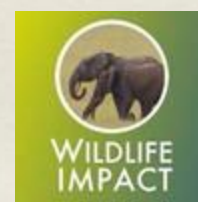
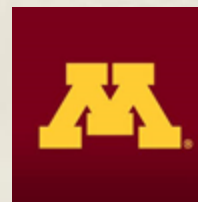




# Introduction to Wildlife ~~Disease~~ Risk Analysis. Health

Steve Unwin (WHA, IUCN CPSG/WHSG), Fabiana Rocha (IUCN CPSG), Simone Vitali, Andrea Reiss, Erin Davis (WHA), Jamie Copsey, Richard Jakob-Hoff (IUCN CPSG), Fransiska Sulistyو (OVAG), Julie Sherman (Wildlife Impact), Dominic Travis (Marine Mammal Centre)





# **Introduction to Wildlife ~~Disease~~ Risk Analysis. Health**

**Part 1.**

**Maximising impact**

**Part 2.**

**Understanding risk and our response to it.**

**Part 3.**

**The risk analysis process in relation to disease risk in the wildlife trade and what we have covered already in workshop 1.**

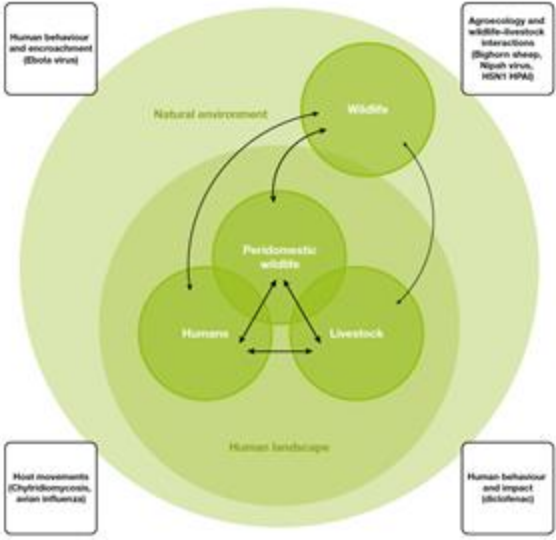
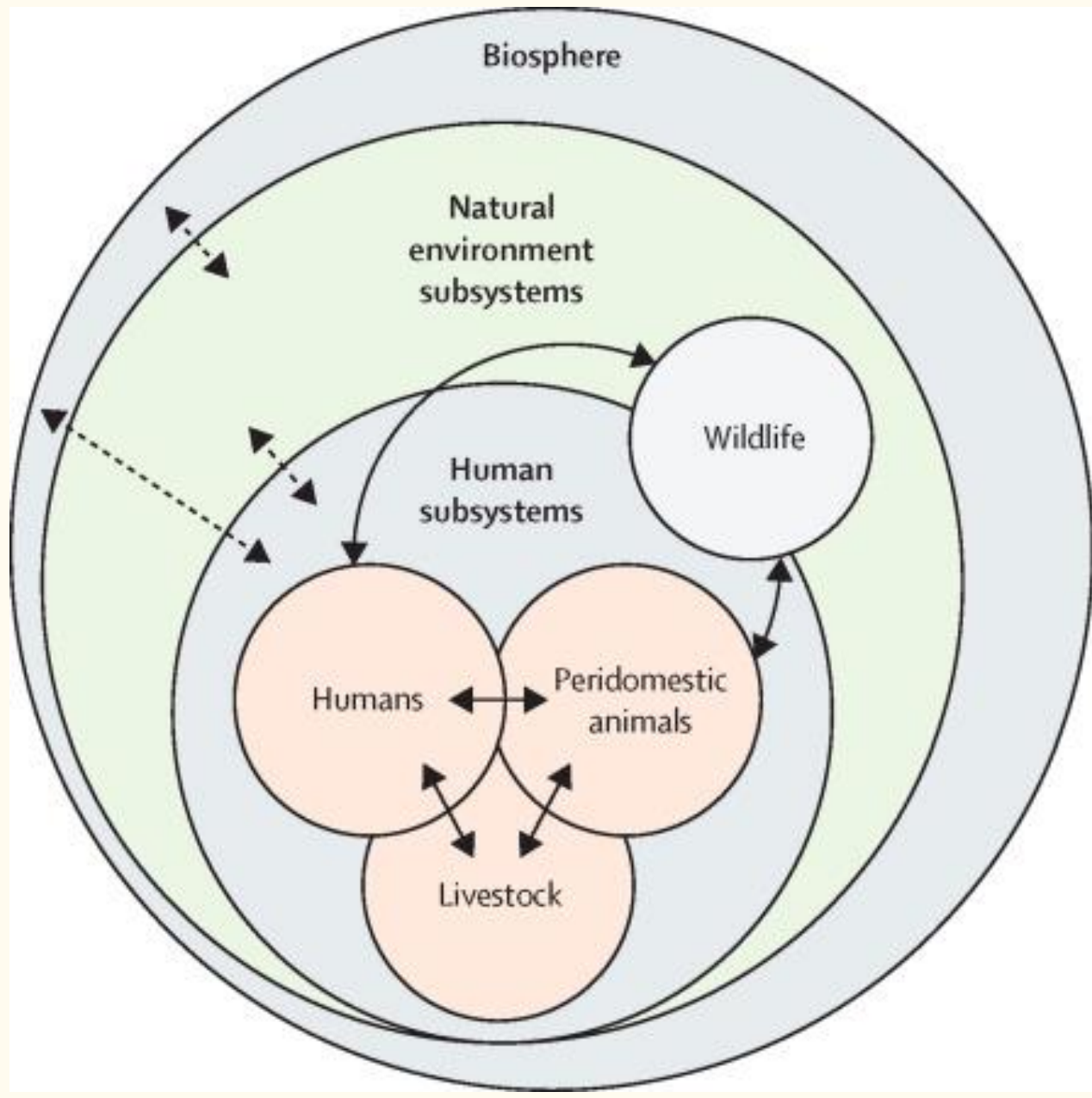


Fig. 2 Pathogen flow and drivers at the human-livestock-wildlife interface. The arrows in Figure 2 indicate direct, indirect or vector borne pathogen flow. Each box represents a driver for which a case study is provided in the text.

Jakob-Hoff et al. 2014



Arnold et al. 2024

**Goal: Our species survival.**  
 A healthy biodiversity (wildlife) must have complexity and integrity to be resilient to challenges such as disease. This is critical not just for biosecurity but also for a liveable climate, breathable air, and drinkable water. ie. human survival.





# **Part 1. Maximising Impact – focus on the decision- making**

# How to maximise our leverage over events – wildlife trade example



Event: Disease transmission from and between traded wildlife

Wildlife trafficker and trader behaviour

Poor wildlife welfare, poor biosecurity along trade route

Understand stakeholder motivations and mitigate accordingly

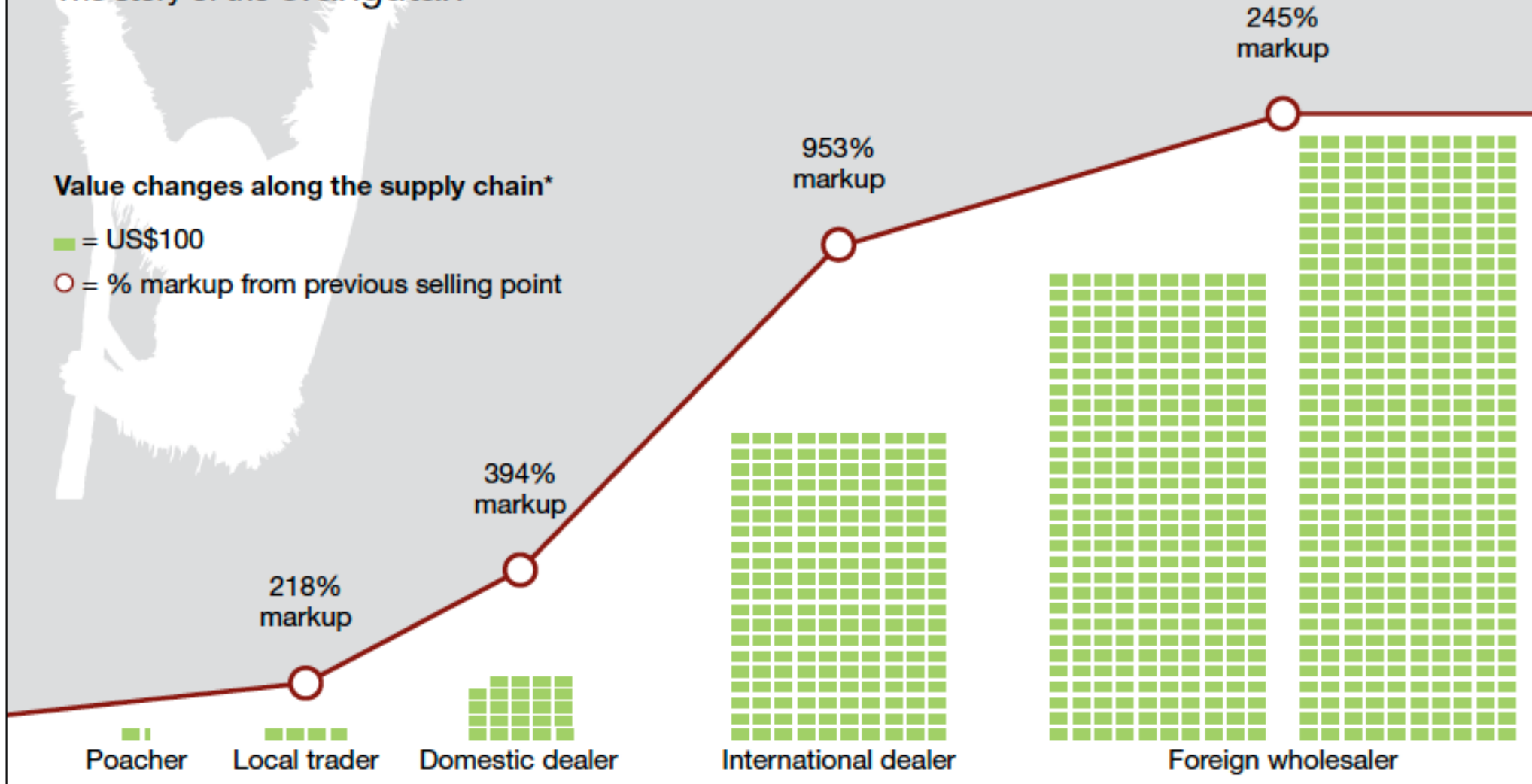
# FROM FOREST TO FOREIGN MARKET

## The story of the orangutan

### Value changes along the supply chain\*

■ = US\$100

○ = % markup from previous selling point



**Note:** \* The original research uncovered a range of prices at each point in the supply chain. For graphical purposes, the study utilized the upper value for each segment of the supply chain.

**Source:** Clough and May (2018, pp. 8, 9, 25). © Global Financial Integrity 2018

# Changing peoples minds: Motivation Vs Manipulation

Reward  
Ideology  
Coercion  
Ego

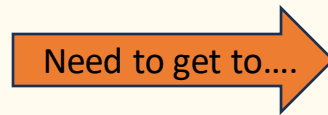
# Ideology

Ego  
Reward  
Coercion



## Perception

90% of people live here  
Go with your gut  
What you believe you see  
Where most decisions are made  
SUBJECTIVE



## Perspective

Must be learned – **Analyse the risks**  
Evidence-based  
What is there  
OBJECTIVE

Effective science communication: Emotional messaging used for a logical narrative

How do you feel about humanity's involvement in environmental degradation and an increase in poor health outcomes through issues such as poorly regulated wildlife trade ?



We can work together to reduce health risks by agreeing on a process and approach with proven quantifiable results.

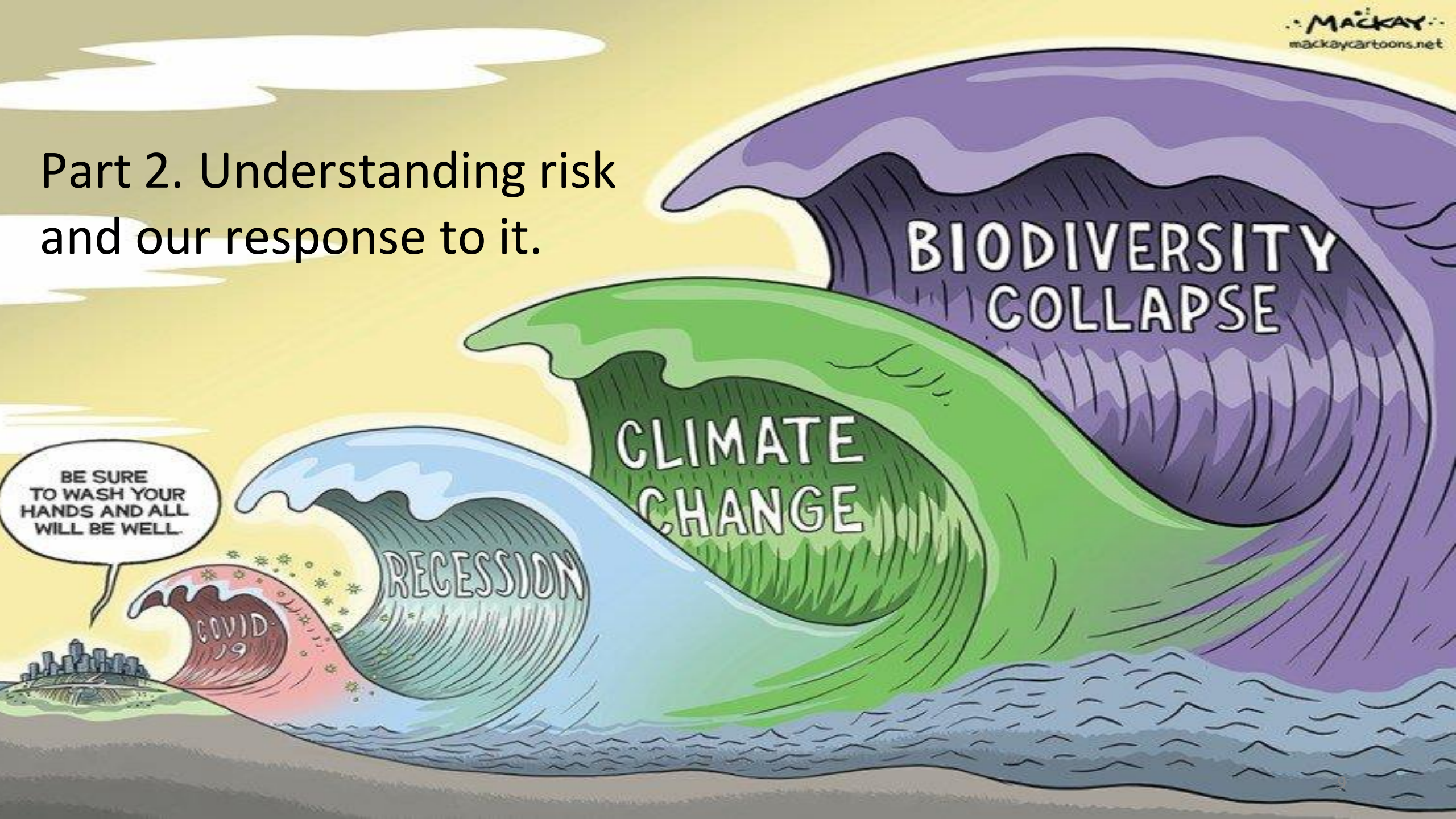
## 5 reasons why many conservation/ environmental efforts fail:

- Lack of local buy-in
- Ignoring history
- Lacking of funding
- Lack of law and order
- Lack of clearly stated goals



Part 2. Understanding risk  
and our response to it.

BE SURE  
TO WASH YOUR  
HANDS AND ALL  
WILL BE WELL.





# Response to risk

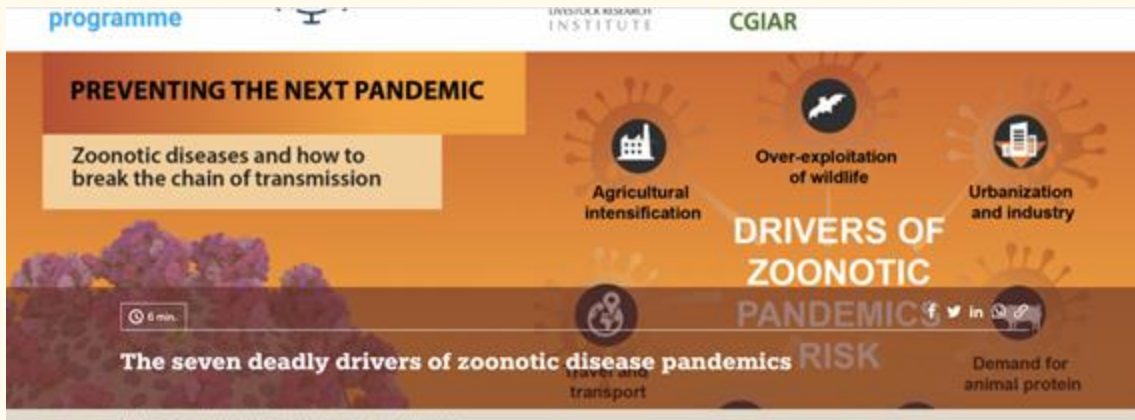
- Repeated, poor responses
- Unintended consequences
- Overcoming our primate brains' psychological discomfort and confronting decision-making and uncertainty

## September 11's indirect toll: road deaths linked to fearful flyers

German professor estimates an extra 1,595 Americans died in car accidents in year after September 11 attacks



<https://www.theguardian.com/world/2011/sep/05/september-11-road-deaths> Poor decision-making skills as a species in a crisis



<https://www.ilri.org/news/seven-deadly-drivers-zoonotic-disease-pandemics>

## THE LANCET

Submit Article

HEALTH POLICY | VOLUME 377, ISSUE 9775, P1438-1447, APRIL 23, 2011

### Priority actions for the non-communicable disease crisis

Prof Robert Beaglehole, DSc • Prof Ruth Bonita, PhD • Richard Horton, FMedSci • Cary Adams, MBA • George Alleyne, MD • Perviz Asaria, MPH • et al. Show all authors

Published: April 06, 2011 • DOI: [https://doi.org/10.1016/S0140-6736\(11\)60393-0](https://doi.org/10.1016/S0140-6736(11)60393-0)

<https://www.thelancet.com/article/S0140-6736%2811%2960393-0/fulltext-> systems approach to priority assessment of non communicable diseases in humans

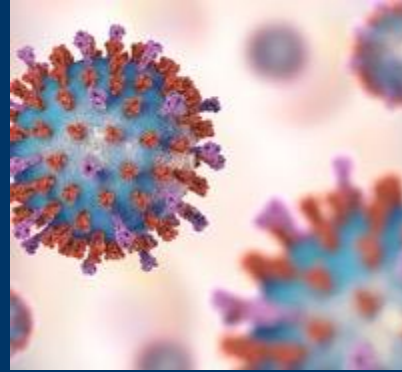
# Describing the problem: Disease emergence is an ecological process



**Human-induced  
environmental  
degradation**



**Changes in  
interactions  
between host,  
disease agents, and  
their environment**



**Natural selection -  
disease agents  
adaptations**



**Global transport  
of people,  
animals, and  
goods**



**Severe impacts on  
global health,  
conservation and  
socioeconomics**







**Urbanization**  
**Population density**



**Poor social and  
sanitary conditions**



**Human-Livestock-Domestic  
- Wildlife interactions**



**Encroaching into new  
environments**



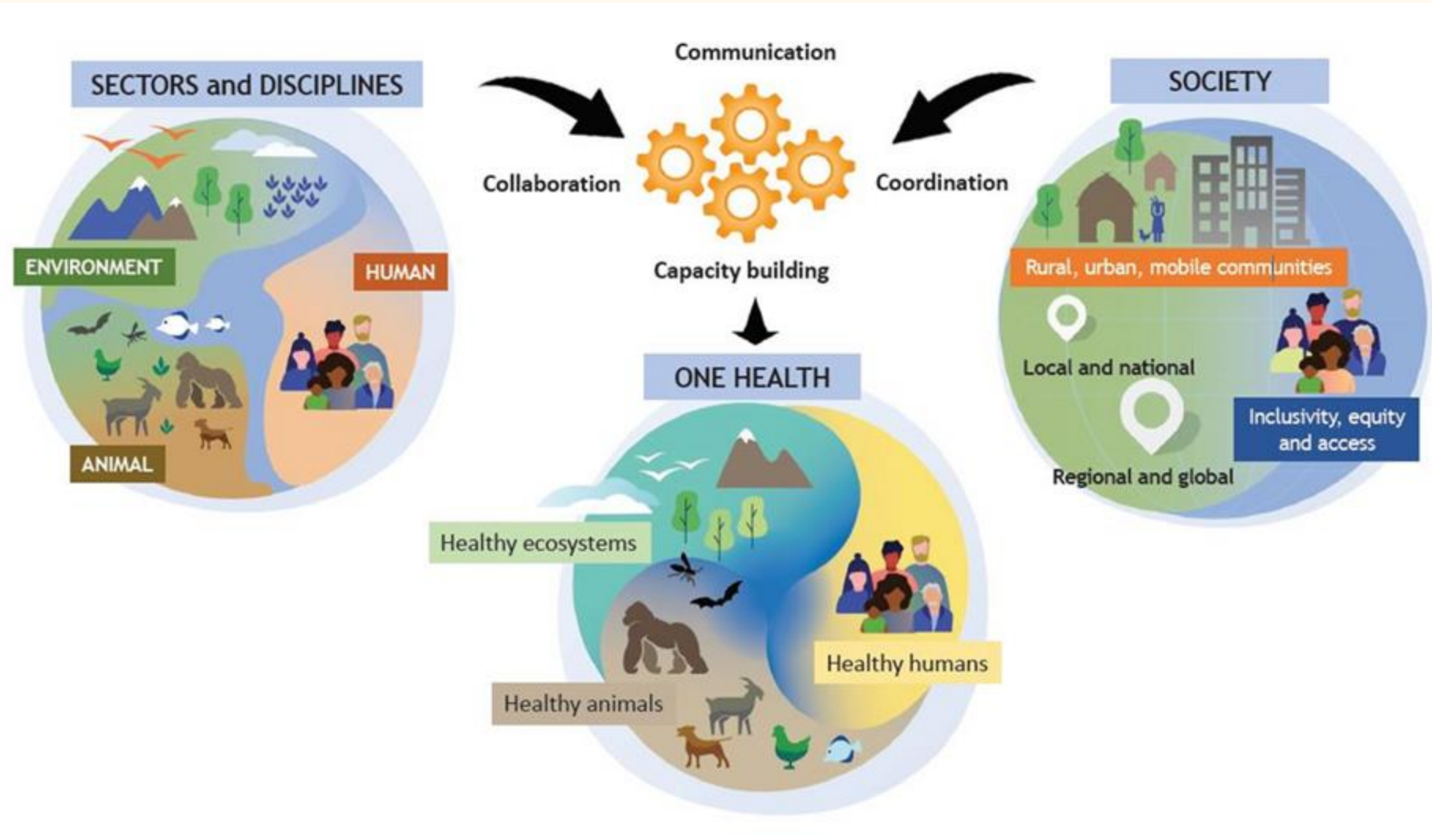
**Disease  
emergence**



**Climate change**



# A solution? One Health – systems thinking



**WOAH/ IUCN Wildlife Trade guideline recommendation:** Use a One Health approach that includes a multisectoral and multidisciplinary, consultative, collaborative and inclusive effort to inform all steps of the risk analysis and risk reduction process.

# What is Risk?

## Two components:

the **likelihood**, or  
probability, of something  
happening and, if it does  
happen

the **consequences**, of the  
deleterious activity



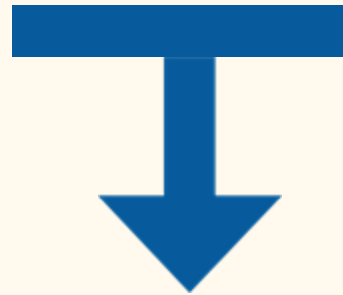


# Wildlife Health Risk Analysis (WHRA)

## WHRA - collaborative process to



Those that could  
have an **impact**

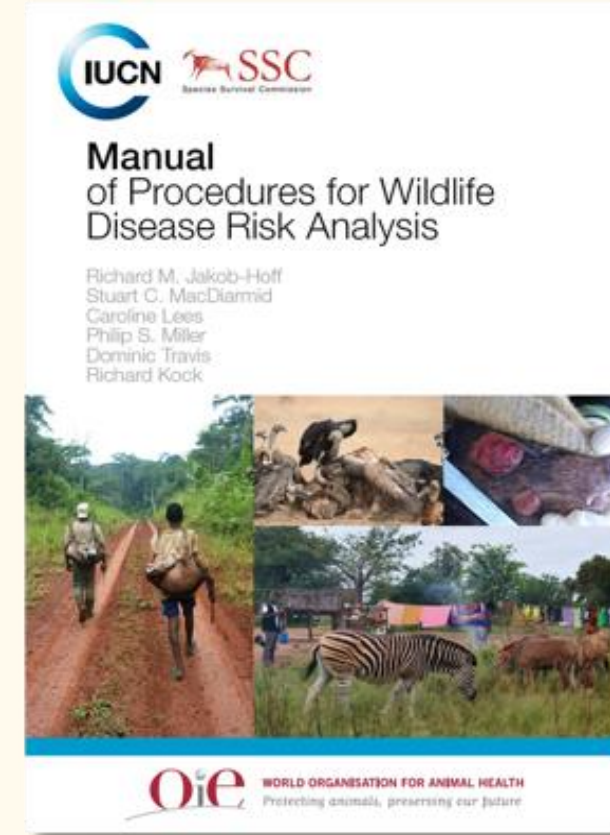
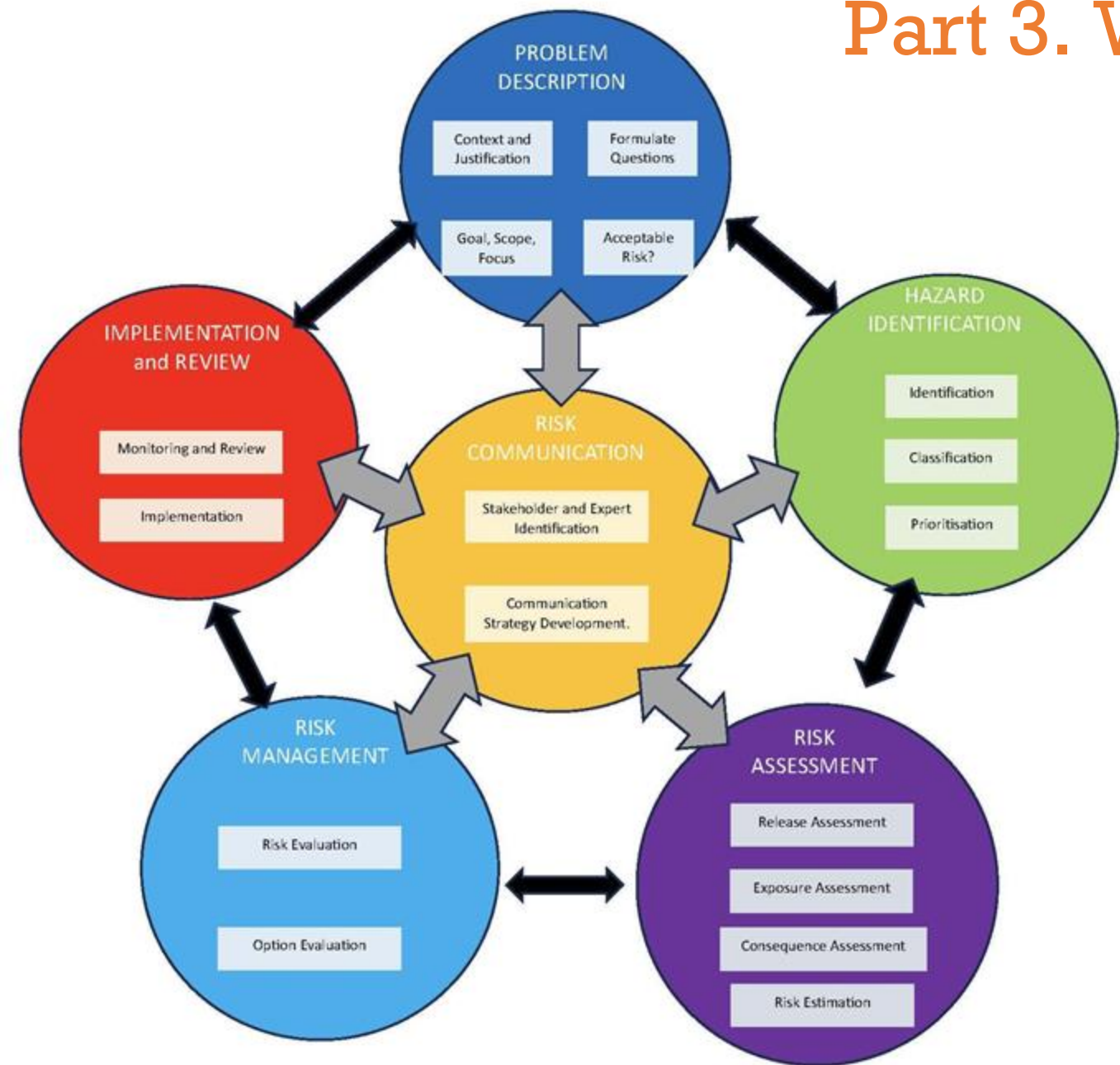


Those that could be  
**impacted**

Support any disease **management decisions**

**Agree** on how to best **respond**

# Part 3. WHRA Process





- 149 participants since 2022
- 53 countries
- From Governments (45), NGO's (50), Academic institutions (21).

### LEARNING OUTCOMES

This course is designed to equip participants with an understanding of how to put the IUCN Guidelines for Wildlife Disease Risk Analysis into practice.

By the end participants will be able to:

- Recognize and justify situations where a WDR process can contribute to a) wildlife conservation, b) domestic animal health care, and c) public health protection
- Explain how the principle of One Health and the science of epidemiology are applied to a WDR
- Design a workshop to effectively engage multiple stakeholders in completing a WDR

*The training has greatly benefited my One Health advisor work globally especially with dog-mediated rabies elimination and spillover to other mammals and for management of snakes used or accessed for venom extraction and subsequent production of life saving snake antivenoms.*



*Picking up on vaccination efforts in species overseas against HPAI and reported back to employer that they were unaware of*



# Risk communication

## ALL STEPS! (Section 2 of the WT guidelines)



- **Engage with relevant experts and stakeholders** in a way that will maximize the quality of analysis and the probability that the **recommendations** arising will be **implemented**



- We are not all equal

# Influence and interest

## Key stakeholders:

High positive/negative impact on project

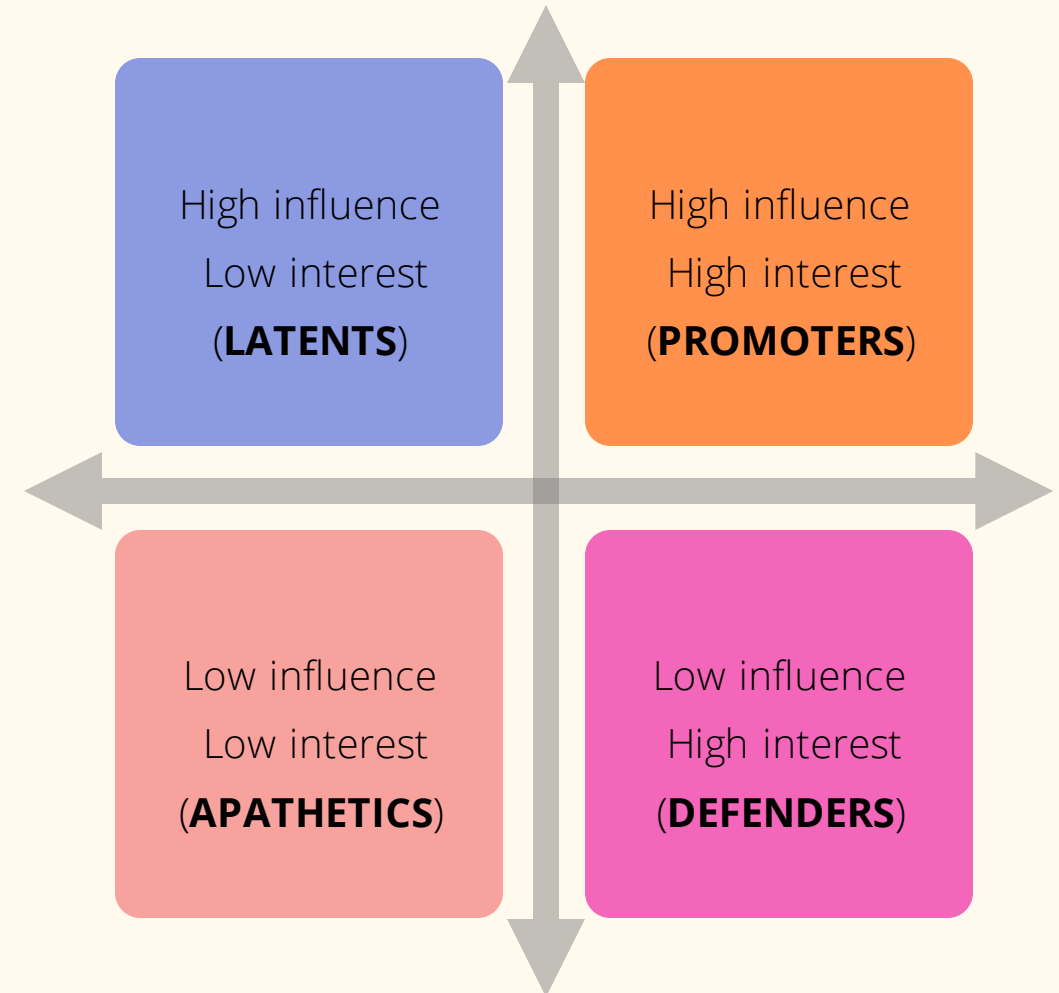
Could be either:

## Primary stakeholders

Directly affected by and influence on the project (positively or negatively)

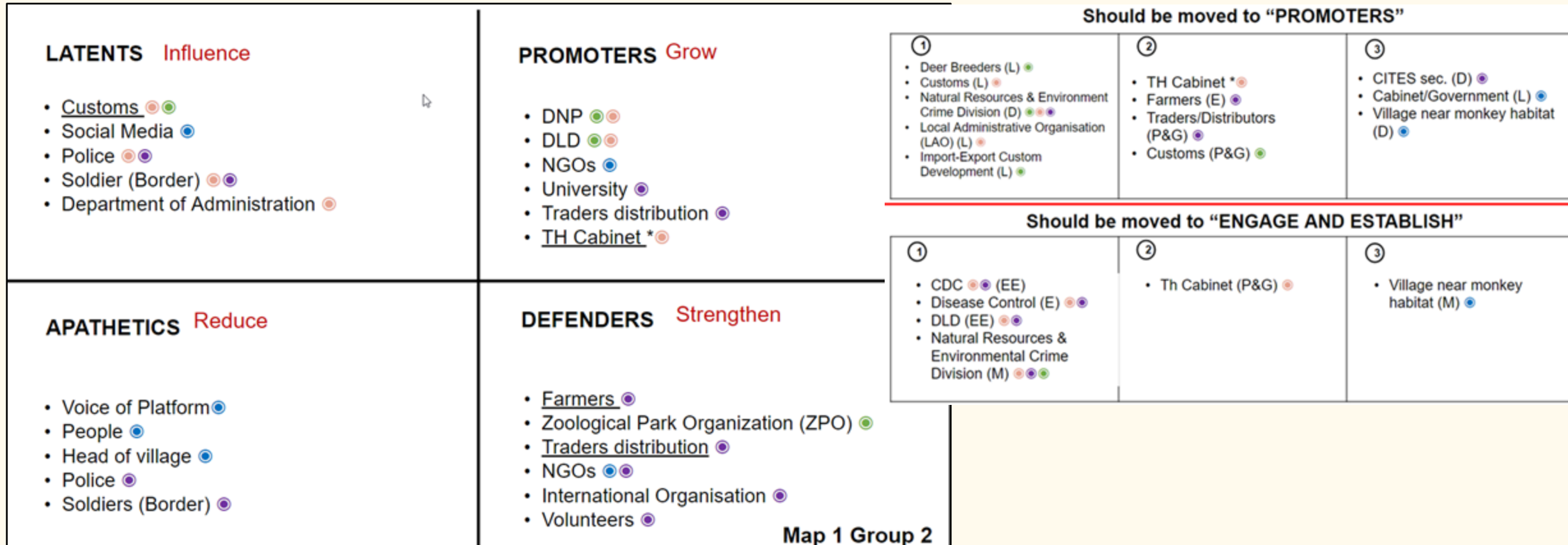
## Secondary stakeholders

Indirectly affected by or influence on the project (positively or negatively)





# From Live Bird supply chain group



Map 1 Group 2

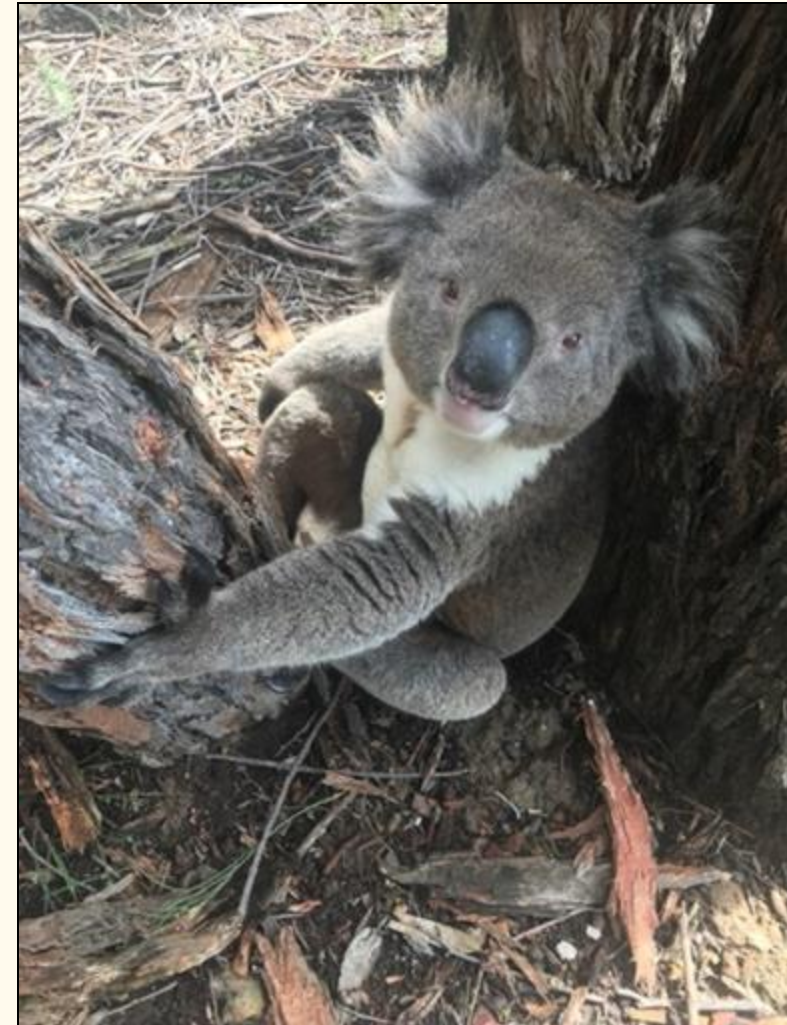
Stakeholder groups and organisations represented	Stakeholder/ Expert
Researchers	University, DNP, National research center, pet hospital, primate center staffs
Government departments	DNP, DLD, Local administrative organization (LAO), Custom department, Department of Public Works and Town & Country Planning (DPT), Ministry of Natural Resources and Environment, National Bureau of Agricultural Commodity and Food Standards, Zoological Park Organization (ZPO), Thailand Community Data (TCD), Police, Ministry of Interior
Captive Breeding	DNP, deer breeder association, Thailand Deer Cooperation, DLD, animal clinics and hospitals, Zoological Park Organization (ZPO), private owner, farm, private zoo, primate center, farm obtain permission from DNP
Indigenous communities	Local administrative organization (LAO), Head of village, spiritual leader, village located at close proximity to monkey habitat
Funding agencies	National Research Council, funding office, NGO, foreign universities, WHO, OIE, World Bank, government, international organizations, NGO, World Bank, GEF, GWP,, WOAHA, WHA
Media	DNP website, FB, news agency, Youtube, radio station, social platform, village, broadcast, posters, public relations department, social media, press
Wildlife health expert participants	University (local and foreign), WOAHA, international organizations and foundations, professional experts, DNP, DLD
Monitoring agencies	CITES, WHO, WOAHA



Communication Risks	Risk Mitigation Plan
Lack of interest and fear	Cultural considerations. Education.
Funds	Research grants (scholarships)
Distance	Involve local population
Access to information	Workshops. Posters, folders, flyers.
Fake news	Workshops, posters, folders, flyers.
Cultural barrier	Education. Involve local populations.

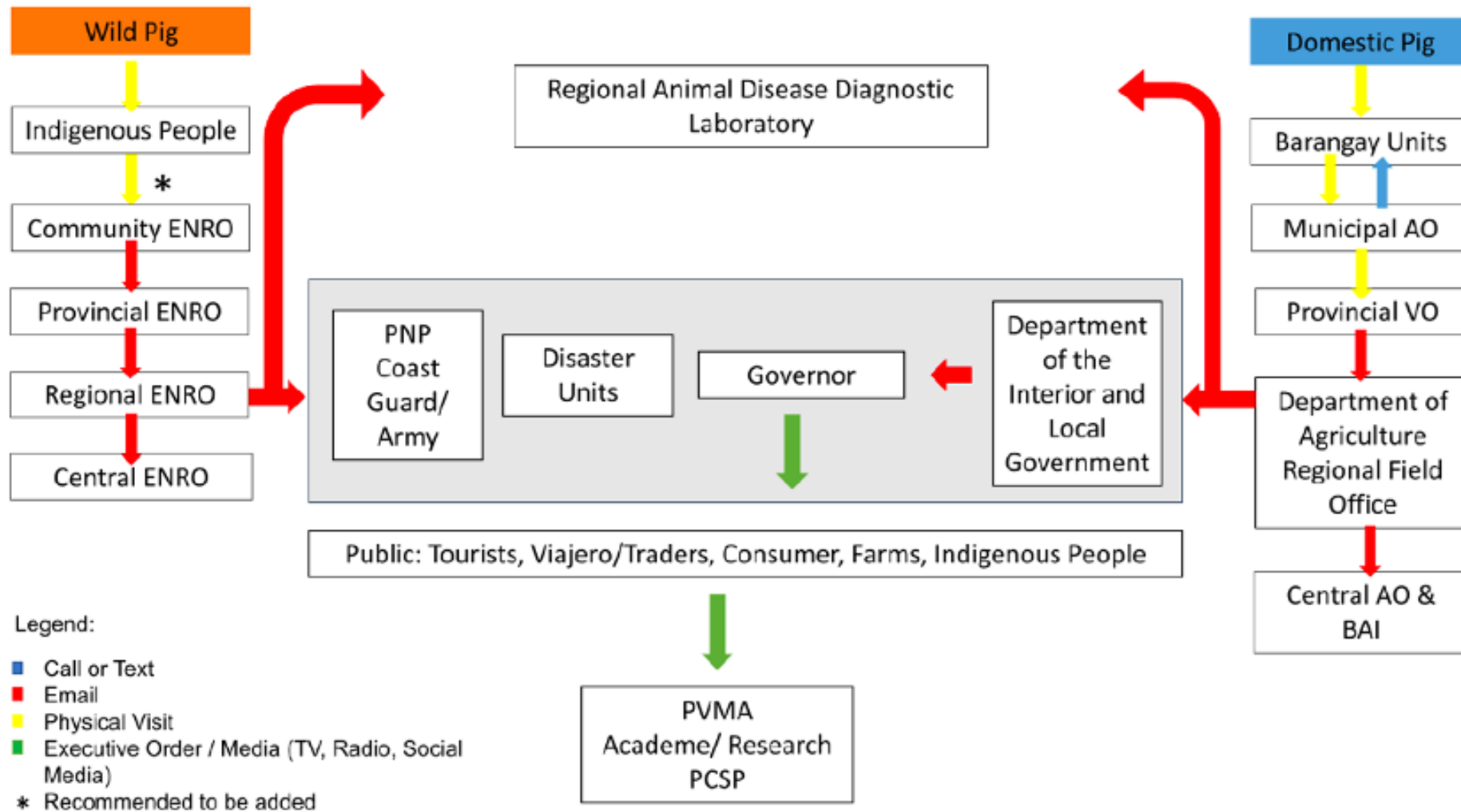
# Example - KDRA - keys to success- communication!

- A strong project team, supported by a world expert in wDRA
- Appropriate funding and resourcing
- Consistent and transparent stakeholder engagement process
- The “right” people in the room – broad and expert stakeholder representation
- Regular cross-checking for alignment to the wDRA process
- Effective use of collaboration tools eg Mural, Teams
- Excellent communication (an ‘open door’ policy for out-of-session comments, the participation agreement, rigorous documentation of decisions and processes)
- Extensive input from Subject Matter Experts to assist in drafting Hazard Literature Reviews and reviewing Hazard Risk Assessments.





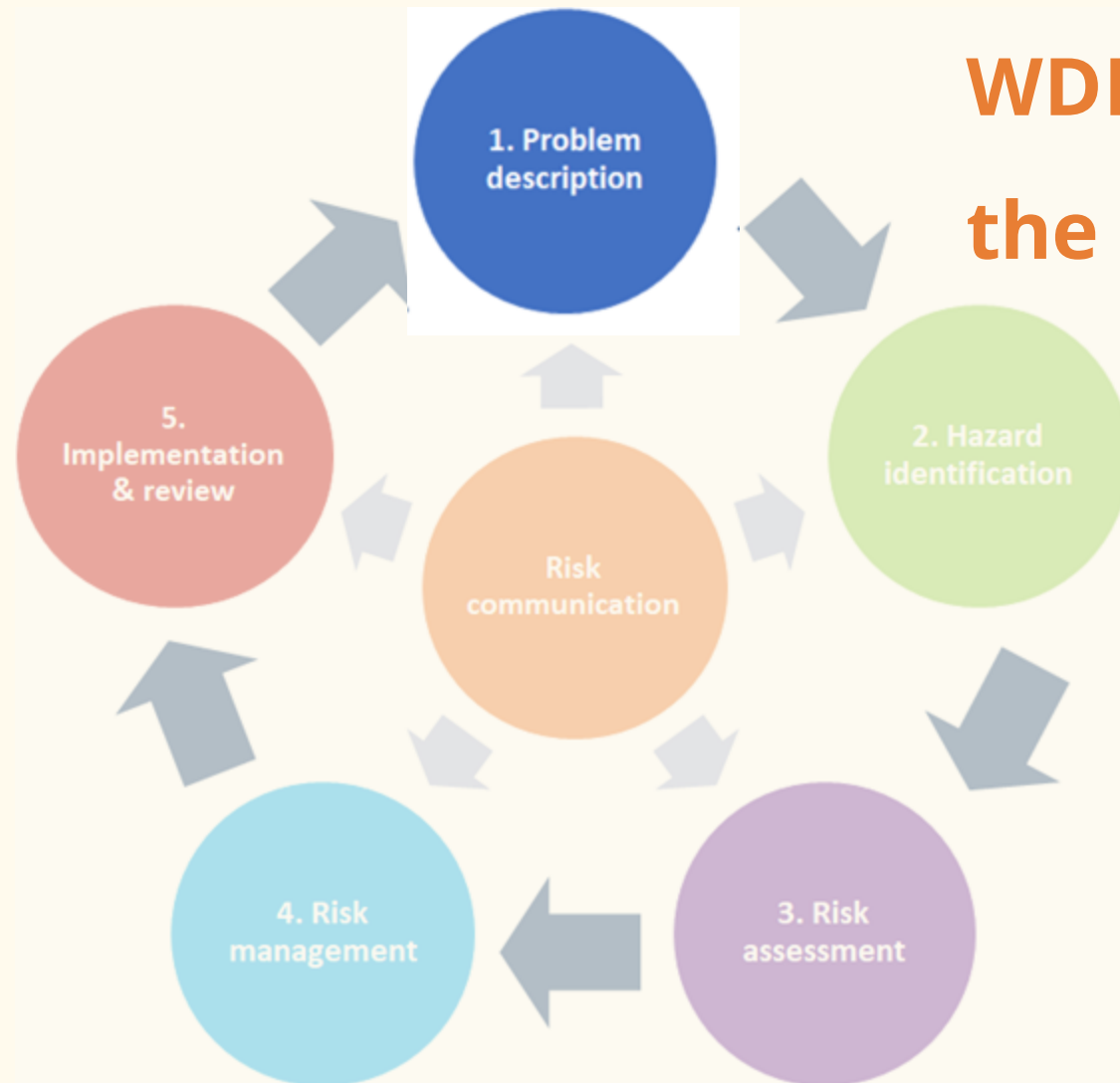
# ASF communications pathways in the Philippines



Legend: Environment and Natural Resources Office (ENRO); Agricultural Office (AO); Veterinary Office (VO); Bureau of Animal Industry (BAI); Philippine Veterinary Medical Association (PVMA); Philippine College of Swine Practitioners (PCSP)

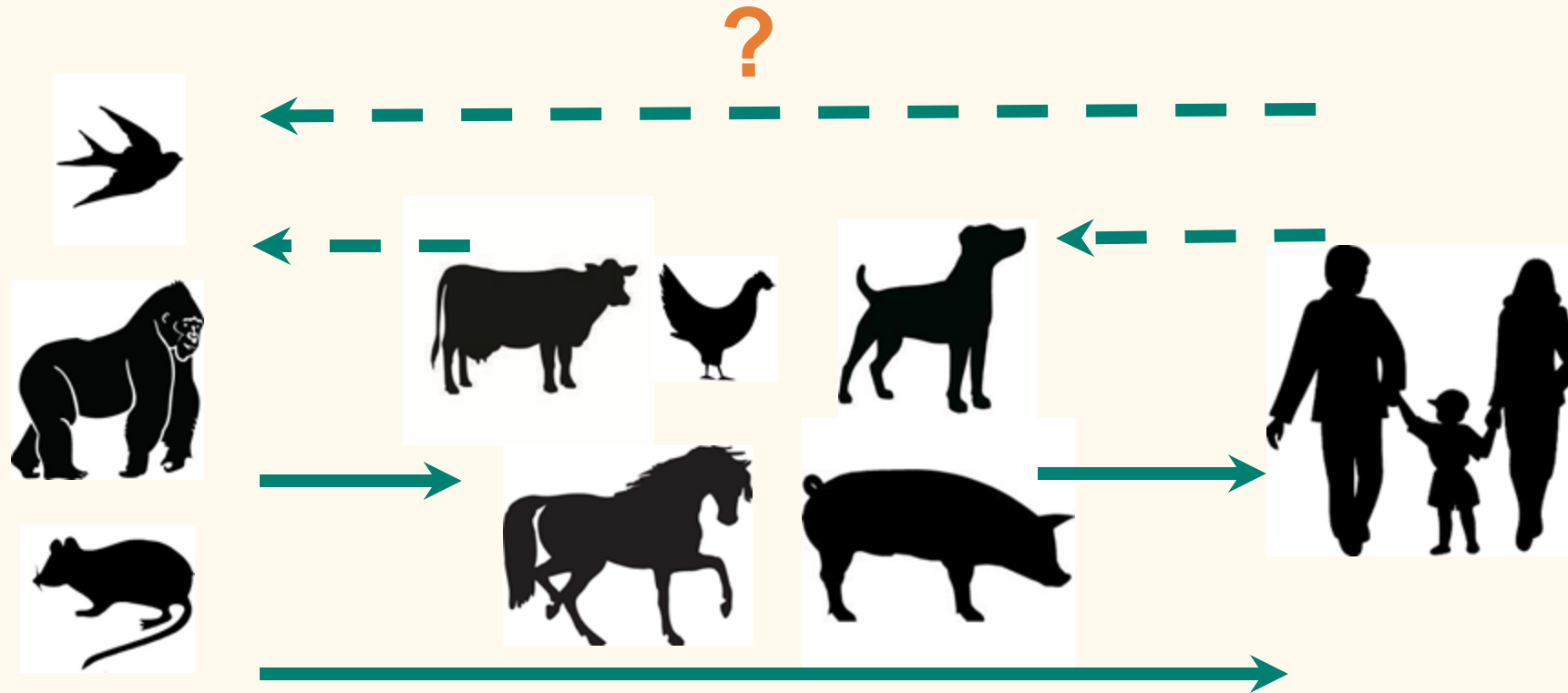
Figure 16: Communication pathway and modes of communication for ASF mitigation

# WDRA Step 1/ Section 1 of the WT guidelines



- Outline the **background and context** of the problem
- Identify the **goal, scope, and focus** of the WDRA
- Formulate the DRA **question(s)**
- State assumptions and limitations
- Specify the acceptable level of risk

# Pathogens do not know directions



Every new host encountered is an opportunity for pathogen adaptation



# Task from workshop 1.

Task	
What question(s) are you trying to answer?	
What is the goal or aim you are trying to achieve?	
What's the scope?	Setting boundaries. E.g. the analysis will be confined to relevant published and unpublished information on disease agent or process X and the population biology of species Y, combined with the input of relevant experts and stakeholders
What's the focus?	E.g. the long-term sustainability of species Y.
What level of risk is acceptable?	

## Live bird

Task	Bird
What question(s) are you trying to answer?	From import of illegal wildlife trade 1. What are the diseases associated with illegal trade? 2. How can we detect diseases within illegal trade groups? 3. If unable to test for diseases, how can we enhance the surveillance system?
What is the goal or aim you are trying to achieve?	Early detection/early response
What's the scope?	1. Species: illegal pet trade (birds) 2. Place: border (sea, air, land), check point, market, hospital, farm 3. Rescue center 4. Online trade monitoring 5. Long-term monitoring illegal trade
What's the focus?	Long term sustainability of pet bird species
What level of risk is acceptable?	Very low

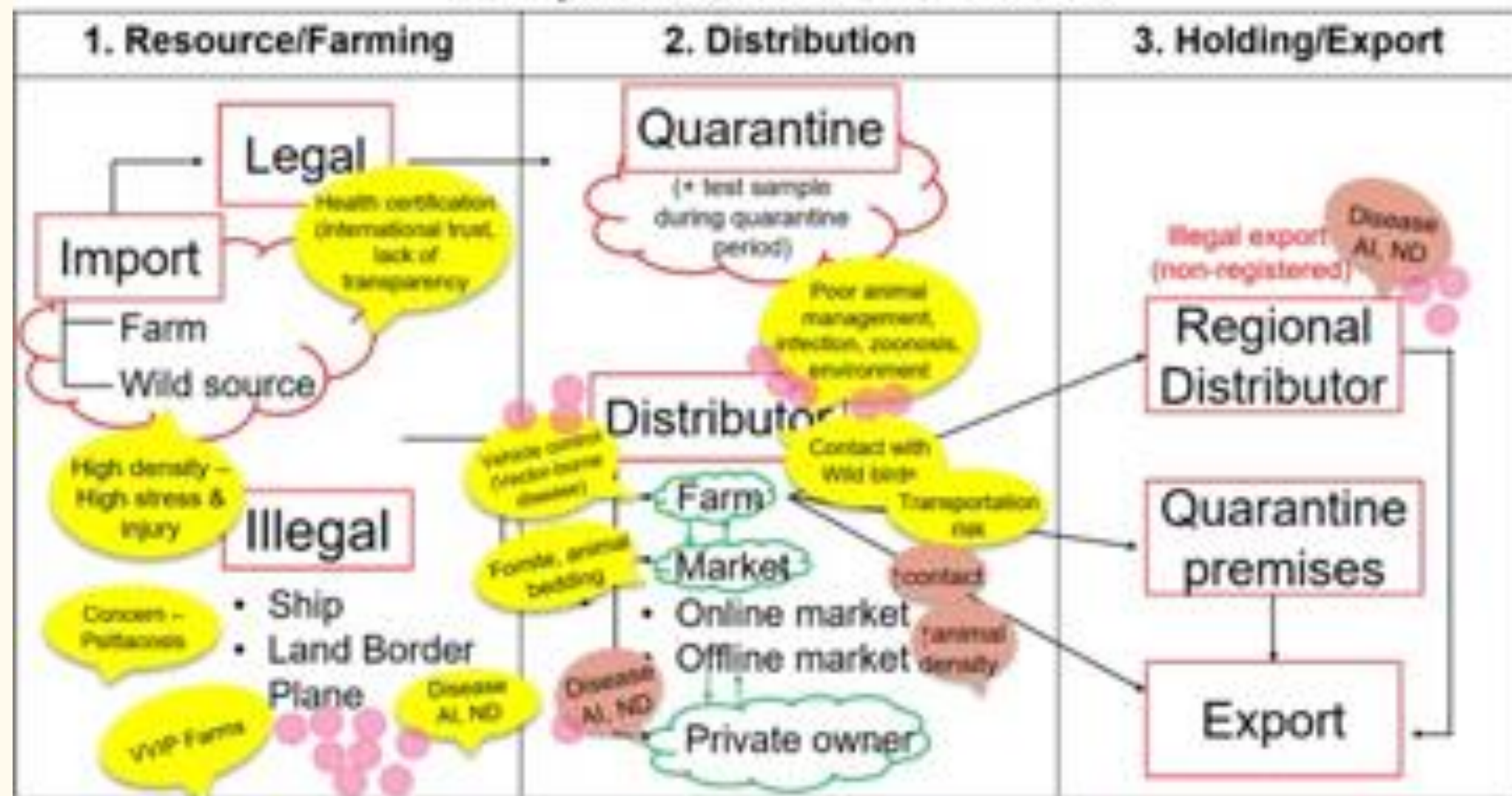
## Deer meat

Task	Deer
What question(s) are you trying to answer?	Proceed of deer killing (no standard slaughterhouse, example killing at backyard, forest, farm) may be got unsafety food, spread disease
What is the goal or aim you are trying to achieve?	Safety and hygiene of food, spread disease
What's the scope?	Law enforcement on slaughter
What's the focus?	More quality and increased prizes of deer meat products. Free from disease spread
What level of risk is acceptable?	Medium (have slaughtered rule but not much enforcement)

## Macaque Biomedical

Task	Monkey
What question(s) are you trying to answer?	Are there disease risks from illegal monkeys, eg, zoonotic disease, punishment for illegal trade, accidents during illegal trading?
What is the goal or aim you are trying to achieve?	1. To do disease surveillance of monkeys in forest To provide disease risks awareness to villagers To implement punishments for illegal movement for wildlife
What's the scope?	Improve understanding on disease risks from monkeys and identify ways for disease surveillance, zoonotic PR media, focus on law enforcement, perform more surveillance in areas with high illegal capture of monkeys
What's the focus?	Reduce number of monkey capture in forest Push new policies to manage high population of monkeys
What level of risk is acceptable?	Level of risk acceptable: low

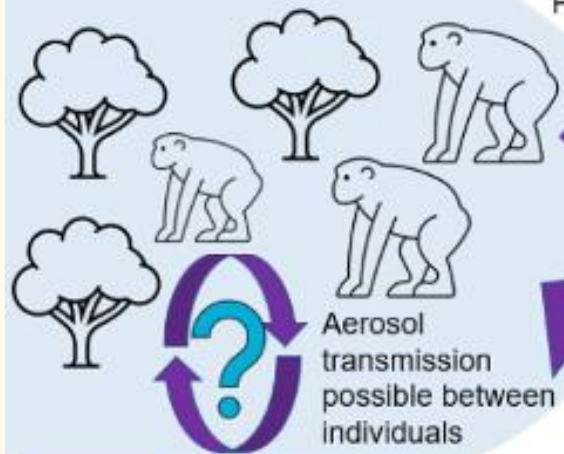
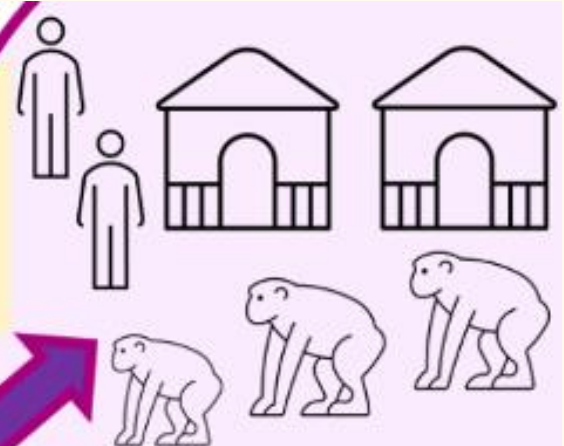
## Group 2: International trade of Birds





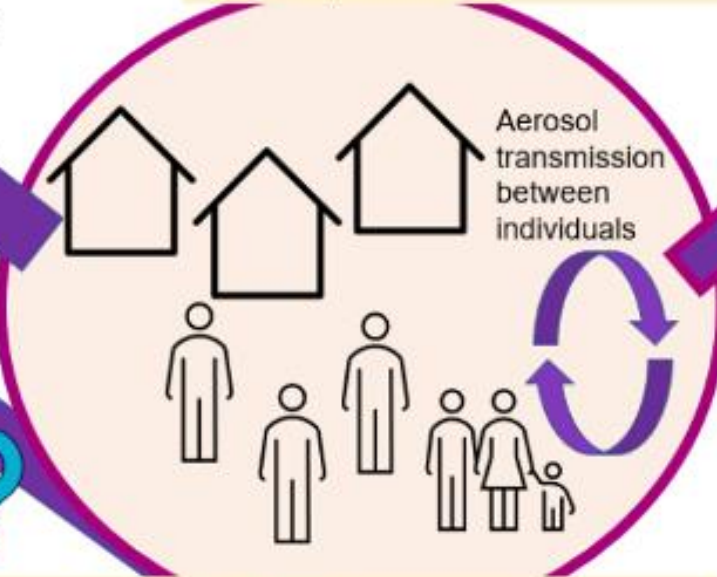
Possible aerosol transmission following reintroduction to the wild (free-living populations)

Chimpanzee (*Pan troglodytes*) sanctuaries within human-dominated landscapes, semi-captive populations of previously free-living individuals  
Tuberculosis disease present  
Most likely infection with *M. tuberculosis* but other tuberculous mycobacteria infections possible  
Unknown prevalence



Free-living chimpanzee populations  
No reports of tuberculosis disease presence except the Chimpanzee bacillus

Possible aerosol transmission



Human settlements in Africa  
Known *M. tuberculosis* and *M. africanum* infection (primary reservoir)  
Also *M. bovis* infection in some areas  
Unknown true prevalence in many areas

Likely aerosol transmission

Possible aerosol and alimentary transmission of *M. bovis*



Aerosol transmission possible between individuals

Possible aerosol or alimentary transmission

Possible aerosol or alimentary transmission

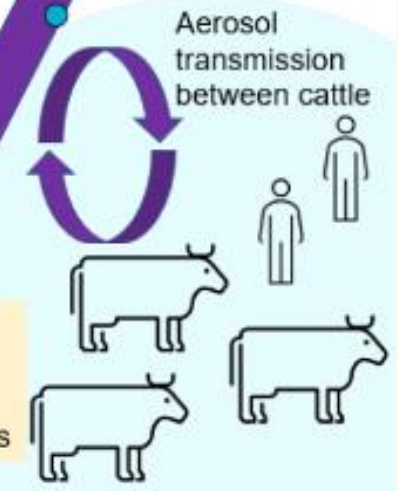


Aerosol or alimentary transmission possible between wildlife species/individuals

Other wildlife known spillover hosts for *M. bovis*, possibly others but unknown  
African buffalo (*Syncercus caffer*) known maintenance hosts for *M. bovis*  
Unknown true prevalence

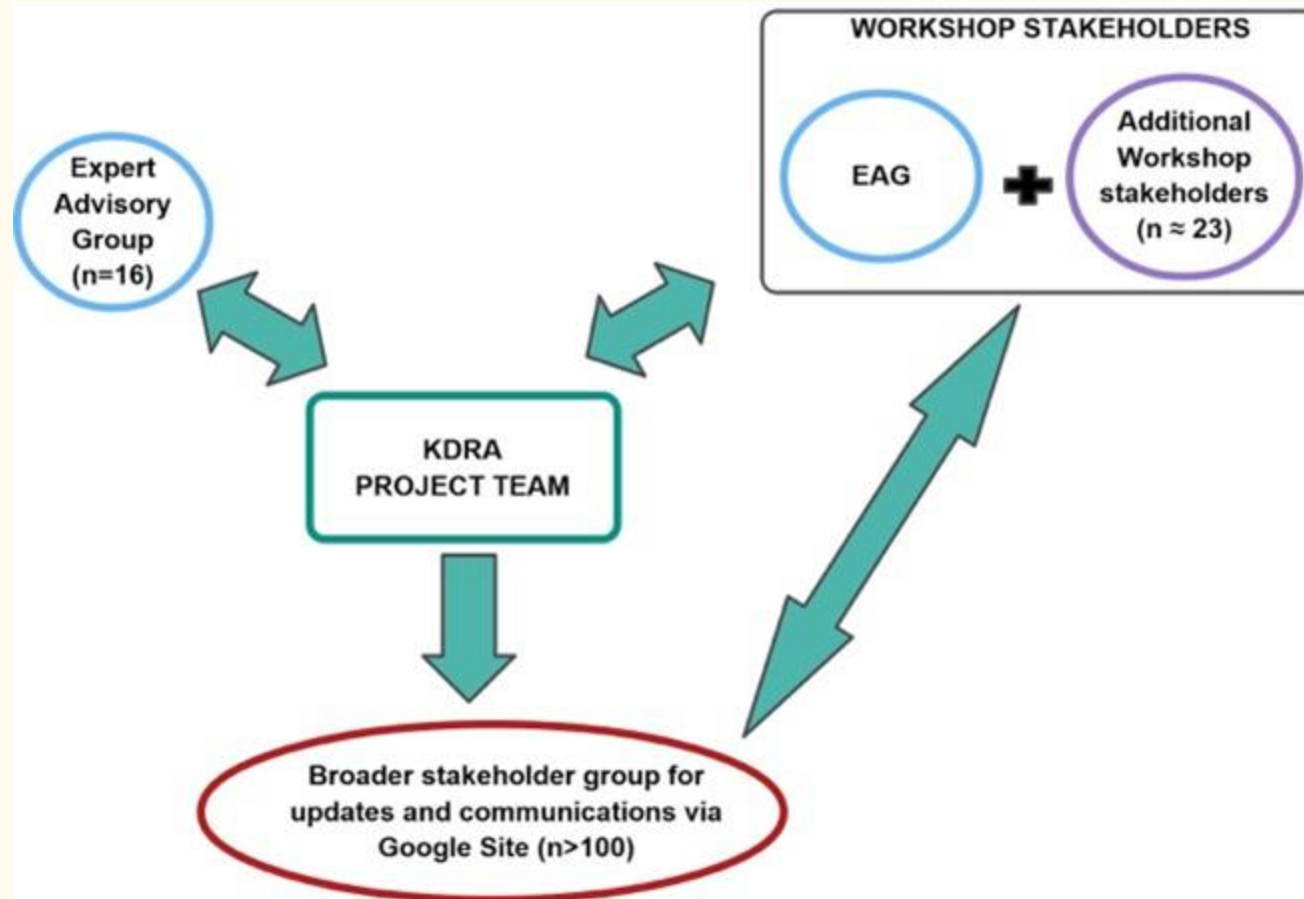
Aerosol transmission

Human-dominated landscape  
Domestic cattle (*Bos taurus*) known maintenance host for *M. bovis*  
Unknown true prevalence in many areas

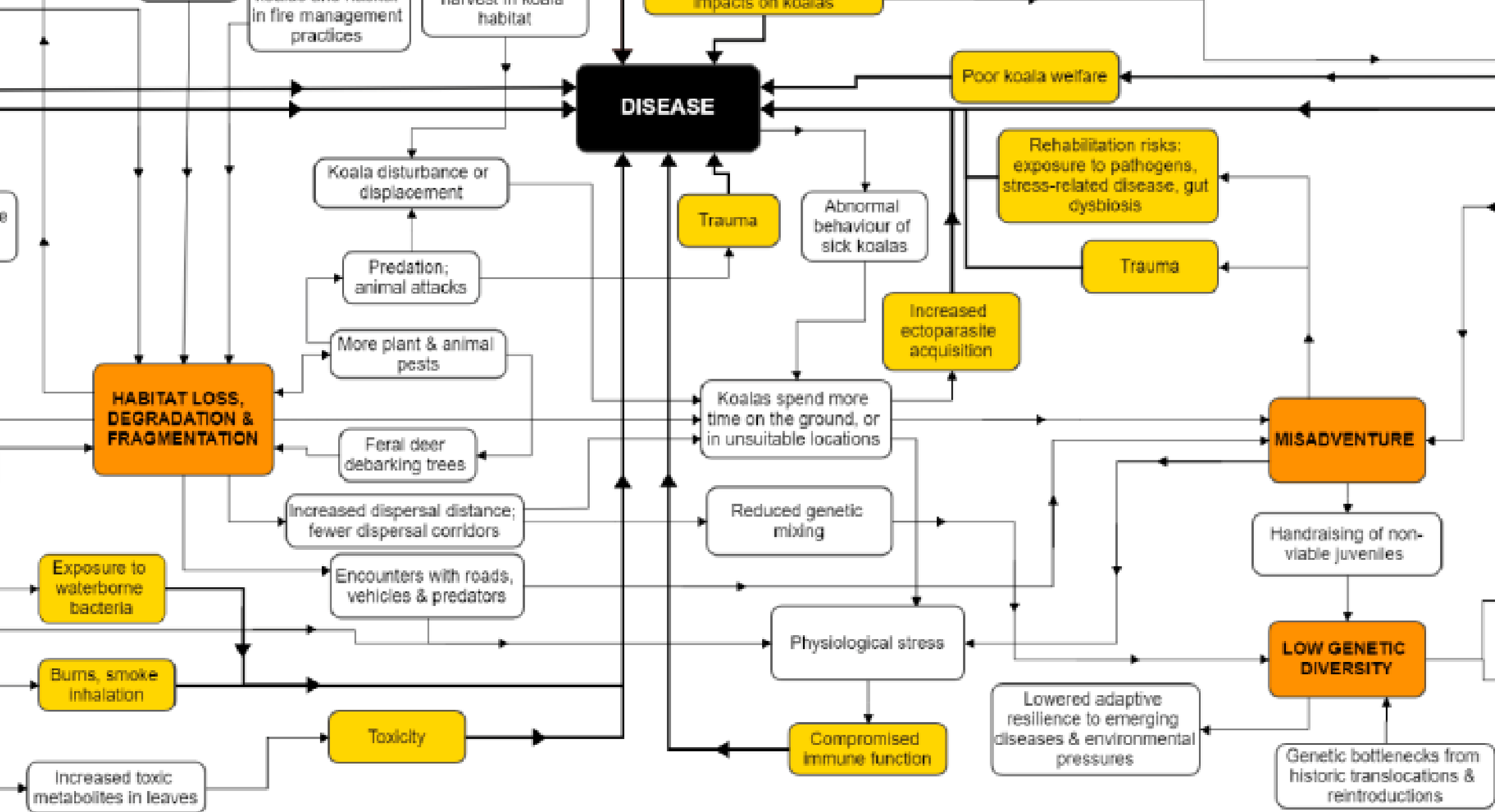


Aerosol transmission between cattle

# KDRA – workshop stakeholders – getting to the problem



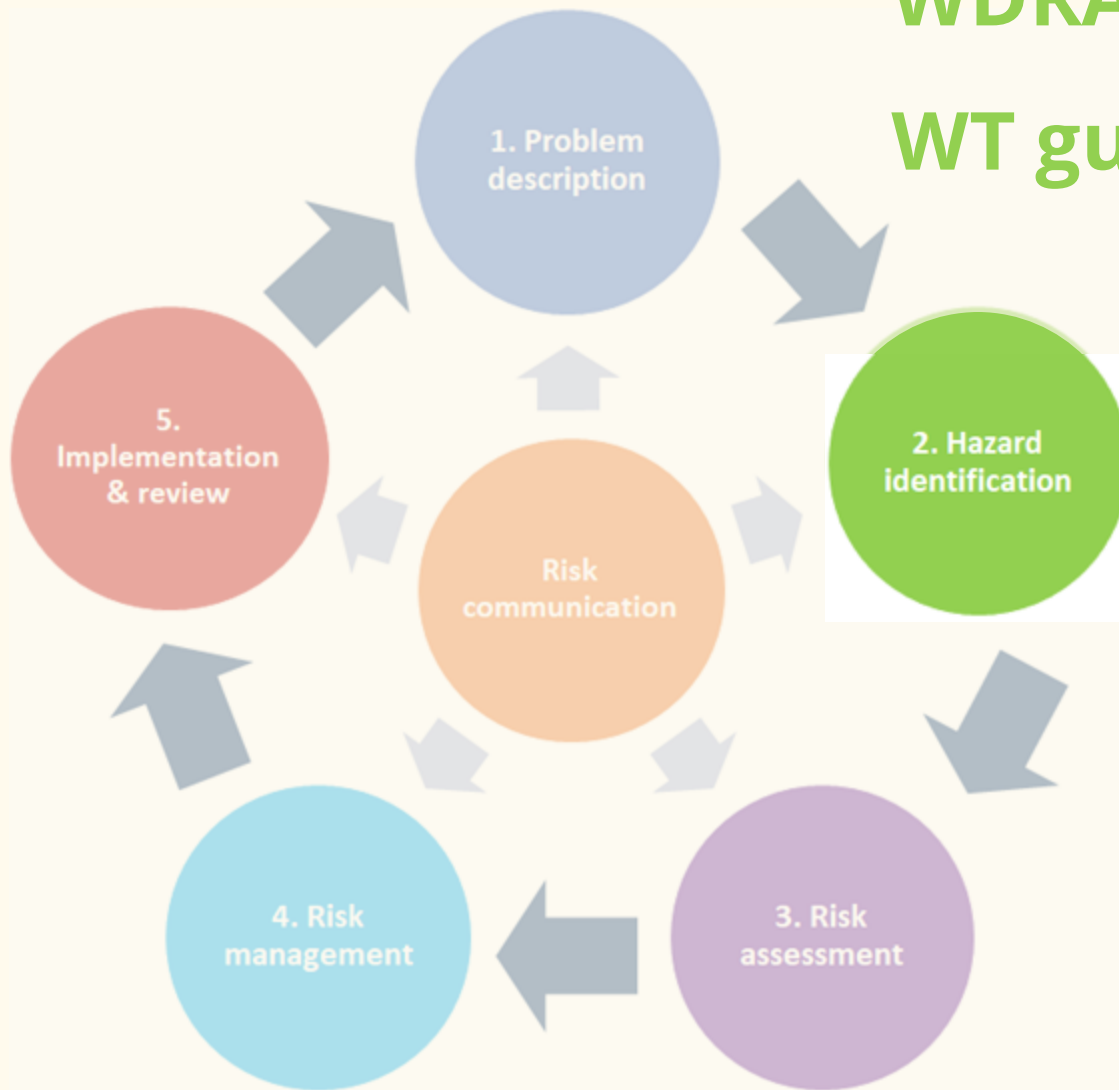
- Stakeholder participant agreement
- 32 hours of online workshops
- Post Workshop evaluations
- 14 MURAL workspaces containing over 1000 sticky notes
- Feedback on 13 literature review chapters by 30 reviewers (many of whom reviewed multiple versions of more than one chapter)
- Review of 13 disease risk assessments by 23 subject matter experts



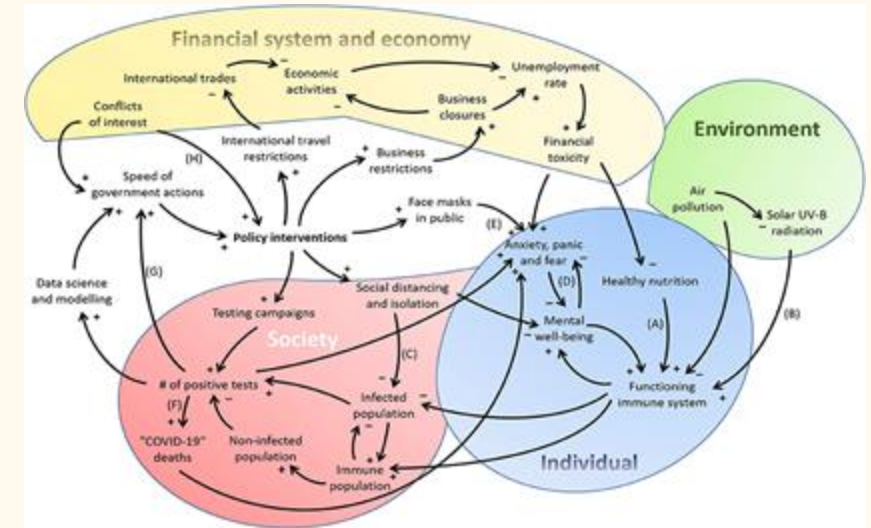


## WDRA Step 2 (section 2 of the WT guidelines

- Identify **all possible health hazards** of concern
- Establish criteria for **ranking the importance** of each hazard within the bounds of the defined problem



# An example of an ALL HAZARDS approach.



Klement 2020 – Covid-19 system analysis

For each selected hazard take into account:



**Specific  
circumstances**



**Risky activities**



**Population at  
risk**



**Geographical  
location**



**Socio-  
environmental  
context**



### Describing the problem - What are the main drivers of disease risk from wildlife trade in your region?

Pick a species or taxonomic class and indicate what that is in your submission. Write what you think are the main factors contributing to disease. To do this, we ask you to follow three steps: 1) Click on the + icon symbol in the lower right corner to create a new note, 2) Write the FACTOR as the title of the note (ONE FACTOR PER NOTE - see example below) and please also add your country/region, 3) Briefly describe why this factor contributes to disease in your chosen species and the consequences that lead to the disease. When ready, click ENTER. 4) If the FACTOR you are thinking about is already listed by someone else, there is no need to repeat it. However, you can provide extra information. In the COMMENTS for this factor, including any OTHER CONSEQUENCES, or ADDITIONAL IDEAS, or different LOCATIONS, if different from the original description of the factor and its consequences.



**EXAMPLE: Genetic inbreeding**

**Health Fact Area**  
BRIEF DESCRIPTION  
Overbreeding in tiger facilities for the wildlife trade could lead to inbreeding

**Consequences that lead to**

**Health Fact Area**  
BRIEF DESCRIPTION  
Overbreeding in tiger facilities for the wildlife trade could lead to inbreeding

**Consequences that lead to disease:**  
Reduced genetic diversity weakens the species' ability to cope with disease and other environmental challenges

**Stakeholder groups and organisations represented**

Q 3  
Researchers | University staff, Penang center staff  
Government departments | DNP, DLD, Police, Ministry of Interior (ประเทศไทย)  
Captive Breeding: Institute for...

**Q2/ pet bird**

**Q2: international trade of pet birds**

what question are you trying to answer:  
From report of illegal wildlife trade

1. What are the diseases associated with illegal trade?
2. How can we detect diseases within the illegal trade group?
3. If unable to test for diseases, how can we enhance surveillance system?

1. มีโรคอะไรบ้างที่มาจาก illegal trade  
2. เราจะหาเจอโรคอะไรบ้างจาก illegal trade ได้บ้าง  
3. หากไม่เจอโรคที่เราได้หาเจอ เราจะหาเจอโรคอะไรบ้าง

**A:**

- ควบคุมการนำเข้าสัตว์ป่าและสัตว์น้ำ
- ควบคุมการส่งออกสัตว์ป่าและสัตว์น้ำ
- ตรวจหาโรคในสัตว์ป่าและสัตว์น้ำ
- ควบคุมการนำเข้าสัตว์ป่าและสัตว์น้ำ
- ควบคุมการส่งออกสัตว์ป่าและสัตว์น้ำ
- ตรวจหาโรคในสัตว์ป่าและสัตว์น้ำ
- ควบคุมการนำเข้าสัตว์ป่าและสัตว์น้ำ
- ควบคุมการส่งออกสัตว์ป่าและสัตว์น้ำ

**Goal:**  
1 early detection/early response

**what's the scope:**  
1 species: illegal pet trade (birds)  
2 police: border (sea or land)  
3 check point, market, hospital, farm  
4 online trade monitoring  
5 long term monitoring illegal trade

**what's the focus:**  
1 long term sustainability of pet bird species

**what level of risk is acceptable:**  
1 very low

**Q2 stakeholder reasons:**

- University, pet hospital, government departments:
- DNP, DLD, ZPO, TCD
- captive breeding:
- DNP, ZPO, private owner, farm
- indigenous communities:
- head of village, spiritual leader
- funding agencies:
- government, international organization
- media:
- social platform, village broadcast, poster

**Trading deer**

**Question 1** | Proceed of killing deer (Not have standard slaughterhouse & killing at back yard, forest, at farm may be got unsafe food, spread disease. Goal or aim: Have safety and hygiene food. And not have spread out disease. Scope: Law enforcement about slaughter. Focus: Got more Quality and up prices of deer meat product. Free from disease spread. Level of risk: Medium (Have slaughtered rule but not much enforcement)

**Question 1** | Proceed of killing deer (Not have standard slaughterhouse & killing at back yard, forest, at farm may be got unsafe food, spread disease. Goal or aim: Have safety and hygiene food. And not have spread out disease. Scope: Law enforcement about slaughter. Focus: Got more Quality and up prices of deer meat product. Free from disease spread. Level of risk: Medium (Have slaughtered rule but not much enforcement)

**Focus:** Got more Quality and up prices of deer meat product. Free from disease spread. Level of risk: Medium (Have slaughtered rule but not much enforcement)

**Focus:** Got more Quality and up prices of deer meat product. Free from disease spread. Level of risk: Medium (Have slaughtered rule but not much enforcement)

- when
- responsibility

**public:**

- stakeholder/report
- information needs
- communication method
- when
- responsibility

**when**

- when
- responsibility

**deer treading**

**Question 1** | Proceed of killing deer (Not have standard slaughterhouse & killing at back yard, forest, at farm may be got unsafe food, spread disease. Goal or aim: Have safety and hygiene food. And not have spread out disease. Scope: Law enforcement about slaughter. Focus: Got more Quality and up prices of deer meat product. Free from disease spread. Level of risk: Medium (Have slaughtered rule but not much enforcement)

- University, DNP, National Research Center
- Government department
- DNP, DLD, สำนักตรวจและป้องกันด่านศุลกากร, กรมศุลกากร, กรมปศุสัตว์, กรมส่งเสริมการค้าระหว่างประเทศ, กรมส่งเสริมการค้าระหว่างประเทศ, ส.ป.ด.ช.
- Indigenous community
- Captive Breeding
- DNP, สำนักส่งเสริมการค้า, กรมส่งเสริมการค้าระหว่างประเทศ, กรมศุลกากร, กรมปศุสัตว์, กรมส่งเสริมการค้าระหว่างประเทศ, ส.ป.ด.ช.
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- Indigenous community
- ส.ป.ด.ช.

**Funding Agent:**

- รัฐบาลไทย, กรมส่งเสริมการค้า, NGO, สำนักส่งเสริมการค้าระหว่างประเทศ, WHO, GIZ, World bank

**Media:**

- DNP website, FB, อินโฟกราฟิก, Youtube, ไลน์ทีวี

**Wildlife health expert:**

- University (ประเทศไทย), WOH, สำนักส่งเสริมการค้า, ส.ป.ด.ช., อินโฟกราฟิก

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**Live for Biomedical Research (Monkey-long tailed macaques)**

**Q 3 Live for Biomedical research**

**Question 1** | เป้าหมายในการใช้ลิงแสมในการวิจัยทางการแพทย์ (ใช้ลิงแสมในการวิจัยทางการแพทย์, ใช้ลิงแสมในการวิจัยทางการแพทย์, ใช้ลิงแสมในการวิจัยทางการแพทย์) Goal: การศึกษาโรคในลิงแสม, ศึกษาโรคในลิงแสม, ศึกษาโรคในลิงแสม Scope: การควบคุมการนำเข้าลิงแสม, การควบคุมการนำเข้าลิงแสม, การควบคุมการนำเข้าลิงแสม Level of risk: Medium (Have slaughtered rule but not much enforcement)

**Q 3 Live for Biomedical research**

**Question 1** | เป้าหมายในการใช้ลิงแสมในการวิจัยทางการแพทย์ (ใช้ลิงแสมในการวิจัยทางการแพทย์, ใช้ลิงแสมในการวิจัยทางการแพทย์, ใช้ลิงแสมในการวิจัยทางการแพทย์) Goal: การศึกษาโรคในลิงแสม, ศึกษาโรคในลิงแสม, ศึกษาโรคในลิงแสม Scope: การควบคุมการนำเข้าลิงแสม, การควบคุมการนำเข้าลิงแสม, การควบคุมการนำเข้าลิงแสม Level of risk: Medium (Have slaughtered rule but not much enforcement)

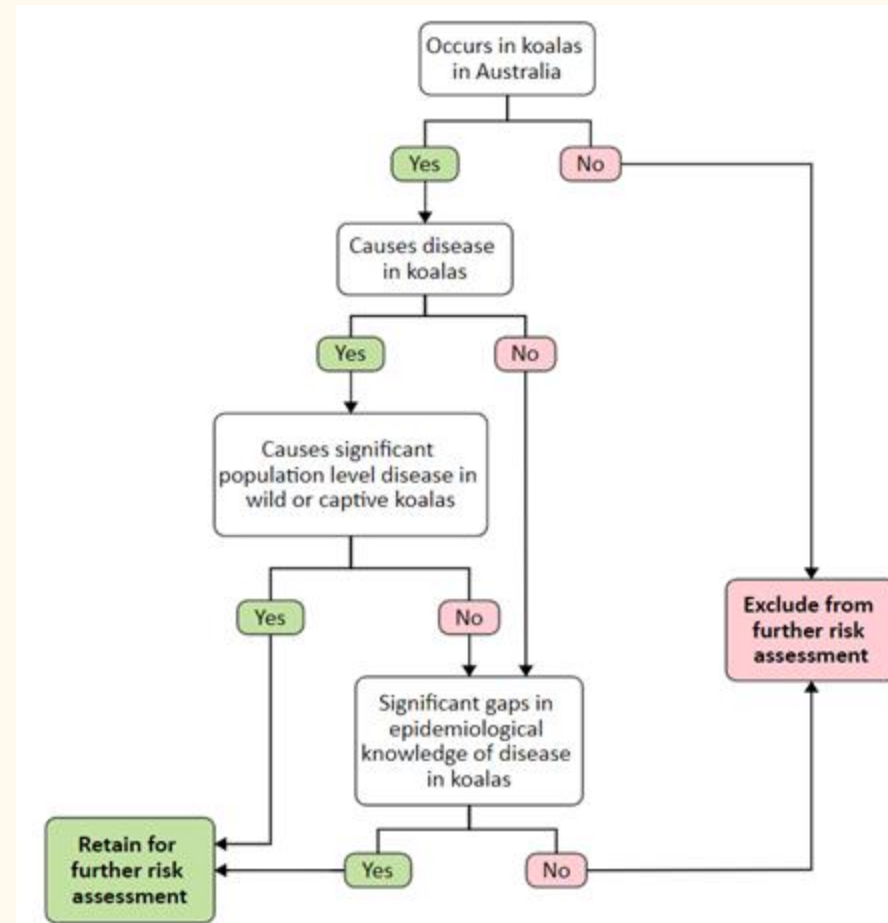
**Focus:** การศึกษาโรคในลิงแสม, ศึกษาโรคในลิงแสม, ศึกษาโรคในลิงแสม

**level of risk is acceptable:** low

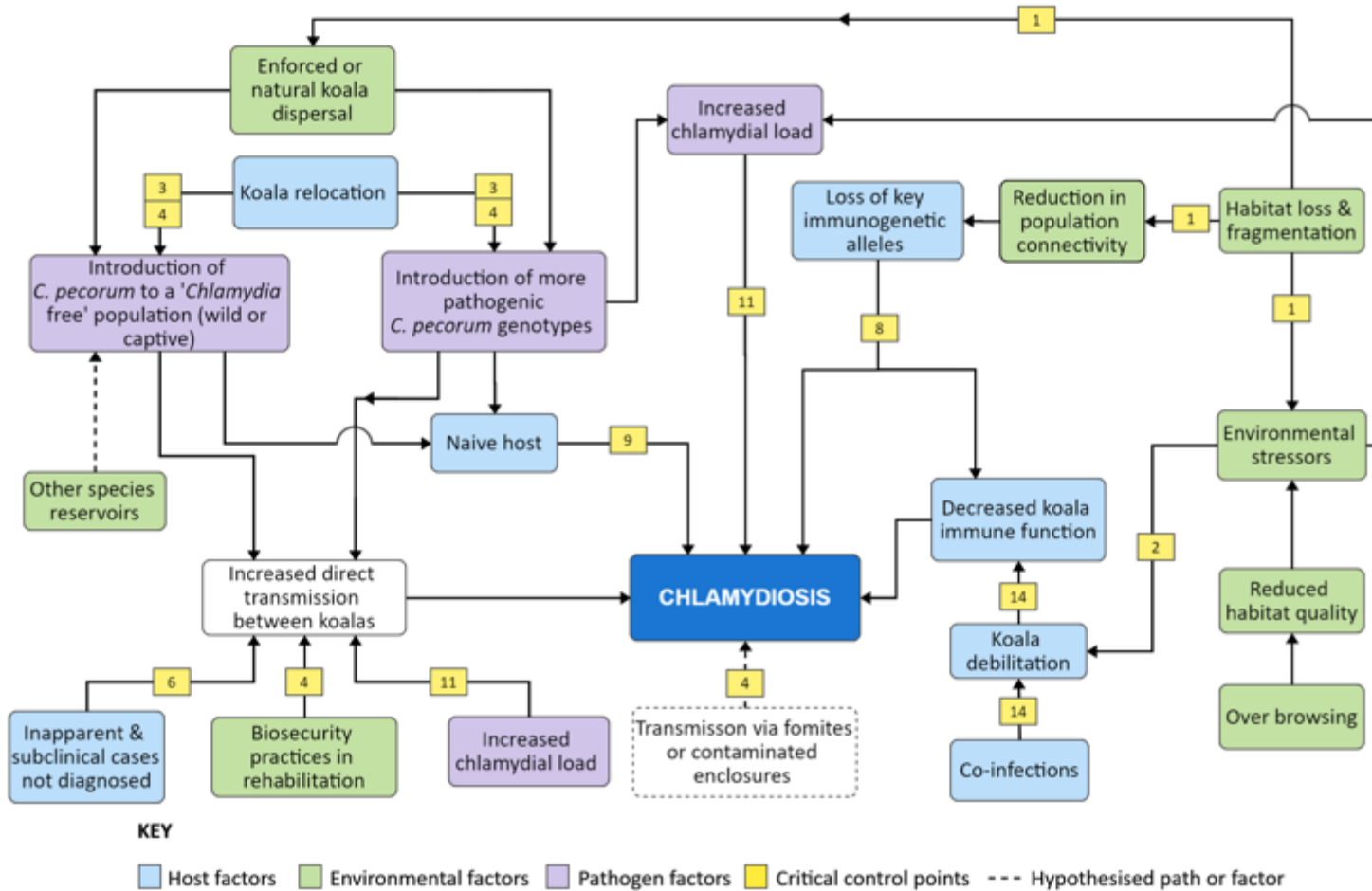
**level of risk is acceptable:** low

# KDRA - hazard identification and refinement

- Disease = any disturbance in the health or function of an animal or human
- Hazard identification
  - 91** disease hazards
    - 56 Infectious diseases
    - 35 Non-infectious diseases
- 13 disease hazards identified as requiring detailed risk assessment



# KDRA: For each hazard...



- Detailed literature review
- Hazard pathway
- Critical control points
- Risk assessment
- Risk mitigation options
- Recommendations



## WDRA Step 3 (section 2 of the WT guidelines)



To assess for **each hazard** of concern:

- the **likelihood of release** (introduction) into the area of concern;
- the likelihood that the species of interest will **be exposed to the hazard** once released;
- the **consequences of exposure**. On this basis, the hazards can be **prioritized** in descending order of importance

			Consequences					
			Insignificant	Minor	Moderate	Significant	Catastrophic	
<i>Species &amp; ecosystem conservation consequences and likelihood</i>			No expected risk to conspecifics, other taxa, or ecosystem	Low risk to conspecifics or ecosystem; possible risks to other taxa	Some risks for conspecifics and/or other taxa	Significant risk of possibly lethal effects in conspecifics and/or other local taxa; possible ecosystem effects	Lethal effects pose population or species risk; likely negative effects on other taxa or ecosystem	
			<i>Health &amp; biosecurity consequences and likelihood</i>			No health effect; little or no transmission risk	No long term health effect; little or no transmission risk	Some health effects, moderate transmission risk
Likelihood ↑	Near certain	Species or ecosystem effects often occur in OU releases	Transmission or disease in OU happens regularly					
	Likely	Species or ecosystem effects have occurred multiple times in GA or OU releases	Transmission or disease in GA or humans working with GA has occurred multiple times			Reintroduction: Lower initial risk of disease presence due to mitigation. Opportunities for infection through captivity, release and post-release human proximity. Released OU populations susceptible and non-immune; other taxa may be also	Wild-to-wild translocation and reinforcement: Many people in contact/proximity to OU. Confirmed human-GA transmissibility; all wild OU susceptible and non-immune; other taxa may be susceptible	Tapanuli translocation: Infection, death and transmission could pose catastrophic species impact and effect ecosystem; disease spillover to other taxa and local human populations possible
	Possible	Species or ecosystem effects have occurred at least once in OU or other primate releases	Has happened at least once before in GA or other primates, or in humans involved in GA care		Captive OU: Lowered risk of disease presence due to mitigation; any active infection poses high risk to OU which are susceptible and non-immune			
	Unlikely	Species or ecosystem effects have occurred but not in primate releases	Has not happened in GA but has in other animals					
	Rare	Species or ecosystem	Possible; has not					

# KDRA- Risk estimates infectious diseases

	Chlamydia	KoRV	Cryptococcus	Sarcoptic mange	Actinomyces	Herpesvirus	Trypanosomes
<b>Overall risk estimates for koalas</b>							
Koala population resilience & viability	High	High (north) Moderate (south)	Moderate	Low	Negligible	Negligible	Negligible
Koala individual health & welfare	High	High (north) Moderate (south)	Moderate	Moderate	Moderate	Moderate	Moderate
<b>Level of confidence in assessment</b>							
	High	Low	Medium	Medium	Low	Low	Low



# Transparency

- Literature review
- Expert opinion
- Pooled knowledge of workshop participants
- Modeling scenarios





# Identify Sources of Uncertainty

More reliable



Less reliable



**Identify**



**Categorize**



**Do not paralyze**

## WHRA Step 4 (Section 2 of the WT guidelines)



- Review **potential risk reduction** or **management options** and evaluate their likely outcomes
- On this basis **decisions and recommendations** can be made to **mitigate the risks** associated with the identified hazards.



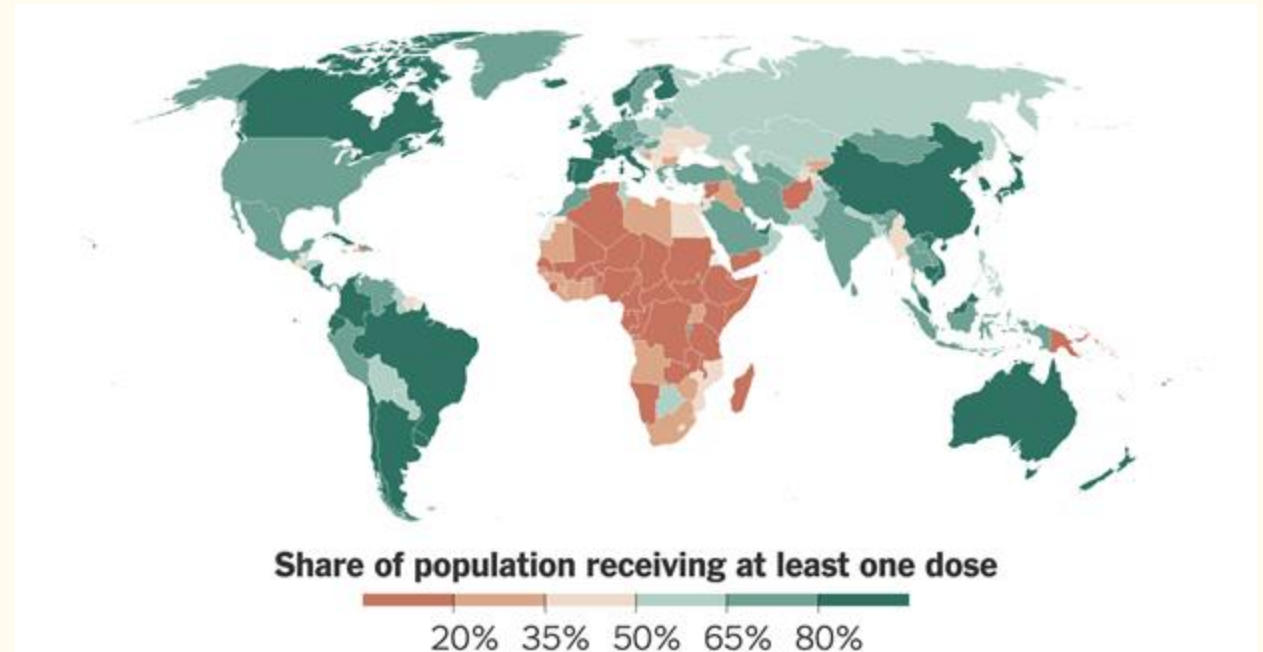
# Evaluating Risk Management Options



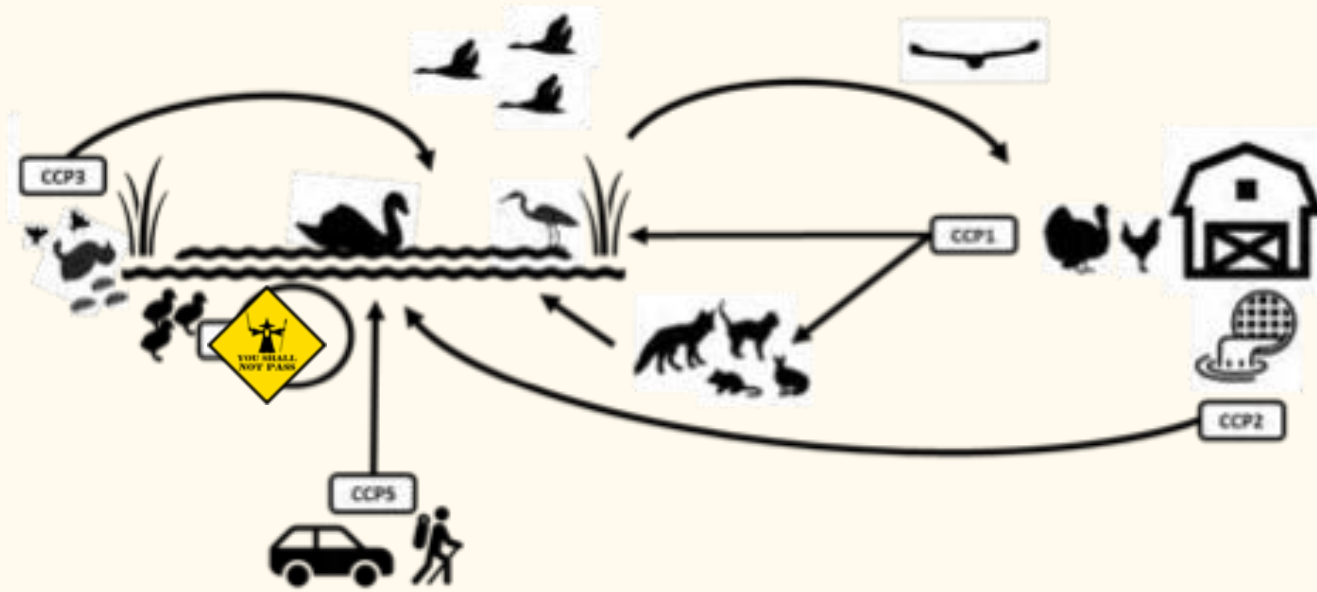
## Is it Effective?



## Is it Feasible?



<https://www.nytimes.com/interactive/2021/world/covid-vaccinations-tracker.html>



Hazard transmission pathways and critical control points (CCPs) for pasteurellosis.



Hazard transmission pathways and critical control points (CCPs) for pollutants.

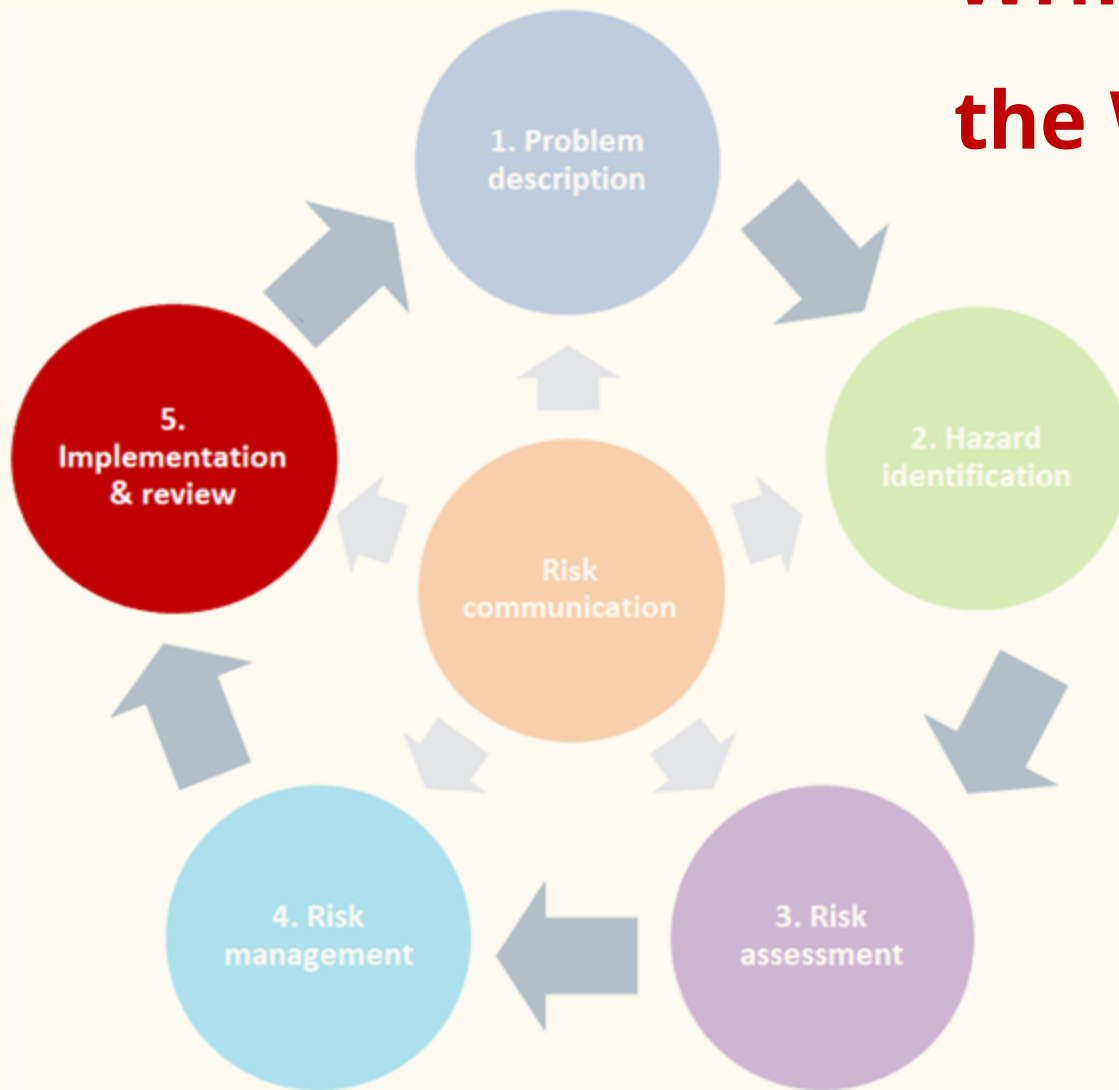
# Establish Critical Control Points (CCPs)





## WHRA Step 5/ Section 3 of the WT guidelines

- Formulate **actions and contingency plans** and establish a process and timeline for **monitoring, evaluating, and reviewing** risk management actions.
- The review may result in a **clearer understanding** of the problem and enable **refinement** of the WDRA









# Risk management action plan for botulism to wild birds at Port Phillip Bay (Western Shoreline) and Bellarine Peninsula

Action target	Description	Lead	Collaborators/ Partners	Timeline	Indicators of success
Disease surveillance CCPD	Development and implementation of a comprehensive general surveillance program to detect and collect sick and dead birds in Ramsar wetlands for early detection of a botulism outbreak	Pam Whiteley Lee Berger	University of Melbourne Parks Victoria Melbourne Water CMAs Agriculture Victoria Australian Centre for Disease Preparedness (ACDP) DELWP Zoos Victoria, Leanne Wicker, Healesville, Paul Eden, Werribee Wildlife Health Australia Community groups, citizen science reporting International partners (e.g. USGS National Wildlife Health Center,	Seek funds from DAWE in 2020  Implementation of the program by start of 2021.	<ul style="list-style-type: none"> <li>Funds secured</li> <li>- Surveillance program developed for Victorian Ramsar sites</li> <li>- Increased reporting of sick and dead birds</li> <li>- Investigation of disease events, diagnosis, identification of agents</li> <li>- Implementation of a systematic ongoing data collection process and reporting on pathogens and diseases at the Victorian Ramsar sites</li> </ul>



# Monitor



# Evaluate

How much did we do?

Are we doing the right thing?

How well did we do it?

What has changed as a result of our work?



# Wildlife Health Risk Analysis: a 'One Health' approach



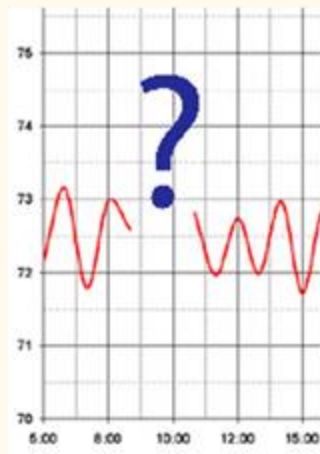
Science based



Succession planning



Communication

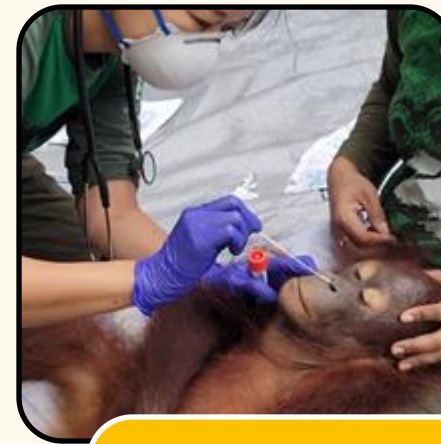
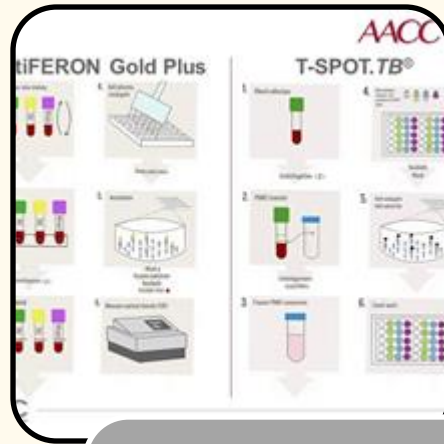


Data gaps



Cost benefit

# One Health Disease Surveillance: A Tool to Assist in the Conservation Management of Asian Apes



**1. Wildlife Health Risk Analysis**

- Restrospective study
- Medical record analysis

**2. Detection strategy**

- Fit-for-purpose
- Point-Of-Care dx tests

**3. Design control measures**

- Preventive
- Transmission containment

**4. Template for a country-wide One Health Wildlife Disease Surveillance**



# How to maximise our leverage over events – wildlife trade example



Event: Disease transmission from and between traded wildlife

Wildlife trafficker and trader behaviour

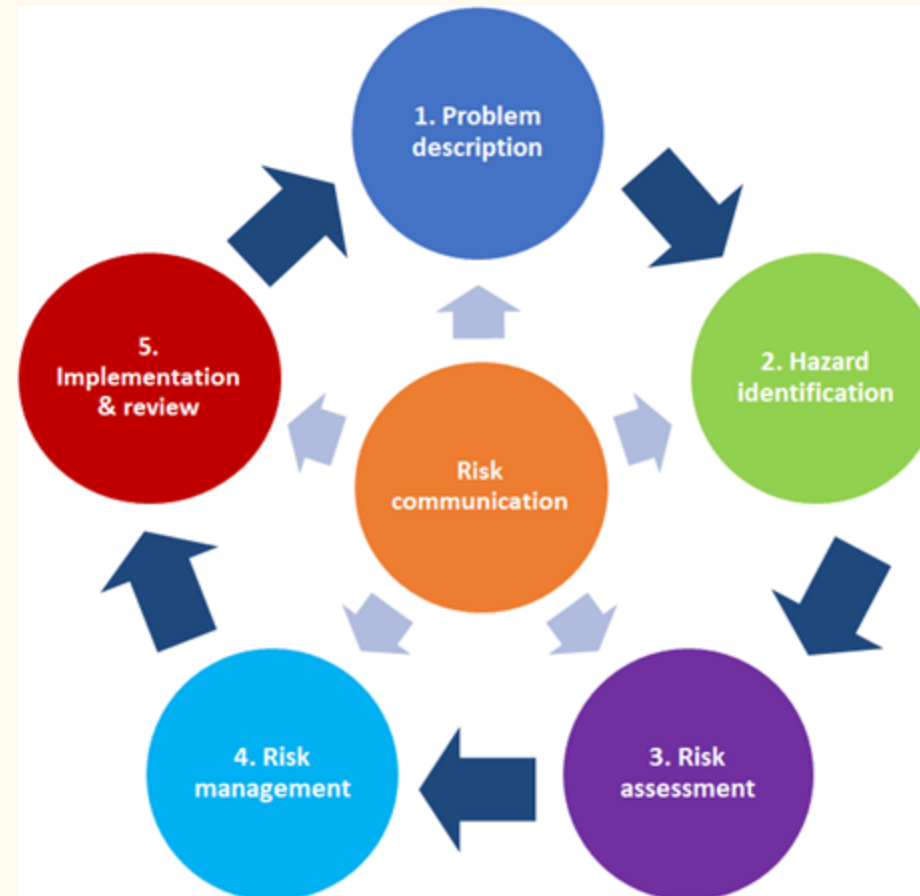
Poor wildlife welfare, poor biosecurity along trade route

Understand stakeholder motivations and mitigate accordingly

If you want to go fast, go  
**ALONE.**

If you want to go far, go  
**TOGETHER.**

WDRA – collaboration, co-ordination, communication to capacity build One Health.  
Thank you for your attention



## Introduction to PADLET

An online tutorial in case you are new to this technology  
[https://www.youtube.com/watch?v=delW1Jtoq\\_w](https://www.youtube.com/watch?v=delW1Jtoq_w)

<https://padlet.com/sunwin401/describing-the-problem-what-are-the-main-drivers-of-disease--gh6hrx2kxr9jkstg> - from workshop 1.

**Don't forget to discuss and input  
ASSUMPTIONS and LIMITATIONS**