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Rapid risk assessment (RRA)

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Rapid risk assessment

The main objectives of a rapid risk assessments could be:

- To determine the **likelihood** and the **impact** of emerging or evolving health threats,
- To identify possible data gaps and propose next steps to fill them,
- To make proposals for prevention, management, response.

Need for rapidity of the assessment

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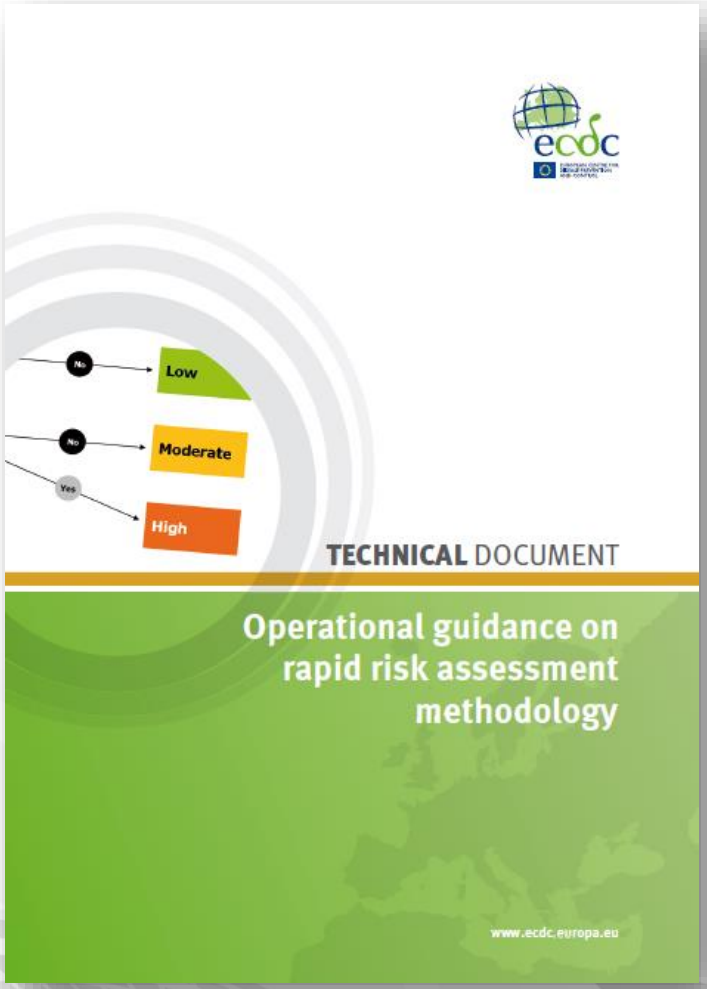
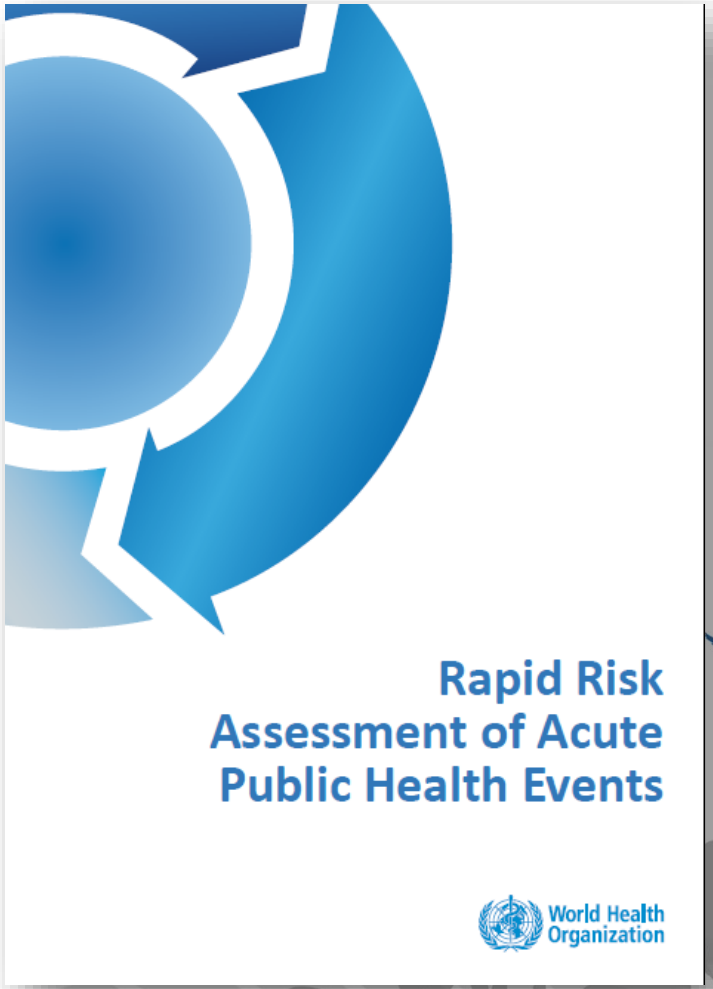
Available guidelines





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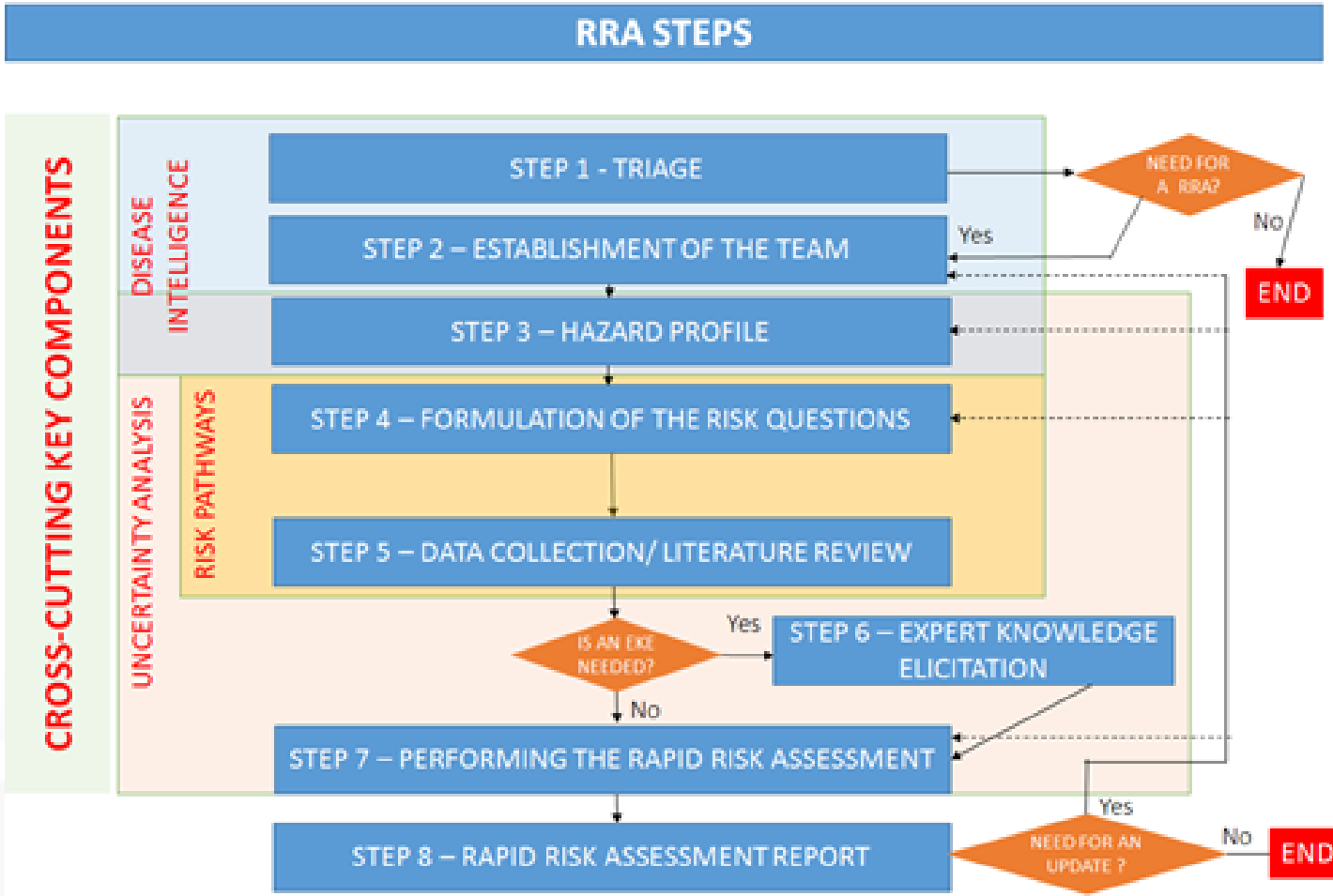
Steps for a Rapid risk assessment



Approach used in FAO

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Need for RRA

Need for a RRA ?

FAO approach

- Four main criteria:
  - Credibility of data sources
  - Severity of the disease and its consequences
  - Relevance of the health event
  - Efficacy of risk management measures

Need for a RRA ?

Criteria	*Scoring* *(Yes=1; No=0)*
1. Credibility of data sources	
Has the health event been reported or confirmed by an official source (e.g. animal health authorities, FAO offices, OIE, WHO, etc.)?	Yes □ No □
Has the health event been reported by multiple independent unofficial sources (e.g. media, ProMED, reports from field sources, twitter etc.)?	Yes □ No □
Sub-total score =	
2. Severity of the disease and its consequences	
Has the international spread of the disease (via live animals or their products, vectors or fomites) been proven?	Yes □ No □
Has the disease been shown to have a significant impact on the health of domestic animals at multi-country level?	Yes □ No □
Is it a zoonotic disease associated with severe consequences for the public health?	Yes □ No □
Has the disease been shown to have a significant impact on the animal productions and/or trade with possible detrimental economic consequences for the affected (*one or more*) countries?	Yes □ No □
Has the disease been shown to have a significant impact on the health of wildlife, or on the environment, including biodiversity, in one or more countries?	Yes □ No □
Has the causative agent developed resistance to treatments which poses a significant danger to public and/or animal health?	Yes □ No □
Sub-total score =	

Need for a RRA ?

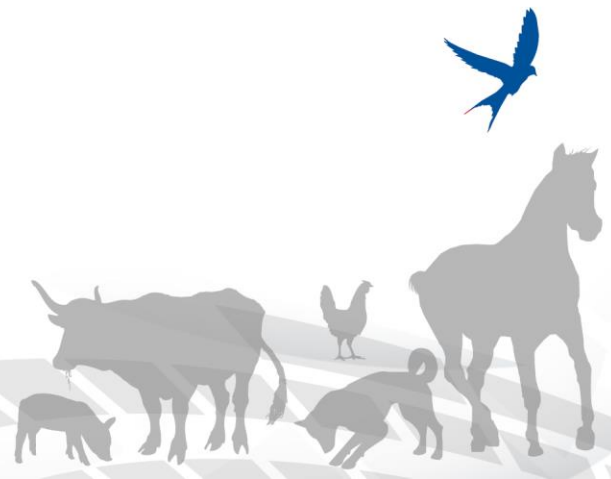
Criteria	*Scoring (Yes=1; No=0)*
3. Relevance of the health event	
Is the observed health event possibly linked to the evolution or change of an existing disease agent?	Yes □ No □
Is the observed health event related to a known disease spreading to a new geographic area, species or population?	Yes □ No □
Is the observed health event related to a known disease occurring with an increased incidence or morbidity in host population(s)?	Yes □ No □
Is the observed health event caused by an unknown or previously unrecognised disease agent?	Yes □ No □
Is the observed health event affecting vulnerable groups of the population, e.g. infants or elderly, who are likely to be disproportionately affected?	Yes □ No □
Is the observed health event characterised by a high actual or potential level of media interest or public concern?	Yes □ No □
Sub-total score =	
4. Efficacy of risk management measures	
Could the risk posed by the disease be effectively mitigated by measures able to prevent or limit its occurrence and spread?	Yes □ No □
Sub-total score =	
TOTAL SCORE=	

Need for a RRA ?

Examples

Criteria	*Scoring (Yes=1; No=0)*
1. Credibility of data sources	
Has the event been reported or confirmed by an official source (e.g. animal health authorities, FAO offices, OIE, WHO, etc.)?	1
Has the event been reported by multiple independent unofficial sources (e.g. media, Promed, reports from field sources, twitter etc.)?	1
Sub-total score =	**2**
2. Severity of the disease and its consequences	
Has the international spread of the disease (via live animals or their products, vectors or fomites) been proven?	1
Has the disease been shown to have a significant impact on the health of domestic animals at multi-country level?	1
Is it a zoonotic disease associated with severe consequences for the public health?	0
Has the disease been shown to have a significant impact on the animal productions and/or trade with possible detrimental economic consequences for the affected (*one or more*) countries?	1
Has the disease been shown to have a significant impact on the health of wildlife, or on the environment, including biodiversity, in one or more countries?	1
Has the causative agent developed resistance to treatments which poses a significant danger to public and/or animal health?	0
Sub-total score =	**4**
3. Relevance of the health event	
Is the observed health event possibly linked to the evolution or change of an existing disease agent?	0
Is the observed health event related to a known disease spreading to a new geographic area, species or population?	1
Is the observed health event related to a known disease occurring with an increased incidence or morbidity in host population(s)?	0
Is the observed health event caused by an unknown or previously unrecognised disease agent?	0
Is the disease affecting vulnerable groups of the population, e.g. infants or elderly, who are likely to be disproportionately affected?	0
Is the observed health event characterised by a high actual or potential level of media interest or public concern?	1
Sub-total score =	**2**
4. Efficacy of risk management measures	
Could the risk posed by the disease be effectively mitigated by measures able to prevent or limit its occurrence and spread?	1
Sub-total score =	**1**
TOTAL SCORE=	**9/15**

ASF in China

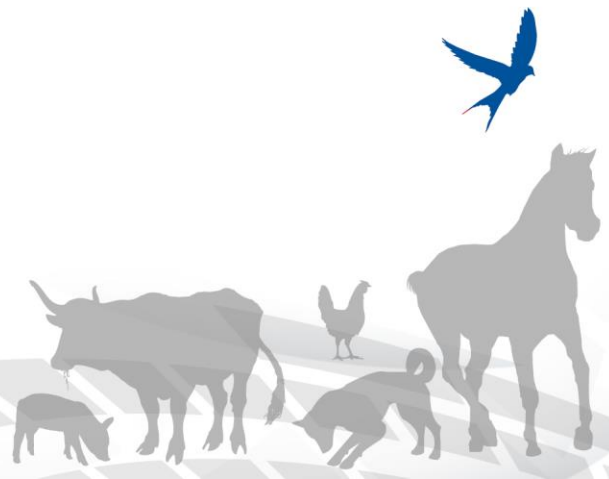


Need for a RRA ?

Examples

Criteria	*Scoring (Yes=1; No=0)*
1. Credibility of data sources	
Has the event been reported or confirmed by an official source (e.g. animal health authorities, FAO offices, OIE, WHO, etc.)?	1
Has the event been reported by multiple independent unofficial sources (e.g. media, Promed, reports from field sources, twitter etc.)?	0
Sub-total score =	**1**
2. Severity of the disease and its consequences	
Has the international spread of the disease (via live animals or their products, vectors or fomites) been proven?	1
Has the disease been shown to have a significant impact on the health of domestic animals at multi-country level?	0
Is it a zoonotic disease associated with severe consequences for the public health?	1
Has the disease been shown to have a significant impact on the animal productions and/or trade with possible detrimental economic consequences for the affected (*one or more*) countries?	1
Has the disease been shown to have a significant impact on the health of wildlife, or on the environment, including biodiversity, in one or more countries?	0
Has the causative agent developed resistance to treatments which poses a significant danger to public and/or animal health?	0
Sub-total score =	**3**
3. Relevance of the health event	
Is the observed health event possibly linked to the evolution or change of an existing disease agent?	0
Is the observed health event related to a known disease spreading to a new geographic area, species or population?	0
Is the observed health event related to a known disease occurring with an increased incidence or morbidity in host population(s)?	1
Is the observed health event caused by an unknown or previously unrecognised disease agent?	0
Is the disease affecting vulnerable groups of the population, e.g. infants or elderly, who are likely to be disproportionately affected?	0
Is the observed health event characterised by a high actual or potential level of media interest or public concern?	0
Sub-total score =	**1**
4. Efficacy of risk management measures	
Could the risk posed by the disease be effectively mitigated by measures able to prevent or limit its occurrence and spread?	0
Sub-total score =	**0**
TOTAL SCORE=	**5/15**

RVF in Kenya



Establishment of risk assessment team

The first step is the formal appointment of the risk assessment team. It should include at least:

- The responsible of the risk assessment procedure,
- Personnel in charge of data retrieval and literature search and selection,
- Personnel responsible for data analysis.

This team may be enlarged including additional expertise, and people directly involved in the event under evaluation, like local or international experts/authorities.

Establishment of risk assessment team

Professionals that can be involved:

- Epidemiologists / Animal Health scientists (Entry and Exposure assessment);
- Experts with trade knowledge (Entry assessment);
- Entomologists (geographic distribution; capability to transmit certain diseases; Entry and exposure assessment for Vector Borne Disease only);
- Experts with knowledge on the main relevant aspects concerning the animal populations at risk in the exposed countries (Exposure assessment);
- Animal health economists (Consequence assessment);
- Public health specialists (zoonotic diseases only),
- Wildlife experts (wildlife diseases only).

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Hazard profile

Hazard profile

- Comprehensive description of an animal health problem and its context.
- It does not provide any risk estimation but can support the formulation of appropriate **risk questions**.

The completeness and level of details of risk profile must be evaluated according to the time available!

Hazard profile

When preparing a hazard profile the following aspects should be taken into consideration:

- Classification of the causative agent
- Persistence in the environment, food, biological products
- Pathogenesis
- Epidemiology
- Diagnosis
- Prevention and Control
- Impact

It is not a literature review !
Only those data and information relevant for risk assessment !

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Formulation of risk questions

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Risk questions

- A good systematic approach:
  - Starting from the RRA objectives, a certain number of risk questions have to be formulated.
  - Each risk question should be split into a number of detailed and specific sub-questions.
  - For each sub-question the data needed and related possible sources must be listed.
  - It is also extremely useful to identify and list the possible data analysis approaches and related methods intended to be followed during the risk assessment.

Risk questions

- In this phase it must be decided which kind of risk assessment approach will be followed (e.g. qualitative vs. quantitative) and how to address the existing uncertainties.
- The results of this first preliminary analysis are also fundamental to identify:
  - the data needed for risk assessment
  - Time needed
  - Human resources, type of skills and expertise required.
- It is useful to describe the limitations of the selected approach among the list of uncertainties.

Risk questions
Example

- Occurrence of Rift Valley fever (RVF) human cases in Niger. Considering the following RRA objectives:
  a. To assess the risk of RVF spreading into neighbouring countries.
  b. To assess the potential consequences for public and animal health in Niger.

Possible risk questions could be:

- What is the probability of RVF spreading in the following months into Mali, Burkina Faso, Benin, or Nigeria considering that the RVF occurred in Niger ?
- What are the potential consequences for public and animal health in Niger in the months following the report of the outbreak?

Risk questions
Example

Question	Sub-question	Data Needed	Data sources	Data Analysis
What is the probability of RVF spreading in the following months into Mali, Burkina Faso, Benin, or Nigeria considering that the RVF occurred in Niger?	What is the risk of RVF spreading by contiguity, through infected vectors (either via active vector movement or windborne dissemination)	Duration of infection in vectors and in the vertebrate hosts Data related to vector capacity (animal/vector density, biting rate, vector survival, vector competence) Biological Characteristics of Vectors (temperature range/humidity conditions for breeding/hatching, etc). Biotic and abiotic conditions in the countries where the disease could potentially spread Etc..	Literature results Expert opinion	Vector Capacity Calculation Modelling Expert elicitation
	What is the risk of RVF spreading by animal movements?	Data on international trade of live ruminants in the region. Data on animal movement for pastoralism / transhumance, etc.	Literature results International databases Expert opinion	Modelling Expert elicitation

Risk questions
Example

Question	Sub-question	Data Needed	Data sources	Data Analysis
What are the potential consequences for public and animal health in Niger in the months following the report of the outbreak?	What are the expected impacts on public health in Niger?	Incidence of human cases in similar circumstances. Length of epidemic Data on the proportion of severely affected people	Data from official notifications Results on ad hoc surveys Literature results Expert Opinions	Modelling Expert elicitation
	What are the expected impacts on animal health and production in Niger?	Prevalence and incidence in the different animal species, categories (young, adults) and seasons. Basic Reproduction number Demographic data on vertebrate hosts Efficacy of vaccination Vaccination rate	Data from official notifications Results on ad hoc surveys Literature results Expert Opinions	Modelling Expert elicitation
	Is there any trade impact for Niger?	Are there any existing trade certificates which require RVF freedom at the regional or country-wide level? What is the value of the export market?	Data from trade sources (for example UN Stat, Com Trade); imports / exports teams for certificate requirements	Economic analysis of trade impacts; cost benefit analysis of disease control measures.

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Risk pathways

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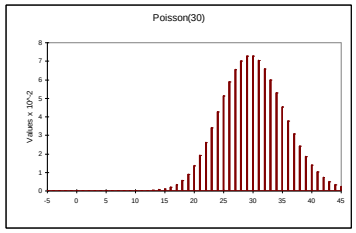
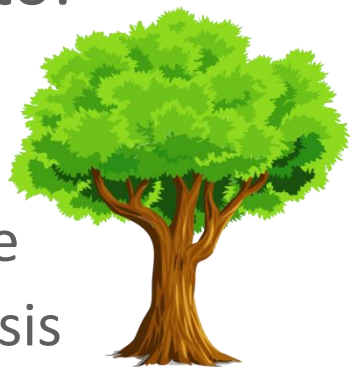


What is a scenario?

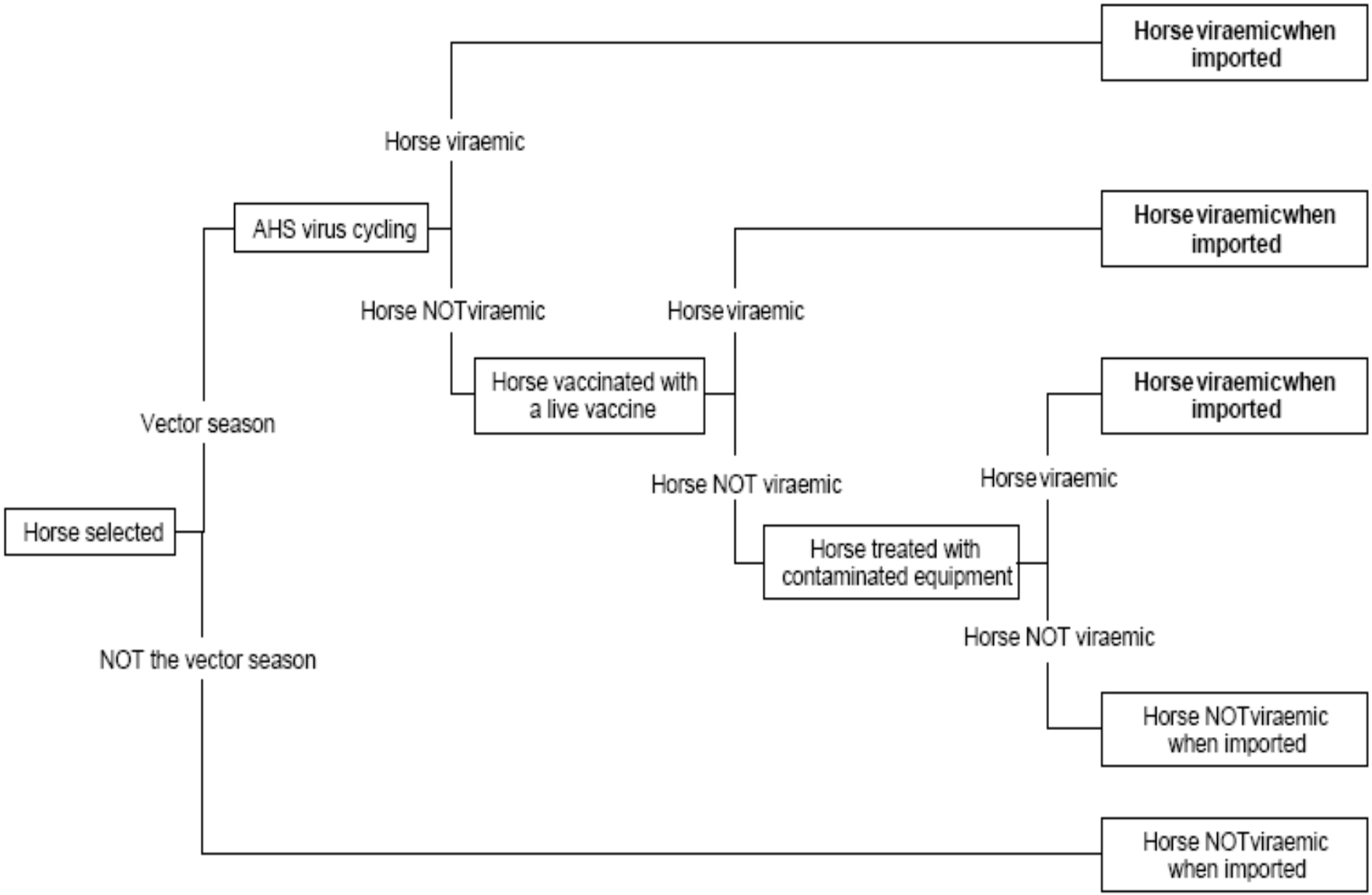
- A scenario comprises a series of events which could occur and which should be identified. A risk assessment should take into account all these components
- Scenario definition also includes the definition of health control measures which should be applied
- Different alternative scenarios are compared so to obtain all the necessary decisional elements (*what if* scenarios)

Scenario trees

- They provide a useful visual representation to:
  - Identify pathways
  - Identify information requirements
  - Insure a logical chain of events in space and time
  - Assist with communicating the import risk analysis
  - Clarify ideas and understanding of the problem
  - Assist with identifying risk management measures
  - Assist with determining the likelihood of occurrence and subsequent consequences
  - Provide a framework for the later development of a quantitative model, should this be required



Scenario trees



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ASF in China - RRA

Food and Agriculture Organization of the United Nations

March 2018

AFRICAN SWINE FEVER THREATENS PEOPLE'S REPUBLIC OF CHINA

A rapid risk assessment of ASF introduction

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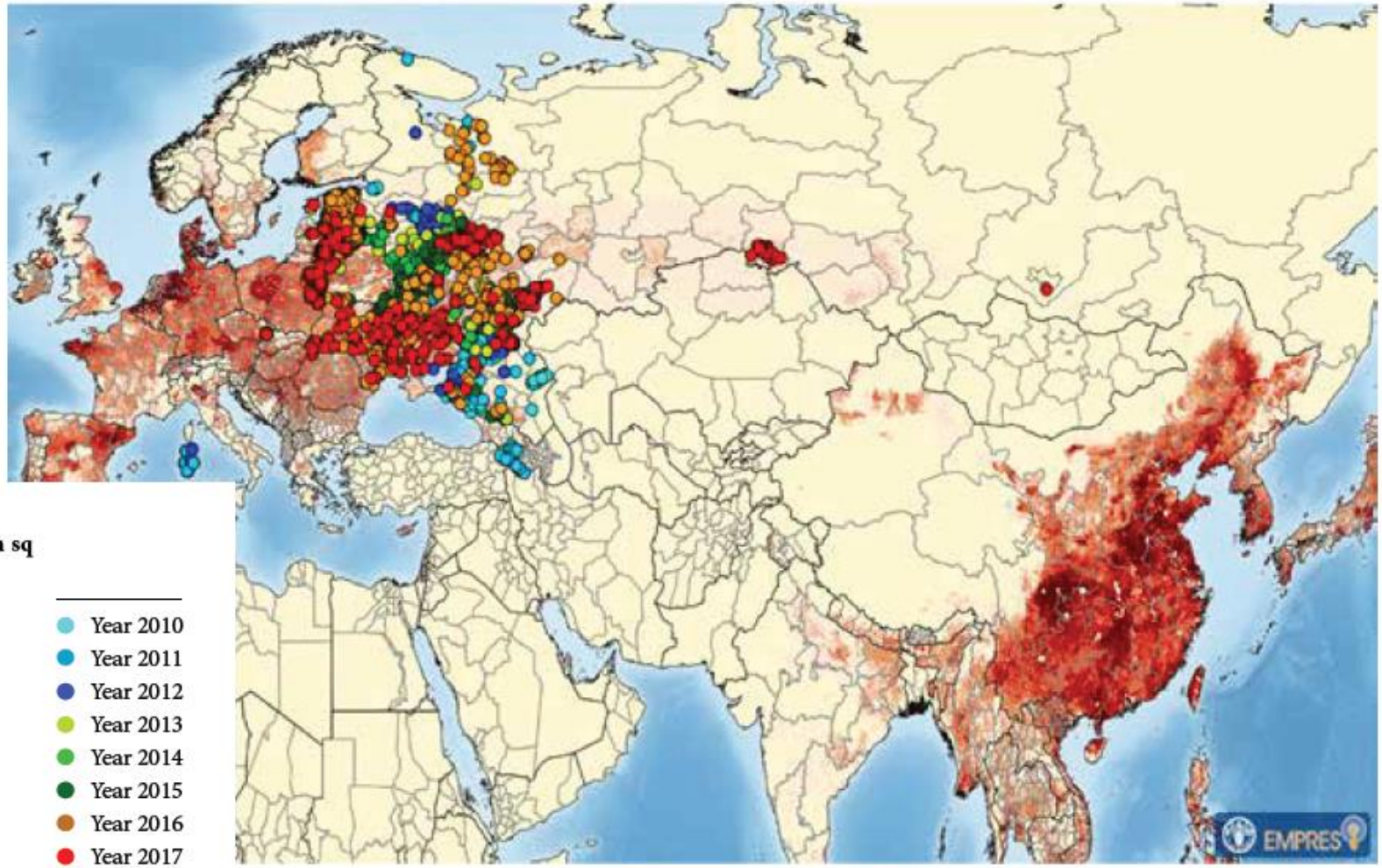
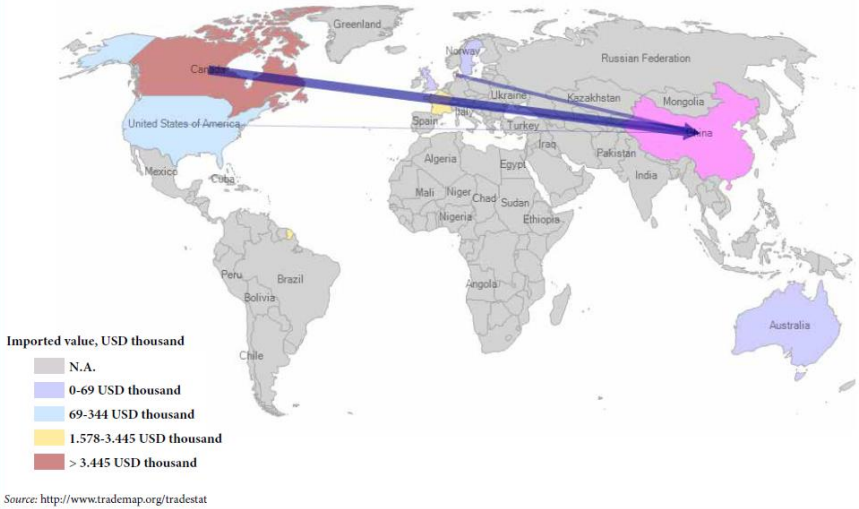
ASF situation up to 2017

FIGURE 1. *January 2010 to June 2017 ASF outbreaks and backyard pig distribution*



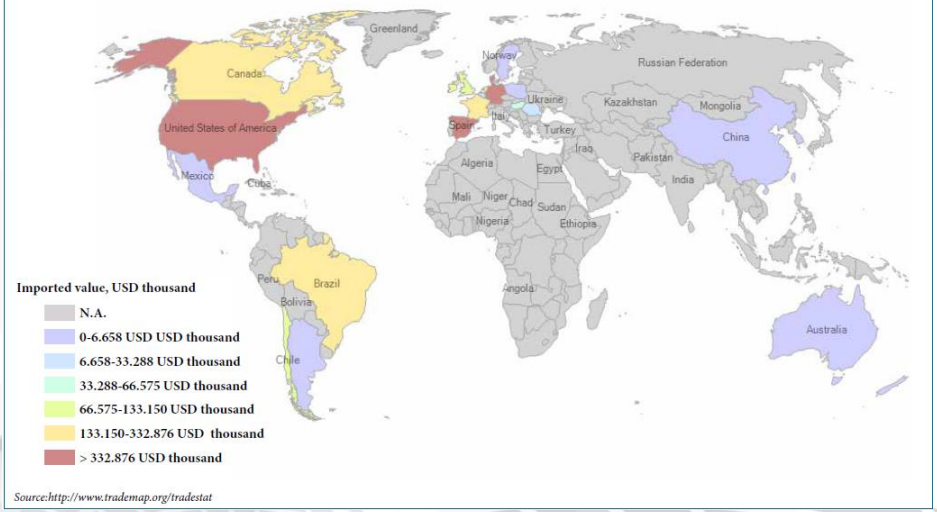
Useful data for scenarios setting

FIGURE 10. *Country of origin and flow of trade in live swine*



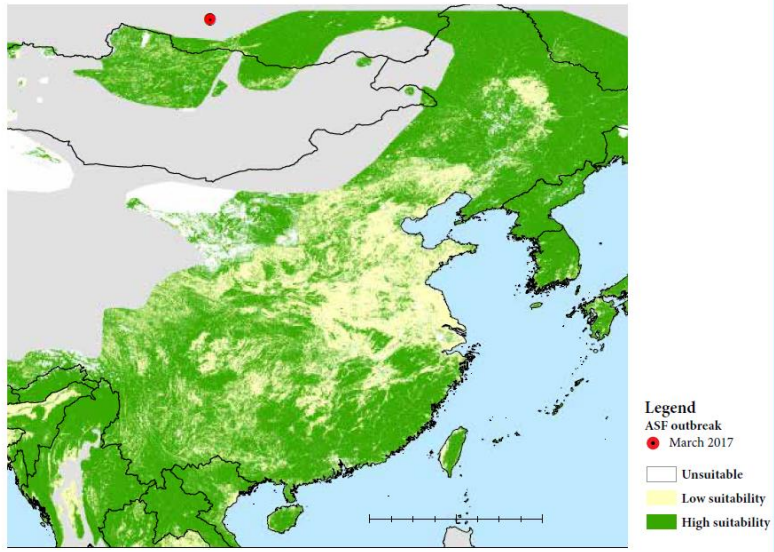
Source: http://www.trademap.org/tradestat

FIGURE 11. *Country of origin of trade in fresh and frozen pigmeat*



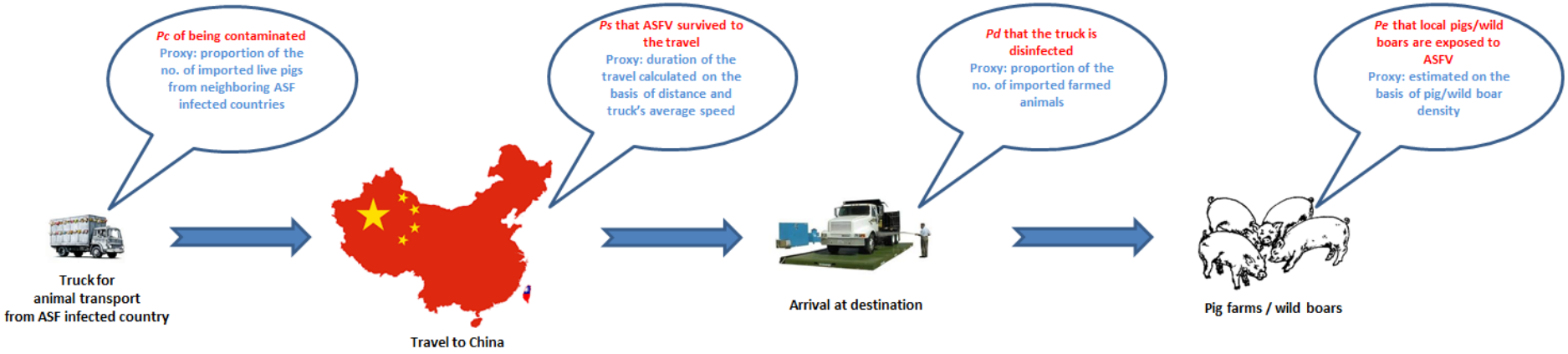
Source:http://www.trademap.org/tradestat

FIGURE 13. *Wild boar suitability in the Central and South East Asia Region*



Transport Associated Routes

Contaminated trucks from ASF affected countries: vehicles having contacts with infected animals, not disinfected and then moved to China



Final Prob. = $Pc * Ps * (1-Pd) * Pe$

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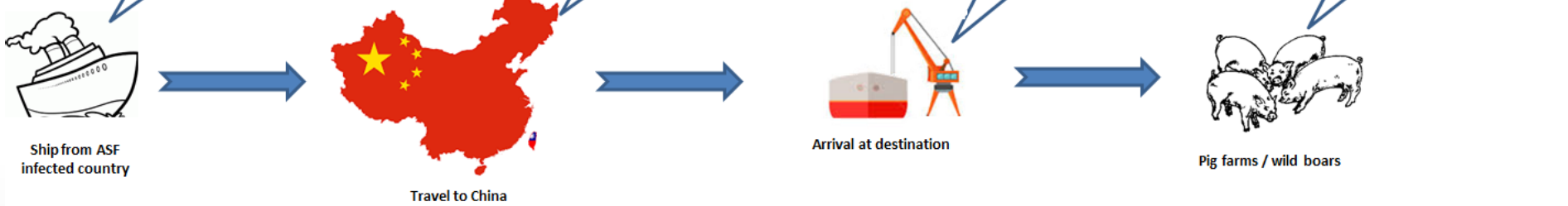
Transport Associated Routes

Pork meat waste from international ships



Final Prob. = *Pc* * *Ps* * *Pw* * *Pe*

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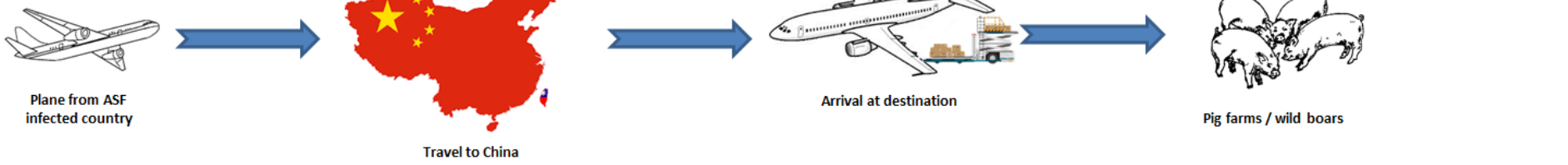
Transport Associated Routes

Pork meat waste from international airplanes



Final Prob. = *Pc* * *Ps* * *Pw* * *Pe*

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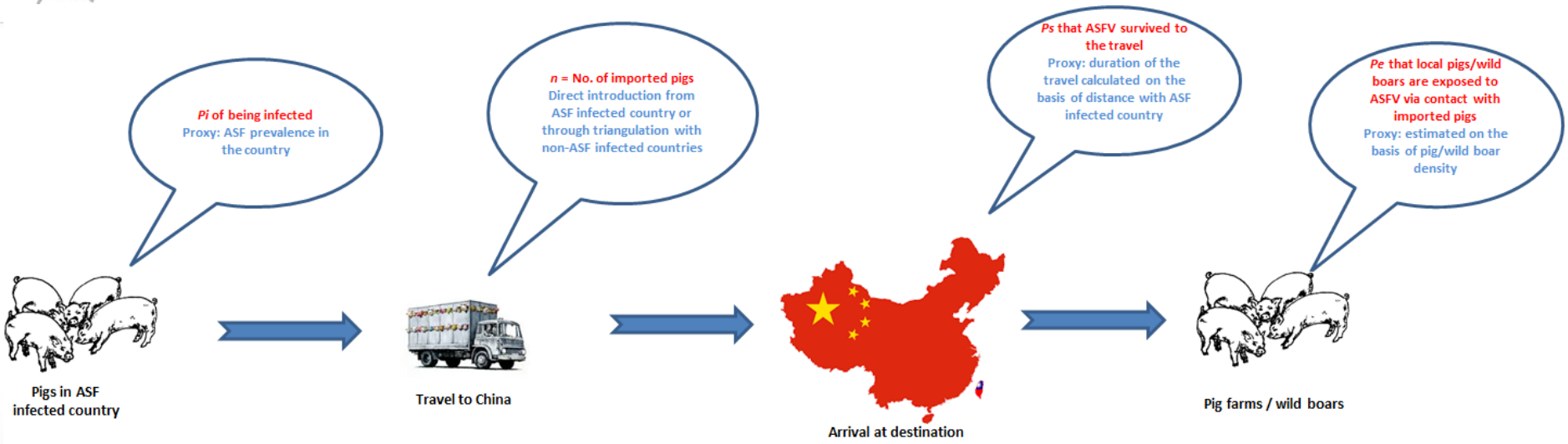
Through live animals

Legal introduction of swine



Final Prob. = $1-(1-Pi)^{n} * Ps * Pe$

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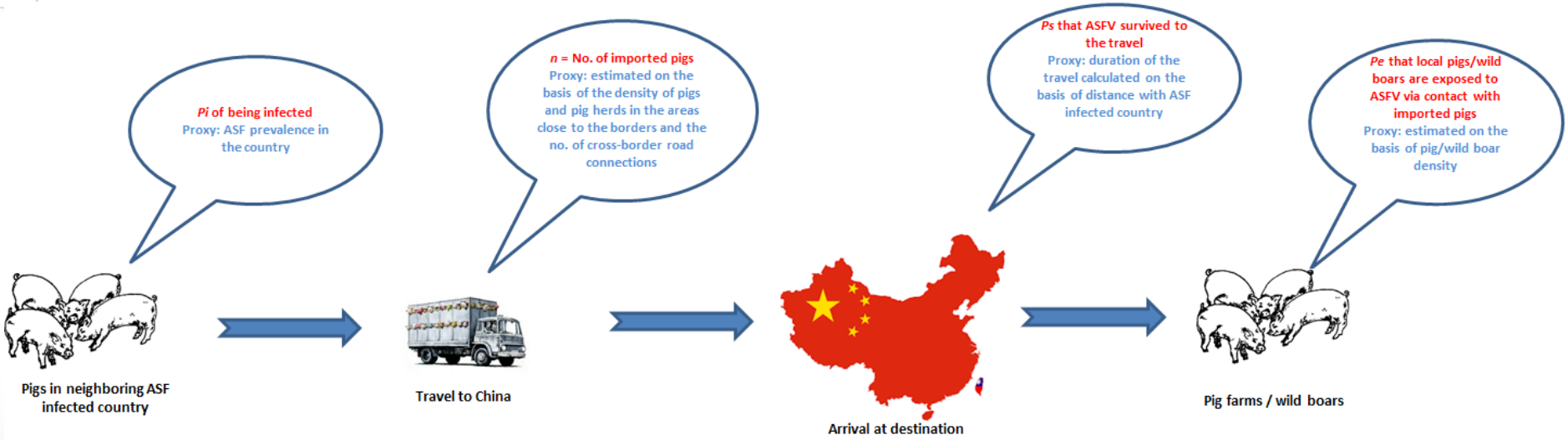
Through live animals

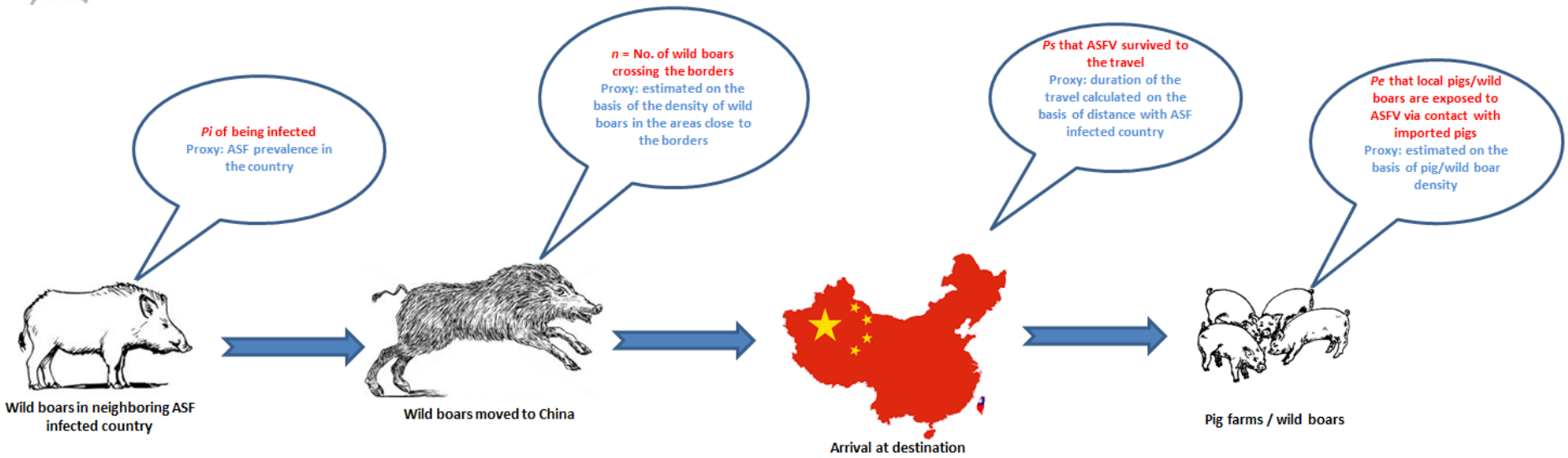
Illegal cross-border introduction of swine



Final Prob. = $1-(1-Pi)^{n} * Ps * Pe$

Through live animals

Introduction of infected wild boars



Final Prob. = $1-(1-Pi)^{n} * Ps * Pe$

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Expert Knowledge Elicitation (EKE)

Paolo Calistri

Expert knowledge elicitation (EKE)

- When the information deriving from available papers is quite limited or affected by poor quality, pre-selected group of experts can be asked to provide their knowledge on the questions under evaluation.
- EKE is a standardised method to draw out knowledge from experts, who can be asked for specific information (data, facts, etc.) or for judgements (probabilities, estimates, etc.).

Protocols for EKE 1/3

The Sheffield protocol

- It allow experts to interact each other during **face-to-face meeting** or elicitation workshops, during which the experts discuss and exchange opinions about the questions under the supervision of the elicitor.
- This method does not need for mathematical manipulation/aggregation of estimates and the results can be quite robust, since deriving from an in depth discussion among experts.
- Possible shortcomings can derive from the problems related to the management of groups, where minority opinions, although valid, may be overwhelmed by the most popular judgements.
- Time required: **from several weeks to months**.

Protocols for EKE 2/3

The Cooke's method

- It does **not allow the experts to discuss** their judgements and the interaction is limited to the initial training and briefing.
- Instead of the behavioural aggregation, a form of mathematical aggregation is applied.
- This method can be performed in quite short time, especially when a web-survey approach is used instead of individual interviews, but a great attention must be paid in the formulation of the questions to be clearly understood by the experts, and mathematical procedures for the aggregation of answers must be carefully chosen and applied to avoid unwanted distortions.
- Time required: **few weeks**.

Protocols for EKE 3/3

The Delphi method

- It lies between the two above reported protocols.
- A **certain interaction** between experts is allowed during repeated elicitation rounds managed by an elicitor. Judgements for each round are fed back to the experts in the subsequent round in anonymised form.
- It allows some benefits deriving from the sharing information between experts, without the risk of personal factors influencing the judgements inappropriately.
- After all round are completed the final estimates are obtained by a simple equal-weighted mathematical aggregation.
- Time required: **several weeks**.

Choice of EKE methods

The choice of one method instead of another should be made taking into consideration:

- The deadlines and time available for performing a formal EKE,
- The availability of human and financial resources for organising physical meetings and/or elicitation workshops,
- The languages spoken by the experts and difficulties in finding a common language,
- The disciplines of experts and the possible difficulties in having common understanding about the risk questions and related terminology,
- The possible existence of differences in opinions due to institutional relations or scientific positions.

Choice of EKE methods

- The Delphi method and Cooke's protocol can be performed through written material or only individual contacts, whereas the Sheffield method requires a major physical interaction among experts. It implies that the Sheffield method works better with a limited number of expert (about 6-10 experts), whereas Delphi and Cook's protocols can be used also with larger groups.
- Regardless the protocol considered, experts need to be trained before any EKE exercise on the context of the assessment, the single questions and the implications beyond each parameter estimation. The training should also include some examples to allow the experts to familiarise with the EKE protocol.

Aggregate the individual judgements of the experts

Probability expressed using categorical levels

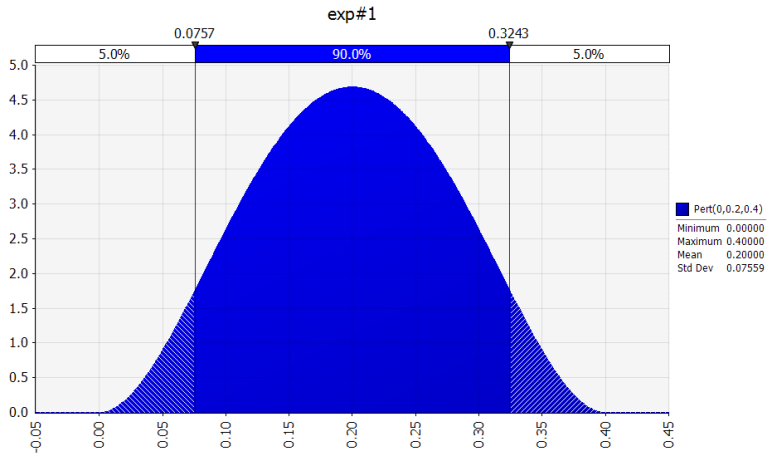
If experts are requested to express their probability judgements using categorical levels, the following method can be used to aggregate their estimates:

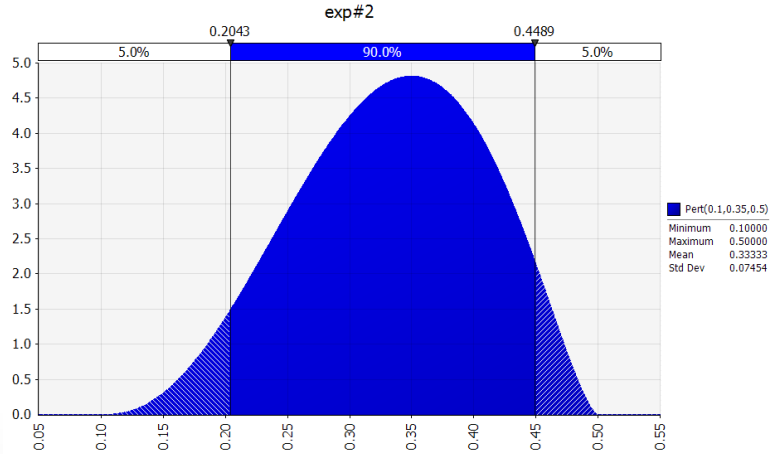
1. If it is possible to gather experts (even by telephone) and to have a collegial discussion, an agreement should be reached discussing discrepancies in the judgements (starting from the most extreme values) and the rationale for them.
2. If it is not possible to gather experts or agreement is not reached, the uncertainty in the judgement has to be reflected by a range of levels that includes as lower bound the **minimum** level estimated in the group and as upper bound the **maximum** level.
3. Alternatively an empirical distribution could be set based on the relative frequency of the experts providing each level as an estimate.

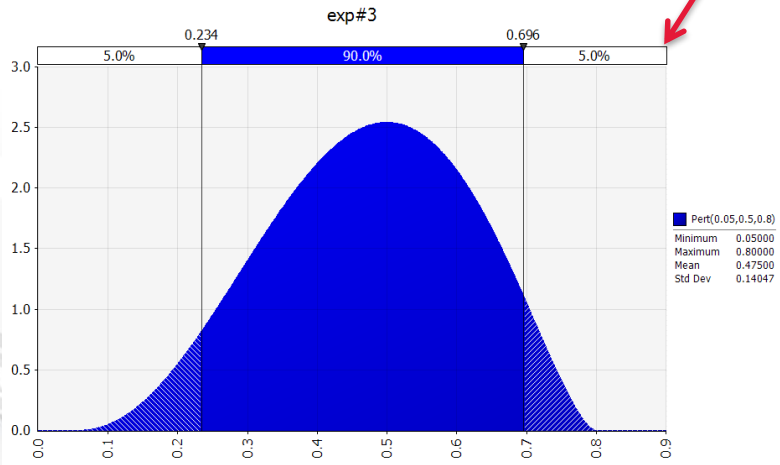
Example 1

- Assume 3 experts are requested to express their judgement on the probability that ‘disease X enters into country Y by commodity Z’ and the uncertainty around this judgement giving: a minimum, maximum and most probable value.
- A Pert distribution is commonly used to describe individual judgement expressed as extremes and most probable value.

Example 1







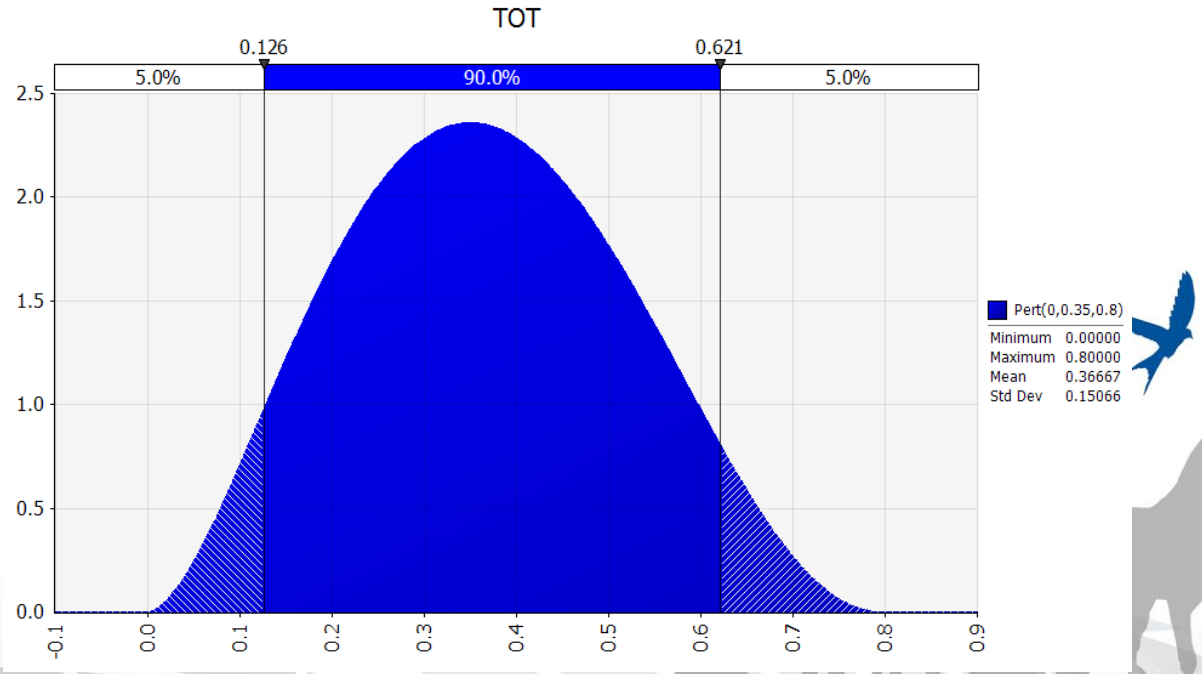
	Min	Most prob	Max
exp#1	0	0.2	0.4
exp#2	0.1	0.35	0.5
exp#3	0.05	0.5	0.8

Example 1

	Min	Most prob	Max
exp#1	0	0.2	0.4
exp#2	0.1	0.35	0.5
exp#3	0.05	0.5	0.8

Min Mean Max

TOT	0	0.35	0.8



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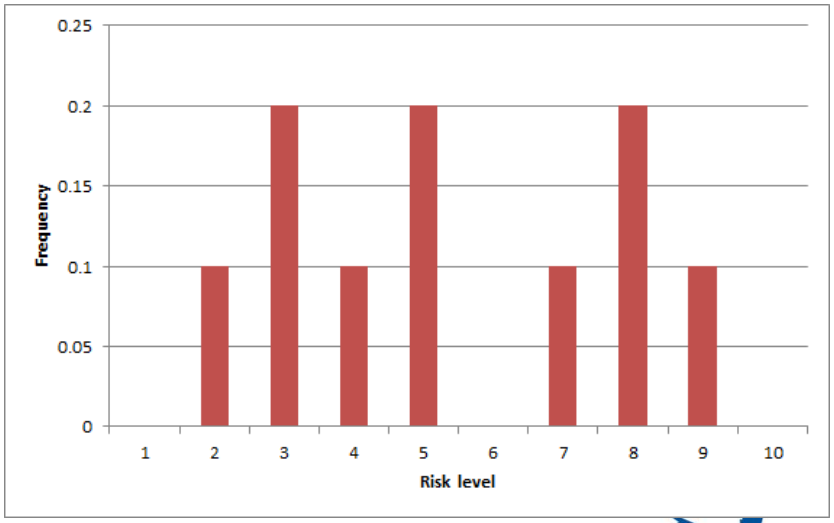
Example 2

- Assume 10 experts are requested to express their judgement on the risk level on the basis of a risk matrix with possible values from 1 to 10

	Risk estimations (1-10)
exp#1	5
exp#2	3
exp#3	4
exp#4	8
exp#5	8
exp#6	7
exp#7	5
exp#8	3
exp#9	9
exp#10	2

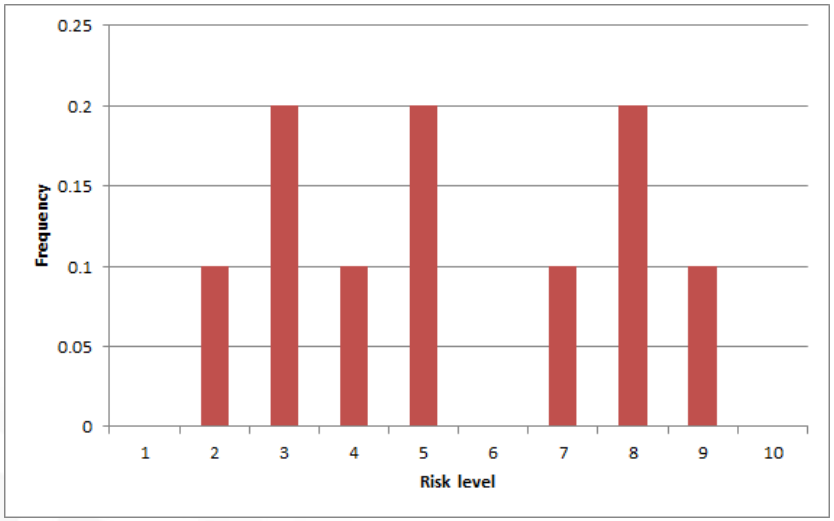
Risk levels	No. of answers	Frequency
1	0	0
2	1	0.1
3	2	0.2
4	1	0.1
5	2	0.2
6	0	0
7	1	0.1
8	2	0.2
9	1	0.1
10	0	0

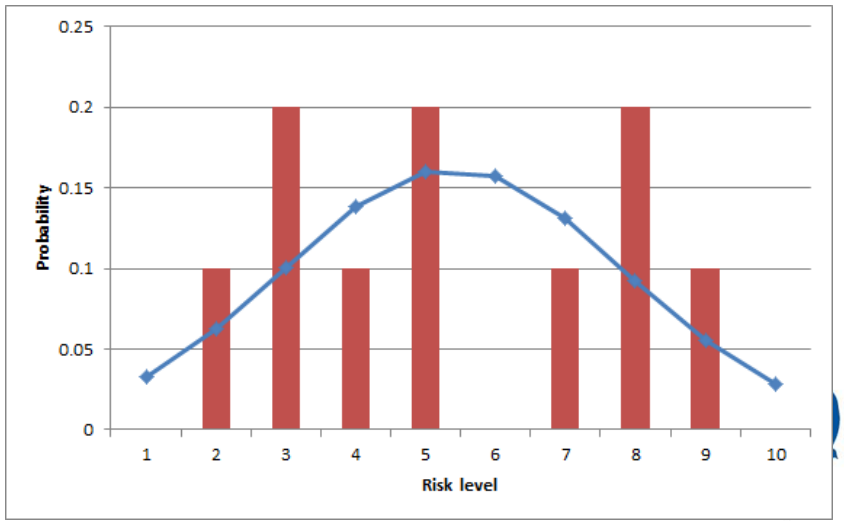


Example 2

- Looking at the graph it is quite symmetric.
- It could be represented by a Normal distribution:

  Normal(mean, st. dev.)





mean	5.4
median	5
st. dev.	2.458545

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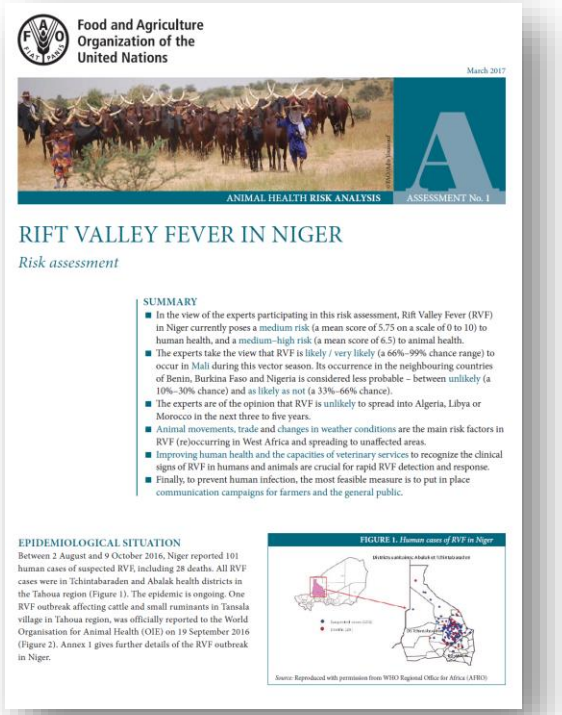
RRA report: data representation and report structure



Food and Agriculture Organization of the United Nations

March 2017

ANIMAL HEALTH RISK ANALYSIS

ASSESSMENT No. 1

RIFT VALLEY FEVER IN NIGER

Risk assessment

SUMMARY

- In the view of the experts participating in this risk assessment, Rift Valley Fever (RVF) in Niger currently poses a medium risk (a mean score of 5.75 on a scale of 0 to 10) to human health, and a medium–high risk (a mean score of 6.5) to animal health.
- The experts take the view that RVF is likely / very likely (a 66%–99% chance range) to occur in Mali during this vector season. Its occurrence in the neighbouring countries of Benin, Burkina Faso and Nigeria is considered less probable – between unlikely (a 10%–30% chance) and as likely as not (a 33%–66% chance).
- The experts are of the opinion that RVF is unlikely to spread into Algeria, Libya or Morocco in the next three to five years.
- Animal movements, trade and changes in weather conditions are the main risk factors in RVF (re)occurring in West Africa and spreading to unaffected areas.
- Improving human health and the capacities of veterinary services to recognize the clinical signs of RVF in humans and animals are crucial for rapid RVF detection and response.
- Finally, to prevent human infection, the most feasible measure is to put in place communication campaigns for farmers and the general public.

EPIDEMIOLOGICAL SITUATION

Between 2 August and 9 October 2016, Niger reported 101 human cases of suspected RVF, including 28 deaths. All RVF cases were in Tchintabaraden and Abalak health districts in the Tahoua region (Figure 1). The epidemic is ongoing. One RVF outbreak affecting cattle and small ruminants in Tansala village in Tahoua region, was officially reported to the World Organisation for Animal Health (OIE) on 19 September 2016 (Figure 2). Annex 1 gives further details of the RVF outbreak in Niger.

FIGURE 1. *Human cases of RVF in Niger*

Source: Reproduced with permission from WHO Regional Office for Africa (AFRO)

Paolo Calistri

The audience

- It must be taken into account the audience to which the RRA must be addressed
- Usually the RRA has been requested by the risk manager in reply to his/her information needs, and therefore risk managers / decision makers are those to which the RRA is primarily addressed
- Therefore, a clear, precise but not too technical language must be used
- A communication expert should be involved

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The audience

When different type of audience must be addressed, different types of RRA reports can be prepared. For example:

- An exhaustive anc complete report for who requested the RRA
- An executive summary for top decision makers
- Key messages to be disseminated through leaflet, media and other social networks for stakeholders and general public

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RRA structure

A RRA report should include at least:

- A clear description of the event and the context
- The risk questions and sub-questions that have been addressed
- The method(s) used
- The list of experts that have been consulted
- The assumptions on which the assessment is based and the limits and the applicability of the results of the assessment

RRA structure

- In depth description of the outcomes, with a clear interpretation of the possible implications for the choice of proper control and preventive measures
- A list of all possible sources of uncertainty related to the input data and the methodology used for the assessment
- Clear summary with a concise description of the main conclusions for each risk question.