

# Importance of Entomology in Public Health

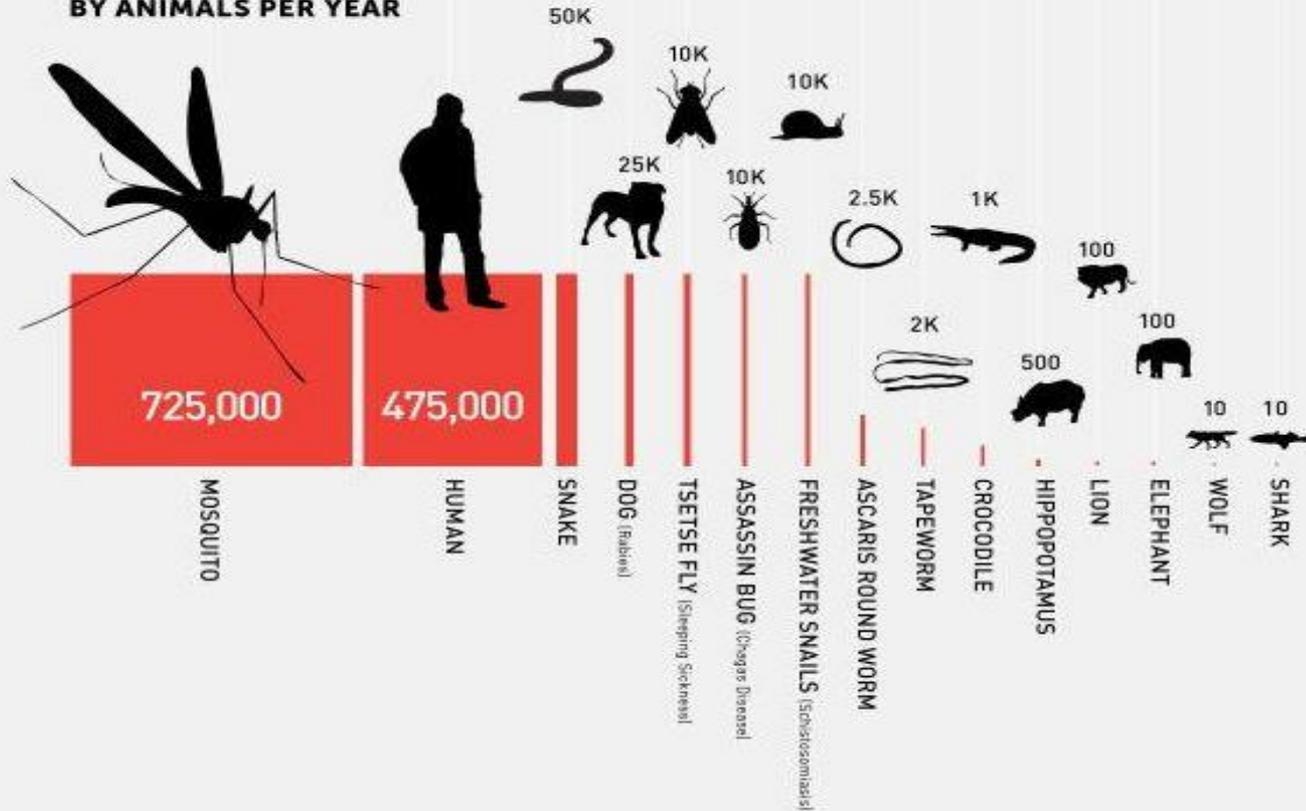


What is the world's most dangerous  
animal?

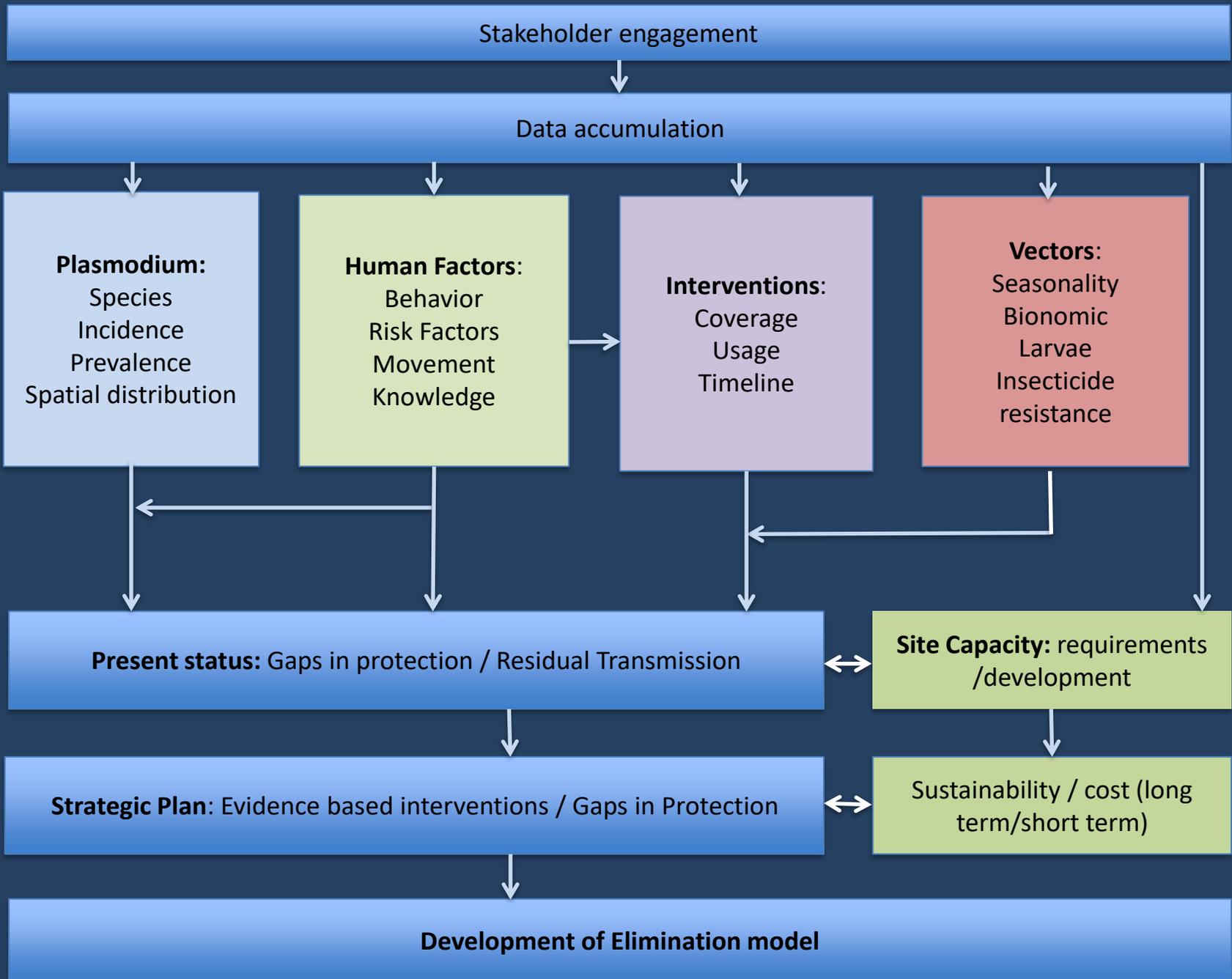
# WORLD'S DEADLIEST ANIMALS

NUMBER OF PEOPLE KILLED BY ANIMALS PER YEAR

**MOSQUITO WEEK**  
on gatesnotes.com



SOURCES: WHO, crocodile-attack.info; Kasturiratne et al. [doi.org/10.1371/journal.pmed.0050218](https://doi.org/10.1371/journal.pmed.0050218); FAO [webcitation.org/7AGp5R5WQ](http://webcitation.org/7AGp5R5WQ); Lobetti et al. [webcitation.org/4ORL70BU0](http://webcitation.org/4ORL70BU0); Packer et al. [doi.org/10.1038/2F43e927x](https://doi.org/10.1038/2F43e927x); Alessandro Di Maddalena. All calculations have wide error margins.



Stakeholder engagement

Data accumulation

**Plasmodium:**

Species  
Incidence  
Prevalence  
Spatial distribution

**Human Factors:**

Behavior  
Risk Factors  
Movement  
Knowledge

**Interventions:**

Coverage  
Usage  
Timeline

**Vectors:**

Seasonality  
Bionomic  
Larvae  
Insecticide  
resistance

**Present status:** Gaps in protection / Residual Transmission

**Site Capacity:** requirements /development

**Strategic Plan:** Evidence based interventions / Gaps in Protection

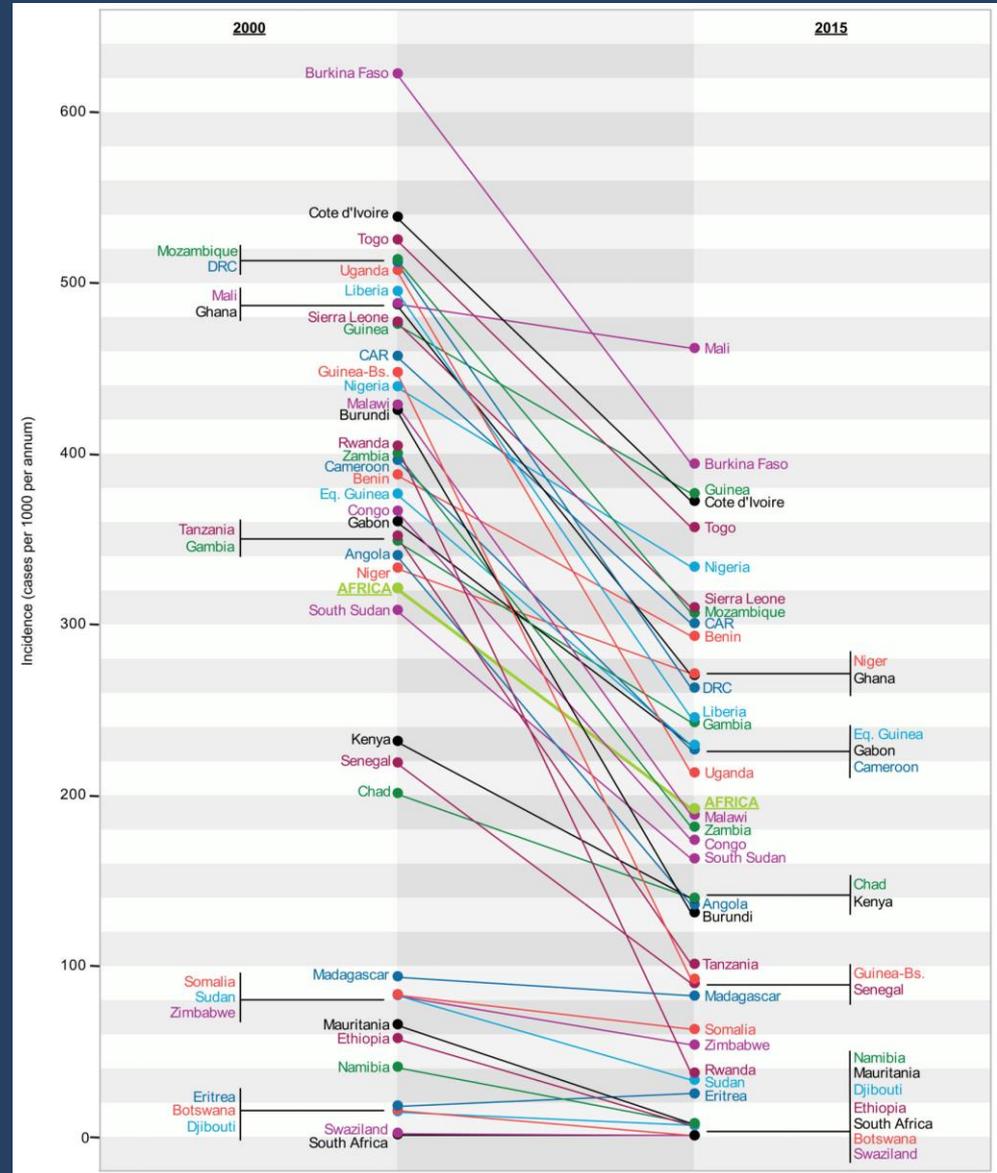
Sustainability / cost (long term/short term)

**Development of Elimination model**

# Why are vector interventions so successful?

The effect of malaria control on *Plasmodium falciparum* in Africa between 2000 and 2015. Bhatt et. al. Nature. 2015 October 8; 526(7572): 207–211.

We estimate that interventions have averted 663 (542–753 credible interval) million clinical cases since 2000. Insecticide-treated nets, the most widespread intervention, were by far the largest contributor (68% of cases averted).



# Why are vector interventions so successful?

## Mosquito age and malaria

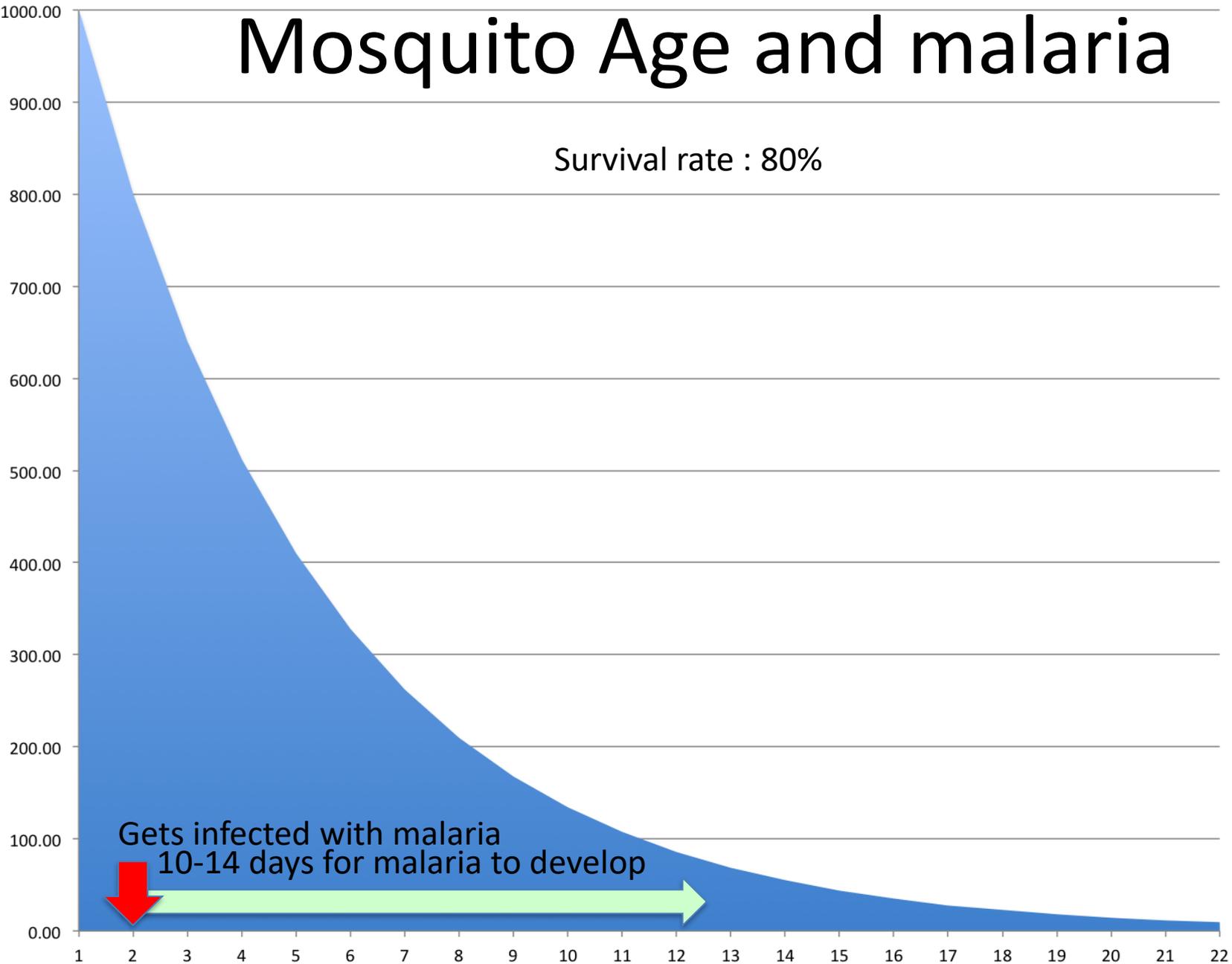
- Survival rate of mosquito : 77 - 84% every day
- Plasmodium takes 10-14 days to mature in mosquito
- Mosquito is infectious to humans **only** 10-14 day **AFTER** biting an infected human
- So **OLD** mosquitoes are more dangerous

# Mosquito Age and malaria

Survival rate : 80%

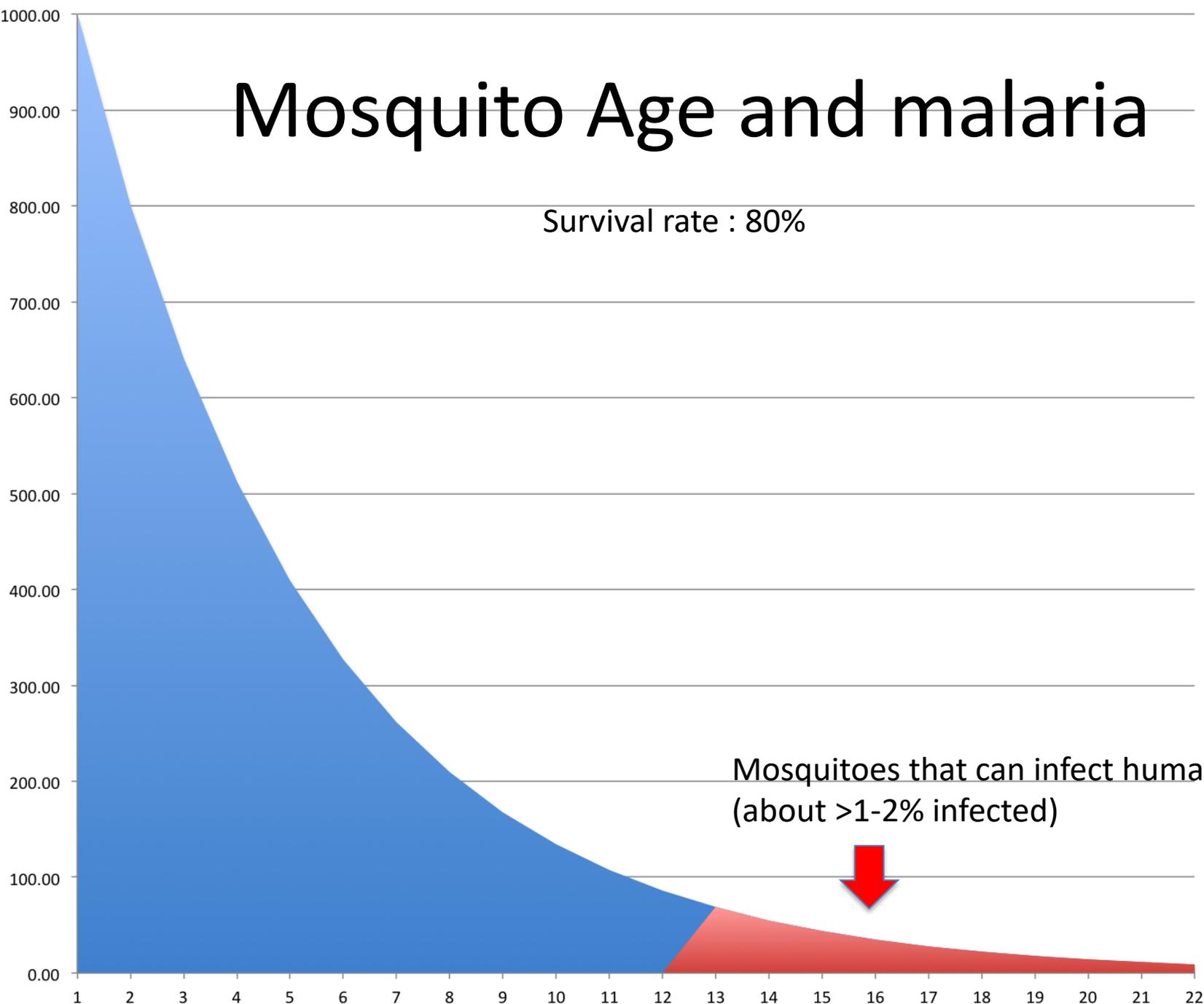
■ Survival rate(.8)

Gets infected with malaria  
10-14 days for malaria to develop



# Mosquito Age and malaria

Survival rate : 80%



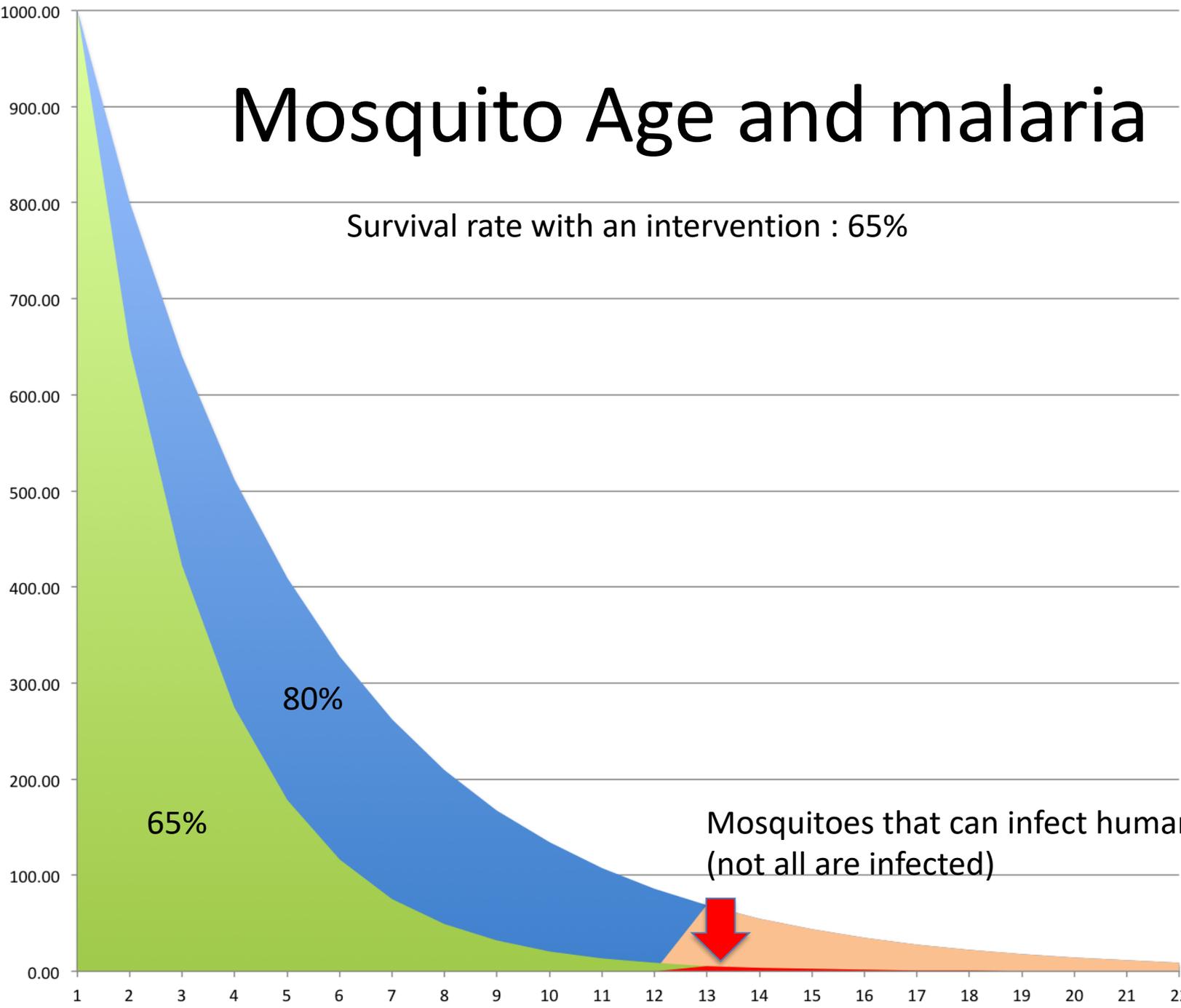
Survival rate(.8)  
Infectious

Mosquitoes that can infect humans  
(about >1-2% infected)



# Mosquito Age and malaria

Survival rate with an intervention : 65%



- Survival rate(.8)
- Infectious
- Survival rate (.65)
- Infectious

80%

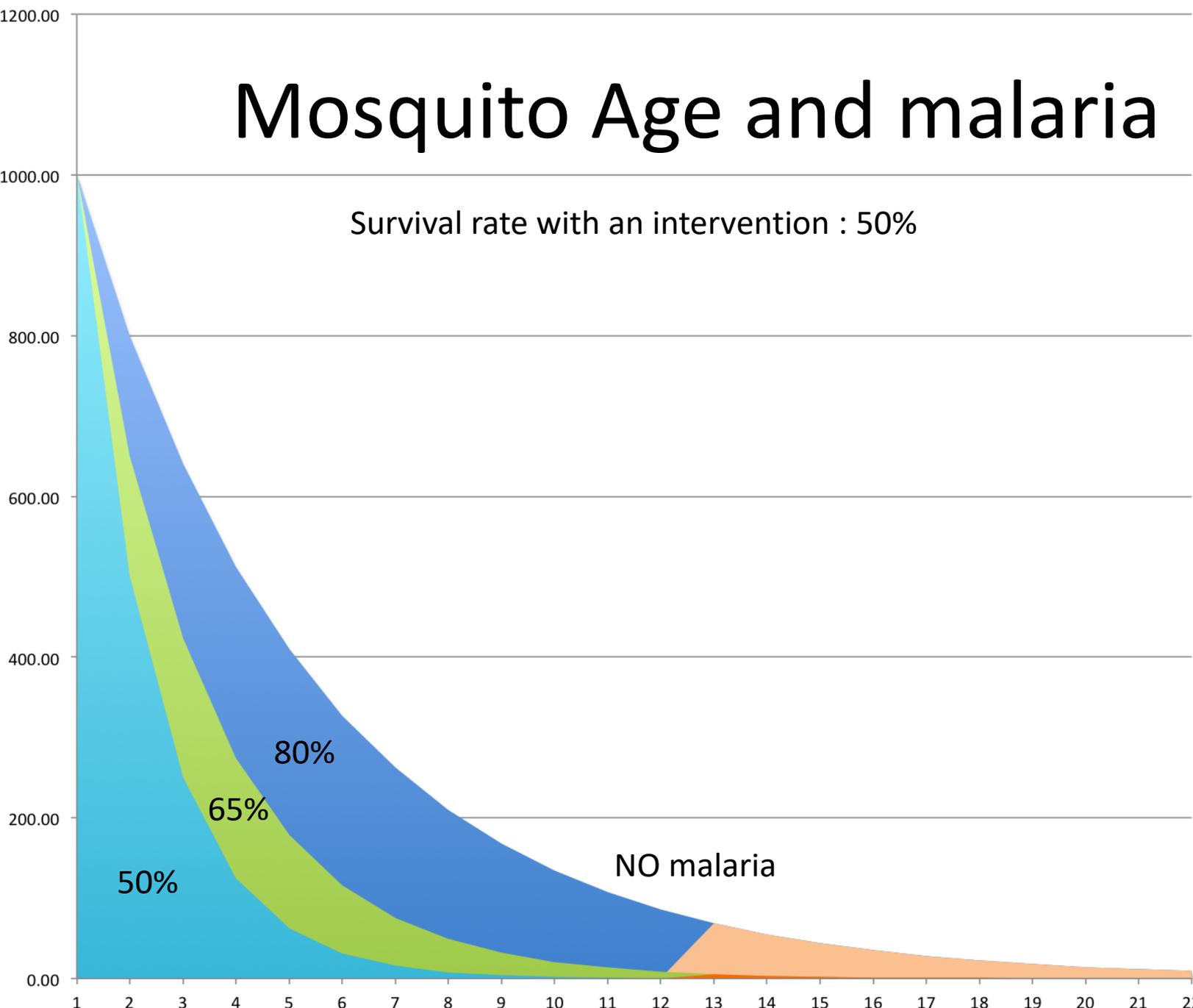
65%

Mosquitoes that can infect humans  
(not all are infected)



# Mosquito Age and malaria

Survival rate with an intervention : 50%



- Survival rate(.8)
- Infectious
- Survival rate (.65)
- Infectious
- Survival rate (0.5)

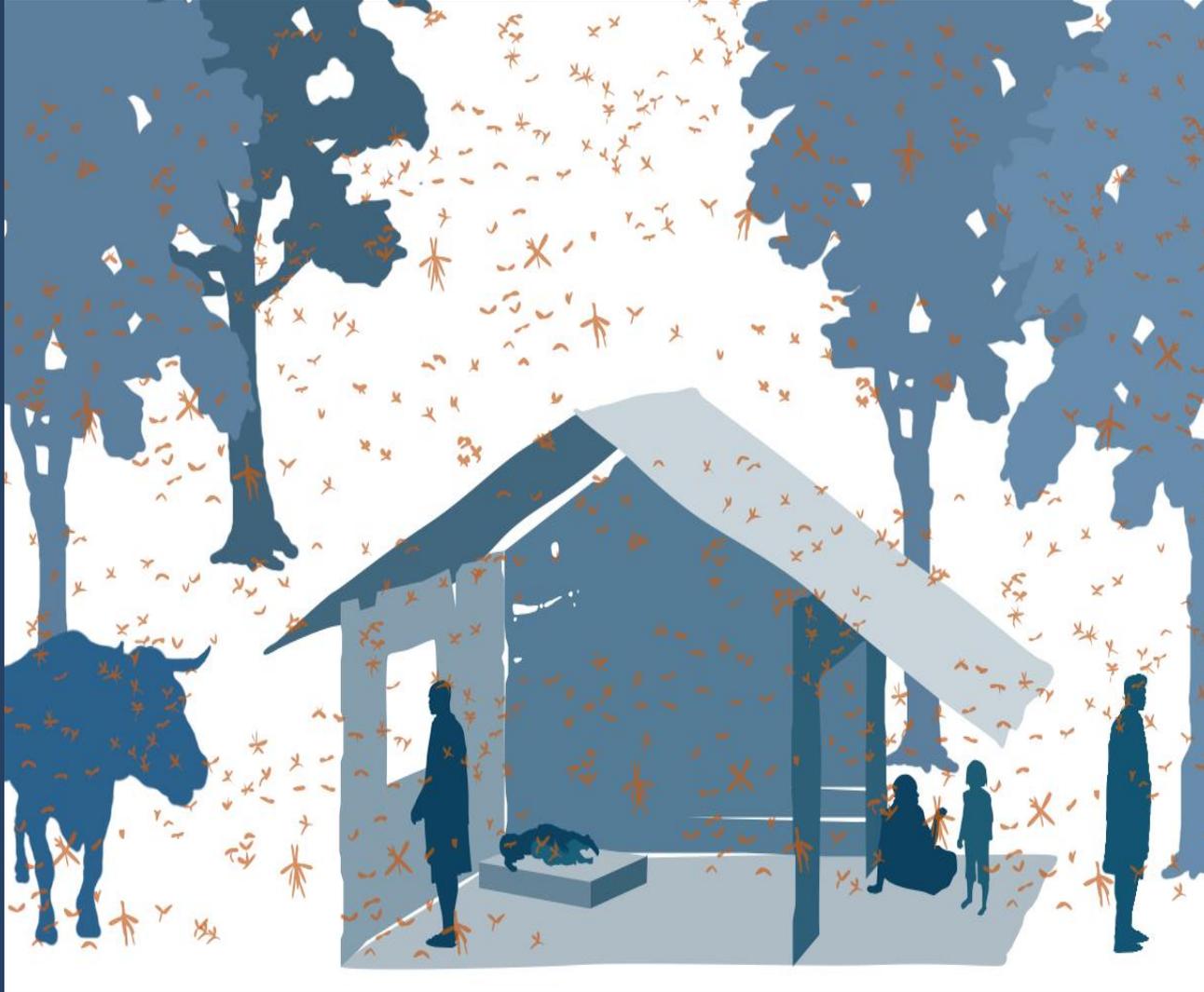
80%

65%

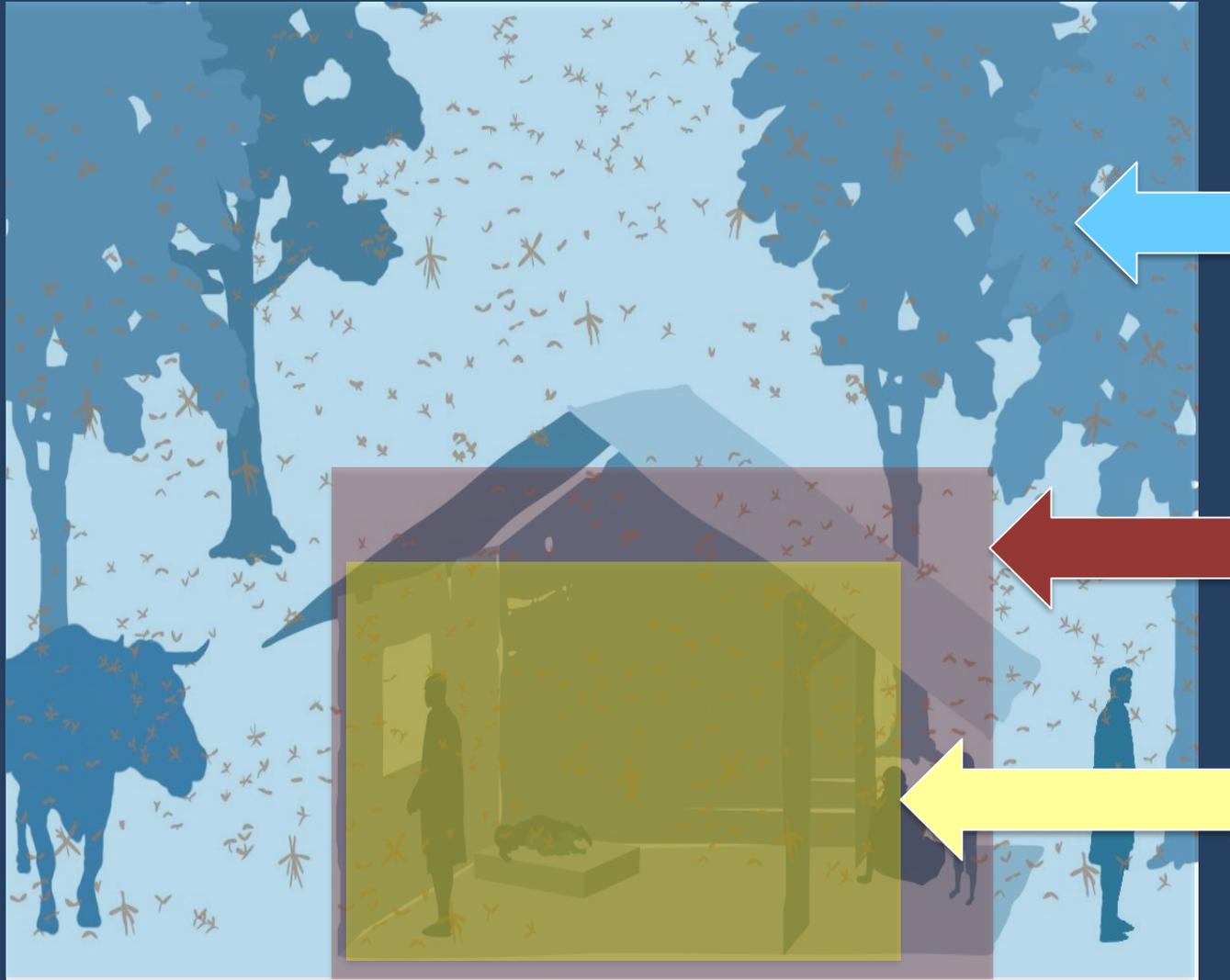
50%

NO malaria

# Mosquito behaviors and interventions



# Mosquito behaviors and interventions



Species 1  
(feeds  
outside)

Species 2  
(feeds both  
inside and  
outside)

Species 3  
(feeds  
inside)

Interventions take advantage of  
**susceptible** mosquito behaviors



Bed Nets (LLINs)

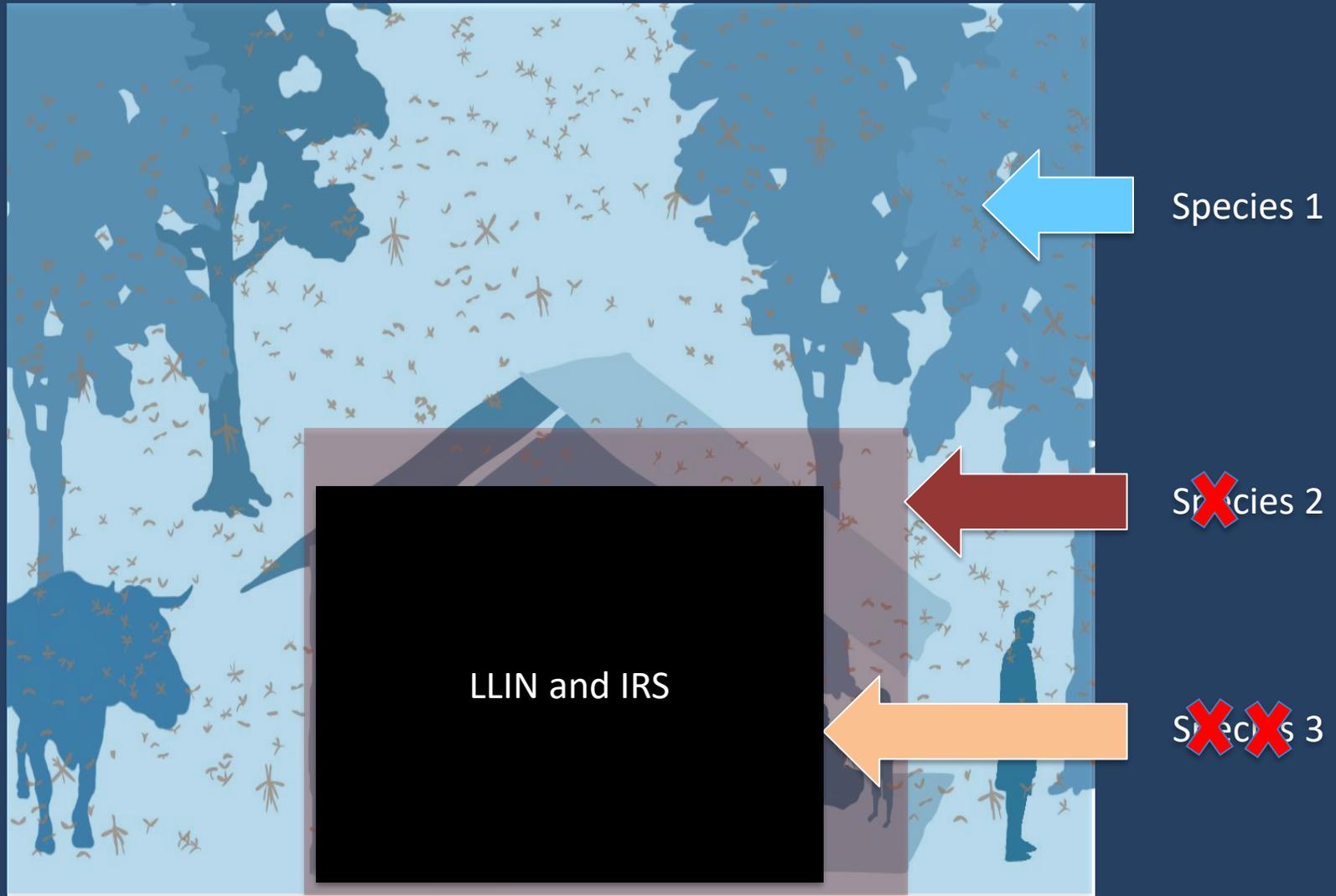
Human and indoor biting mosquitoes



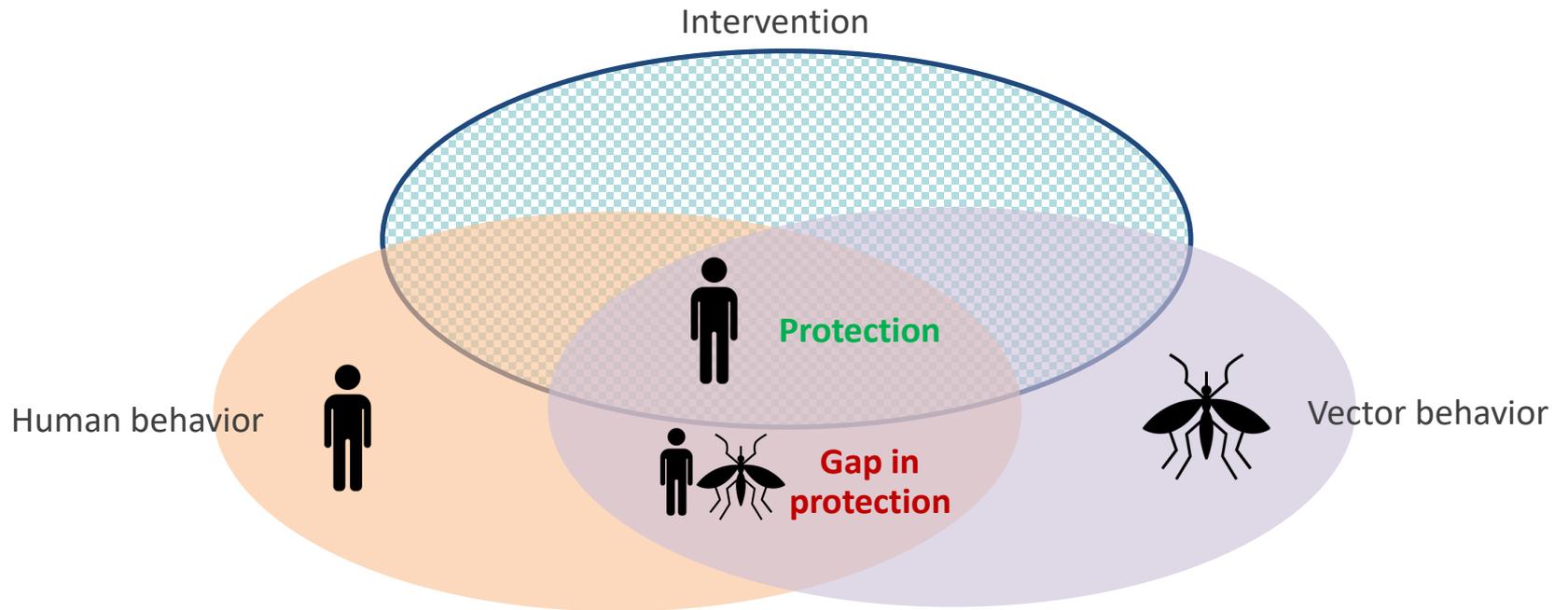
Indoor Residual Spraying

Indoor resting mosquitoes

Effective interventions **ONLY** effect vectors with susceptible behaviors



# Gaps in protection



# Importance of Entomological Surveillance

Entomological surveillance is crucial for VBDC programs

- Drivers of transmission
  - Vectors
  - Populations
  - behaviors
  - seasonality
- The potential of an intervention
- How well the intervention works
- How to optimize the intervention
- Where the intervention is NOT working (gaps in protection)
- Spaces and times where we need more interventions
- Residual transmission
- Monitors changes – responses required



- 240 million cases / year



- 627,000 deaths/year





Before DDT, malariologists were trained to be **problem solvers**; after DDT malariologists were trained to be **solution implementers**.

-José Najera, former WHO epidemiologist