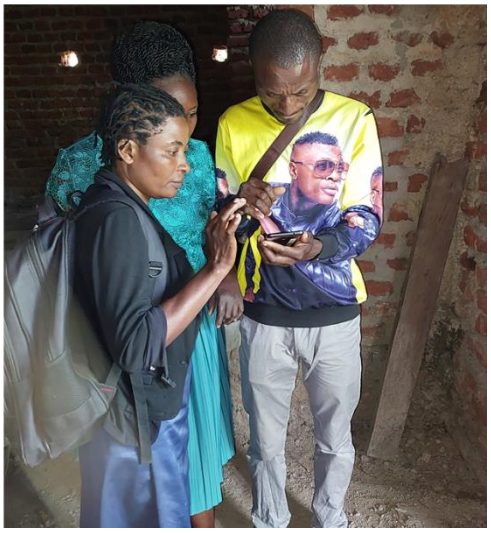
A framework to guide participatory community-based bat-human interaction monitoring in Bundibugyo District, Uganda

A Report from STOP Spillover

May 2023



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CONTENTS

STOP SPILLOVER

Strategies to Prevent Spillover (or "STOP Spillover") enhances global understanding of the complex causes of the spread of a selected group of zoonotic viruses from animals to humans. The project builds government and stakeholder capacity in priority Asian and African countries to identify, assess, and monitor risks associated with these viruses and develop and introduce proven and novel risk reduction measures. "Spillover" refers to an event in which an emerging zoonotic virus is transferred from a non-human animal host species (livestock or wildlife) to another, or to humans.

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ACRONYMS

AFROHUN:	Africa One Health University Network
GPS:	Global Positioning System
ODK:	Open Data Kit
OH-DReaM:	One Health Design Research and Mentorship
PA:	Participatory Assessment
SBC:	Social Behavioural Change (SBC)
SOP:	Standard Operating Procedure
STOP:	Strategies to Prevent
USAID:	U.S. Agency for International Development

INTRODUCTION

Since 2000, Uganda has documented a total of six Ebola outbreaks involving the districts of Gulu (2000), Bundibugyo (2007), Luwero (2011 & 2012), Kibaale (2012), Luwero (2012), and Mubende and Kasanda (2022). Additionally, three outbreaks of Marburg viral haemorrhagic fever have occurred in the country in recent years in Ibanda district (2007), Kabale district (2012), and Kween district (2017). The recent Marburg outbreak in Kween district was traced to rock salt mining in a bat cave [1]. While the viral reservoir for Ebola virus disease has not been definitively determined, *Rousettus aegyptiacus* has been identified as the reservoir for Marburg virus. Zoonotic spillover has been associated with activities that increase human-bat contact [1]. Likely bat-human interface areas include caves and mines with roosting cave-dwelling bats (especially *R. aegyptiacus*); human dwellings for tree-dwelling insectivorous bats [2], and bat hunting, processing, and consumption. Other identified and more generic activities that may lead to increased spillover risk include land-use change, development, large-scale agricultural intensification, and deforestation [3-5].

To both improve understanding of the risk factors for potential spillover and to develop interventions to reduce human exposure to bats, which will reduce spillover risk, a community-based bat-human interface monitoring program was recommended. The purpose of this community-based bat monitoring program is to build the capacity of local community members to monitor key human-bat interaction interfaces in both space and time. Specifically, they will be able to identify bat roosts, feeding sites and bat-human interfaces that might pose risks for zoonotic spillover events. Maintaining this intervention over time will enable collection of information on seasonality of bat roosting behavior, bat population composition, changes and risks for zoonotic disease spillover to the human population. This will guide development of risk maps and an early warning system for potential bat related spillovers. Additionally, the data generated during the community-based bat-human interface monitoring program will allow us to measure the efficacy of other interventions looking at social behavioural changes and technologies to reduce human contact with bats.

ACTIVITY OBJECTIVES

To both improve understanding of the risk factors for spillover to support the development and implementation of effective interventions to reduce human exposure to bats, which will reduce spillover risk.

This document thus provides a detailed description of the planned community-based program for monitoring bat human interactions in Bundibugyo District. It outlines the activities that will be involved, the data to be collected, indicators to be monitored, frequency of monitoring, data

processing, analysis and reporting. It should be noted that this document could be used in other regions of the country implementing a similar bat monitoring program during the scale up period.

The specific objectives of the bat monitoring framework are indicated in Table 1 below.

Table 1: Specific objectives

Objective 1: 1. To establish standard operating procedures for monitoring bat populations and bat-human interactions.
Objective 2: 2. To provide standard data collection tools to be used by bat monitoring agents during the data capture process.
Objective 3: 3. To highlight key training areas of focus while conducting community capacity building activities.
Objective 4: 4. To highlight the supervision process, monitoring and evaluation of the bat monitoring program

ABOUT BUNDIBUGYO DISTRICT

The STOP spillover project team used an outcome mapping process from which national stakeholders selected the bat-human interface as a priority spillover risk in the country, and Bundibugyo district as a starting point. Bundibugyo is located in Western Uganda approximately 378 kms by road, from the capital city, Kampala. It is located along the Rwenzori Mountain ranges and in close proximity to the Democratic Republic of Congo. Predominant ethnicities include the Bamba-Babwisi and the Bakonjo however, other ethnicities coexist with them including the Batooro. The district lies between two conservation areas, the Semliki National Park and the Rwenzori National Park, which has led to a high level of human-wildlife-forest ecosystem interactions. The area has plenty of rock shelters and caves that are habitats for wildlife, including bats. The people of Bundibugyo are largely farmers who depend on cocoa, coffee, and vanilla to earn a living. Farming activities evolve around the two major rainy seasons of March-May and July November.

Selection of sentinel bat-human interaction monitoring sites

Within Bundibugyo district, three (3) regions were selected by stakeholders during a 3-day outcome mapping process for research and intervention activities around the bat-human interface. The regions considered and reasons for consideration are indicated below and in the map in Figure 1.

1. Burondo subcounty (neighbors Semuliki National Park)
2. Harugale subcounty (neighbors Rwenzori Mountains National Park)

3. Ntandi town council (represents areas with bats in homesteads, schools, churches and also has areas where bat hunting is known to occur).

The project team held participatory community meetings from which it was agreed that within each of the three sub-counties, five parishes should be selected for monitoring making a total of fifteen parishes in the district. Each parish will have one (1) bat monitoring agent, making a total of fifteen (15) agents across the bat-human interface sites (Figure II summarizes the setup of the monitoring framework). Each parish has between 4-8 villages. Monitoring agents will identify bat roosts within these villages that will include caves, homesteads, schools, churches, and trees among others. The initial plan is that each agent will monitor a maximum of five (5) sentinel roosts, making a total of 75 roosts to be monitored. Based on the results and performance, sites will be increased gradually to levels agreed upon with the community members.

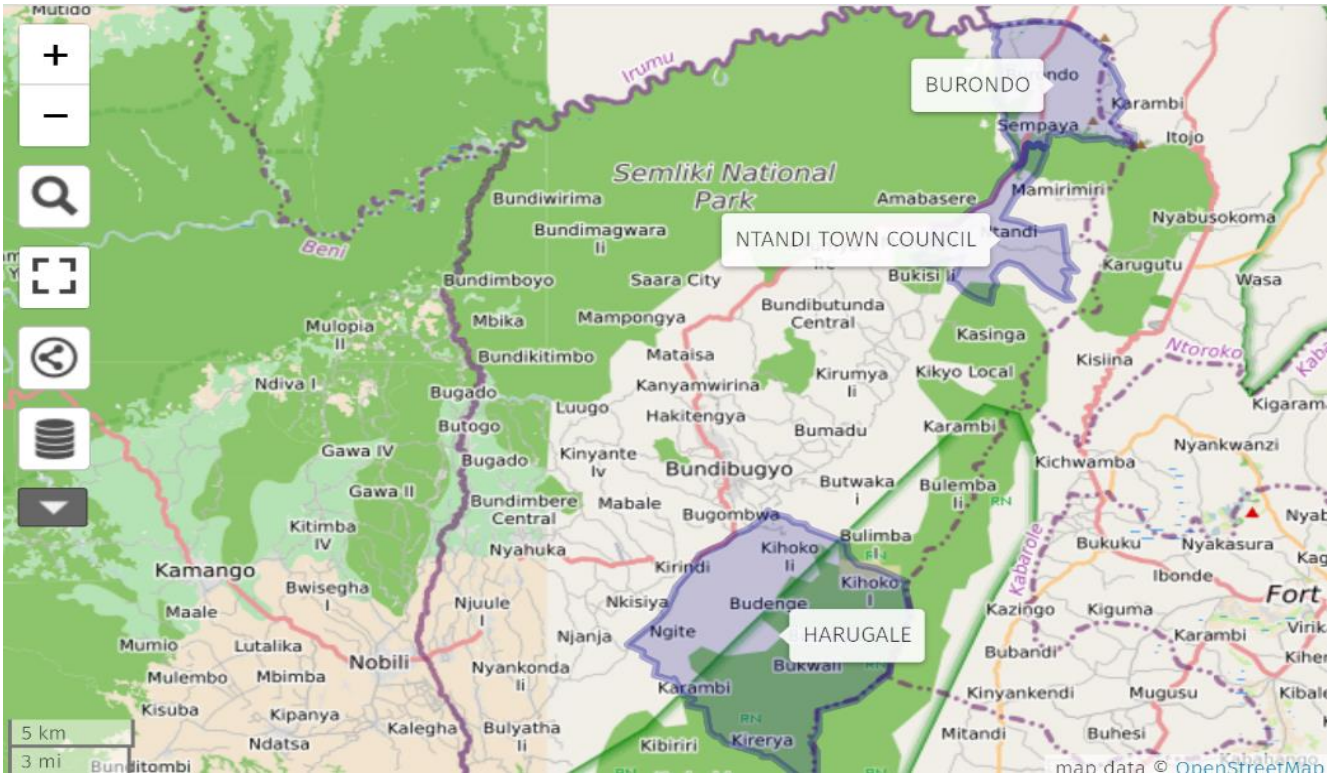

Figure 1. Map of Bundibugyo showing the 3 bat-human interface project areas.

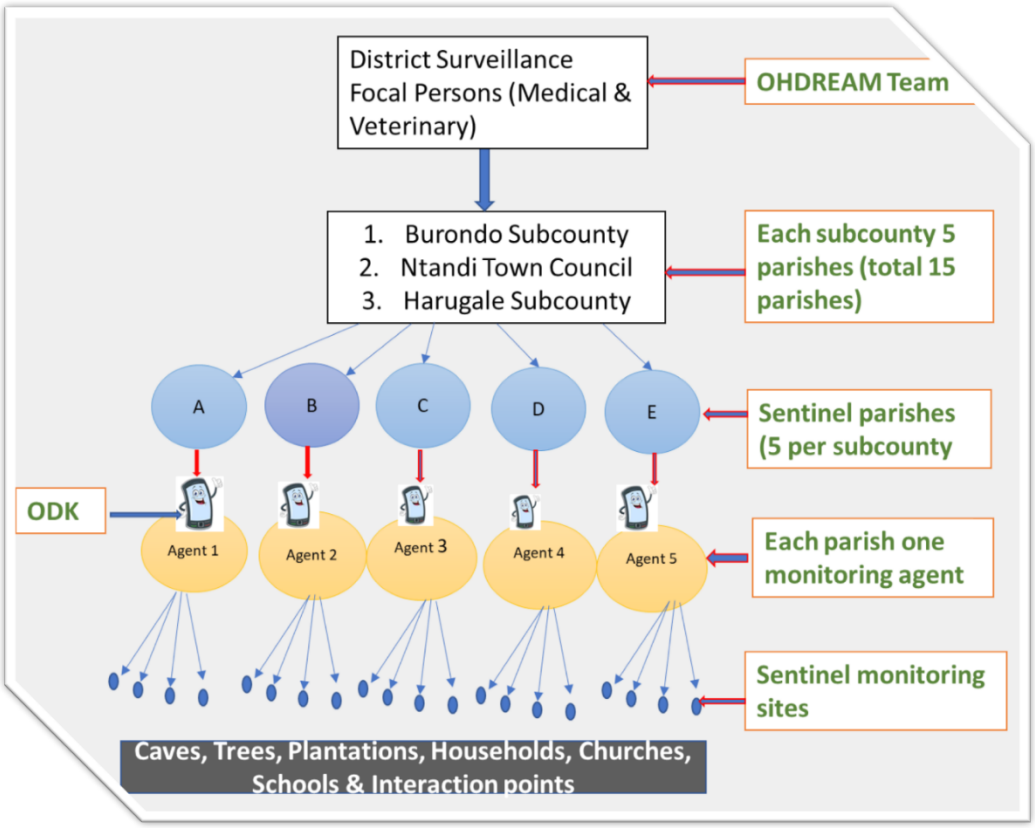

Figure 2. Graphic description of the Bat Monitoring plan

Selection of monitoring agents

Monitoring agents will be selected following a community participatory process. Communities will be tasked to come up with a criterion for selecting agents and later nominate names for subsequent consideration (Appendix 1). Box 1 indicates some of the parameters to be considered for selecting monitoring agents and sentinel surveillance sites. The monitoring agents will be responsible for collecting data using the ODK tool (Appendix 2), make observations on bats, making pictorial/video documentation of bats, identifying new roosts, identifying key informants for bat-human interactions, recording bat sounds among others.

Box 1. Considerations for selecting monitoring agents and sentinel sites

Key considerations for selection of sentinel parishes.

- The parish should have a considerable population of bats.
- The parish should have prominent bat roosts
- The parish should have a number of households to be considered for household-based bat surveillance.
- The parish should have manageable villages, in terms of terrain, village size, and population commitment.
- The parish should have easy accessibility to the bat roosts to avoid agents and supervisors climbing a great distance on the hills.

Key considerations for selecting monitoring agents.

- The potential agent should have basic Knowledge on the use of smartphones, or be easily trained.
- The potential agent should have basic knowledge about bats in the local context
- The potential agent should have prior participation in data collection for other agencies.
- The potential agent should be willing to work and communicate as observed from previous engagements with other agencies.
- The potential agent should have a good knowledge of the area and preferably a resident of the area for easy monitoring.
- The potential agent should be a person of high integrate as observed from previous engagements or recommendations.
- The potential agent should be stable and reliable in the community of operation.

Training of monitoring agents

Monitoring agents will be trained in the following aspects:

1. **Bat Roost identification**
    - **a.** Bats live in a variety of habitats which may include but is not limited to: Caves, trees, leaves, human structures, disused mines, barks of trees, rock crevices, tree hollows & holes, termite nests, etc. Monitoring agents will be trained to identify bat roosts.
2. **Bat species identification (elementary)**
    - **a.** There are mainly two types of bats; and these are also known by several local names in Bundibugyo.
        - **i.** Mega-bats (Fruit bats)- **m*beheli*/*omulema*** and
        - **ii.** Micro-bats (Insectivorous bats)- ***kakorokombe* /*keribo***
        - **iii.** NOTE: Globally there are over 1300 species of bats. In Uganda we have over 90 species of bats with about 13 species belonging to Mega / Fruit bats and over 77 species belonging to the micro/ insectivorous bats. For the case of Bundibugyo, we estimate over 30 bat species are present in the project area from our initial assessments. However, there is a need for a baseline survey to determine the exact number of bat species in the monitoring area.
3. **Bat population counting**
    - a. Depending on the species, bats have different forms of natural history with regard to their social structures and population associations. Some prefer living a solitude life, others form small clusters (comprising of less than 10 individuals); others live in big colonies or congregations comprising of hundreds, thousands or millions of individuals. The monitoring agents will be practically trained in the counting of the number of bats in the roosts.
4. **Bat acoustic monitoring**
    - a. Bats make several sounds ranging from audible sounds to ultrasounds (the sound that our human ears cannot detect). Notably different species of bats can be identified based on the ultrasound they make (i.e., "voice-print" similar to human fingerprint). But this requires an ultrasound detector to gather sound data and analyse it. Bat monitoring agents will be trained on the use of ultrasound detectors for recording bat sounds.
5. **Bat-human interaction**
    - a. Bats and humans live in the same ecosystem where interactions between the two are inevitable. Interactions may be in several forms depending on the human agenda. It may range from cultural attachment to tourism purposes. Some of the bat-human interactions identified during the Participatory Assessment (PA) were but not limited to: hunting of bats for

human consumption, bushmeat trade, destruction of bats to prevent bat associated damage or nuisances, cultural attachments, sharing homes with bats, entering bat caves, etc.

Parameters to be monitored and how

1. **Bat roost identification**
    a. This will give information regarding the type of Bat roost(s). The data will be collected mainly through: Direct observation, opportunistic encounters and purposeful searches or surveys. A given place will be identified as a bat roost based on the fact that it hosts bats for a considerable amount of time during the year (both seasonal or permanent). The parameters to be recorded at any identified bat roost would include but not limited to following:
        i. Type of roost (as described above)
        ii. Location of the roost (GPS Coordinates and Place name (village, parish, sub county)
        iii. Presence of bats (whether permanent or seasonal) i.e. Are Bats seen here all-year round or are they seen in some seasons?
        iv. Types of bats in the roost (Either megabats or microbats as described above)
        v. Population estimates of bats in the roost. This could be based on the following general abundance estimates classes:
            1. < 5 individuals
            2. >5<15 individuals
            3. >15<100 individuals
            4. >100<500 individuals
            5. >500<1000 individuals, and
            6. >1000 individuals
        vi. Accessibility of roost to humans (YES or NO)
2. **Bat sounds (Acoustic surveillance) monitoring**

    NOTE: Analysis of Bat calls is highly technical and so it will require the technical expertise of bat ecologists.

    The main focus in acoustic surveillance will be echolocation call recording (ultrasound detection from free flying bats or roosting bats). The bat call data will be analysed using **Kaleidoscope Pro software** on a computer to generate bat sonograms. The bat sonograms will be used to classify and identify bats to the species or at least up to genus level. Based on the number of bat passes per minute (Bpm), we can also estimate and monitor the population of insectivorous bats at a given site. Fruit bats cannot be studied by these methods as they do not echolocate and so do not produce ultrasound. The purpose of this is also to augment data from direct counts at known monitoring site bat roosts.

The instruments to be used in collecting bat calls will be mainly Echo Meter Touch Bat Detectors (Wildlife Acoustics, USA) fitted onto either Android or iPhone devices. Other instruments will include SM4 Bat detectors (Wildlife Acoustics, USA), and these will be mounted at sentinel sites to programmatically record bat calls at selected- intervals.

An echo-meter touch device will be connected to a phone of each monitoring agent. The agents will visit specific known bat monitoring sites (House roost, cave roost, open environment, foraging ground, etc.) to record bat calls. Recording would preferably be done in the evening times when the bats are emerging for night activity (18:30 Hr to 20:30Hrs). For each recording activity, we suggest a duration of 1hr, with episodes of 5-minutes continuous recording after every 1-minute break interval. The purpose of this is to avoid recording very heavy sound files which might be difficult to process during the analysis.

However, for special roost types such as caves, one may still enter the cave during the day (when bats are resting) to record bat sounds for a duration of one hour as described above. For all known established bat roosts or sentinel sites under monitoring, the suggested frequency of recording would be 2 times a month. These would include the first and third week of the month.

The key data elements during acoustic monitoring would be:

i. Location of sentinel site (X and Y coordinates/GPS location)
ii. Duration of recording (hours, start time, end time)
iii. Date and time of day
iv. Name of data collector
v. Type of recorder
vi. Etc

3. **Bat population monitoring and abundance estimates**

The main focus in bat population monitoring are the variations in species and their population sizes or abundances at selected sentinel sites. For a site to be selected as a sentinel site for population monitoring, we propose that it should:

i. Contain bats
ii. Either temporary, seasonal or permanent roosts
iii. Have a consistent population greater than five bats individuals (n> 05). But we bear in mind the fact that some bat species do not congregate in large numbers (i.e., Some live a solitude life).
iv. If seasonal, the site should be frequented by bats during conventional seasons of the year (DRY and WET).
v. Should be accessible to humans
vi. Be an occasional/potential foraging ground (open site/open country)

For each established site for monitoring, the main method of data collection will be as follows: Monitoring agents will move to each site to collect data using a mobile device

with an ODK tool enabling direct observations, Direct Total roost counts and Tally counts**, Roost-exit counts.**

The table below shows the approaches for use at given roosts/ sentinel sites during bat population monitoring activities.

Sentinel site/Roost Type Description	Method of Counting /estimating bats	Data element (s)	Timing	Duration	Frequency
Cave Roost (Caves are permanent roosts but not found everywhere)	Total roost counts	•Bat species/ Type •Estimated Number of Bats in the roost	Any time convenient for the monitoring agent But preferably between (09:00hrs and 14:00hrs)	Variable (depending on nature of cave roost and Number of bats and or species in the roost)	Twice (02) a month (At beginning of the month and Mid-month)
	Roost-exit counts	• Bat species/ Type • Estimated Number of Bats flying out of the roost	Either early morning (06:00Hr to 07:00Hrs) or Evening time (18:00Hrs to 20:00Hrs)	Range between One to TWO hours	Two (02) times per month. (At beginning and Middle of the month)
	Acoustic surveillance	• Number of Bat passes per minute analysed from Echolocation bat call data	Either early morning (06:00Hr to 07:00Hrs) or Evening time (18:00Hrs to 20:00Hrs)	One Hour	Two (02) times per month. (At beginning and Middle of the month)
Tree Roost (Tree roots are usually for fruit bats	Total roost count	•Estimated Number of Bats at tree roost	Any time convenient for the monitoring agent But preferably between (09:00hrs and 14:00hrs)	Variable (depending on nature of tree roots and Number of bats or species at the roost)	Twice (02) a month (At beginning of the month and Mid-month)
	Roost-Exit counts	• Bat species/ Type • Estimated Number of Bats flying out of the roost	Either early morning (06:00Hr to 07:00Hrs) or Evening time (18:00Hrs to 20:00Hrs)	Range between One to TWO hours	Two (02) times per month. (At beginning and Middle of the month)
Crevice Roost (These are Crevices in rocks or walls of infrastructures were bats live).	Roost-exit counts	• Bat species/ Type • Estimated Number of Bats flying out of the roost	Either early morning (06:00Hr to 07:00Hrs) or Evening time (18:00Hrs to 20:00Hrs)	Range between One to TWO hours	Two (02) times per month. (At beginning and Middle of the month)

Sentinel site/Roost Type Description	Method of Counting /estimating bats	Data element (s)	Timing	Duration	Frequency
Humans usually cannot enter these	Acoustic surveillance	• Number of Bat passes per minute analysed from Echolocation bat call data	Either early morning (06:00Hr to 07:00Hrs) or Evening time (18:00Hrs to 20:00Hrs)	One Hour	Two (02) times per month. (At beginning and Middle of the month)
Man-Made structurer (House, Bridges, Church, school etc.) Bats here would be expected to hang in the Roofing structures	Total roost count (for structures with normal roofs)	•Bat species/ Type •Estimated Number of Bats in the roost	Any time convenient for the monitoring agent But preferably between (09:00hrs and 14:00hrs)	Variable (depending on nature of cave roost and Number of bats and or species in the roost)	Twice (02) a month (At beginning of the month and Mid-month)
	Roost-exit counts	• Bat species/ Type • Estimated Number of Bats flying out of the roost	Either early morning (06:00Hr to 07:00Hrs) or Evening time (18:00Hrs to 20:00Hrs)	Range between One to TWO hours	Two (02) times per month. (At beginning and Middle of the month)
	Acoustic surveillance	• Number of Bat passes per minute analysed from Echolocation bat call data	Either early morning (06:00Hr to 07:00Hrs) or Evening time (18:00Hrs to 20:00Hrs)	One Hour	Two (02) times per month. (At beginning and Middle of the month)
Foraging Grounds, Places where bats go to look for food. Bats may also occasionally roost there. Eg: Cocoa gardens, Banana Plantations, Coffee gardens or Bush land	Tally counts	• The number of Bats observed flying(foraging) at a given site. • Type/ species of bats encountered	Either early morning (06:00Hr to 07:00Hrs) or Evening time (18:00Hrs to 20:00Hrs)	One hour	Two (02) times per month. (At beginning and Middle of the month)
	Acoustic surveillance	• Number of Bat passes per minute analysed from Echolocation bat call data	Either early morning (06:00Hr to 07:00Hrs) or Evening time (18:00Hrs to 20:00Hrs)	One Hour	Twice a day (morning and Evening) two times a month (At beginning and Middle of the month)

DESCRIPTION OF BAT COUNTING METHODS

Total roost counts: This will entail a monitoring agent going at a monitoring site and directly counts the different individuals and species (types) of bats they can see at a given time. After counting, the monitoring agent will give a rough estimate of the species or abundance (population size) of the bats. The population estimate given by the monitoring agent may be based on the classes described in section 5(i) above.

Roost-exit counts: This method entails counting individual bats either ENTERING or EXITING a given roost site at a given time. The monitoring agent would be expected to synchronize the counting with either the diurnal exit time or entry time of the bats in their roosts.
Acoustic surveillance: This method has been described already in section 5 (ii) above. The monitoring agent would only need to be consistent with the monitoring schedule chosen.

Bat species

There are several bat species (types) expected within the Bundibugyo area. These are also known by different local names according to the local communities. The main method of identifying any species by the monitoring agent would be through direct observation (i.e., visual means). Upon clear observation, the monitoring agent will record the bat species as either a Mega bat (fruit bat) or Micro bat (Insectivorous bat) using the local names. Additionally, the monitoring agent will go ahead to record other elementary parameters such as the Colour and size. The example of the data element is demonstrated in the table below:

Species Name / Bat Type	Size	Colour
Kerribo/akakorokombe (Insectivorous bat/ Micro bat)	Small	Black, Dark Grey, Brown, Orange,
Omulima (Fruit bat/ Mega bat)	Big	Brown or Black

Opportunistic Bat roost discovery

This will entail the discovery of new bat roosts as and when the monitoring agents or community members come across them. For any identified new roost, the agent or community member shall determine which type of roost it is (For example: Cave roost, Tree roots, House Roost, Crevice, etc.). Other data shall include: Bat species found in the new roost, Location of new roost (GPS + administrative unit), Date of roost discovery, etc.

SUPERVISION OF THE MONITORING PROCESS

Overall, the establishment and operations of the bat monitoring program will be overseen by the One Health-Design Research and Mentorship Working Groups (OH-DReaM). Field activities at the district level will be supervised by the Bundibugyo district team comprised of the District Veterinary Officer, the District Health Officer, the District Surveillance Focal person and at the subcounty level by respective Parish Chiefs. The monitoring agents will be directly supervised by Parish Chief's and community-selected non-government supervisors.

DATA ANALYSIS, REPORTING AND UTILIZATION

Data collected using ODK by mobile devices will be downloaded and analyzed by the participatory surveillance team guided by the OH-DReaM team on a monthly basis. A report will be generated to show the number of new roosts discovered during the reporting period, trends in the number of bats at the sentinel monitoring sites, bat-human interactions observed during the reporting period, likely disease spillovers/early warning events detected during the reporting period (indicated by dead bats, reduction in the number of bats in a roost). Furthermore, to aid observation of this data in real-time, a computer-based dashboard will be designed by the project and this will have the capacity to expand into a nationwide bat monitoring dashboard. For the identification of bat species using bat sound recorders, this data will be analyzed on a monthly basis by bat ecologists on the project and bat species observed for that period identified and recorded.

The information gathered in establishing the bat monitoring activity indicates that aspects of the monitoring data will shed light on constraints and opportunities that might hinder or enable the implementation of Social behavioural Change (SBC) strategies. It is expected that the monitoring program will be an important source of information to inform and might thus require mindset strategies to be incorporated in STOP Spillover risk-reduction interventions

EVALUATION OF THE PARTICIPATORY COMMUNITY BAT MONITORING PROGRAM

Evaluation of the program will be done with support from the Monitoring, Evaluation and L earning team at STOPS global. Midterm evaluation of the community bat monitoring program/framework will be conducted after 6 months of the participatory surveillance program. The purpose of the midterm evaluation will be to determine the perceived relevance of the program by the stakeholders and to identify areas for improvement so as to achieve a fully functional and relevant bat monitoring program able to support decision making. The end line evaluation will be conducted at the end of the program. This will involve qualitative interviews of different stakeholders/users, review and analysis of surveillance data to determine the perceived relevance of the program, its simplicity to use, flexibility, acceptability, sensitivity, timeliness, completeness, representativeness and predictive value positive (ability to detect likely spillover/outbreak events).

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ANNEX

ANNEX ONE: LIST OF BAT MONITORING AGENTS

Sub county	Name:	contact	Parish	villages
Harugale Sub County	Masika Justin	0786427942	Bumate	Bimara Village; Bimara Full Gospel Church
	Mbusa Daniel	0789147319	Kihoko	Ngugho Village, Ngugho stone cave
	Mercy Orine	0777538177	Bupomboli	Kihoko II Village; S/C HQ & Kathengu's home
	Masereka Lugard	0778524652	kasulenge	Kasulenge II; Nyalulu stone cave
	Bwambale Josam	0787500507	Kitsolima	Kalhalhu Village; kalhalhu stone cave
Ntandi Town Council	Mbambu Yones	0782283017	Kahumbu	Isura II, kahumbu, Nyambowe, karongoti and Nkisya villages
	Asiimwe Gloria	0774985883	Mpulya	Mpulya I, II and III; Mpulya Central and Mpulya west cells
	Sekalombi Alex	0770863976	Bundimasoli	Bundimasoli central, Bundimasoli, Bundimasoli West, Kapepe, Kabale and Kabale central Cells
	Baluku Edson	0781375732	Ntandi	Ntandi west, Ntandi east, Bumaga I and Bumaga II cells
	Muhindo Sadam	0783974809	Nyabugesera	Bitahura I, Butahura II, Nyabugesera & Kapangu cells
Burondo Sub county	Muhindo Nyahoma Joram	0773086545	Burondo	Kinyambogo
	Thembo Edson	0785735878	Karambi	Karambi I and Kinyanjojo
	Sekalombi David	0785428419	Sempaya	Kinoni III
	Muzima Juliet	0776121712	Karambi	Burangapasi II
	Masika Ellen	0762599548	Burondo	Burondo Central

ANNEX TWO: BAT-HUMAN INTERACTION DATA CAPTURE TOOL FOR MONITORING AGENTS

1. **Name of Data collector:……**
2. **Date & Time of data collection:……..**
3. **Subcounty**
   - ☐ Harugale Subcounty
   - ☐ Burondo Subcounty
   - ☐ Ntandi Town Council
4. **Parish:……..**
5. **Village:……**
6. **GPS Location:……**
7. **Type of roost**
   - ☐ Tree
   - ☐ Cave
   - ☐ House
   - ☐ School
   - ☐ Church/mosque
   - ☐ Hospital
   - ☐ Crevice
8. **For bats in house structures, is there a ceiling?**
   - ☐ Yes
   - ☐ No
   - ☐ Not applicable
9. **For bats in house structures, what bat excreta do you commonly encounter? (Multiple answers)**
   - ☐ Fecal matter
   - ☐ Urine
   - ☐ Both

☐ Not applicable

10. What is the average number of people accessing the roost per month?

☐ *< 5 individuals*

☐ *6-15 individuals*

☐ *>15 individuals*

11. Type of bat seen (local name) (Multiple answers)

☐ Emilima (Big bats)

☐ Keribo/Kakolokombe (small bats)

☐ Both types

12. Number of bats seen

Emilima	*Keribo/Kakolokombe*
< 5 individuals	*< 5 individuals*
>5<15 individuals	*>5<15 individuals*
>15<100 individuals	*>15<100 individuals*
>100<500 individuals	*>100<500 individuals*
>500<1000 individuals, and	
>1000 individuals	

13. Colour of the bat (Multiple answers)

☐ Black

☐ Brown

☐ Grey

☐ Unknown

14. Bat Activity (i.e., what are the bats doing?) (Multiple answers)

☐ Resting

☐ Sleeping

☐ Grooming/socializing

☐ Flying

15. Proximity to human settlement (i.e., location of the roost in relation to human settlement)

☐ Inside building

- [ ] Garden
- [ ] Compound
- [ ] Cave/tourist site

16. Number of dead bats seen

- [ ] *0 individuals*
- [ ] *1-5 individuals*
- [ ] *6-10 individuals*
- [ ] *>10individuals*