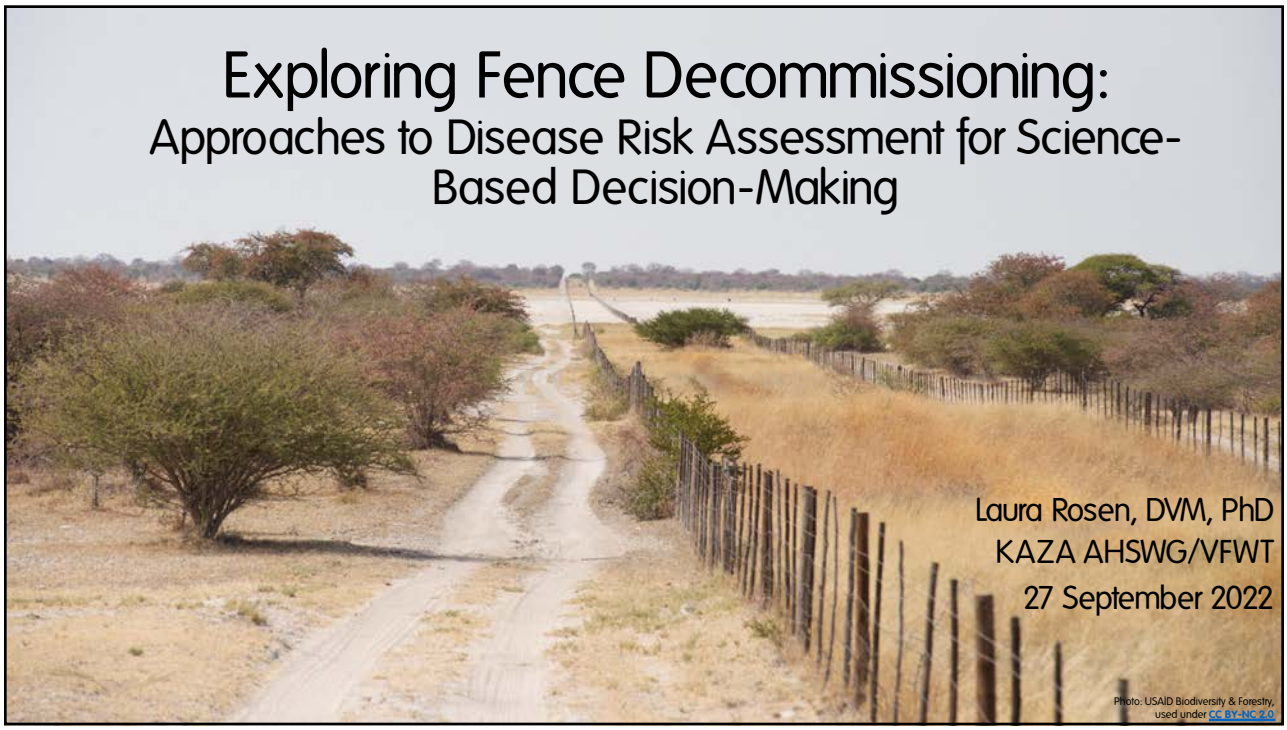
# Exploring Fence Decommissioning:
## Approaches to Disease Risk Assessment for Science-Based Decision-Making



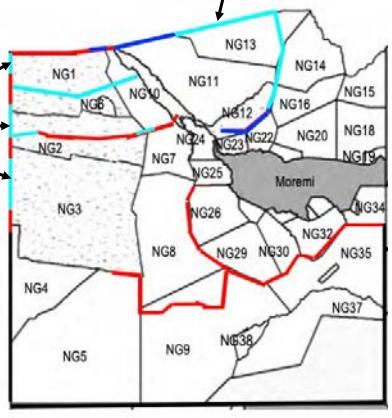
Laura Rosen, DVM, PhD
KAZA AHSWG/VFWT
27 September 2022



# Proposed Namibia/Botswana Border Fences

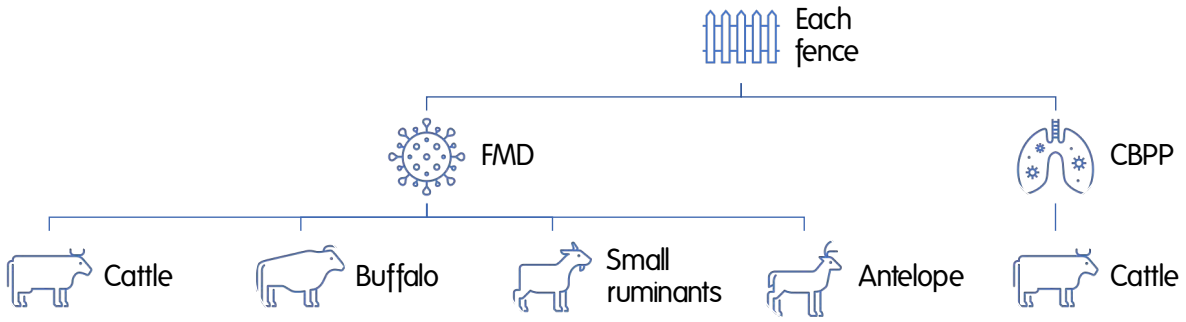
Zambezi Fence, east of Okavango River

Western Border Fence, sections along Khaudum NP and Nyae Nyae Conservancy




Map: AHEAD, non-public report

## Proposed Risk Assessments




Baseline risk?

What could go wrong?

How likely is it to happen?

What is the magnitude of the consequences?

## What could go wrong?

- Identify hazards
- Develop scenario tree

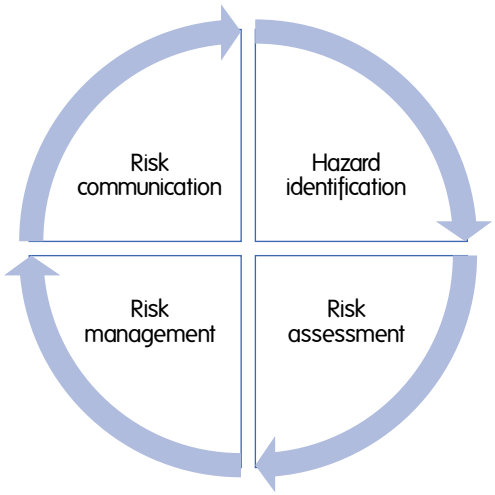
## How likely is it to happen?

- Collect data sources/elicit expert opinions
- Determine risks (qualitative/quantitative)

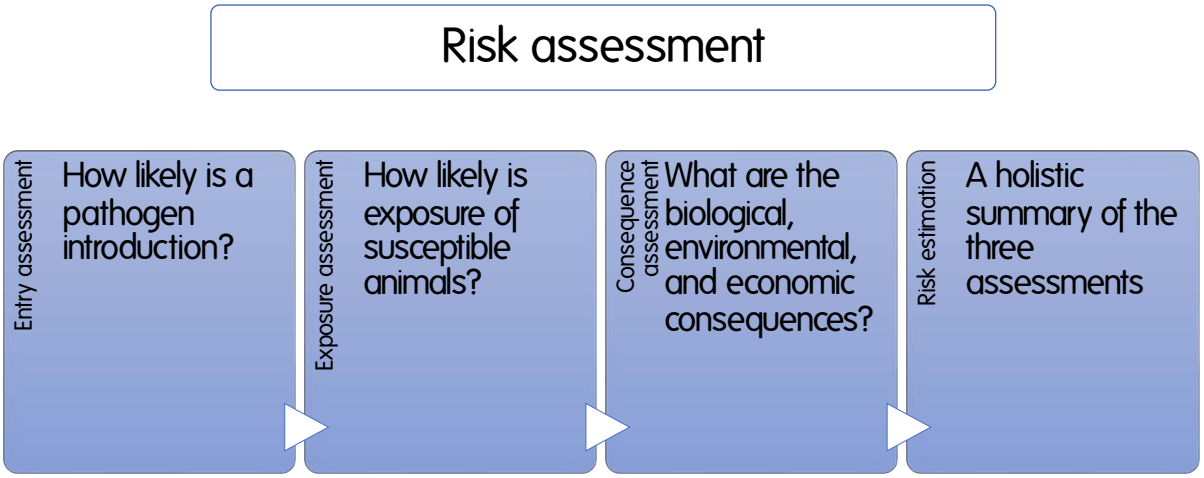
## What is the magnitude of the consequences?

- Consider biological, economic, and environmental

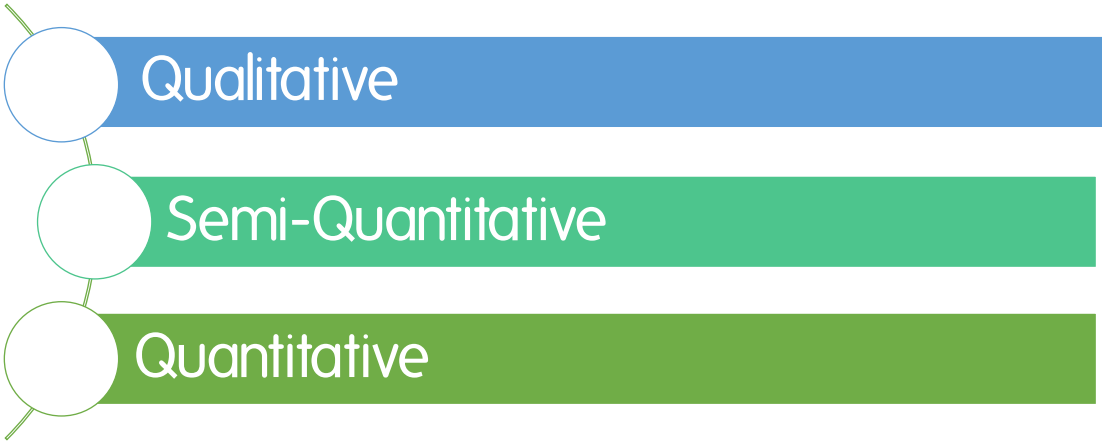
## OIE (WOAH) Framework for Import Risk Analysis



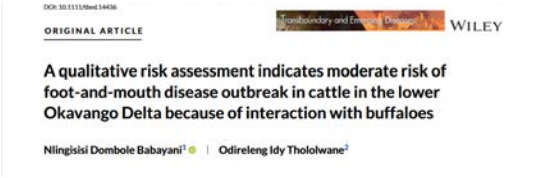
## OİE (WOAH) Framework for İmport Risk Analysis




## Risk Assessment Approaches



# Qualitative


ORIGINAL ARTICLE

A qualitative risk assessment indicates moderate risk of foot-and-mouth disease outbreak in cattle in the lower Okavango Delta because of interaction with buffaloes

Nlingisisi Dombole Babayani[1] | Odireleng Idy Tholoiwane[2]

| Risk Level | Definition |
|---|---|
| Negligible | Rare occurrence to be ignored |
| Low | Rare but occurrence a possibility in some cases |
| Medium | Regular occurrence |
| High | Very regular occurrence |

# Qualitative

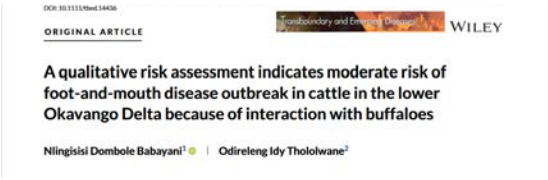

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**TABLE 4** Uncertainty categories for parameter value estimates depending on data availability (Fournié et al., 2014)

| Uncertainty category | Interpretation |
|---|---|
| Low | There are solid and complete data available; strong evidence is provided in multiple references; authors report similar conclusions. Several experts have multiple experiences of the event, and there is a high level of agreement between experts. |
| Moderate | There are some but not complete data available; evidence is provided in a small number of references; authors report conclusions that vary from one another. Experts have limited experience of the event and/or there is a moderate level of agreement between experts. |
| High | There are scarce or no data available; evidence is not provided in references but rather in unpublished reports or based on observations, or personal communication; authors report conclusions that vary considerably between them. Very few experts have experience of the event and/or there is a very low level of agreement between experts. |

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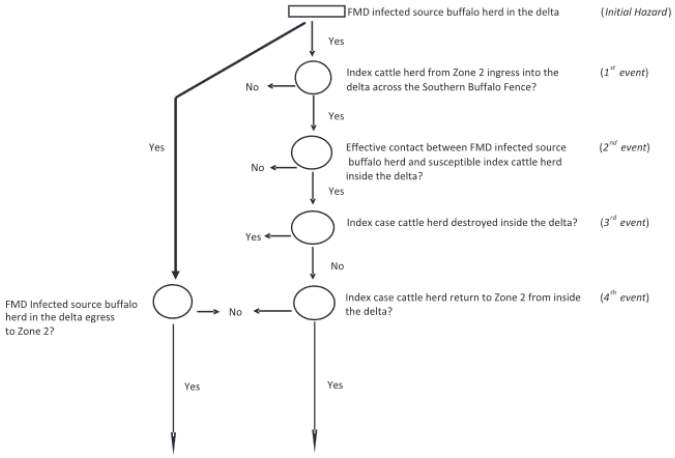


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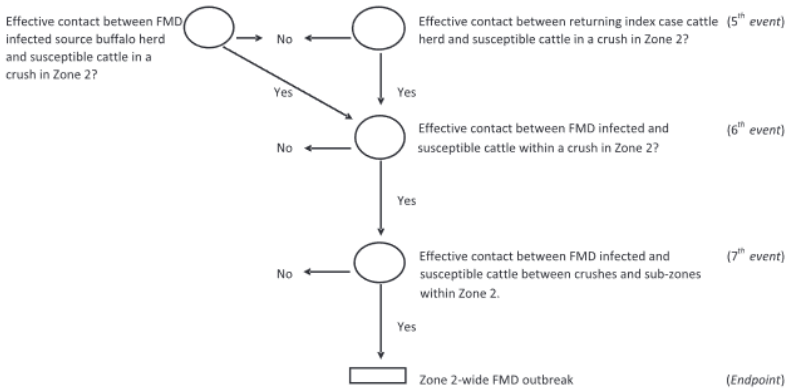

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**TABLE 2** Combination matrix used for conditional events occurrence probabilities (Gale et al., 2010)

| | Result of the assessment of Parameter 2 | | | |
|---|---|---|---|---|
| **Results of the assessment of Parameter 1** | **Negligible** | **Low** | **Moderate** | **High** |
| Negligible | Negligible | Negligible | Negligible | Negligible |
| Low | Negligible | Low | Low | Low |
| Moderate | Negligible | Low | Moderate | Moderate |
| High | Negligible | Low | Moderate | High |

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**A. Probability of release**

***(i) Cattle ingress into delta and return***

1. FMDv infection of buffalo. 'high'
2. Cattle from Zone 2 ingress into the delta. 'high' → high†
3. Effective contact between FMDv infected buffalo and susceptible cattle inside the delta. 'low' → low†
4. FMDv Infected cattle inside the delta being missed for destruction. 'high' → low†
5. FMDv Infected cattle returning to zone 2 from inside the delta. 'high' → low†

***(ii) Buffalo egress to zone 2***

1. FMDv infection of buffalo. 'high'
2. FMDv Infected buffalo egressing to zone 2. 'high' → high†

# Qualitative

**B. Probability of exposure**

***(i) Cattle ingress into delta and return***

1. FMDv infected cattle returning from inside the delta having an effective contact with susceptible cattle in an index crush in zone 2. — 'high'

***(ii) Buffalo egress to zone 2***

1. FMDv infected buffalo egressing to zone 2 having an effective contact with susceptible cattle in an index crush in zone 2. — 'low'

**C. Probability of occurrence of hazard**

***(i) Cattle ingress into delta and return***

1. Probability of Release [A(i)] — 'low'
2. Probability of Exposure [B(i)] — 'high'

→ low† → low‡

***(ii) Buffalo egress to zone 2***

1. Probability of Release [A(ii)] — 'high'
2. Probability of Exposure [B(ii)] — 'low'

→ low† → low‡

† Table 2 combination matrix adopted.
‡ Table 3 combination matrix adopted.

DOI: 10.1111/tbed.14436

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# Qualitative

**A Qualitative Risk Assessment of Rabies Reintroduction Into the Rabies Low-Risk Zone of Bhutan**

*Sangay Rinchen[1*], Tenzin Tenzin[1], David Hall[2] and Susan Cork[2*]*

**TABLE 1 |** Qualitative probability scales with definitions used for assigning the probability to any factor or event in this assessment.

| Likelihood scale | Definition |
|---|---|
| Negligible | Likelihood of an event occurring is so rare that it does not merit consideration |
| Extremely low | Likelihood of an event occurring is extremely rare but cannot be excluded |
| Very low | Likelihood of an event occurring is rare but does occur |
| Low | Likelihood of an event occurring is occasional |
| Medium | Likelihood of an event occurring is regular |
| High | Likelihood of an event occurring is very often |

# Qualitative

**A Qualitative Risk Assessment of Rabies Reintroduction Into the Rabies Low-Risk Zone of Bhutan**

*Sangay Rinchen[1*], Tenzin Tenzin[1], David Hall[2] and Susan Cork[3*]*

**TABLE 2 |** Combination matrix used to combine two probabilities.

| Probability | Negligible | Extremely low | Very low | Low | Medium | High |
|---|---|---|---|---|---|---|
| Negligible | Negligible | Negligible | Negligible | Negligible | Negligible | Negligible |
| Extremely low | Negligible | Extremely low | Extremely low | Extremely low | Extremely low | Extremely low |
| Very low | Negligible | Extremely low | Very low | Very low | Very low | Very low |
| Low | Negligible | Extremely low | Very low | Low | Low | Low |
| Medium | Negligible | Extremely low | Very low | Low | Medium | Medium |
| High | Negligible | Extremely low | Very low | Low | Medium | High |

*Concept adapted from Dufour et al. (15) when combining two probabilities, the resulting probability is not greater than the lower probability scale of the two.*

# Qualitative

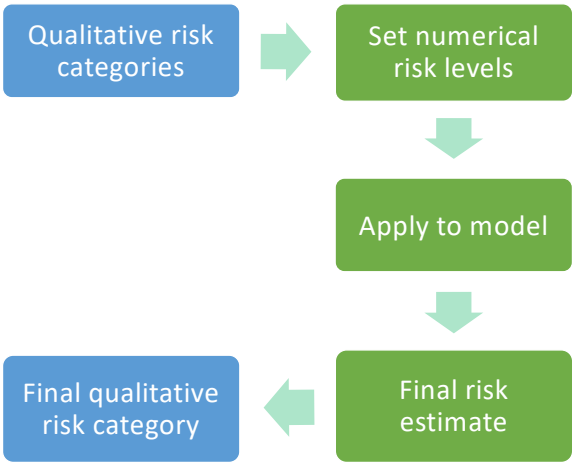
Pros

- Most commonly used, many examples
- Can be done even with minimal hard data

Cons

- Subjectivity in assigning risk
- Qualitative outcome

# Semi-Quantitative




# Semi-Quantitative

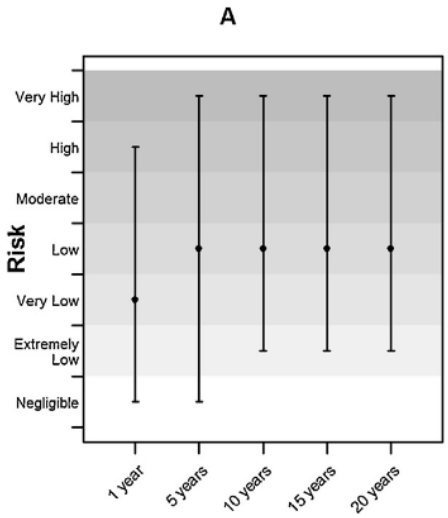
Contents lists available at ScienceDirect
Preventive Veterinary Medicine
journal homepage: www.elsevier.com/locate/prevetmed

The risk of rinderpest re-introduction in post-eradication era

Guillaume Fournié[a,*], Bryony Anne Jones[a], Wendy Beauvais[a], Juan Lubroth[b], Felix Njeumi[b], Angus Cameron[c], Dirk Udo Pfeiffer[a]

| Category | Numerical range | Interpretation | |
|---|---|---|---|
| Negligible | $[0; 10^{-9}]$ | Event is so rare that its probability cannot be differentiated from zero, and in practical terms can be ignored | Close to 0 |
| Extremely low | $[10^{-9}; 10^{-4}]$ | Event is extremely rare but cannot be excluded | Occurs less often than 1 in 10,000 ($10^{-4}$) |
| Very low | $[10^{-4}; 10^{-2}]$ | Event is very rare | Occurs between 1 in 10,000 ($10^{-4}$) and 1 in 100 ($10^{-2}$) |
| Low | $[10^{-2}; 10^{-1}]$ | Event is rare | Occurs more often than 1 in 100 ($10^{-2}$) up to 1 in 10 |
| Moderate | [0.1; 0.5] | Event occurs sometimes | Occurs more often than 1 in 10 up to 5 times out of 10 |
| High | [0.5; 0.8] | Event occurs often | Occurs more often than 5 times out of 10 up to 8 times out of 10 |
| Very high | [0.8; 1] | Event occurs almost always | Occurs more often than 8 times out of 10 |

# Semi-Quantitative

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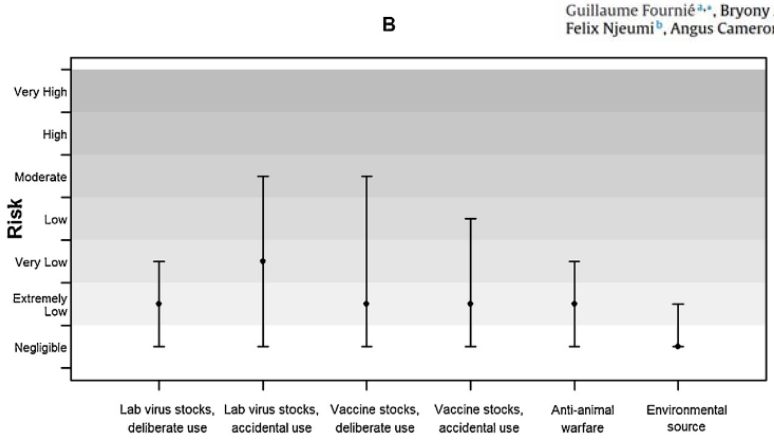

# Semi-Quantitative

Pros

- Often used for rapid screening tools
- Considered more objective

Cons

- Not recommended by OIE guidelines
- Quantitative levels arbitrary

# Quantitative

The foot-and-mouth disease risk posed by African buffalo within wildlife conservancies to the cattle industry of Zimbabwe

Paul Sutmoller[a,*], Gavin R. Thomson[b], Stuart K. Hargreaves[c], Chris M. Foggin[d], Euan C. Anderson[d]

| | A | B | C | D | E | F | G | FORMULAS |
|---|---|---|---|---|---|---|---|---|
| 1 | Probability of buffalo infecting antelope | | | | | 0.051 | | RiskNormal(0.051,0.09) |
| 2 | Days infected antelope is contagious | | | | | 3 | | RiskTriang(1,3,5) |
| 3 | Age in days | | | | | 1582 | | RiskTriang(1,4,8)*365 |
| 4 | Probability that infected antelope is contagious | | | | | 0.002 | | E2/E3 |
| 5 | Probability that any one antelope is contagious | | | | | | 0.0001 | F1*E4 |
| 6 | Number of antelope escaping the SVC / year | | | | | 310 | | Round(RiskPert(60,300,600),0) |
| 7 | Probability that contagious antelope escape the | | | | | | | |
| 8 | SVC / year | | | | | | 0.03 | 1-(1-F5)^E6 |
| 9 | Probability of antelope - cattle contact | | | | | | 0.1 | RiskPert(0.05,0.10,0.15) |
| 10 | Probability of antelope / cattle transmission | | | | | | 0.06 | RiskUniform(0.02,0.10) |
| 11 | **Probability of FMD outbreak cattle / yr** | | | | | | **0.0002** | PRODUCT(F8:F10) |

Fig. 10. Excel/@RISK worksheet for transmission of FMD by buffalo to cattle resulting from antelopes jumping over perimeter fences of a wildlife-conservancy (Zimbabwe).

# Quantitative

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Table 1
Scenarios ranked by the annual risk of FMD posed to the cattle industry by buffalo within the Save Valley Conservancy in Zimbabwe

| Scenario | Scenario description | Mean risk (10 000 iterations) | 95th percentile |
|---|---|---|---|
| Antelope | Buffalo transmit FMD to cattle indirectly by infecting antelope that jump over the outer game fence of the conservancy (scenario 4) | 1:5000 | 1:1500 |
| Buffalo-escape | Buffalo transmit FMD to cattle following escape of buffalo from the conservancy through a major fence break (scenario 1) | 1:200 000 | 1:60 000 |
| Aerosol | Buffalo transmit FMD to cattle by aerosol transported across the perimeter fence by air currents (scenario 5) | $10^{-5}$ | $10^{-4.7}$ |
| Cattle-enter | Buffalo transmit FMD to cattle entering and leaving the conservancy though a major fence break (scenario 2) | $10^{-7}$ (if cattle are destroyed, risk=0) | $10^{-6}$ |
| Sheep-and-goats | Buffalo transmit FMD to cattle indirectly by infecting sheep and goats entering and exiting a conservancy (scenario 3) | Less than $10^{-10}$ | |

# Quantitative

Pros
- Numerical estimate of risk
- Referenced data inputs
- Objectivity

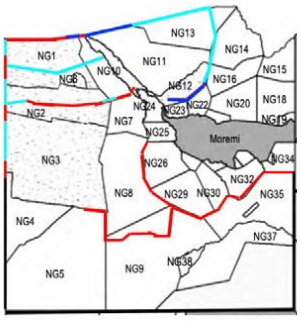
Cons
- Data intensive
- Sensitivity to inputs
- Time consuming to build

# Final Steps

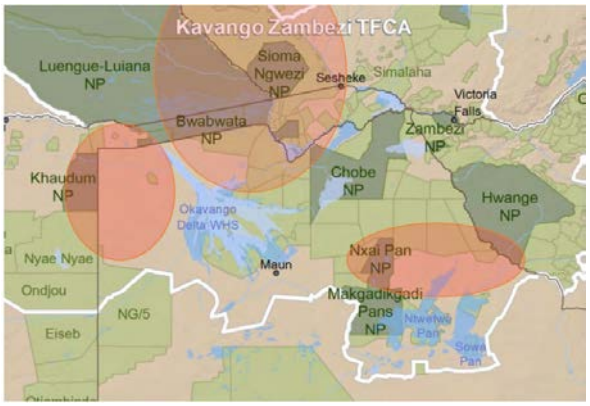
- Make recommendations
- Prepare report
- Stakeholder engagement

# A Unique Scenario for Risk Assessment

- Not starting at zero baseline risk
- Risk in association with fencing vs importation
- Risk in a TFCA context




Map: AHEAD, non-public report




Map: AHEAD, non-public report, adapted from Peace Parks Foundation

## Recipe for Collaborative Disease Risk Assessment

Ingredients:

Directions:

## Thoughts for moving into breakout groups

Ingredients

- What should we be thinking about on the Namibian side of Zambezi and Western border fences?
- What data are available and should be included?
- If data are lacking, what expert opinions should be elicited?
- Who should be involved?
- How should local communities be engaged?

Directions

- What is the *current* level of risk, with fences as is?
- What pathways should be included for FMD?
  - Cattle, small ruminants, buffalo, antelope
- What should be involved in a holistic examination of consequences?
  - What positive outcomes might result from removing fences?
- What solutions can we offer for risk mitigation?