MonkeyFeverRisk Stakeholder workshop

Optimizing Forest Benefits whilst Minimizing Impacts of Kyasanur Forest Disease and Other Zoonotic Diseases

Report of the Stakeholder Workshop, Bengaluru 16th August 2018

Ashoka Trust for Research in Ecology and the Environment

Centre for Ecology & Hydrology
NATURAL ENVIRONMENT RESEARCH COUNCIL

National Institute of Epidemiology
(Indian Council of Medical Research)

MonkeyFeverRisk Stakeholder workshop

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For further information on the report or the MonkeyFeverRisk project, please contact the Principal Investigators (see below) or visit https://monkeyfeverrisk.ceh.ac.uk

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Executive Summary

The Centre for Ecology & Hydrology, UK in partnership with Ashoka Trust for Research in Ecology and Environment (ATREE) hosted a one day stakeholder workshop on "Optimizing Forest Benefits whilst Minimizing Impacts Of Kyasanur Forest Disease and Other Zoonotic Diseases". The workshop was held in Bengaluru on 16th August 2018. This workshop report aims to outline the perspectives and inputs of stakeholders on this topic and how these are framing the work of the project. This report therefore does not reflect the views of the project partners and does not provide scientific recommendations - the latter will be produced at the end of the project.

What is MonkeyFeverRisk?

MonkeyFeverRisk[1] is an Indo-UK project that aims to develop an inter-disciplinary framework to help communities minimise exposure to zoonotic diseases whilst maximising the livelihood benefits derived from tropical forests. The project focuses on the emerging tick-borne infection, Kyasanur Forest Disease (KFD) that affects poor communities in the forests of the Western Ghats mountain range in Southern India. It links expertise in public and animal health, forest and wildlife ecology, human behaviour and priorities, empirical measurements and models to understand the ecological and social processes that make communities more vulnerable to KFD (Fig.1).

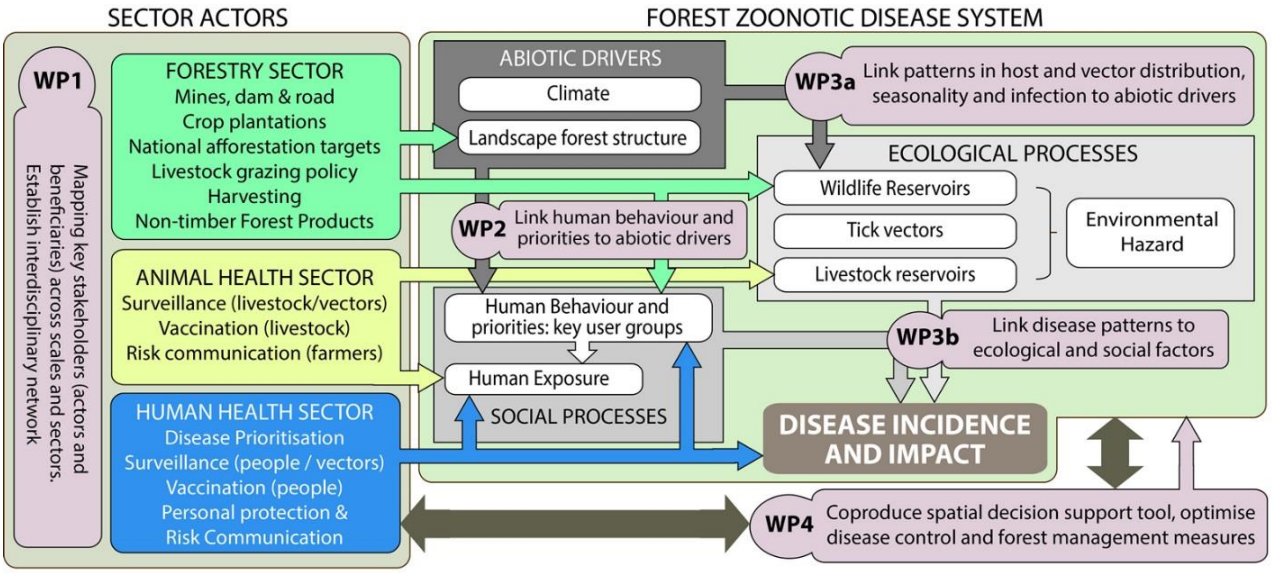

Fig.1. Schematic showing inter-linked project work packages, cross-sectoral policies and actions and abiotic drivers and ecological and social processes that influence zoonotic disease systems.

[1] The MonkeyFeverRisk project is supported by the Global Challenges Research Fund and funded by the MRC, AHRC, BBSRC, ESRC and NERC [grant number MR/P024335/1]

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What was the aim of the stakeholder workshop?

An overarching aim of the project is to co-produce decision support tools and guidance based on this improved scientific understanding with the wide-ranging actors and beneficiaries that interact with the disease system across the public health, animal health and forestry sectors. As part of this co-production process, this first 'framing' workshop was held with over 20 experts from different KFD-affected districts and state level officials of Karnataka, Maharashtra and Kerala from the public and animal health, agriculture, forestry and social welfare sectors. The workshop aimed to map stakeholders' knowledge about KFD, prioritizing risk factors for the disease, identifying key policies that affect KFD, and feeding that knowledge into project approaches and models. This workshop will be followed by two more: on knowledge integration (planned for June 2019) and experimentation (planned in late 2019) to complete the co-production process.

Outcomes of the framing workshop and how they have changed the project approaches and models

The table below outlines the main **risk factors** identified by stakeholders (with over 4 scores each) (for a full list of risk factors, see section 2.2), their ranking and scoring, together with how the risk factors are or will be incorporated in the project approach and models. A more complete list of lower ranked risk factors can be found in Annex 1.

Ranking	Risk factors	Number of votes	How risks are or will be addressed in project
1	Lack of education/awareness about KFD	10	Not a direct research project aim, measured in WP2
2	Under or late reporting of monkey deaths	9	Accounted for in data interpretation in risk modelling
2	Deforestation and/or forest degradation	9	Integrated as a risk factor in models
2	Lack of awareness of preventative measures (tick repellants, vaccination)	9	Not a direct research project aim, measured in WP2
3	Lack of awareness or understanding of alternative hosts	8	Addressed in WP2 and WP3a research
4	Human use of forests	7	Addressed in WP2 and in WP3b modelling

Ranking	Risk factors	Number of votes	How risks are or will be addressed in project
4	Low vaccination coverage	7	Addressed in WP2 and WP3b modelling
4	Poor diagnostics and surveillance	7	Improving surveillance and diagnostics is not a direct project aim but could result from a strengthened One Health network
4	Lack of OneHealth policy	7	Project will establish a OneHealth network on KFD
5	Poor data management	6	The project will provide a blueprint for future data management on KFD
5	Poor understanding of tick ecology	6	Addressed in WP3a research
6	Side effects and concerns about vaccines	5	Measured as part of the household surveys (WP2) but not a direct research project aim
7	Living in or around forests	4	Addressed in WP3b modelling, WP2 and field site selection
7	Favorable environment for ticks	4	Addressed in WP3a (habitat associations will be measured)
7	Poor tick identification	4	Addressed in WP3a research

The table below outlines the **main needs** identified by stakeholders, together with how the needs are or will be incorporated in the project approach and models.

Key needs identified by workshop participants	How needs are or will be addressed in project
Human resources: need for better trained manpower; more equipment; tick experts and taxonomists	A post-doctoral tick taxonomist will be trained during the project by a tick expert. Tick taxonomy resources will be made publicly available
Improved surveillance: need for active surveillance; surveillance for disease, vectors and hosts	WP3b will provide risk maps and models to improve targeting of surveillance. WP3a will understand ecological communities most strongly linked to KFD
Better diagnostic facilities	Not a direct research project aim but One Health network can advise on location/type of facilities
Better communication: real-time reporting; social media use	Part of experimentation phase 2;
Funding for research and action	Not a direct research project aim but opportunities will be communicated through the One Health network

Key needs identified by workshop participants	How needs are or will be addressed in project
Better understanding of disease ecology: alternative hosts and vectors; seasonality; tick movement; tick distribution; tick ID and taxonomy	Covered in WP3a research and resources
Vaccines and vaccination innovations: better quality/efficacy/single dose; availability; shelf life	Not a direct research project aim
Multi-sectoral coordination: better communication and coordination	Stakeholder workshops (WPs 1 and 4); establishing a One Health network
Raise profile of KFD and hence generate political will for KFD control and management	Could be covered in WP1 as part of a communication strategy
Improved knowledge, awareness and better practices for KFD management	Could be covered in WP1 as part of a communication strategy
Improve detection of at-risk human populations early	Covered in WP3a and WP3b research
Restrict human-forest interface wherever feasible	Covered in WP2 as part of raising awareness
Remove invasive species	WP3a will measure the role of invasive plants in KFD (WP3)

Concerning the **impacts of national and state level policies on KFD management**, key policies that were identified as having a negative impact or as being poorly implemented were those concerning deforestation, grazing and encroachment in and around forest areas, with abrupt shifts in land use in these areas being identified as making communities more vulnerable to KFD. In the health sector, policy changes that were suggested to benefit management were making KFD a notifiable disease, learning from wide-scale vaccination and vector control campaigns for other diseases, improving the coordination between veterinarians conducting post-mortems and public health professionals involved treating human patients, improving the screening of livestock for pathogens and ecto-parasites before transportation. A full list of policies linked to KFD management by participants can be found in Annex 1.

Concerning the mapping and forecasting information needed to manage KFD, having risk predictions at scales from village-level to clusters of villages would be most helpful to plan vaccination and awareness campaigns. Climate, land use change, altitude and densities of certain cattle breeds should be integrated into risk models but also appear alongside risk maps in a tool, together with contextual features like roads and household locations that health managers routinely use to plan their management across the landscape. Interfacing the seasonal activity of ticks with different groups of forest users in the tool was felt to be very important. Predictions of the month and villages at highest risk would be most useful at least six but better two months before the KFD season. The project team is now tailoring the scale and appearance of the tools to these needs and also conducting time-series modelling to understand the longer term impacts of monsoon climate variation and land use changes on the risk of KFD.

Next steps

- The **One Health network** will be established as a WhatsApp group and member list, accessible through the project website, where members can view the interests, contact details and queries of other network members. The project website will also provide the opportunity to share project resources such as risk maps, community guidance materials, resources for tick taxonomy and for members to share resources with each other.
- The **identification of risks and needs** will feed into the data collection phase of the project (November 2018-May 2018) and the development of models (see tables above to for details). The input from workshop participants on key policies affecting KFD will contribute to the policy mapping part of the project.
- There will then be a **second co-production workshop** focused on knowledge and data integration (planned for June 2018).
- The input from workshop participants on the future decision-support tool will feed into the development of the tool – which will be tested at the **third and final co-production workshop** planned for late 2019.

Summary

The workshop was instrumental in framing the research of the project and its future direction. As a result of the workshop, these are the ways in which the project approaches and models have been changed by our One Health partnership and co-production to date:

- Improved integration of key risk factors into understanding and tools for zoonotic diseases
- Maintained focus on quantifying both ecological and social components of risk at regional and landscape scales
- Focused us on tuning the study grain to the scale of landscape use by people, hosts and vectors
- Developing predictive tools that account for the way that disease managers collect disease data, interpret and use seasonal and geographical information.

Annex 1: Full workshop report

1.1 Background and Objectives

Kyasanur Forest Disease (KFD) is a fatal hemorrhagic disease of forest populations in India that cycles naturally amongst ticks, rodents, and primates. Forest users, especially tribal groups and other villagers that harvest non-timber forest products and farmers that graze livestock, access food, fuel, fodder and other products from degraded forests, are particularly at risk of exposure. A new decision-support tool is needed to reduce the health, welfare and livelihood impacts of KFD that identifies places, times and activities that increase the risk of exposure and makes forest users aware of these risks. This tool will be based on an improved understanding of the ecological and social processes that lead to KFD risk.

A framing workshop was held on 16th August 2018 at Royal Orchid Resort and Convention Centre – Bengaluru as part of the co-production approach of the project. This workshop was part of a larger UK-India research project '**Optimizing forest benefits whilst minimizing impacts of emerging zoonotic diseases: co-developing an interdisciplinary tool for forests in India**', led by Centre for Ecology & Hydrology (CEH) in partnership with key organizations from the Indian public health sector: National Institute of Traditional Medicine (ICMR -NITM), Department of Health & Family Welfare Bengaluru, National Institute of Epidemiology (NIE), and the Animal Health sector: National Institute of Veterinary Epidemiology and Disease Informatics (ICAR - NIVEDI) and the Environmental sector: Ashoka Trust for Research in Ecology and the Environment (ATREE).[2]

Co-production is based on the recognized need to integrate different forms of knowledge into decision-making. The concept is linked to Participatory Action Research, community-based participatory research and Mode 2 knowledge production[3]. Such approaches actively engage knowledge holders in the research process as agents of change and should lead to situations where "academic and non-academic communities assumes mutual respect, no hierarchy of knowledge forms, fluid and permeable disciplinary and professional boundaries, and a normative concern with action". Co-production is particularly well suited to the development of models to understand and predict zoonotic diseases, where stakeholders from different sectors and scales are integral as knowledge holders and future model users. The steps of co-production are:

- Engaging with key stakeholders to frame the research (purpose of this framing workshop)
- Feeding in knowledge from wider stakeholders into research and resulting tools (2nd Knowledge integration workshop)

[2] See blog about the workshop (and the co-production approach of the project) here: https://bit.ly/2MT2q0F. Further information about the overall project can be found at the following link:https://gtr.ukri.org/projects?ref=MR%2FP024335%2F1

[3] For more information on these approaches see Wright and Nelson (1997), Durham Community Research Team [DCRT] (2011) and Nowotny et al., (2001).

- Validating decision support tool (3rd validation workshop)

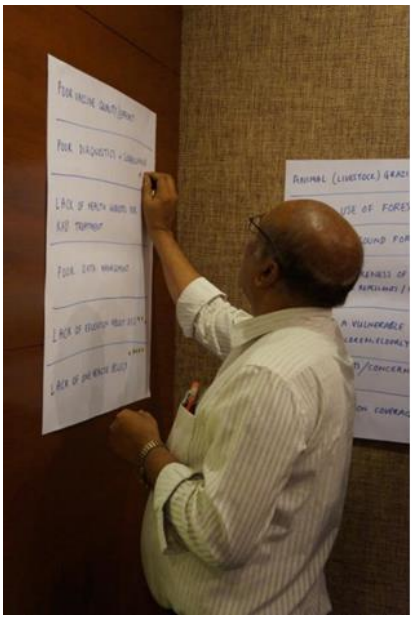
1.2 Objectives of the framing workshop

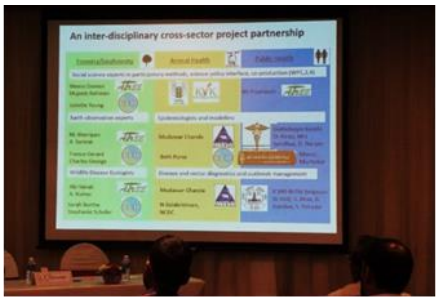
- To map knowledge of stakeholders about KFD
- To prioritize risk factors for the disease
- To identify key policies which affect KFD
- To understand the needs for an effective decision support tool

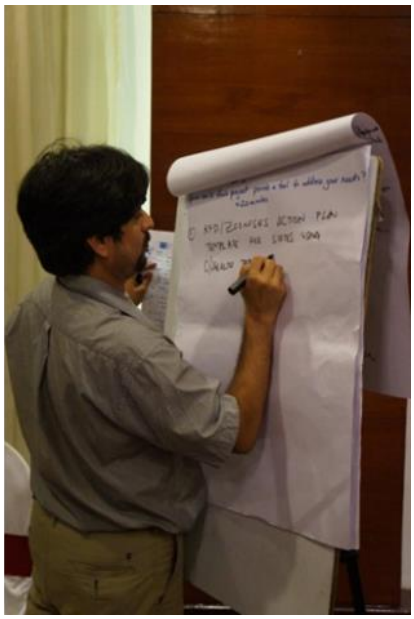
1.3 Workshop Approach

Several documents and approaches were developed to conduct and evaluate the workshop.

- **Workshop Agenda:** The workshop agenda is included in Annex 2.
- **Participant List:** A list of all workshop participants is included in Annex 3.
- **Workshop Presentation and Handouts:** The principal investigator of the project Dr. Bethan Purse presented the project highlighting the purpose of the framing workshop, objectives of the project, brief information on zoonosis including KFD and need for interdisciplinary approaches.
- **Small group discussions and joint worksheets:** During the workshop, participants were asked to discuss a range of different topics, helped by a facilitator who took down the key points made on worksheets.
- **Participatory approach:** Participants were encouraged to feed in their knowledge and experience during the workshop using a range of different approaches including group discussions, brainstorming and prioritization exercises.
- **Workshop Evaluations**: At the end of the workshop, participants were asked for their views on the workshop. This was followed up with a workshop evaluation sheet emailed after the workshop.







2.0 Workshop Discussions

This section summarizes the discussions at the KFD Workshop. The workshop was structured around four sessions:

1. What are the key risk factors for KFD as prioritized by stakeholders
2. What are the key needs for KFD management?
3. What is the impact of various policies on KFD management?
4. What are the characteristics/features that should be available in a decision-support tool?

2.1 Methodologies adopted for the workshop discussion

Participants of the workshop were divided into 5 groups and each group was given a table for the discussion. A facilitator was nominated for each table to moderate the discussion to keep in line with the objectives. The facilitator was instructed to initiate the discussion with clear explanation of the session and topics to be discussed in addition to providing general instructions such as duration, ground rules and expectations of the discussion. Each facilitator was given a worksheet to note the important points for the each topic given for discussion.

2.2 Key risk factors for KFD

Stakeholders sat in small groups at round-tables and conducted a self-evaluation of their knowledge and experience of KFD (1-3 stars to add on each sticky note with 1 indicating limited knowledge and experience and 3 high knowledge and experience). Along with the self-evaluation of their knowledge and experience, participants identified key risk factors according to them on the sticky notes. Facilitators compiled and typed up sticky notes (Part 1) for participants to rank individually. Participants were given 5 stars to use as they wished in ranking the identified risks. Based on the ranking exercise, the following were identified as the key risk factors that need to be addressed for effective KFD management – and how they are or will be addressed:

Rank	Risk factors	Number of votes	Addressed in project
1	Lack of education/awareness	10	Not a direct research project aim

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Rank	Risk factors	Number of votes	Addressed in project
2	Under or late reporting of monkey deaths	9	Integrated as a risk factor in models
2	Deforestation and/or forest degradation	9	Integrated as a risk factor in models
2	Lack of awareness of preventative measures (tick repellants, vaccination)	9	Not a direct research project aim
3	Lack of awareness or understanding of alternative hosts	8	Addressed in WP3a research
4	Human use of forests	7	Addressed in WP2 and in WP3b modelling
4	Low vaccination coverage	7	Addressed in WP3b modelling
4	Poor diagnostics and surveillance	7	Poor diagnostics is not a direct project aim. Surveillance is carried out regardless.
4	Lack of OneHealth policy	7	Project will establish a OneHealth network on KFD
5	Poor data management	6	The project will provide a blueprint for future data management on KFD
5	Poor understanding of tick ecology	6	Addressed in WP3a research
6	Side effects and concerns about vaccines	5	Part of this will be considered as part of the household surveys (WP2) but not considered a direct research project aim
7	Living in or around forests	4	Addressed in WP3b modelling, WP2 and site selection
7	Favorable environment for ticks	4	Addressed in WP3a (Habitat associations)
7	Poor tick identification	4	Addressed in WP3a (Habitat associations)
7	Poor tick surveillance	4	Addressed in WP3 through provision of risk maps to better target tick surveillance, and through provision of tick taxonomy resources
8	Animal (livestock) grazing in forests	2	Addressed in WP2 (household surveys) and in risk factors integrated into WP3b modelling
8	Being in a vulnerable group: women, children, elderly, poor, health workers	2	Addressed in WP2 (household surveys)
8	Livestock movement (long range)	2	Not addressed directly in project, except in data interpretation in WP3

Rank	Risk factors	Number of votes	Addressed in project
8	Migratory birds	2	Not addressed directly in project, except in data interpretation in WP3
8	Poor vaccine quality/efficacy	2	Not direct aim of project, though community perceptions of this will be measured in WP2 (household surveys)
9	Invasive vegetation	1	Addressed in WP3a (habitat associations)
9	Contact with rodents	1	Measured in WP3a (habitat associations) and WP2 (household surveys)
9	Exposure to monkeys	1	Measured in WP3a (habitat associations) and WP2 (household surveys)
9	Contact with ticks	1	Measured in WP3a (habitat associations) and WP2 (household surveys)
9	Lack of tick control	1	Measured in WP2 (household surveys)
9	High numbers of ticks	1	Measured in WP3a (habitat associations)
10	Flavivirus	0	Co-location of KFD with other zoonotic diseases will be addressed in WP3b
10	Lack of health workers for KFD virus	0	Measured in WP2 (household surveys) and integrated as risk factors in WP3 models

2.3 Key needs for effective KFD management

For this session, participants were allocated to tables according to the district they worked on. As such, there were two tables for national-level stakeholders, two tables for those working in the Shimoga district and one table for participants working in other districts.

The following three questions were given for the discussion in the first session:

1. What are the key needs to deal with KFD in your district?
2. How could this project provide a tool to address your needs?
3. Can other initiatives that work well in your district teach us how to deal with KFD?

The identified needs were compiled by two members of the project, and listed on worksheets. Workshop participants were then given five sticky dots each and encouraged to position those dots according to the needs they felt were the most important. This resulted in the prioritization of key needs, as outlined below:

1. **Strengthen Human resources and health systems in KFD-affected areas**

Participants highlighted the need for better trained health workers, provisioned with appropriate equipment. There is also a need for new types of skills in the workforce, e.g. expertise in tick identification. Government departments in KFD-affected districts are quite under-resourced. Hence emphasis should be given to increase the workforce and financing to better deal with KFD. In all KFD-affected districts, there is a need to appoint district level veterinary professional within the forest department. Due to the role of wild and domestic animals in transmission, such appointments will improve early detection and management of KFD as well as other vector-borne and zoonotic diseases. District entomologist positions are often unfilled. This is a high priority in KFD-affected districts, but with benefits beyond KFD for detection and management of other vector-borne infections. Need for a diagnostic facility in Karnataka, Kerala and Tamil Nadu States upgraded to the biosecurity level (BSL-4) of the National Institute of Virology (NIV), Pune to avoid dependency on NIV for diagnosis of cases.

2. **Improve surveillance**

   Participants identified the need for active surveillance in outbreak seasons. There is also a need to conduct surveillance for vectors and hosts in addition to early identification of outbreaks in people. Surveillance is currently passive, event-based. There is a need to strengthen active surveillance to tell us about possible outbreaks and spread to other areas, including date of first case, the need for vaccination in that area, what age group KFD is affecting. There are currently no standard SOP/ guidelines for tick collection like appropriate pool size, taxonomy of ticks, tick biology etc.
3. **Advances in diagnostic facilities** including point of care testing
4. **Funding for research and action on KFD**
5. **Advances in understanding of disease ecology**
   a. alternative hosts other than monkeys and vectors
   b. local seasonality patterns
   c. tick movements and distributions
   d. tick identification and taxonomy
6. **Vaccines and vaccination innovations**

   (a) quality of vaccines,
   (b) efficacy,
   (c) producing single-dose vaccines,
   (d) improved availability and
   (e) improvements in shelf-life of vaccines

   Stakeholders expressed the need for better vaccine than the existing one as it is relies on technology dating back 30-40 years, and required multiple doses for effective protection. Participants expressed the concern that there used to be at least 50% of vaccine coverage earlier but that it has now reduced. We explored the reasons for the reduced uptake; participants mentioned the pain at the site of injection as the main reason. Insulin type syringes would help in reducing the pain. The current practice is vaccination of target

population within a 5 km radius of sites where either monkeys or ticks have found to be positive to KFD. Increasing the radius to cover more people will be helpful but difficult. Tick positivity should be taken as criteria for vaccination in all affected areas. Post vaccination monitoring is required to know the effectiveness of vaccine.

7. **Multi-sectoral coordination** including improved partnerships within and across government and non-governmental sectors
   There is a need for improved inter-sectoral (Animal health, Forestry, Human health, Family welfare, NGOs) and cross-scale cooperation (Administration, State, District, Taluk, and at village level) to address the issue of KFD and prioritise management aspects in a better way.
8. **Raise profile of KFD and hence generate political will for KFD control and management**
   There is a need to position KFD on the agenda in routine review meetings at district level in the affected districts rather than only during outbreaks. KFD should be brought into discussions in routine district level monitoring meetings chaired by the Deputy Commissioner, for example, when tick populations increase in the summer.
9. **Improved knowledge, awareness and better practices for KFD management**
   There is often a media-hype during outbreaks that sometimes results in reactionary killing of monkeys. There is a need to get appropriate messages on the steps to be taken during such incidents and disseminate these widely in print and social media.
10. **Identify human at-risk populations early**
    Individuals belonging to tribal communities and other villagers are typically at higher risk of infection as they are often hired during these outbreaks for various activities and often with little information and/or protection. There are increasing activities within forests by forest department staff, especially related to clearing fire-lines, and by NGOs in tribal areas for social development activities. All these stakeholders need to be aware of the risks and protect frontline staff involved in such activities.
11. **Human-forest interface** with respect to forest dependence/use.
    Since KFD has a strong link with human use of forests, this has been suggested as a potential solution. However, it needs to stressed that undue restrictions should not be placed on local communities that traditionally utilize forests and forest products.
12. **Remove invasive species.**
    There is increased incidence of ticks in sites where invasive species such as lantana and eupatorium are present. Therefore, it would be useful for these species to be monitored and if possible, removed.

A description of how the project is addressing these key needs can be found in the executive summary of this report.

2.4 Impact of various policies on KFD management

In this session, stakeholder groups addressed the impact of various policies on KFD management. The key question was "How do you see national and state level policies affecting KFD management?" The following points emerged during the discussion and we categorized them below. While some of the discussion focused on positive/negative impacts of various policies on KFD, participants also discussed the potential positive impact of better implementation of some policies as well as new policies and programmes that are needed for KFD management.

Policies related to forests, environment and land-use

1. Implementation of policies related to deforestation, grazing and encroachments in and around forest areas. It was mentioned that limited implementation and governance in some forested districts of policies related to land-use, encroachment could have a negative impact on KFD management.
2. Forest dependence is reducing due to greater use of LPG in and around forest areas. Clean fuel policies might reduce exposure to KFD, but participants noted that forest communities still entered the forest to collect dry leaves for animal bedding and fodder so would still be exposed.
3. Lack of a gradient with respect to shifts in land-use from forests to villages/towns is important. This means that we have smaller/narrower buffers between forests and people. Policies that cause abrupt land use changes also impact KFD. For example when fruit plantations are grown in forests bordering agricultural areas this could lead to entry of monkey hosts into agricultural areas. Areca/Pineapple plantations are promoted in some coastal districts leading to deforestation. This may lead to more KFD cases in newer areas.

Policies related to the health sector

1. KFD is not a notifiable disease (like Tuberculosis and Malaria for example).
2. Mobilize workforce during outbreaks: Like in the case of Polio vaccination program, health workers and staff from different departments are deputed to carry out vaccination on a mass scale and this could be done for KFD as well.
3. Need to learn from the campaign mode adopted by the INDIRADHANUSH campaign for vaccination against 4 – 5 diseases (e.g. BCG, Diphtheria, Measles).
4. National deworming day is observed in Karnataka. On this day school children are given deworming tablets. The deworming day is supported by education, social welfare and women/child development departments. Similar observation of a day to improve public awareness on KFD and launch widespread tick control in animals and vaccination could be thought of.
5. Pyrethroid spraying: Pyrethroids extracts are used for spraying to control other vector borne diseases. Some participants suggested this could be used in KFD-affected places to control tick population.

6. Clinicians and nursing staff handling confirmed cases of KFD should have Personal Protective Equipment

Policies related to Animal Health

1. Reporting wild animal deaths and coordination between animal and human health professionals: Currently there is a lack of coordination between animal health professionals who carry out post-mortems and public health professionals involved in curative and preventive work in human public health.
2. There is currently no policy or regular training for animal health professionals about KFD. Workshop participants suggested a workshop aimed at raising awareness amongst vets and clinicians especially in high-risk areas. They also suggested newsletters to all relevant stakeholders in endemic areas.
3. Tick control initiatives and programs are lacking and need to be instituted.
4. Livestock transport policy needs to be more strictly enforced across districts and the screening of animals (for ecto-parasites and for zoonotic infections) needs to be improved.
5. There is currently no policy on bio-security for transport of bio-hazardous material and/or storage in all states.
6. There should be standard protocols and materials that are well-stocked in risk areas; including a standard procedure for disposing of dead monkeys; and proper Personal Protective equipment to prevent tick bites.
7. Vector control (ticks) in animals may be effective in controlling KFD. Department of AH & VS (Animal Husbandry and Veterinary Services) provide ecto-parasiticides like Ivermectin, Doramectin, BUTOX^{R} etc. to the veterinary dispensaries. The supply can be targeted in KFD affected districts to control ticks.

Wider public policies and programs in general:

1. Programs such as the Anganwadis that targets pre-school children during day time tend to decrease children-forest interaction and hence increasing their operation time could have a positive impact on children's exposure to ticks.
2. Various policies and programs focusing on women empowerment and microfinance also help decrease forest dependence and interaction by women.

   Socio-economic policies and programs favoring non-forest occupations including skill development and entrepreneurship programs providing employment opportunities in towns and cities decrease exposure and forest dependence.


2.5 Decision-support tool for KFD

In this session, the small groups addressed the following questions:

1. What are your usual sources of information on KFD?
2. What mapping or forecasting information do you need and at what geographical scale?
3. What seasonal information about KFD transmission is most useful when deciding on a control strategy?
4. What are the most relevant outputs for you from the project?

Sources of information on KFD

Participants mentioned that they were currently using vector control guidelines from the health department given in the KFD manual that recommend controlling tick vectors in and around 50 meters of monkey deaths. They were following the vaccination strategies as per the guidelines from the State government which states that if either a tick positive, monkey positive, or a human positive is found in a village, then affected village within radius of 5 km should be vaccinated and repeated every year for 5 years. No other sources of information on KFD were mentioned.

Mapping or forecasting information needed at which geographical scale

The geographical scales mentioned by participants as being most useful were village land risk maps, for carrying out vaccination in high risk areas, and predictions for clusters of village within 5 km zones.

Participants mentioned that maps should ideally be available for: (a) Outbreaks by year, (b) Vaccination status by year, (c) tick population and tick positives (d) Animal health surveillance data (e) Animal tick control measures (f) Results of active and passive tick surveillance (g) Rainfall (h) Temperature (i) Altitude (j) Tick density. Temperature and elevation maps are needed because cases of KFD are more prevalent in low-lying areas. Some participants mentioned that the spatial distribution of exotic/crossbreed animals could be useful as it is observed that more ticks are found on such breeds compared to local breeds (e.g. Malnad gidda). The importance of strengthening reporting of animal deaths by lay people, health staff, forest staff and other frontline staff was highlighted. Participants also requested that the tool could assess and inform action related to land-use change over the years and its effects on KFD.

Seasonal information needed about KFD transmission

Participants mentioned that information on the peak season of the tick population (infected nymphs peak before the monsoon) and on the peak season for different forest users would be useful. For example, in Kerala grazing only occurs in summer while in other areas such as Shimoga, grazing will be year-round due to perennial rains. Collection of minor forest produce such as dry leaves is also a seasonal activity. It can be useful to gather such information on seasonal forest use in KFD affected places so that the intervention strategy can be planned. Participants requested that risky activity be categorized by season in the tool. Understanding the behavior of livestock themselves was also felt to be important to predicting KFD, e.g. where livestock hosts roam free in certain areas.

Several participants again mentioned climate as being of importance for predicting KFD risk seasons and suggested integrating monsoon predictions into outbreak predictions. Different climates in different areas will impact on human activities and therefore people might be most affected by KFD. Rainfall, humidity and temperature all impact on the number of KFD cases and outbreaks. The timing of North- East monsoon rainfall is important as it is believed that these rains can wash-off ticks.

In terms of lag times, participants mentioned that having risk predictions two months before would be useful but six months before would be even more useful. On a longer term basis, predicting when (month) and where (village) KFD is likely to occur on a regular basis will enable quick response and improve preparedness.

Most relevant project outputs for the stakeholders

1. Decision support tool to identify changes that can be made in areas surrounding KFD outbreaks in order to contain the KFD outbreak, and reduce the impacts of KFD outbreak.
2. Capacity building of private sector doctors and nurses as well as veterinarians on the use of the tool.
3. Presentation of tool at annual meetings chaired by DC and presentations to all concerned departments
4. Implementation of the tool in districts and expand to neighboring districts.
5. Action plan and guidelines for the district-level including protocols and steps to follow in case of outbreak and inter-outbreak activities
6. Capacity building for all staff who work with KFD
7. Guidelines for better inter-sectoral coordination
8. One health network on KFD
9. Public engagement via existing programs such as Agricultural Technology Management Agency project (a project implemented by the Animal husbandry department for outreach to farmers).
10. Increased education and awareness of KFD, specifically:
    - Importance of vaccination
    - Spread of KFD

- Main time periods when people might be affected by KFD
- Precautionary measures to be taken before going into the forest
- Avoiding taking children into the forests
- Vaccination and risk mapping
- Importance of active surveillance

3.0 Next steps

The workshop was successful in terms of bringing insights from different stakeholders from different departments including veterinary, health, forest department and social welfare. The workshop achieved its objectives in terms of framing the research based on the needs of stakeholders. Knowledge from participants on KFD, including knowledge needs, risk factors, policies and tools, were instrumental in the implementation plan of the project. The workshop also played a role in creating a platform for dialogue and exchange between stakeholders of different backgrounds, areas and sectors working on KFD.

Next steps

- The **One Health network** will be established as a WhatsApp group and member list, accessible through the project website, where members can view the interests, contact details and queries of other network members. The project website will also provide the opportunity to share project resources such as risk maps, community guidance materials, resources for tick taxonomy and for members to share resources with each other.
- The **identification of risks and needs** will feed into the data collection phase of the project (November 2018-May 2018) and the development of models (see tables above to for details). The input from workshop participants on key policies affecting KFD will contribute to the policy mapping part of the project.
- There will then be a **second co-production workshop** focused on data integration (planned for June 2018).
- The input from workshop participants on the future decision-support tool will feed into the development of the tool – which will be tested at the **third and final co-production workshop** planned for late 2019.

Summary

The workshop was instrumental in framing the research of the project and its future direction. As a result of the workshop, these are the ways in which the project approaches and models have been changed by our One Health partnership and co-production to date:

- Improved integration of key risk factors into understanding and tools for zoonotic diseases
- Maintained focus on quantifying both ecological and social components of risk at regional and landscape scales

MonkeyFeverRisk Stakeholder workshop

- Focused us on tuning the study grain to the scale of landscape use by people, hosts and vectors
- Developing predictive tools that account for the way that disease managers collect disease data, interpret and use seasonal and geographical information.

MonkeyFeverRisk Stakeholder workshop

Annex 2: Workshop Agenda

KFD joint problem framing workshop agenda

Thursday 16th August 2018, Bangalore

Time	Details
9.30 to 10.00	Registration and tea/coffee
10.00 to 10.30	Welcome and introductory talks
10.30 to 10.45	Part 1: Main risk factors
10.45 to 11.00	Tea/coffee available
11.00 to 12.00	Part 2: Key needs
12.00 to 12.45	Lunch Risk factor ranking exercise
12.45 to 1.45	Part 3: Impact of policies
1.45 to 3.15	Part 4: Developing the tool
3.15 to 3.30	Tea/coffee available
3.30 to 3.45	Part 5: Communication
3.45 to 4.15	Part 6: Summary and next steps

MonkeyFeverRisk Stakeholder workshop

Annex 3: Participant List

Name	Sector	Designation	State	District	Intervention level
Dr. Shivaraj Sarjan Shetty	Public Health (DHFWS)	Joint Director	Karnataka	Banglore	State
Dr. Pallavi	Public Health (DHFH)	Microbiologist	Karnataka	Shimoga	District
Dr Ravikumar	Public Health (HFW)	Regional Director	Karnataka	Banglore	State
Dr. Anand KJ	Animal Health (veterinary college)	Associate Professor	Karnataka	Shimoga	State
Dr. Shreyas B	Animal Health	Veterinary Officer	Karnataka	Uttara Kannada	District
Somaji S Anuse	Public Health (Assistant Director: Vector-borne Diseases)	Junior entomologist	Maharastra	Kolaphur	State
M R VijayKumar	Forest Department	Assistant Conservator of Forest, Thirthahalli	Karnataka	Shimoga	District
Dr. Venkatesh BC	Public Health	District Health Officer	Karnataka	Shimoga	District
N Chandrappa	Family welfare	District Child Welfare officer	Karnataka	Shimoga	District
Dr. Nagaraj KM	Animal Health (AH&VS)	Chief Veterinary Officer	Karnataka	Shimoga	State
Dr. M Kiran	Agriculture Department	District Head	Karnataka	Shimoga	District
Dr. Arun Kumar	Animal Health (AH&VS)	Assistant Director	Karnataka	Shimoga	State
Dr.Amitha Reena Gomes	Animal Health (Institute of Animal Health & Veterinary Biologicals)	Scientist	Karnataka	Banglore	State
Dr. Ranganatha.S	Animal Health (Institute of Animal Health & Veterinary Biologicals)	Scientist	Karnataka	Banglore	State
Dr. Shivaraj murag	Animal Health (Institute of Animal Health & Veterinary Biologicals)	Scientist	Karnataka	Banglore	State
Dr. Halagappa	Animal Health (DHFWS)	Co- invigilator	Karnataka	Shimoga	State
Dr. Shashidhara K V	Animal Health, Animal Diesease Surveillance Scheme Hebbal	Deputy Director	Karnataka	Banglore	State
Dr. N Balakrishnan	Public Health (NCDC)	Joint Director (Retd)	Karnataka	Banglore	State
Dr.Sakhariya Sadique	Animal Health	Assistant Project Officer, Regional Animal Husbandry Centre	Kerala	Malapuram	District
Dr Srikanth Patil	Public Health	District Entomologist	Karnataka	Shimoga	District
Dr S. Kiran	Public Health	Taluk Health Officer	Karnataka	Shimoga	District
Mrs Sandhya	Public Health	Microbiologist, Virus Diagnostic Laboratory	Karnataka	Shimoga	District