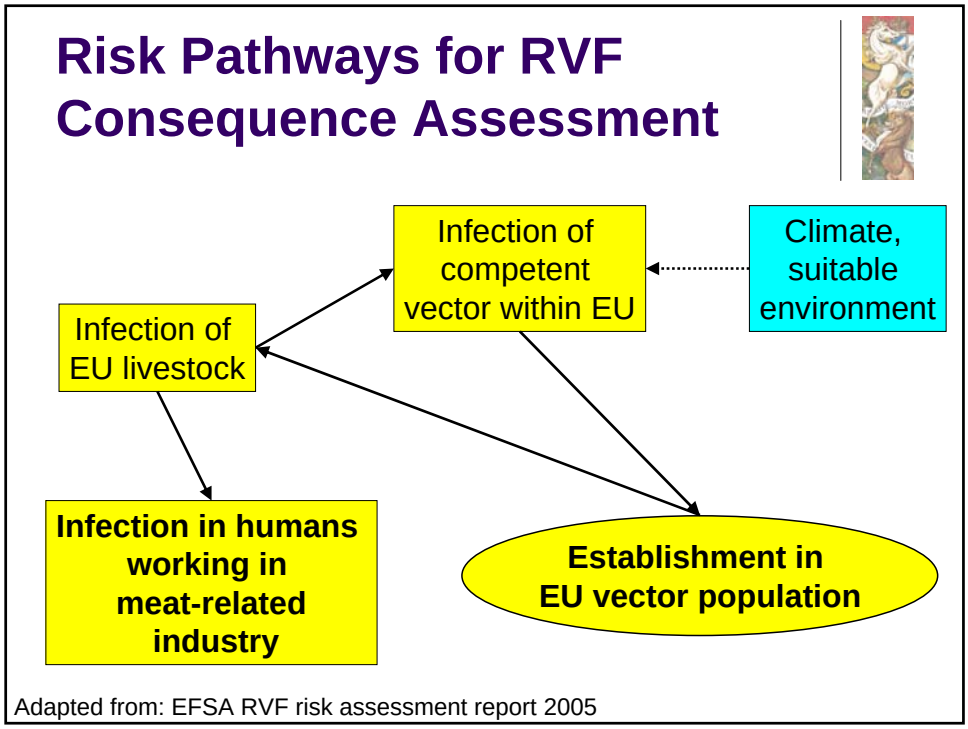
- qualitative risk assessment
- conducted by European Food Safety Authority
  - independent from risk managers (European Commission)
- involved experts from Europe and Africa

Risk Pathways for RVF Release Assessment



Adapted from: EFSA RVF risk assessment report 2005


Risk Pathways for RVF Exposure Assessment
Virus introduced to EU
Virus arrives in vaccine
Virus arrives in competent vector
Virus arrives by any other route
including infected livestock, humans, or as contaminant on animal products or fomites
Infection of EU livestock
Infection of competent vector within EU
Adapted from: EFSA RVF risk assessment report 2005


Risk Pathways for RVF Consequence Assessment
Infection of competent vector within EU
Climate, suitable environment
Infection of EU livestock
Infection in humans working in meat-related industry
Establishment in EU vector population
Adapted from: EFSA RVF risk assessment report 2005

Conclusions from RVF Risk Assessment for EU

- release assessment
  - greatest risk through aerial movement of infected vectors
    - negligible risk during inter-epidemic periods in source country
    - low-to-moderate risk during epidemic periods in source country
- exposure and consequence assessment
  - higher than negligible risk of
    - livestock exposure within EU to infected vectors
    - development of endemic foci of infected vector populations
      - particularly with vectors having potential for trans-ovarial transmission

From: EFSA RVF risk assessment report 2005

Recommendations from RVF Risk Assessment for EU

- establishment of targeted surveillance
- model predictions should be incorporated into RVF early-warning surveillance systems
- research activities aimed at filling existing data gaps

From: EFSA RVF risk assessment report 2005

Conclusion

- risk analysis effectively separates risk assessment from risk management
  - risk assessment provides structured framework for describing risk and uncertainty
- RVF risk management particularly suitable for taking account of modelling predictions
  - dependence of vector densities on environmental variables
  - need to improve validity of model predictions
  - consider model outputs for defining risk-based surveillance activities

Acknowledgement

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