Wildlife Health as a theme for planning/Disease Risk Analysis

Participants
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Background
The SSC mandate to CPSG is to significantly increase capacity and capability in conservation planning, to meet the large and growing need for evidence-based plans that feature meaningful actions aimed at mitigating threats to species survival. Increasingly, for many species, both infectious and non-infectious diseases are recognized as either primary or secondary drivers of population decline. Examples include a) the catastrophic decline of several species of Asian vulture due to toxicity associated with eating carcasses of cattle treated with the anti-inflammatory drug diclofenac; and b) the continuing spread of the fungal disease chytridiomycosis that is driving amphibian declines around the world.

Additionally, wildlife species are primary reservoirs of some pathogens (e.g. rabies, Nipah virus, West Nile Virus) that cause serious disease in people and domestic animals. Such events can lead to extreme responses including indiscriminate culling of wildlife populations. This may, in turn, result in some unintended consequences such as the further spread of the disease, further threats to rare wildlife species and interruption of important biological cycles such as pollination by bats.

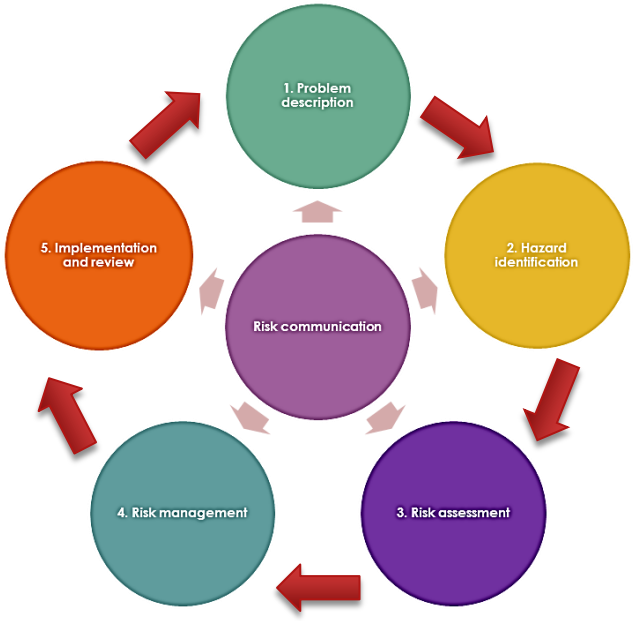
The One Health concept represents a shift in the current dominant approach to wildlife health management from human-centric to eco-centric. This new collaborative, multi-sectoral, and trans-disciplinary approach is founded on evidence of the fundamental interconnectedness of the health of people, animals and their shared environment.

The IUCN Species Survival Commission's Conservation Planning, Wildlife Health, Invasive Species and Reintroduction Specialist Groups joined with the World Animal Health Organization (OIE) to develop an approach incorporating Disease Risk Analysis (DRA) processes founded on the principles of One Health. The result was the publication in 2014 of the Manual of Procedures for Wildlife Disease Risk Analysis, and the companion Guidelines for Wildlife Disease Risk Analysis. Both documents are available for free download from the CPSG website: http://www.cpsg.org/document-repository (keyword search for 'Disease Risk').

Wildlife DRA is a powerful tool for the analysis of risks of disease introduction or emergence in a specified population. Challenges exist where data may be unpublished or otherwise unavailable and the IUCN-SSC/OIE process and tools, in a multi-stakeholder, collaborative environment, provides a standardized, evidence-based means of capturing this information.

A brief synopsis of the steps in the process is given below (see Figure 1):

Figure 1: The IUCN-SSC Disease Risk Analysis (DRA) Framework



As shown in Figure 1, this DRA process is systematic and, when applied in a multi-stakeholder, collaborative environment, enables the pooling of information and perspectives that can reveal new insights on the system under review relevant to the understanding of the system and potential risk mitigation options. The cyclic nature of the diagram indicates the iterative nature of the process i.e. both the development of the analysis and the implementation of actions arising from it generate new information of value to continuous refinement of the analysis.

Risk Communication is placed centrally to emphasize the importance of identification and involvement of relevant stakeholders (experts, influencers and other interested parties) in the process on a continual basis.

Problem Description. A core requirement for a wildlife DRA is a clear understanding of the problem being addressed and the system in which it operates. This step provides the context for the DRA and prescribes its scope, focus and the questions to be addressed. It also considers what level of risk is acceptable.

Hazard Identification. This step identifies and describes the potential disease hazards in the system and criteria used to prioritize their level of threat to the populations of interest. Both published and unpublished sources are used to generate this list with all assumptions and limitations explicitly stated.

Risk Assessment. This step begins with a justification for the selection of each hazard for more detailed assessment. The hazard is then assessed as to the likelihood or probability that it will occur or be released into the focal system and, should this occur, the likelihood or probability that the populations of interest will be exposed. In the event of exposure, the consequences to individuals and/or the population are assessed. Based on these assessments the need for risk mitigation actions to address this hazard is stated. The evidential basis for each part of the assessment is made explicit along with the level of uncertainty and identification of information gaps.

Risk Management. For hazards determined to require risk mitigation, a graphical representation of the system in which the hazard operates is used to identify Critical Control Points (CCP). For each CCP all risk management options are considered and prioritized according to their feasibility and effectiveness.

Implementation and Review. This step takes the risk management recommendations and any identified research to address critical information gaps and formulates a detailed implementation plan and process for monitoring and evaluation of the outcomes. Actions, resources required, timeframes, persons responsible and measures of success are included.

Wildlife Health and DRA Process Working Group Objectives and Results

Aim
The aims of this working group are to:

- Gain an understanding of how the DRA process is typically applied to single-species planning situations.
- Identify approaches and tools to facilitate conservation planning for multiple species facing a common disease threat.
- An action plan and implementation group committed to progressing the further exploration and development of the identified processes and tools.

Process

- Following introductions, participants divided themselves into three equal-sized groups of six and warmed up to the topic by brainstorming a short list of diseases known to impact multiple species together with the range of species or taxa affected.
- This was followed by a presentation by Richard Jakob-Hoff on the use of the IUCN-SSC/OIE Disease Risk Analysis (DRA) to focus on planning for a single species (using a recent example of a proposed translocation of Eastern Barred Bandicoots, *Perameles gunnii*, to islands outside their historic range).
- Using their initial list of diseases threatening multiple species as a basis, the group considered a number of ways to group or 'bundle' relevant parameters in order to apply the DRA process in a multi-species context.
- Once a focal 'bundle' had been selected, this was used to explore, in small groups, the following three questions:
    - What information about this threat to multiple species would be needed to feed into a DRA workshop?
    - What additional expertise, stakeholders and tools might be needed?
    - How does the size of the bundle influence our ability to plan?
- Each group presented their answers to these questions to the whole group and, in plenary, discussed the final question:
- What are the next steps to progressing the development of this multi-species DRA and planning approach?

RESULTS
To begin thinking about diseases that threaten multiple species, participants came up with the list shown in Table 1.

Table 1: Diseases affecting multiple species and their host range

Disease	**Host range includes:**
White nose syndrome (fungal disease)	North American bats
Tuberculosis (bacterial disease)	**Primates, elephants, bovids, humans, tapirs, hoofstock**
Avian influenza (viral disease)	Birds, pigs, humans
Hendra Virus	Horses, fruit bats, humans
Rabies (viral disease)	mammals including raccoons, skunks, bats, foxes, dogs, humans
Chromobacterium (bacterial disease)	Primates, ungulates, humans
Brucellosis (bacterial)	Ungulates, dogs, pigs, sheep, goats, camels, humans
Foot and Mouth Disease (viral disease)	ungulates (domestic and wild bovids, sheep, goats, pigs), hedgehogs, elephants
Herpes (viral disease)	species-specific strains in horses, cats, dogs, humans, most mammals
Chytridiomycosis (fungal disease)	amphibians (frogs, toads, salamanders)
Encephalomyocarditis virus	Apes, pigs (most susceptible), other mammals, humans
Morbilivirus	Humans, dogs, cats, cattle, cetaceans
Malignant catarrhal fever (infectious systemic disease)	ruminants (cattle, water buffalo, banteng, American bison, deer)

A case study of a DRA addressing potential disease risks associated with the reintroduction of the Eastern barred bandicoot (*Perameles gunnii*) was used as an example for applying the DRA Framework to a single species. For further information a copy of the report on this DRA can be found here: http://www.cpsg.org/content/eastern-barred-bandicoot-disease-risk-analysis-2016

As a means of testing the application of this DRA process to a multi-species context the group selected human Tb (which had been identified by each group) and considered the question: In what ways could we bundle this threat for a multi-species DRA? The result was:

- Taxonomic
    - Ungulates
        - Ruminants
        - Non-ruminants
    - Non-human primates
    - Carnivores
- *In situ* Local-regional-global
- *Ex situ* Local-regional-global
- Human – non-human bundle
- Habitat/Ecosystem type
- Species interactions
    - Natural interaction versus non-natural interaction
- Transmission routes
    - Similar transmission paths
- Proximity to human habitation
- Ecological similarity
- Behavior – where they interact with people

In view of its local prevalence and the desire to apply a One Health perspective, the group decided to bundle…

a) the threat of tuberculosis (Tb), caused by *Mycobacterium tuberculosis,* with
b) primates and humans in
c) South-East Asia

…as a case study to test a multi-species DRA planning approach.

The group then considered the following three questions for this bundle:

What information about this threat to multiple species would be needed to feed into a DRA workshop?

- Identify species – orangutans, macaques, gibbons, langurs, leaf monkeys, slow loris, humans
- Identify conservation status (but consider that non-threatened primates may also be involved in the cycle)
- Identify information on prevalence in human and primates – documented cases and current status (health, nutrition, disease)
- Understand the epidemiology of Tb, transmission rates, and species susceptibility
- Distribution, ecology and density of concerned species
- Geographic overlap of concerned species
- Human population densities and distribution
- Identify potential interactions (primates vs humans, primates vs primates)
- Consider culture and beliefs of local community
- *Ex situ* populations (pet, zoo, research)
- Testing and treatment availability
- Latent Tb in species and difficulties in testing
- Financial considerations
- Movement of animals (migration, translocation, plus import-export between *in situ* and *ex situ*)
- Prevalence and location of pet trade

What additional expertise, stakeholders, and tools might be needed?

- Primate ecologist
- World Health Organization (WHO) and World Organization for Animal Health (OIE)
- Expert in geography in the area, familiar with the landscape
- GIS to map disease, human-wildlife interactions, primate ranges, human distribution
- Epidemiology diagnostician
- Pathologist, lab diagnostics
- Animal manager, handling
- Zoo and wildlife vets
- Human doctor
- Local community representative
- Government (Infectious disease and wildlife) authorities
- Religious leader
- Social scientist
- Wildlife trade experts
- IUCN Primate Specialist Group and Wildlife Health Specialist Group representatives
- Park managers
- CPSG Facilitator and conservation action planning modeler

- Tools: Meta Model Manager with Vortex, Spatial, and Outbreak for modeling

- The DRA would be one component in the development of a holistic conservation action plan

How does the size of the bundle influence our ability to plan?

- Need to identify the limiting factors as per the DRA cycle (Figure 1) to determine that the size of the bundle is appropriate. If you try to do too much, it won't all get done.
- One of the biggest issues is animal movement so trade (both legal and illegal) would be a great place to look for potential risk.
- Another bundle may be rescue, rehabilitation and release. If the scope is too wide, the bundle could be by range country (although animal movements and trade may occur between countries).
- Look at case studies and compare Tb issues with that model.
- For bundling, it would depend on how many variables and the amount of uncertainty you are dealing with. The more unknowns and variables, the smaller the bundle should be with a narrower focus.
- You could do a bigger bundle if you have all the information.

Next steps to progress the development of this multi-species DRA and planning approach?
(Whole group):

- Introduce DRA training as part of work of SE Asia CPSG Regional Resource Centre.
- Review human health models to see if there are lessons to be learned on how they bundle, e.g. from World Health Organization (WHO) and Food and Agricultural Organization (FAO) e.g. with Avian Influenza as a case study (has a massive amount of research behind it).
- Trial the process with EEHV (Elephant Endotheliotropic Herpes Virus) as an emerging issue in Asian elephants to identify key risk factors driving disease development e.g. age, habitat fragmentation on which to target early detection and prevention.
- Make sure governments don't make decisions based on random activities. (Currently 'One Health' programs have a tendency to make human factors key. See if we can ensure an equal approach for animals).
- Investigate how this process works for a national park, with animals moving in and out, given the knowledge of which species occur there.
- Test how 'bundling' works at a habitat level
- Include DRA capability in each CPSG Regional Resource Centre
- Incorporate human health aspect in DRA where relevant
- Incorporate DRA into the PHVA process where disease is a key threat
- Increase wildlife health knowledge among lawmakers, potentially facing more and more emerging diseases.
- Investigate prioritization by conservation need
- Contact others with relevant expertise and interests including:
    - Sharon Deem, Director of St. Louis Zoo Institute for Conservation Medicine deem@stlzoo.org
    - Richard Kock and Billy Karesh, IUCN-SSC Wildlife Health Specialist Group rkock@rvc.ac.uk and wkaresh@wcs.org
    - Stephanie Sanderson, Executive Director, European Association of Zoo and Wildlife Veterinarians s.sanderson@ewspartnership.org
    - Steve Unwin (DRA practitioner), Animal Health Consultant, Dubai Safari s.unwin40@googlemail.com