

# Building **O**ut **V**ector-borne diseases in sub-Saharan **A**frica

Prof Steve Lindsay

Multi-sectoral working group

Roll Back Malaria, Geneva, 6<sup>th</sup> Feb 2020

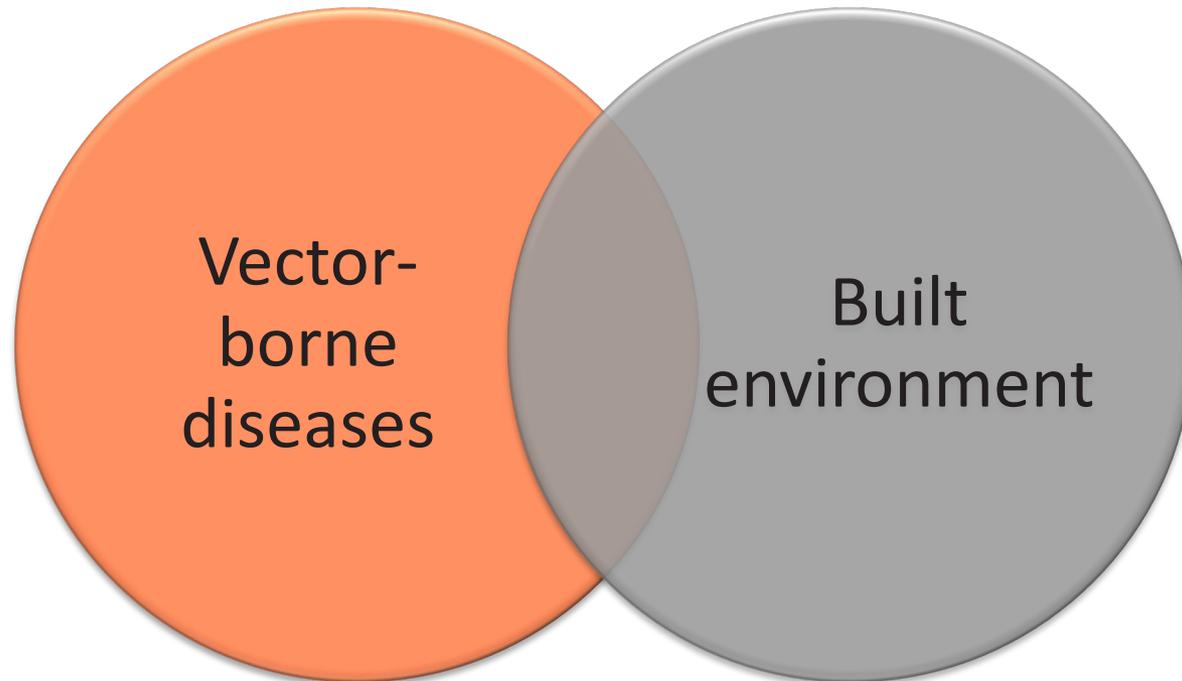
# Introduction

- What's BOVA?
- The threat of vector-borne diseases in sub-Saharan Africa
- Importance of working with those in the built environment

What does BOVA do?

# What is the BOVA Network?

- Interdisciplinary network of researchers and practitioners working on insect-borne diseases and the built environment
- Aims to establish a new research discipline



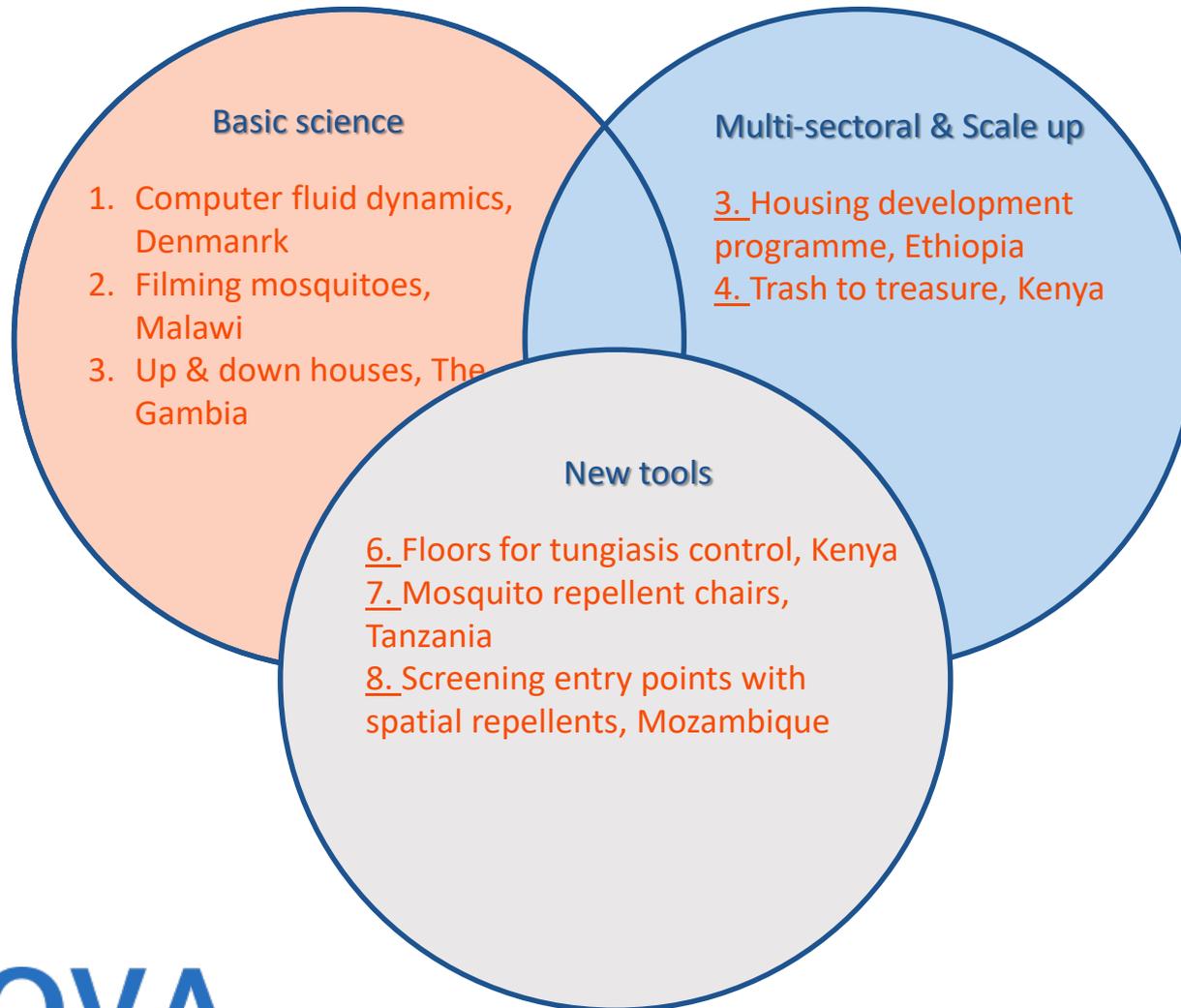
# What BOVA has achieved

- Our Network of 461 members
- Eight pump-priming projects
- Seven grant writing workshops
- Continuing advocacy and contributions to high level reports and policy documents
- Publications
- Simple messages: what can be done now

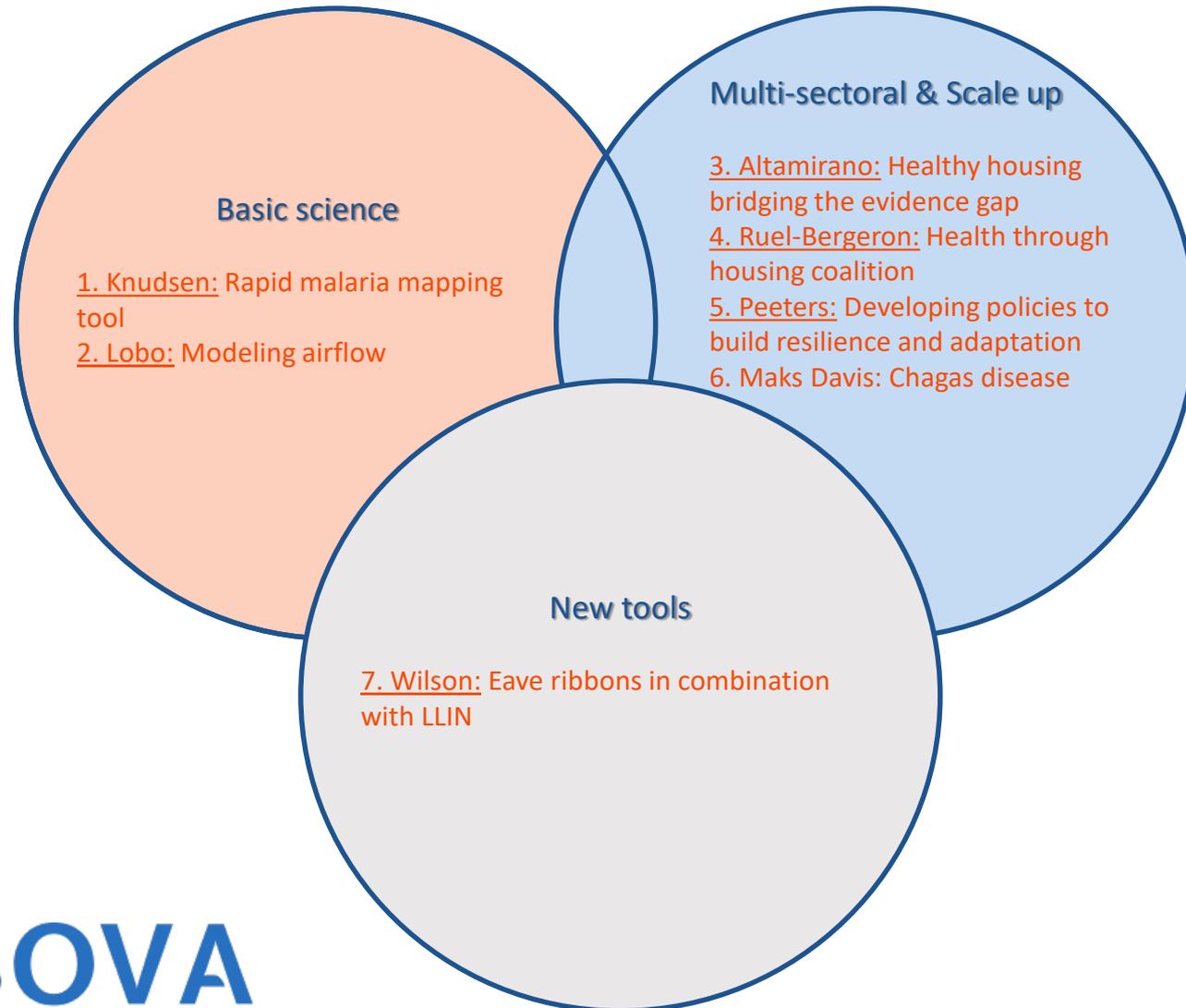
# BOVA Global Membership



# Eight pump-priming projects



# Seven grant writing workshops



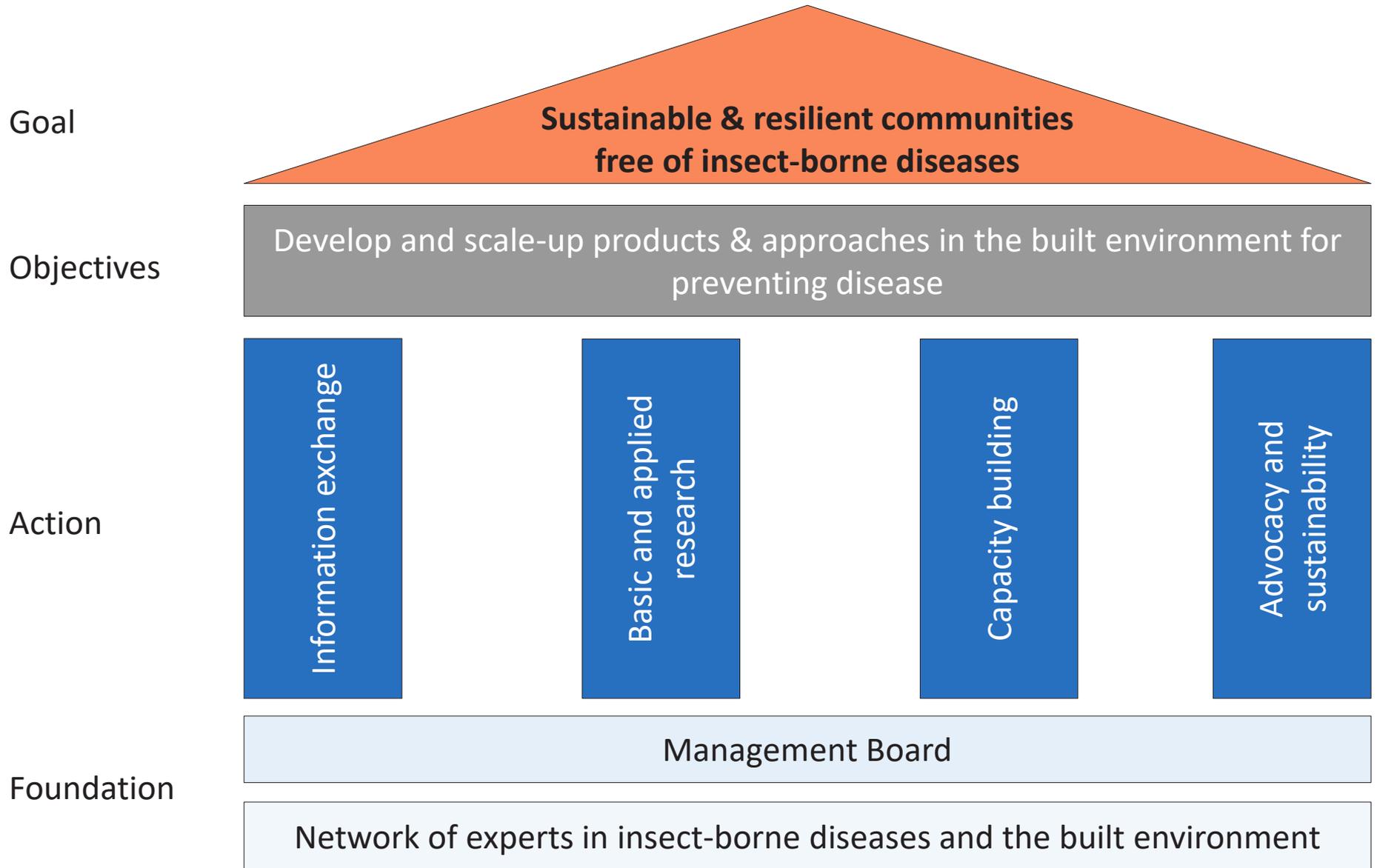
# Publications

- Jatta, E., Jawara, M., Bradley, J., Jeffries, D., Kandeh, B., Knudsen, J.K., Wilson, A.L., Pinder, M., D'Alessandro, U. & Lindsay, S.W. (2018). How house design affects malaria mosquito density, temperature, and relative humidity: an experimental study in The Gambia. *Lancet Planetary Health*, 2, e498-508.
- Rek, J.C., Alegana, V., Arinaitwe, E., Cameron, E., Kanya, M.R., Katureebe, A., Lindsay, S.W., Kilama, M., Staedke, S.G., Todd, J., Dorsey, G. & Tusting, L.S. (2018). Rapid improvements to rural Ugandan housing and their association with malaria from intense to reduced transmission: a cohort study. *Lancet Planetary Health*, 2, e83-94.
- Lindsay, S.W., Jawara, M., Mwesigwa, J., Achan, J., Bayoh M.N., Bradley, J., Kandeh, B., Kirby, M.J., Jeffries, D., Knudsen, J., Macdonald, M., Pinder, M., Tusting, L., Weiss, D.J., Wilson, A.L., D'Alessandro, U. (2019). Reduced mosquito survival in metal-roof houses may contribute to a decline in malaria transmission in sub-Saharan Africa. *Nature Scientific Reports*, 9, 7770.
- Shenton, F.C., Addissie, A., Alabaster, G., Baziwe, D., Carrasco Tenezaca, M., Chinula, D., Jatta, E., Jawara, M., Jones, R., Knudsen, J., Krystosik, A.R., McCann, R., Murima, N., Mutuku, F., Nguela, R.L., Nieto Sanchez, C., Nix, E., Okumu, F., Ruel-Bergeron, S., Spitzen, J., Tusting, L.S., Wilson, A.L., Wood, H., Zahouli, J.Z.B., Davies, M., Lindsay, S. W. (2019). Research agenda for preventing mosquito-transmitted diseases through improving the built environment in sub-Saharan Africa. *Cities and Health*. 2374-8834.
- Tusting, L.S., Bisanzio, D., Alabaster, G., Cameron, E., Cibulskis, R., Davies, M., Flaxman, S., Gibson, H., Knudsen, J., Mbogo, C., Okumu, F., von Seidlein, L., Weiss, D.J., Lindsay, S.W., Gething, P.W. & Bhatt, S. (2019). Mapping changes in housing in sub-Saharan Africa from 2000 to 2015. *Nature*. 568, 391-394.
- von Seidlein, L., Woods, H., Brittain, O.S., Tusting, L., Bednarz, A., Mshamu, S., Kahabuka, C., Deen, J.L., Bell, D., Lindsay, S.W. & Knudsen, J. (2019). Knowledge gaps in the construction of rural healthy homes: a research agenda for improved low-cost housing in hot-humid Africa. *PLOS Medicine*, 6, e1002909.
- Wilson, A.L., Davies, M. & Lindsay, S.W. (2019). Revisiting an old idea: engineering against vector-borne diseases in the domestic environment. *Transactions of the Royal Society of Tropical Medicine and Hygiene*, 113, 53-55.
- Wilson, A.L., Courtenay, O., Kelly-Hope, L.A., Scott, T.W., Takken, W., Torr, S. Lindsay, S.W. (in press). The importance of vector control for the control and elimination of vector-borne diseases. *PLOS Neglected Tropical Diseases*.

# Continuing advocacy and contributions to high level reports and policy documents

- Lancet Commission on mosquitoes, viruses and cities
- International Guidelines on Urban and Territorial Planning
- WHO Health & housing?
- Working groups:
  - RBM work streams
  - Strategic Technical Advisory Group-NTDs
- International meetings:
  - Roll Back Malaria, Switzerland
  - BOVA Open Network Meeting, UN-Habitat, Kenya
  - Healthy City Design, London
  - International Conference on Urban Health, China
  - American Society of Tropical Medicine & Hygiene, USA

# BOVA Conceptual Framework



# The threat of vector-borne diseases in Africa

# The basic split



Rural/Peri-urban  
= malaria



Urban/Peri-urban  
= dengue & worse

# Malaria

- 213 million malaria cases and 380,000 deaths in Africa in 2018
- Africa accounted for 93% of global malaria cases and 94% of malaria deaths in 2018

# Diseases carried by *Aedes* mosquitoes



*Aedes aegypti*, the world's most efficient vector of viral diseases

- Dengue is world's fastest growing infectious disease.
- 390 million dengue cases each year
- Global epidemic of Zika
- Yellow fever outbreaks in Africa

# These are urban viral diseases



dengue haemorrhagic fever



Zika



yellow fever



chikungunya

# *Aedes aegypti*: the enemy within the gates

1. It is the world's most efficient vector of viruses
2. Is an invasive species
3. It breeds in human-made containers e.g. tyres, water storage jars etc.

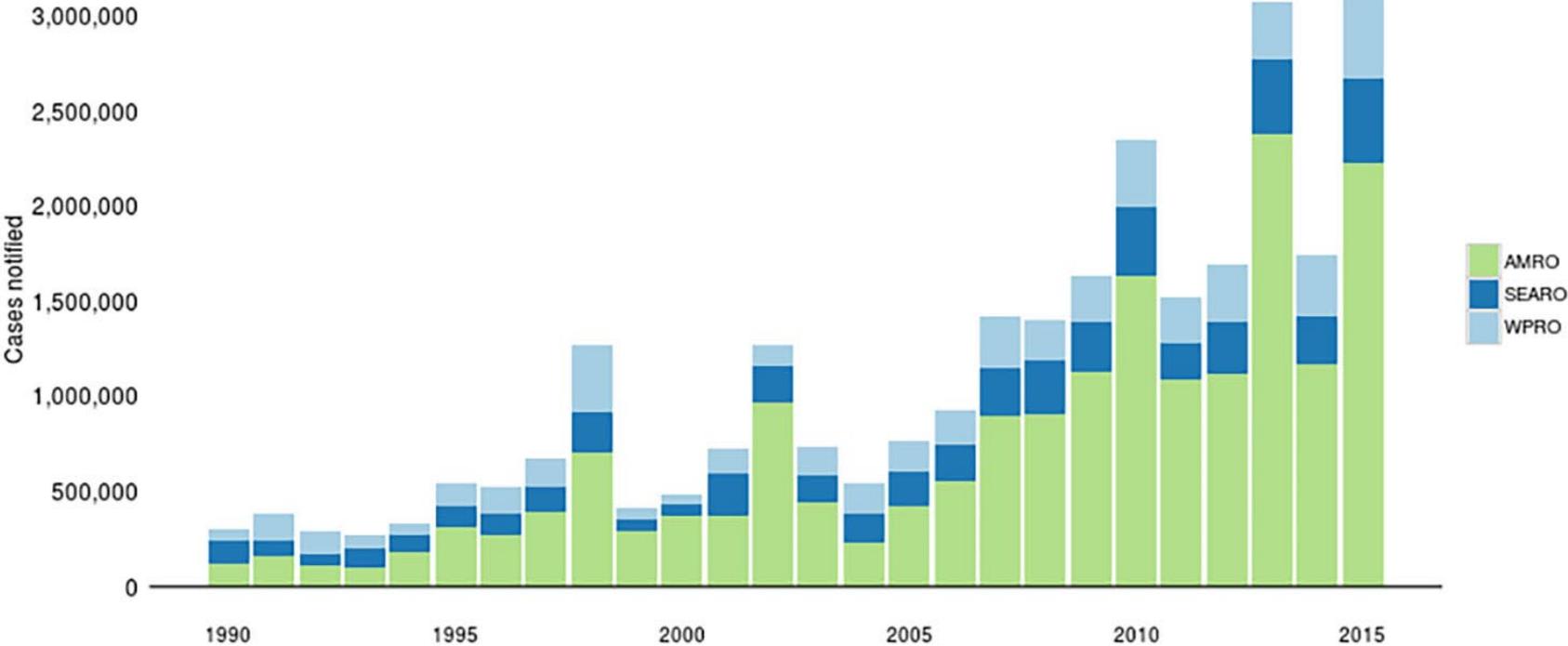


Rainforest



Urban environment

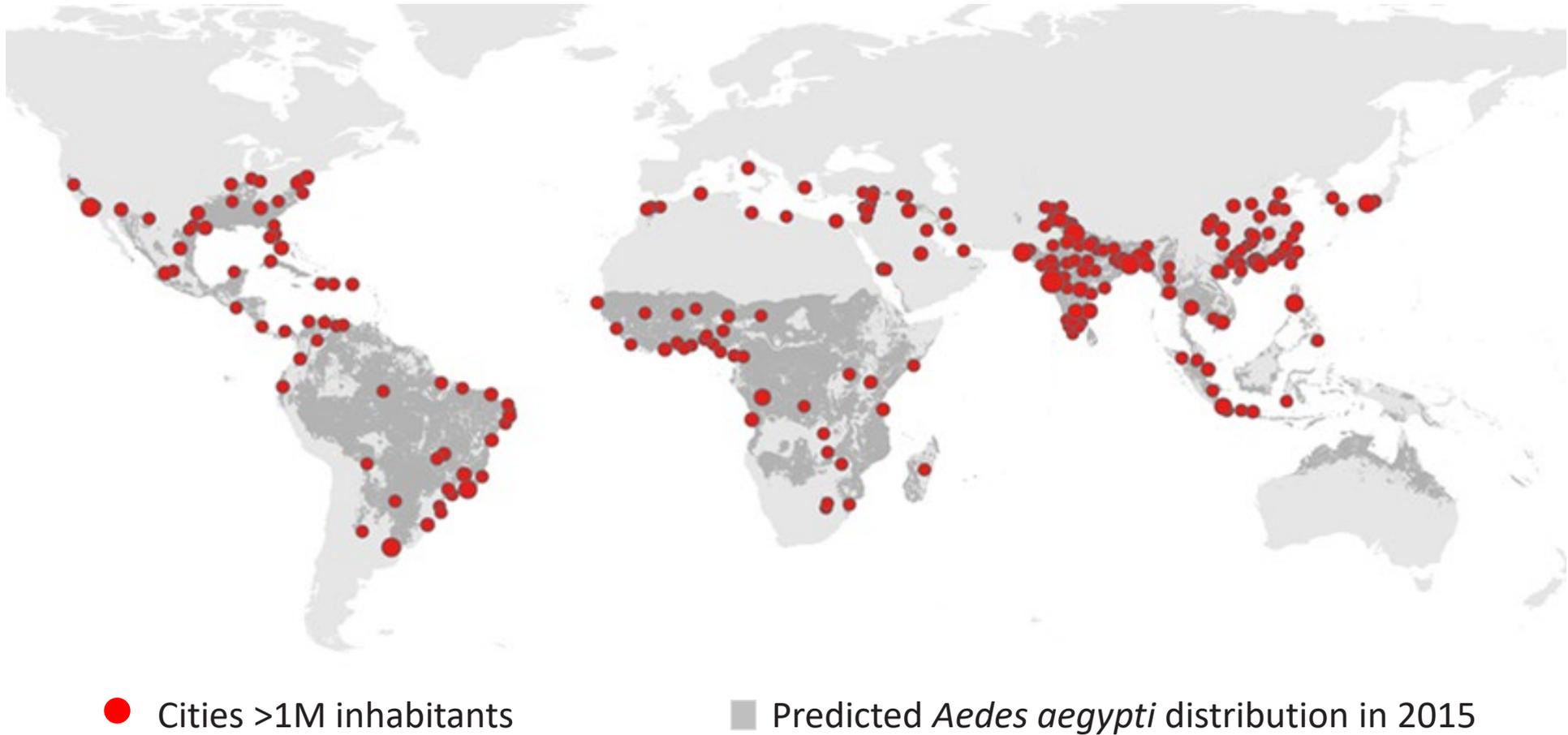
# Dengue cases reported to WHO



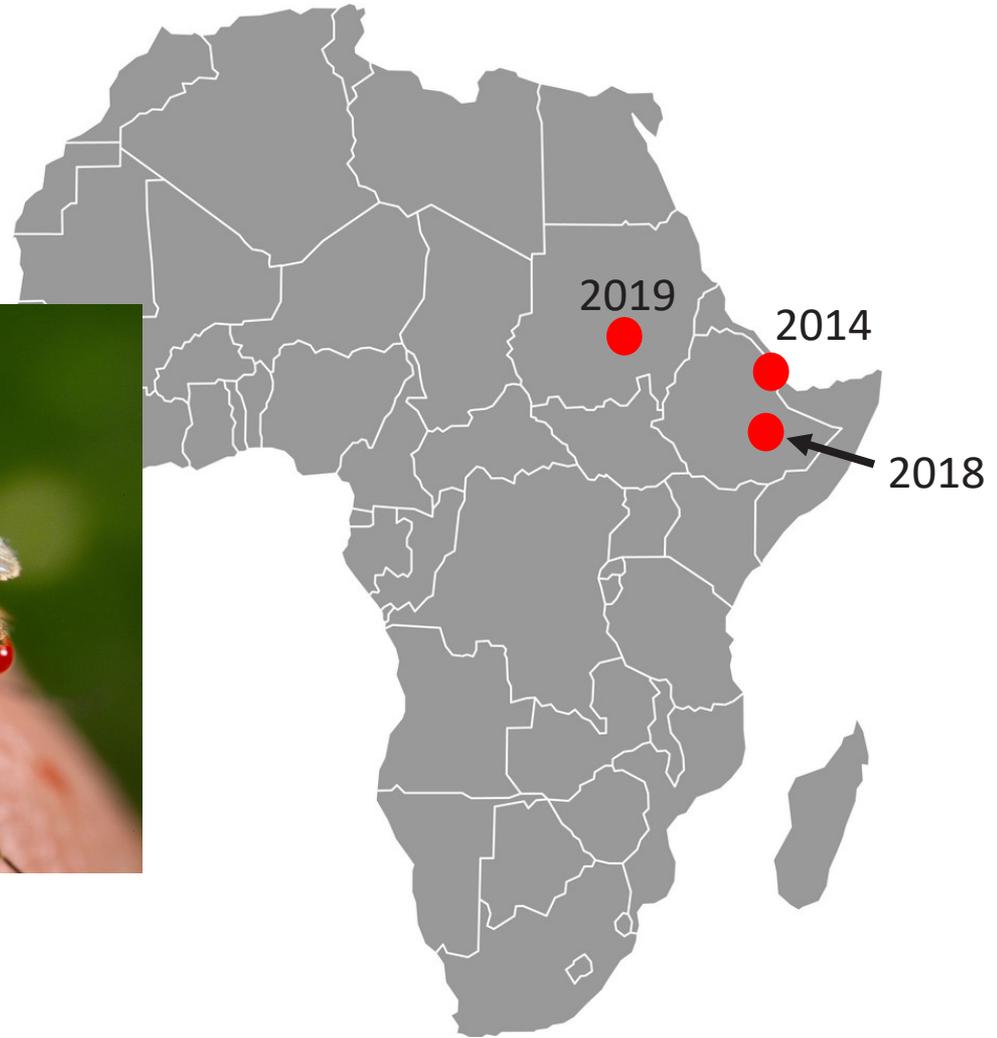
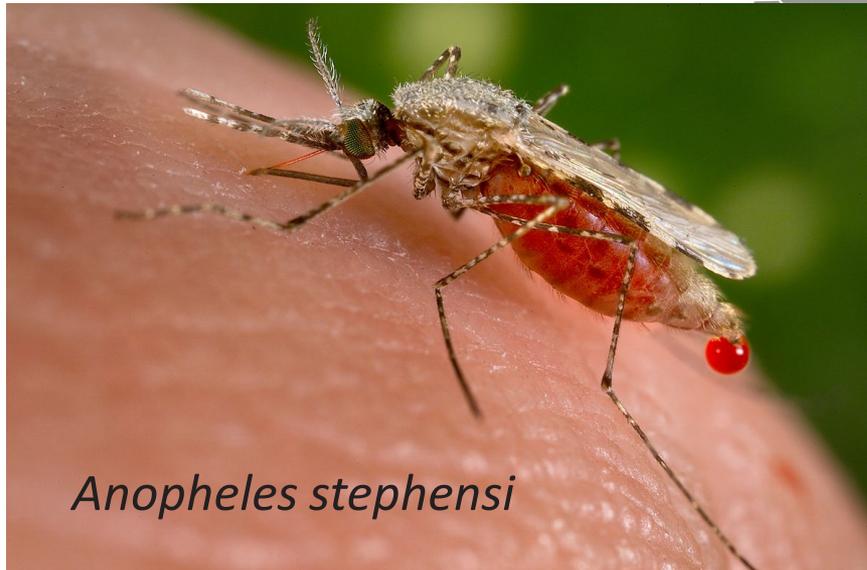
Data accessed 27.03.19



# Overlap between *Aedes* mosquito and human populations



# And for something new....



How should we control these  
diseases?

# What control methods do we currently have?

Insecticide-treated bednets



Fogging



Indoor-residual spraying



Larval source management

# Control of *Aedes*-borne diseases

- No specific treatments for diseases
- No vaccines for Zika & chikungunya, dengue vaccine is partially protective & yellow fever vaccine is in short supply
- Vector control works – but we need to do better

## Space spraying for emergency control of adult *Aedes aegypti*



# Larval source reduction



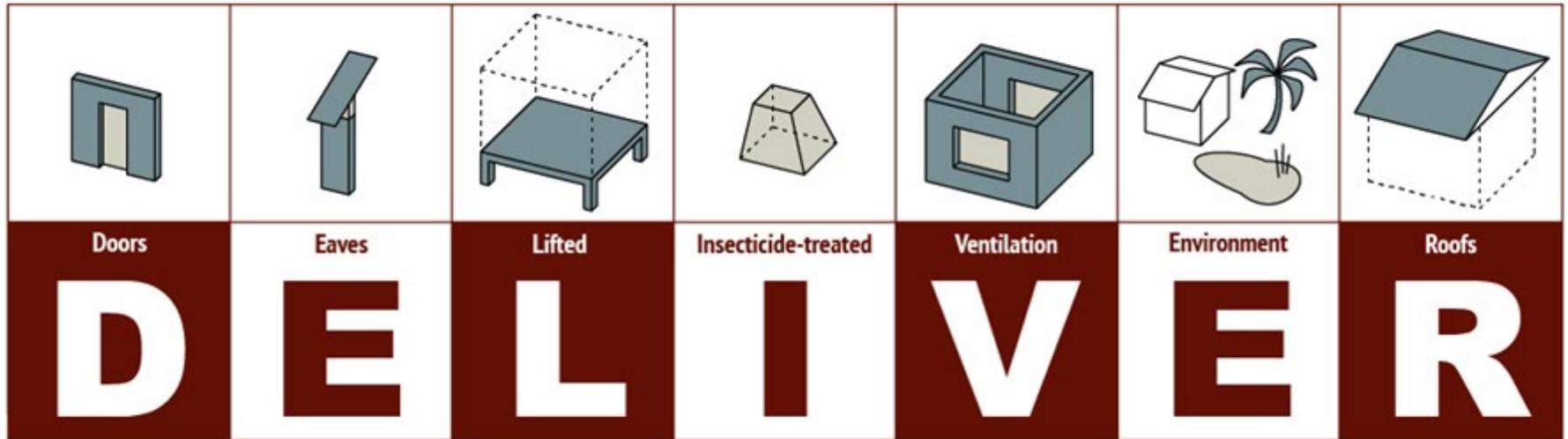
Solid waste management to remove water containers – particularly tyres

# Larval source reduction



Provision of reliable piped water to prevent water storage at home

# Home improvements for households



110 new healthy homes being built in Tanzania  
to **reduce indoor mosquito entry** (reduce respiratory & diarrhoeal  
diseases, & keep the house cool)



Pilot testing

Designed by  
Jakob Knudsen

# Or for urban areas.....

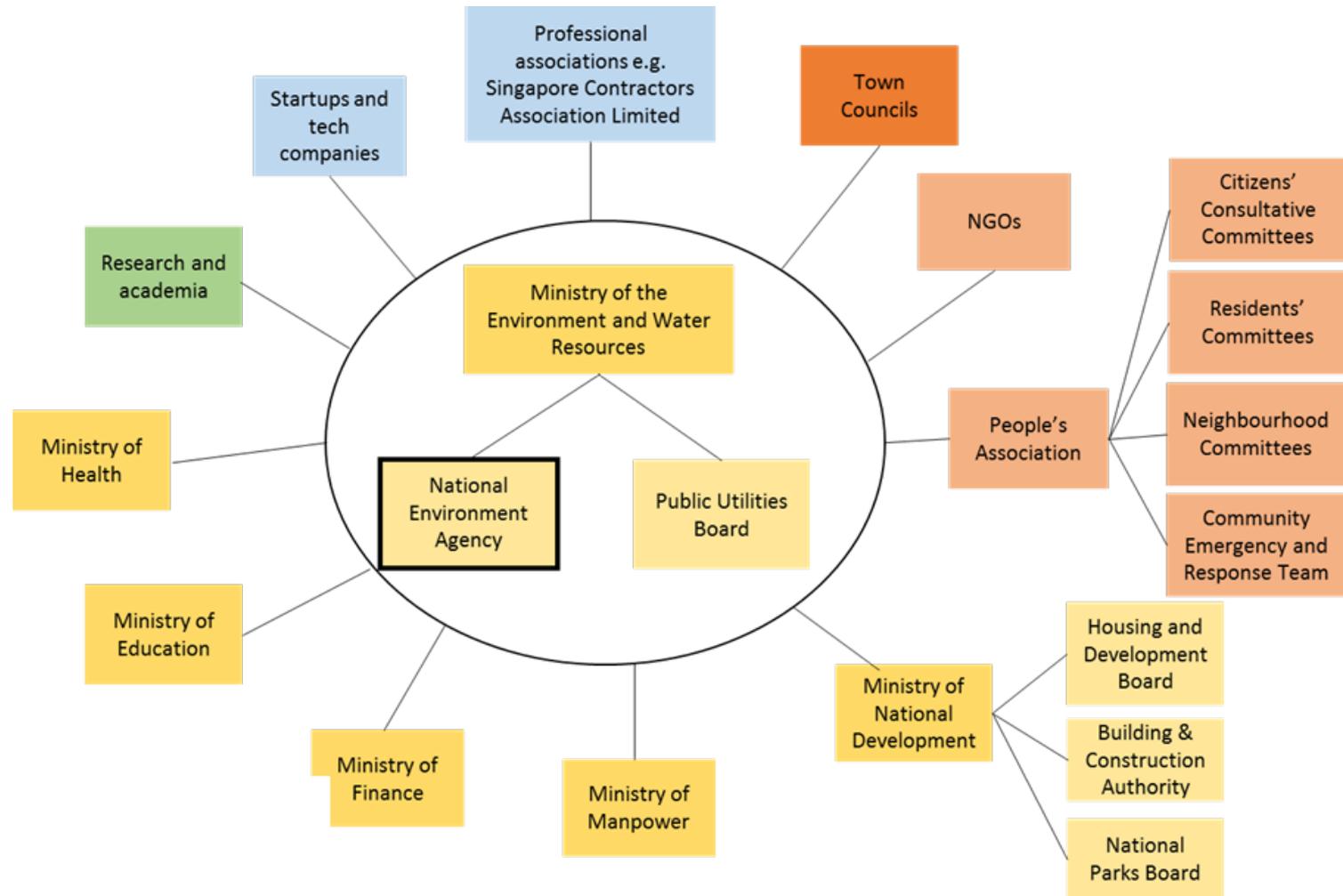


Designed by Jakob Knudsen

# Dengue control in Singapore



# Collaboration between Environment Agency & other sectoral stakeholders in Singapore



# Global policy relevant to mosquito control

## What Margaret Chan said:

... above all, the spread of Zika, the resurgence of dengue, and the emerging threat of Chikungunya are the price being paid for a massive policy failure that dropped the ball on mosquito control in the 1970s.

Margaret Chan

Former Director-General, World Health Organization

*Opening Address at World Health Assembly 69th session, May 2016*

# Housing improvements - policy

## RBM / UNDP / UN-HABITAT Consensus statement on housing and malaria



### Housing and Malaria

### *Consensus Statement*

Vector Control Working Group  
Roll Back Malaria

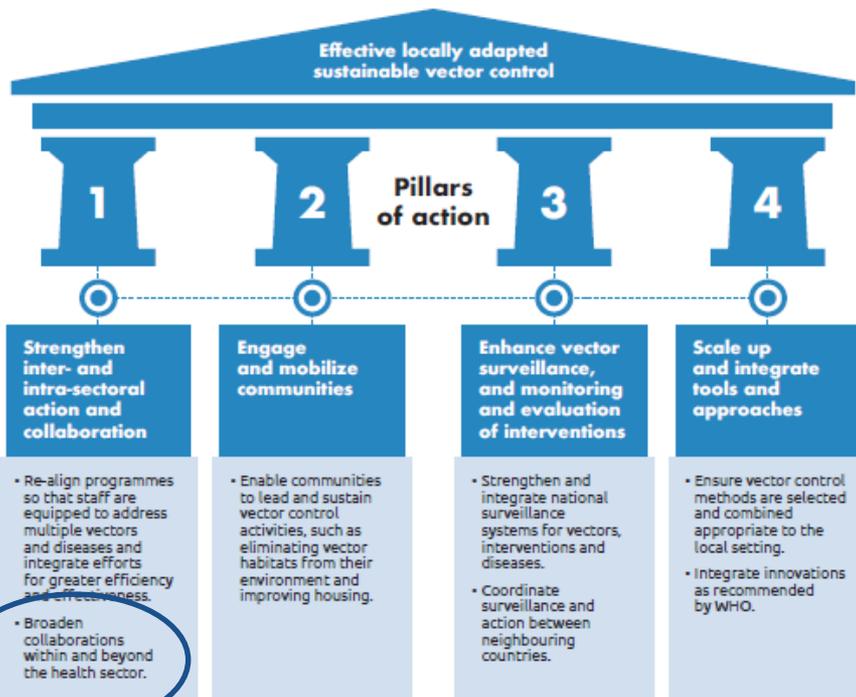
November 2015

#### Introduction

New tools and approaches are required to achieve the ambitious targets outlined in the WHO *Global Technical Strategy for Malaria 2016-2030*<sup>1</sup> (GTS) and the complementary Roll Back Malaria (RBM) global framework for *Action and Investment to Defeat Malaria 2016-2030*<sup>2</sup> (AIM) of at least a 90% reduction in malaria mortality and case incidence, and elimination from 35 countries by 2030, while preventing re-introduction into malaria-free areas. Additional interventions are needed to compliment the current tools which rely heavily on effective insecticides for optimal protection. There is a need to look beyond long-lasting insecticidal nets (LLINs) and indoor residual spraying (IRS), particularly to address the challenges of insecticide resistance and transmission that occurs at places and times when populations are not adequately protected by these two core interventions.

The value of a multi-sector developmental approach that couples current interventions with complementary strategies addressing key social and environmental determinants of malaria has been recognised by RBM and the United Nations Development Programme.<sup>3</sup> The AIM framework cited above, notes the potential contribution of the housing sector to malaria control and elimination. AIM also considers the relation

# Global Vector Control Response 2017-2030



• Broaden collaborations within & beyond the health sector



# Global policy development

11 SUSTAINABLE CITIES AND COMMUNITIES



NEW  
URBAN  
AGENDA



**Health as the Pulse of  
the New Urban Agenda**



United Nations Conference on Housing and  
Sustainable Urban Development

Quito – October 2016



UNDRR's Making Cities Resilient campaign is the key policy document for those dealing with environmental threats



ISDR  
International Strategy for Disaster Reduction



**Making Cities Resilient**

**My City is Getting Ready**

Sign up  
today to make  
your city resilient  
to disasters

2010-2011 World Disaster Reduction Campaign

- SDG11 gave rise to the concept of making cities resilient against environmental threats
- **UN's Disaster Risk Reduction says 'making cities safe from disaster is everybody's business'.**
- ...but, health is not included
- Yet, *Aedes*-transmitted diseases are an environmental threat

# Keeping the messages simple



# Summary

- BOVA Network brings together experts in vector-borne diseases with those in the built environment
- Vector-borne diseases are a major environmental threat to countries & their economies
- Building out vectors will lead to more resilient cities in the future

# Acknowledgments:



# Find out more about the network!

[www.bovanetwork.org](http://www.bovanetwork.org)



@bovanetwork