SYMPOSIUM – 12/03/2014, BRUSSELS

A first-line Risk Assessment Tool for pathogenic and parasitic Micro-Organisms

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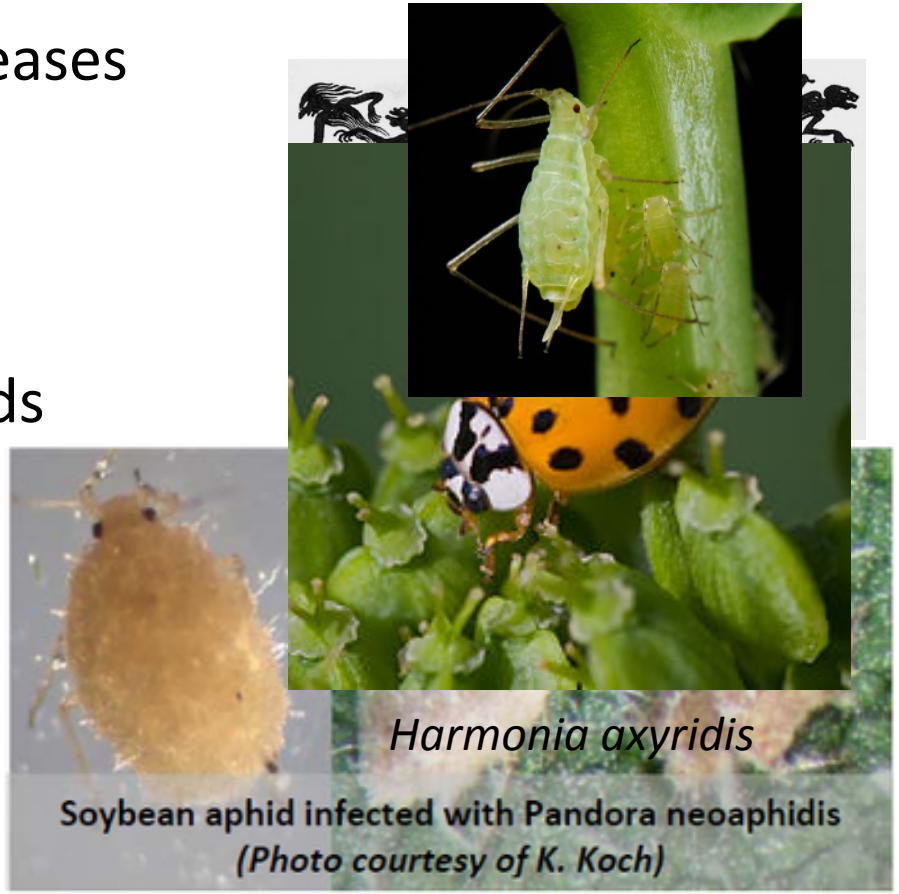
Pandora

Introduction

- **Pandora**
  - *Greek Mythology*
    - Box that contained 'all evils of the world'
    - Especially plagues and diseases
  - *Biology*
    - *Pandora neoaphidis*
    - Pathogenic fungus of aphids
    - Biological control
    - Exotic invasive *Harmonia a*



Harmonia

- **Environmental impacts of Exotic species**

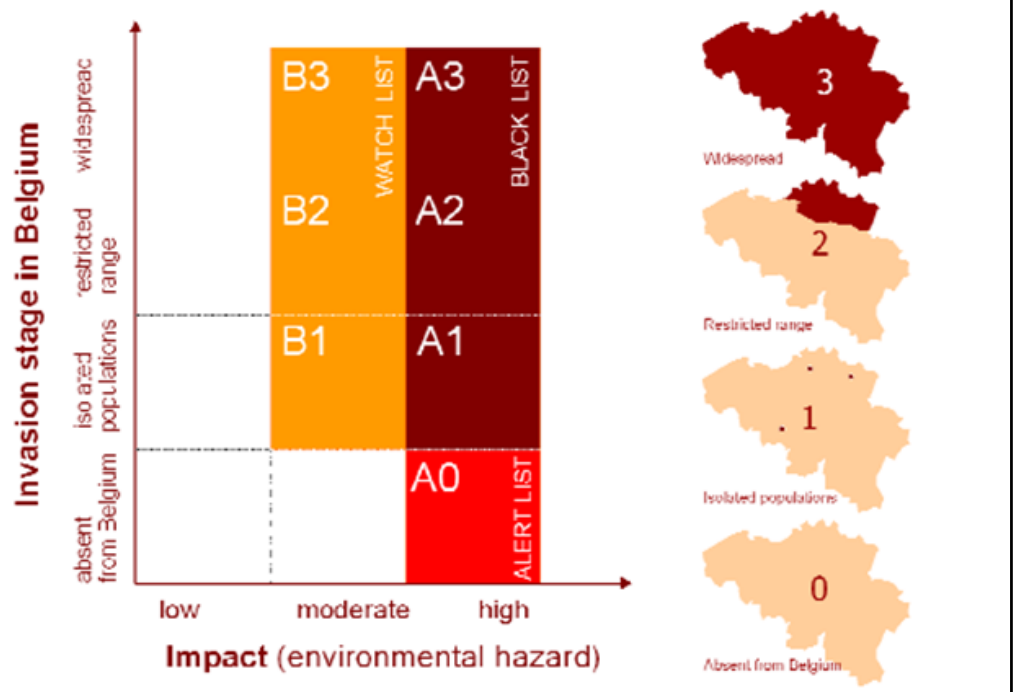


Figure 1 - List system proposed by the Belgian Forum on Invasive Species to identify organisms of most concern for preventive and mitigation actions.

Harmonia+

- **Exotics have other targets and impacts !**
  - *Targets:*
    - Environment
    - Domestic Plants
    - Domestic Animals
    - Humans
    - Society
  - *Impacts:*
    - Environment + Agriculture
    - Economical + Infrastructure
    - Health impacts: **Pathogens**
    - Society – Politics
    - …

- **Pathogens can be Exotic !**
  - *Emerging infectious diseases*
  - *Risk Assessment + Screening*

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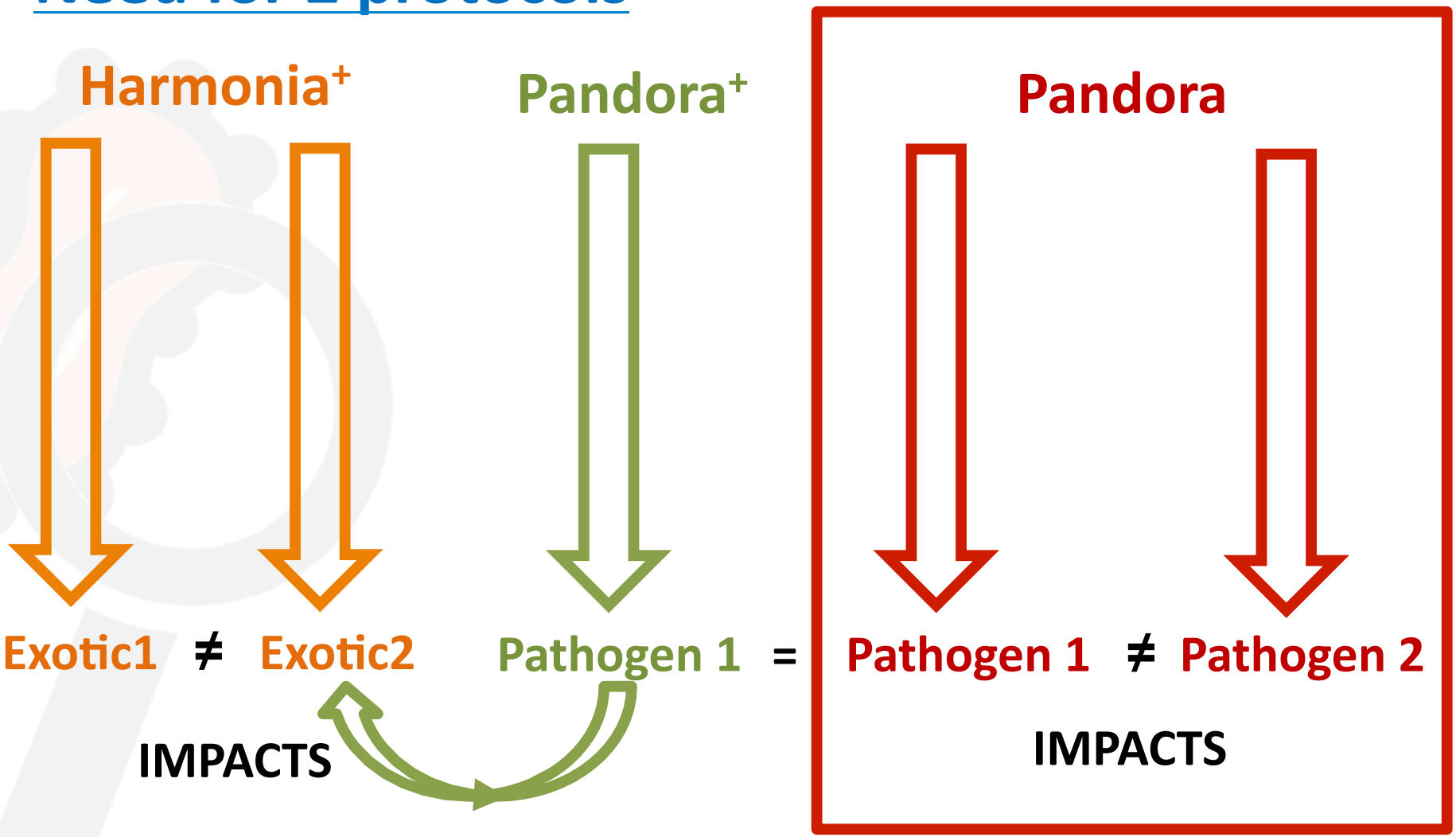
- **Need for 2 protocols**



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- **Concept = Pathogen Risk Assessment**

  – *Literature Review*

  Medical - Veterinary -

  Biology - Ecology sectors

  – *Existing RA Schemes*

  OIE - WHO - EPPO

  – *Results*

  - Many similarities in Risk Assessment
  - Specific vocabulary + impacts ~ Sector
  - Variation complexity ⇔ Simplify for first-line screening

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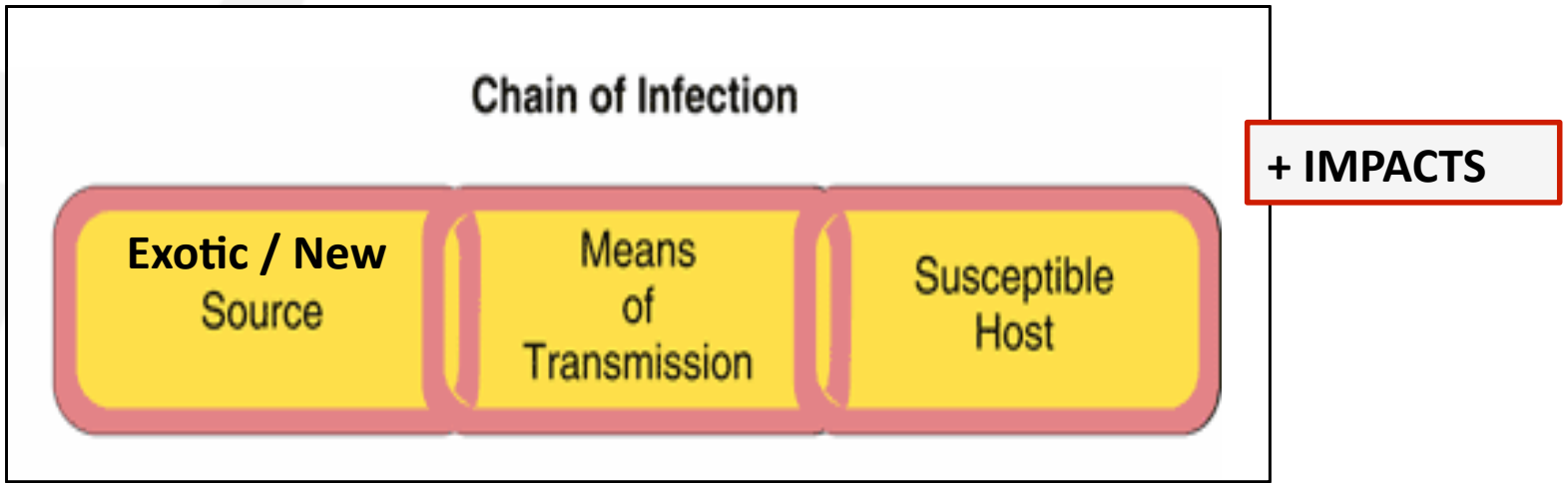
- **Concept = Pathogen Risk Assessment**
  - *Screening Tool : **not** fully quantitative PRA*
    - Limited number questions ~ questionnaire
    - Qualitative: Answers + comments experts
    - Quantitative: score/uncertainty integration ⇔ modelling
  - ***Harmonia*⁺ *Screening Tool*** *(Blackburn et al., 2011)*



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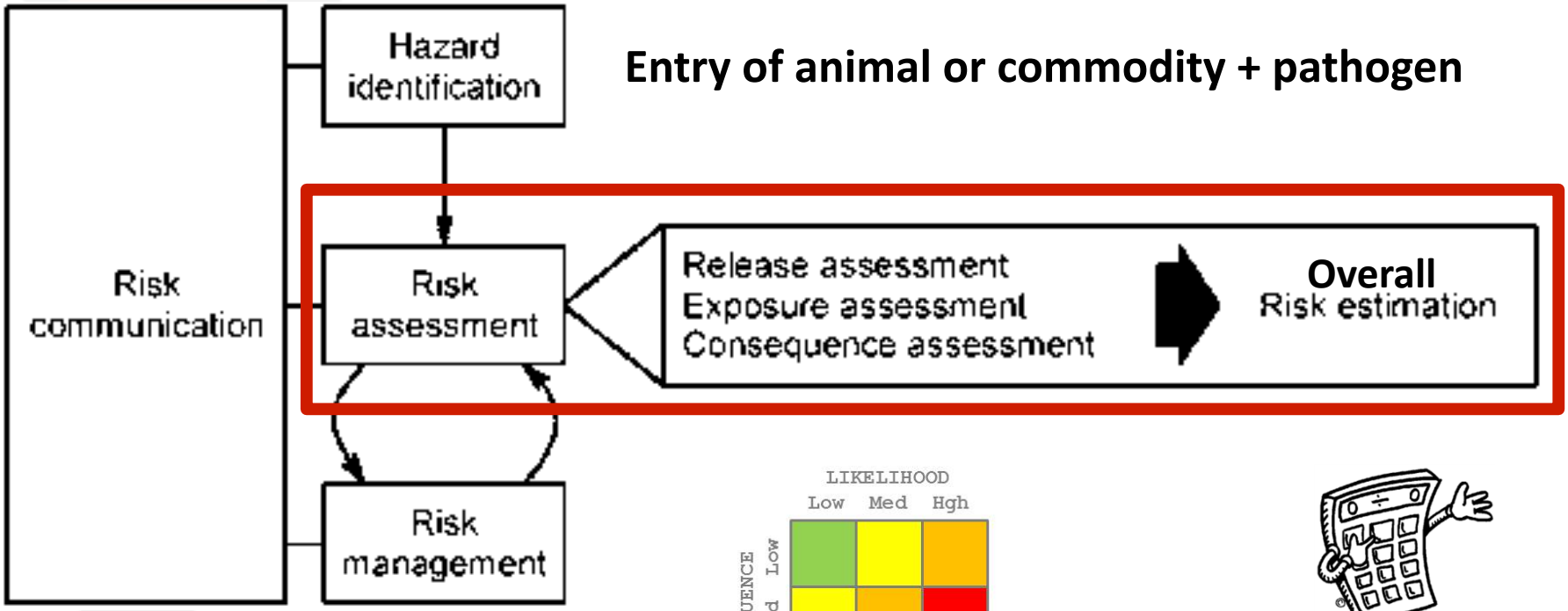
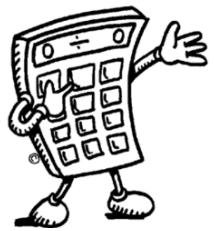
- **Concept = Pathogen Risk Assessment**

  ~ OIE Terrestrial and Aquatic Manuals



Entry of animal or commodity + pathogen



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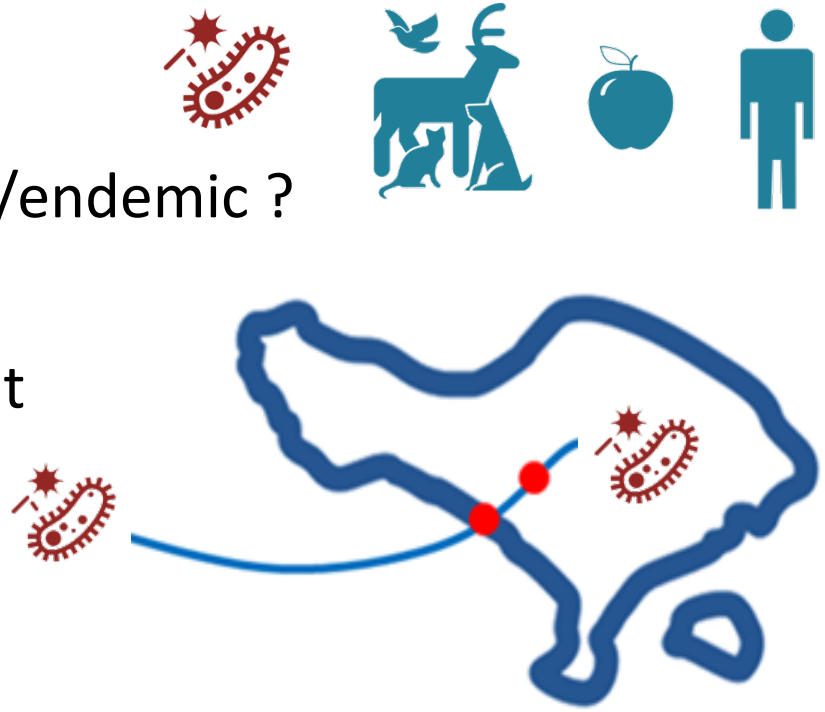
- **15 Protocol Questions**
  - *Context Module (4Q)*
    - Assessor / expert
    - Pathogen(s):emerging/endemic ?
    - Target domain(s)
    - Area under assessment



  - *Entry Module (1Q)*
    - Probability of Pathogen Introduction
    - Implicit: introduction pathways

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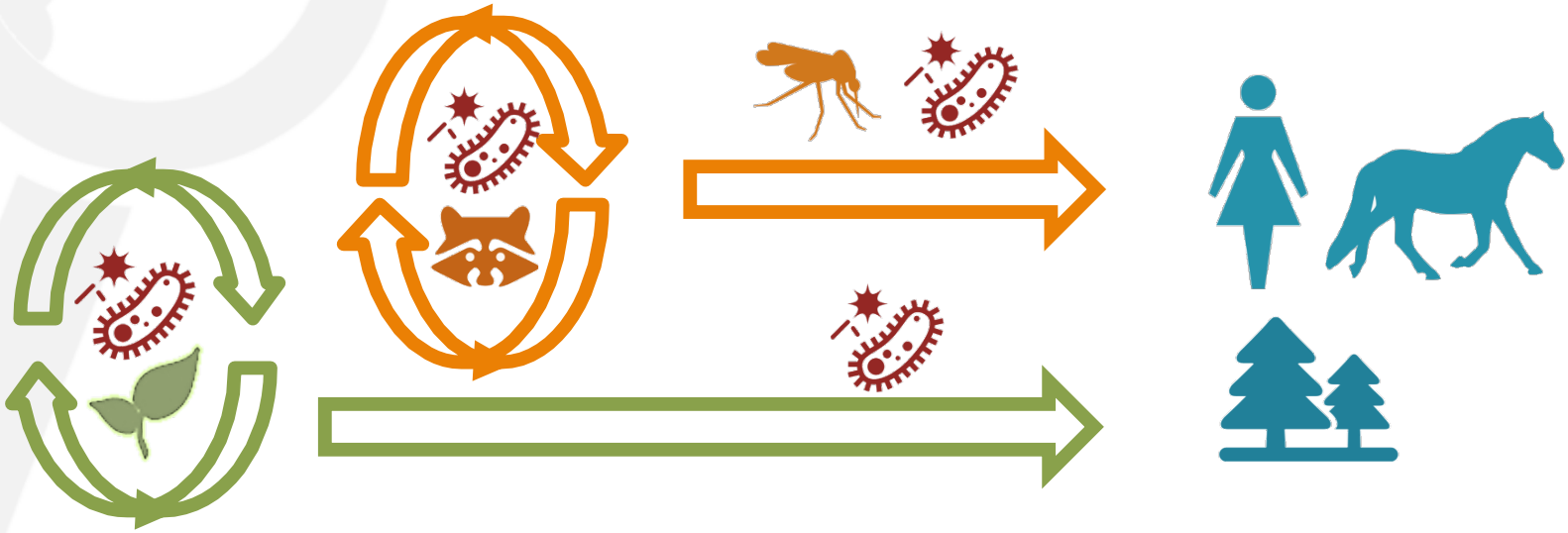
- **15 Protocol Questions**
  - *Exposure Module (2Q)*
    - **Maintenance:** transmissions + spread in any reservoir: **organism** – **environment**
    - **Spillover:** individual transmissions from reservoir to individual **targets**



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- **15 Protocol Questions**
  - *Consequence Modules ~ Targets*
    - **Environment** *(1Q)*
      - Wild animals / plants
      - Effect on the diversity of native species ~ decline, extinction
      - Populations (Implicit: individuals)
    - **Domesticated plants** *(1Q)*
      - Effect on plant quality or crop yield
      - Populations (Implicit: individuals)

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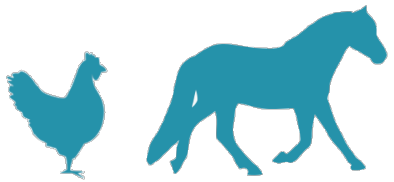
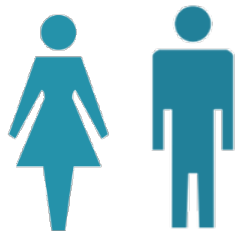
- **15 Protocol Questions**
  - *Consequences ~ Targets*
    - **Domestic animals** *(2Q)*
      - Effect on individual health (physical and welfare)
      - Burden on population health or production



    - **Humans** *(2Q)*
      - Effect on individual health (physical, mental, social)
      - Burden on population health



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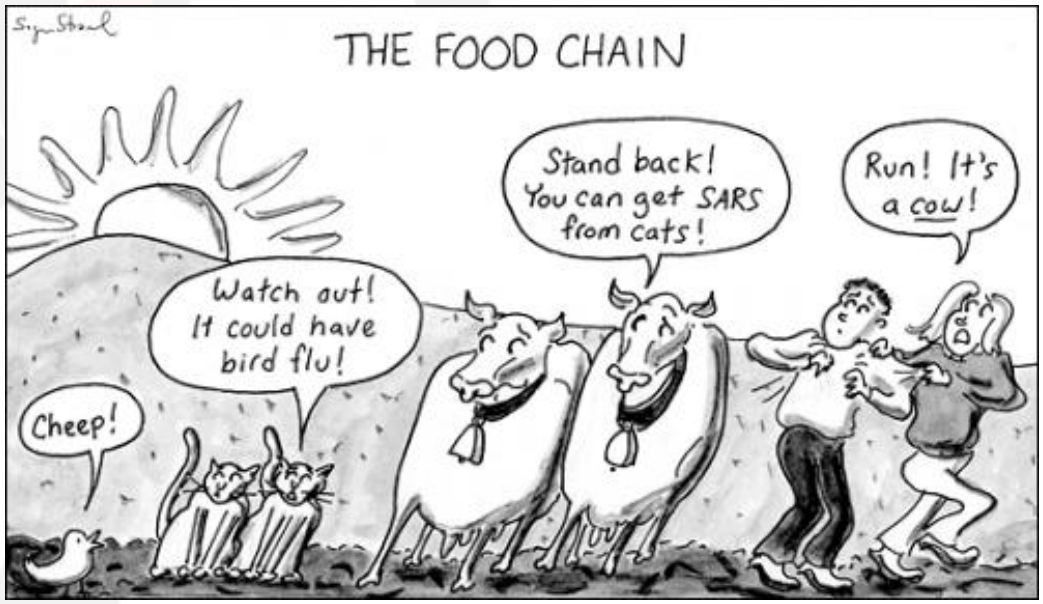
- **15 Protocol Questions**
  - *Consequences ~ Targets*
    - **Other** *(2Q)*
      - Effect on international **trade** and **tourism**
      - Effect on **public attention** and perception



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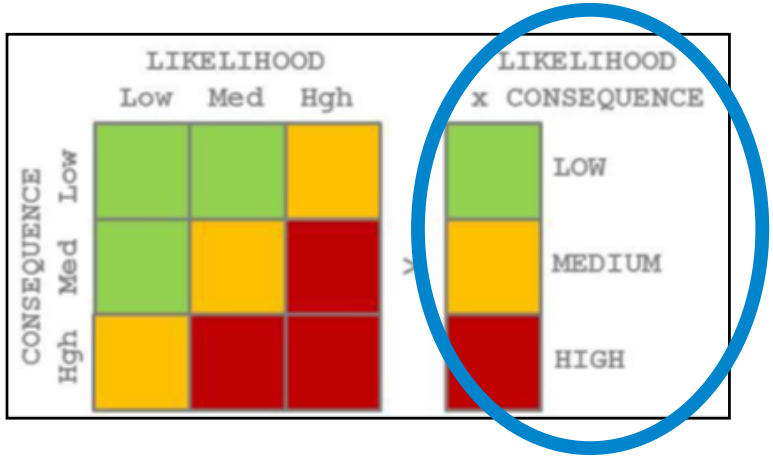
- **Integration of Scores**
  - ***15 Questions***
    - Score per question
    - 3-5 point scale
    - Rescales each score [0-1]
  - ***Aggregation into Module***
    - Choose for each module
    - Max. of question score
    - Average: allows weights



3 Point Scale		
Score	*Rank*	*Rescale*
Low	1	0
Medium	2	0.50
High	3	1
(R-1)/(max -1)		

3 Point Scale					
Rescale	*Weight*	*Weighted*	*Module*		
0	3	0	0.5	0.33	1
0.5	2	1			
1	1	1			
*Σ(R*W) / Σ(W)*			*Average*	*Weighted*	*Max*

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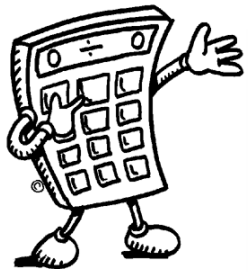
- **Integration of Scores**
  - ***Aggregation of modules***
    - Emerging Score
      - Entry and Exposure modules
      - Product or (weighted) geometric mean
    - Consequence Score
      - Consequence modules
      - Max. module score or (weighted) arithmetic mean
    - Overall Risk Score
      - Emerging Score and Consequence Score
      - Product ES*CS



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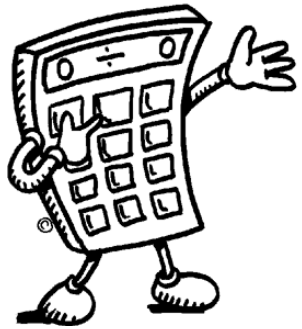
- **Score integration**
  - ***Uncertainty***
    - Same calculations



- **Output**
  - ***1 Report per pathogen per assessor***
    - Overview Context
    - Questions & Answers
    - Integrated Scores
    - Expert remarks and references

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- **Validation**

  - *'Half' RA process:* individual assessors
  - *CODA-CERVA*
    - **Pandora:** Bluetongue 8 – Classical Swine Fever
    - **Pandora^{+}:** *E. multilocularis* in Raccoondogs
    - 4-6 assessors: PDF - scores and weights (< 3.5h)
  - *Criteria*
    - Individual scoring/weighting
    - Compare scores + average
    - Agreement ? ⇔ Variation ?
    - Meeting ? Consensus ?

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- **Validation**
  - *Risk Score = "everything"*

Overall RISK score	Bluetongue	Classical Swine Fever	Echino-coccus
Assessor 1	0.77	0.87	0.75
Assessor 2	0.60	0.60	0.74
Assessor 3	0.69	0.43	0.38
Assessor 4	0.75	0.52	0.38
Assessor 5	0.75	/	/
Assessor 6	0.88	/	/
Mean Score	**0.74**	**0.61**	**0.63**
StDev	0.09	0.19	0.31
Coeff Var	0.13	0.31	0.49

0-33%: **Low** risk - 34-66%: **Medium** risk - 67-100%: **High** risk

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- **Validation**
  - *Overall Confidence*

Overall Confidence	Bluetongue	Classical Swine Fever	Echino-coccus
Assessor 1	0.69	0.54	0.34
Assessor 2	0.00	0.52	0.76
Assessor 3	0.62	0.35	0.25
Assessor 4	0.35	0.25	0.00
Assessor 5	0.25	/	/
Assessor 6	0.87	/	/
Mean Score	0.46	0.42	0.34
StDev	0.32	0.14	0.32
Coeff Var	0.69	0.33	0.94

0-33%: **Low** conf - 34-66%: **Medium** conf - 67-100%: **High** conf

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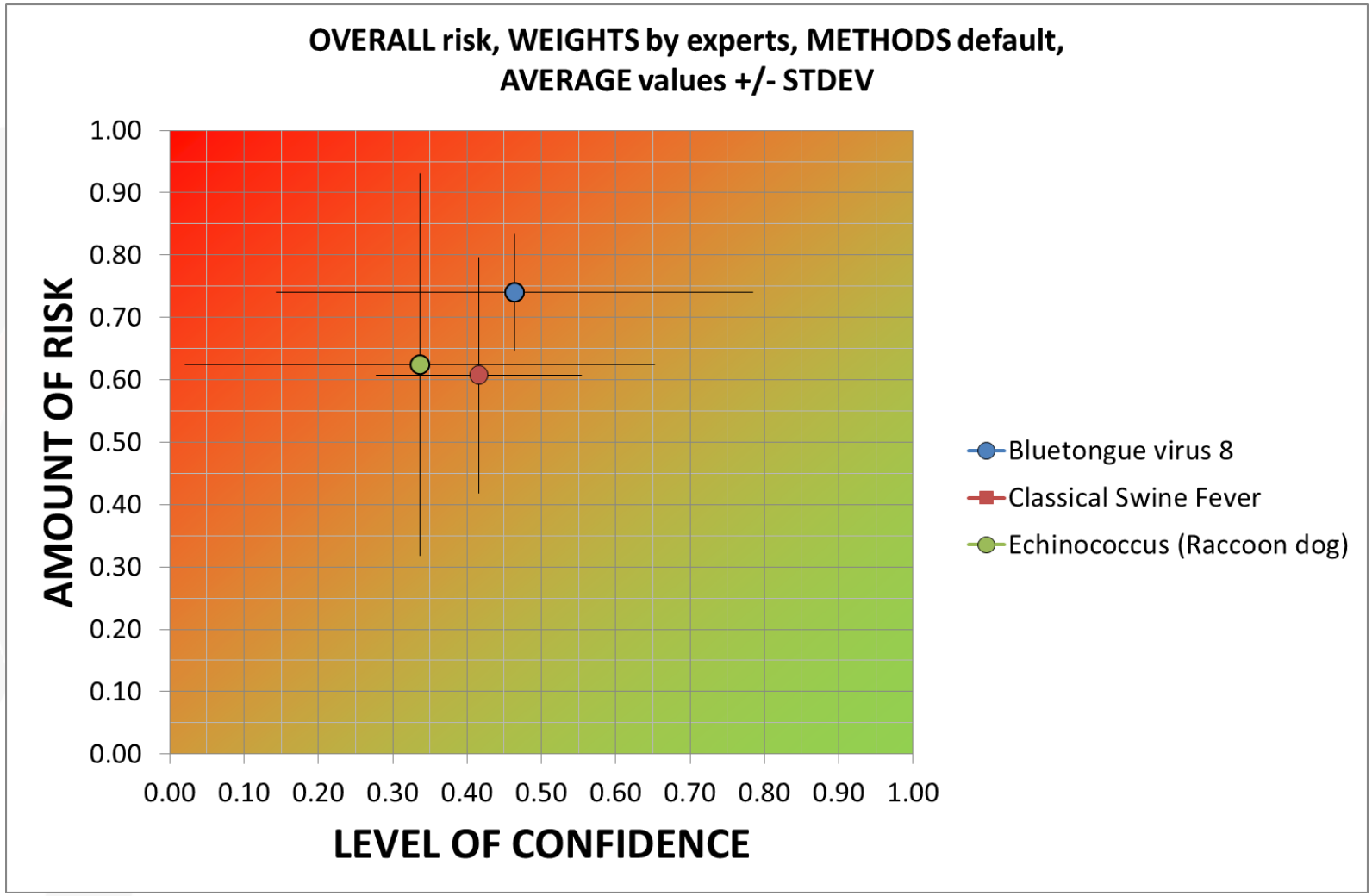
- **Validation**
  - *Risk Score and Confidence*



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- **Validation**
  - *Module Scores + ES/CS*

Modules	BLUETONGUE			CLASSICAL SWINE FEVER		
	Average Score	StDev Score	Confid.	Average Score	StDev Score	Confid.
Entry	0.83	0.26	0.50	0.63	0.25	0.50
Exposure	0.87	0.14	0.79	0.69	0.12	0.63
Conseq. Environment	0.63	0.14	0.67	0.56	0.31	0.63
Conseq. Plant	/	/	/	/	/	/
Conseq. Animal	0.88	0.07	0.92	0.87	0.00	0.81
Conseq. Human	0.02	0.05	0.26	0.07	0.08	0.13
Conseq. Other	0.66	0.21	0.80	0.81	0.16	0.83
EMERGING score	**0.83**	0.12	0.54	**0.65**	0.16	0.55
CONSEQUENCE score	**0.90**	0.09	0.53	**0.94**	0.08	0.48
RISK score	**0.74**	0.09	0.31	**0.61**	0.19	0.26

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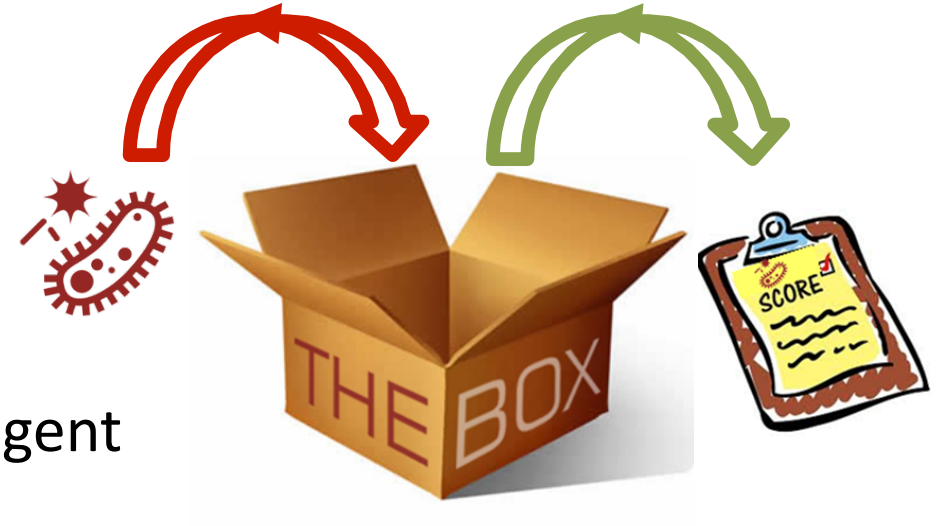
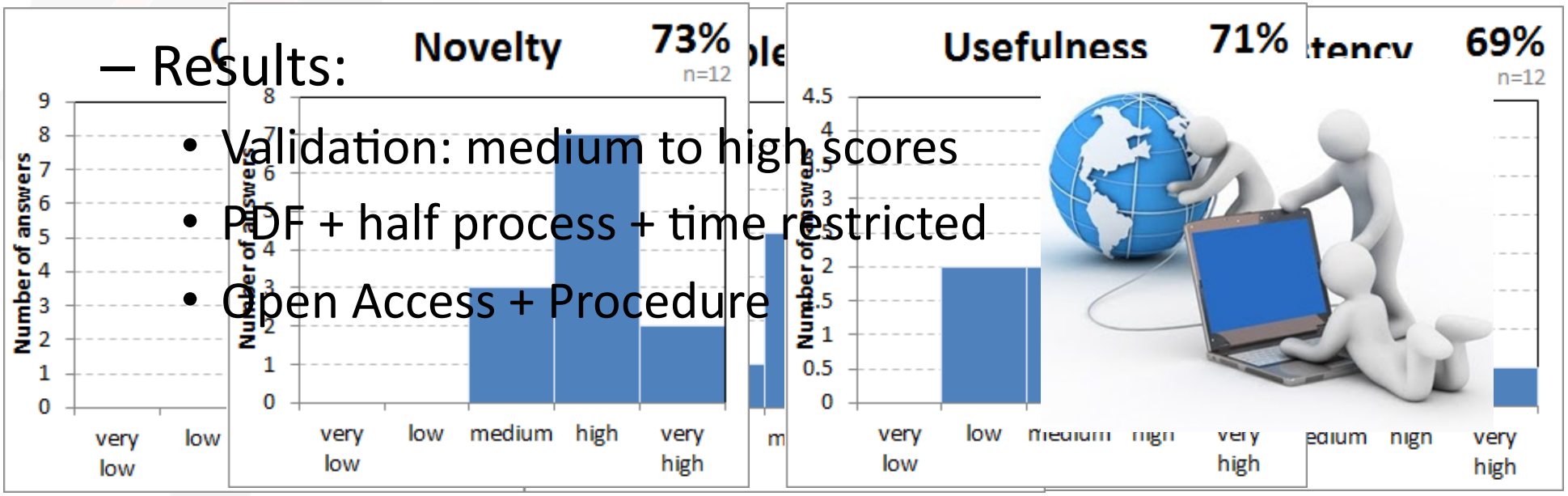
- **Expert Survey**
  - *12 assessors*
    - NL, ES, FR
    - BE: CODA, ILVO, AviaGis, Ugent
    - PDF + 5 criteria
  - Results:
    - Validation: medium to high scores
    - PDF + half process + time restricted
    - Open Access + Procedure





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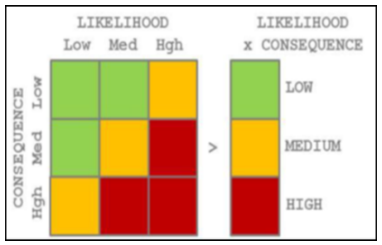
- **Open Access Online Tool**

  - *Easier to use + Download*

    http://ias.biodiversity.be/harmoniaplus

  - *Guidance*
    - Concepts - Practical
    - Structure - Examples
    - Mathematics: scoring / weighing



  - *Links*
    - Info OIE, EPPO, …
    - Notifiable disease lists, …

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- **Suggested Process:**
  - *Stakeholders define:*
    - 5 assessor(s) / expert(s)
    - Context module
    - Score aggregation
    - Weighting

  - *But also:*
    - Discuss disagreements: meeting or online forum
    - Reach 1 set of **consensus scores** per pathogen
    - ***NL: Multi-Expert RA - Kolfschoten, 2014***

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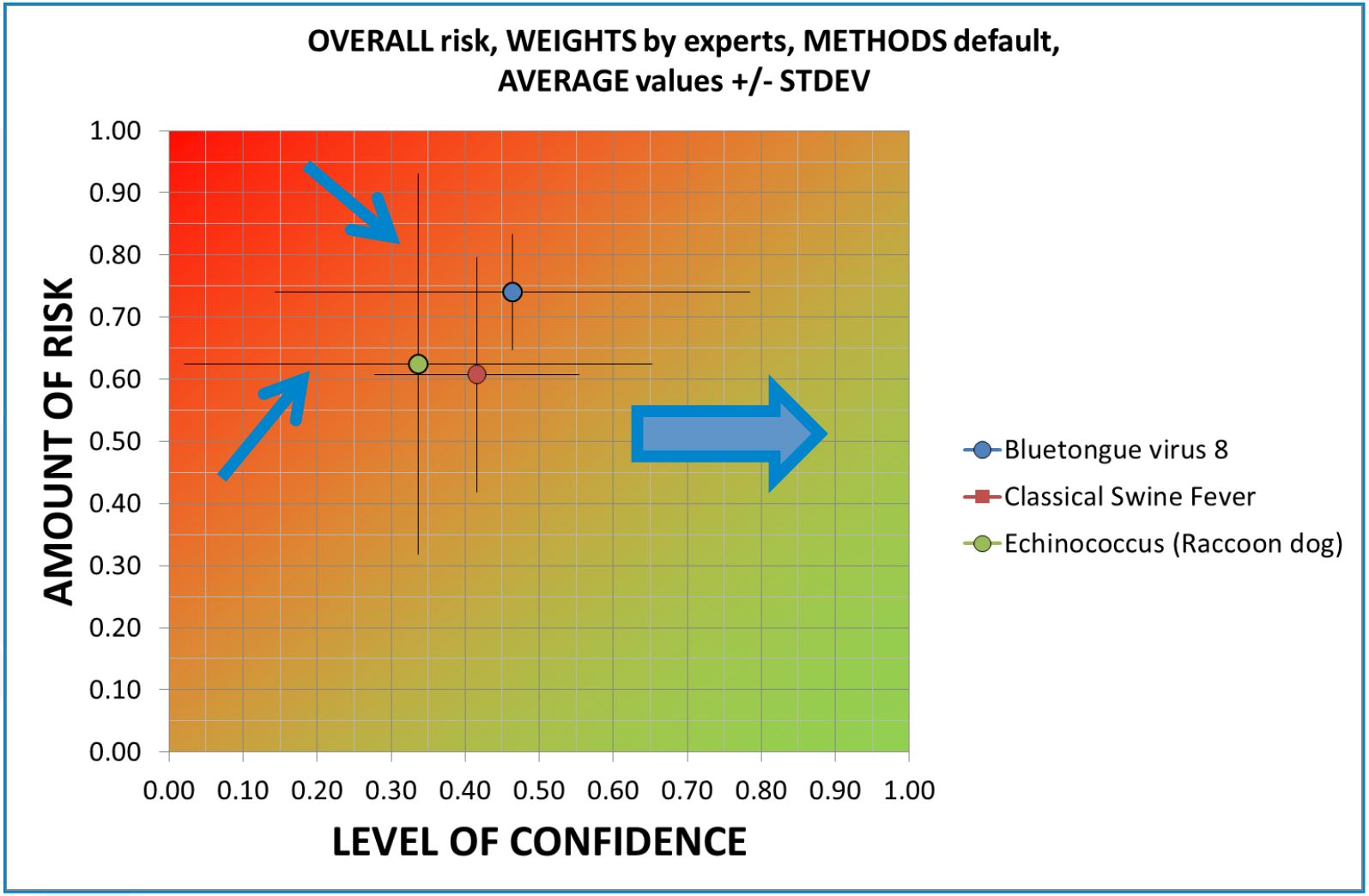
- **Final Procedure + Protocol**
  - *Risk Score and Confidence*



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- **Output** = ***1 Report per pathogen***

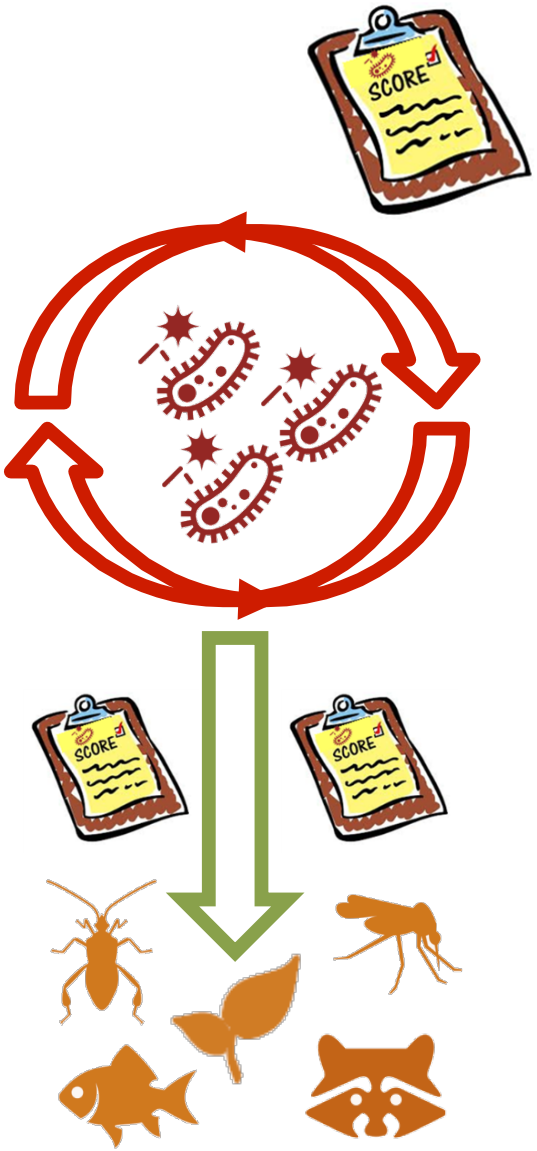
  – ***Usefulness Pandora ?***

    - Compare pathogens ⟶ Policy
    - Priorities ~ Stakeholders ~ Sector
    - Priority lists: intervention
    - Data gaps: research + update scores

    or

  – **Slot Pandora⁺ overall**

    Risk Score into Harmonia⁺ !!!



Conclusions Pandora(+)

– *First-line Risk Assessment*

- Structured ~ existing protocols
- Compare Pathogens = micro-Aliens
- Assess Health ~ macro-Aliens

– *Maths and Procedure*

- Literature → simple and flexible
- Balanced in / between domains
- Decision maker's choice

– *Online Tool*

- Open access + user-friendly
- Feedback + evolution

World Health Organization

oepp eppo

OIE World Organisation for Animal Health

Thank you !

Alien Alert

Alien Alert Consortium

Belgian Science Policy Office belspo

thinking THE BOX

AviaGIS

CODA - CERVA

cra-w

DGO 3

SPW

isp wiv

ULB

Vrije Universiteit Brussel

museum