

# INTERNATIONAL COMMUNITY PROJECTS AND PROVECTOR™

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# INTRODUCTION

- ⌘ Mosquito-borne Diseases - What is the problem?
- ⌘ What are the solutions to MBDs?
- ⌘ Laboratory, Field Trials and ProVector Community Projects



*An. gambiae* photo Univ. Minnesota

# WHAT IS THE PROBLEM?

## WORLDWIDE MOSQUITO BORNE DISEASES

<b>Disease</b>	<b>Vector(s)</b>	<b>Distribution</b>
Barmah Forest disease	<i>Aedes vigilax</i> , <i>Ae. camptorhynchus</i> , <i>Culex spp.</i> , <i>Ae. normanensis</i> and <i>Coquillettidia spp.</i>	Australia
Bunyaviridae infections	<i>Aedes</i> , <i>Culex spp.</i>	Worldwide
California encephalitis group	<i>Aedes</i> , <i>Anopheles triseriatus</i> , <i>Culex</i> , <i>Psorophora</i>	N America, N Asia, Europe
Chikungunya	<i>Aedes</i> ; <i>Ae. furcifer-taylori</i> group in Africa	Africa, Asia
Coltivirus – Old World	<i>Culex</i> , <i>Anopheles</i> and <i>Aedes spp</i>	SE Asia, Europe
Dengue	<i>Aedes aegypti</i> , <i>Ae. albopictus</i> , <i>Ae. polynesiensis</i> , <i>Ae. scutellaris</i>	Worldwide
Dirofilariasis	<i>Aedes</i> , <i>Anopheles</i> , <i>Culex spp.</i>	Worldwide
Eastern Equine Encephalitis	<i>Aedes</i> , <i>Culiseta</i>	N and S America



## CONT'D...WORLDWIDE MOSQUITO BORNE DISEASES

<b>Disease</b>	<b>Vector(s)</b>	<b>Distribution</b>
Filariasis – Bancroftian	<i>Anopheles, Aedes, Culex</i>	Asia, Africa, S America
Filariasis – <i>Brugia malayi</i>	<i>Mansonia, Aedes, Anopheles</i>	Asia
Filariasis – <i>Brugia timori</i>	<i>Anopheles barbirostris, Aedes oceanicus, Aedes samoanus</i>	East Timor, Indonesia
Group C viral fevers	<i>Culex, Aedes, Limatus, Wyeomyia, Coquillettidia, Mansonia and Psorophora spp</i>	C and S America
Ilheus and Bussuquara	<i>Aedes, Culex, Coquillettidia, Haemagogus, Psorophora, Sabethes, Trichoprosopon and Wyeomyia spp.</i>	C and S America
Japanese encephalitis	<i>Aedes spp., Anopheles barbirostris and hyrcanus groups, Culex tritaeniorhynchus group and Cx. annulus</i>	Asia, Australia



## CONT'D...WORLDWIDE MOSQUITO BORNE DISEASES

<b>Disease</b>	<b>Vector(s)</b>	<b>Distribution</b>
Karelian fever	<i>Aedes</i> spp.	Russia
Malaria	<i>Anopheles</i>	Africa, Asia, C and S America
Mayaro	<i>Haemagogus janthinomys</i>	S America
Murray Valley encephalitis	<i>Aedes normanensis</i> , <i>Culex annulirostris</i> and <i>Cx. bitaeniorhynchus</i>	Australia, SE Asia
Mycobacteriosis – <i>M ulcerans</i>	Mosquitoes (probable)	Tropical regions worldwide
O'nyong nyong	<i>Anopheles funestus</i> and <i>An. gambiae</i>	Africa
Ockelbo disease	<i>Culiseta morsitans</i> , <i>Cx. pipiens</i> and others	Sweden
Oropouche	<i>Culex quinquefasciatus</i> , <i>Aedes serratus</i> , <i>Coquillettidia venezuelensis</i>	S America



## CONT'D...WORLDWIDE MOSQUITO BORNE DISEASES

<b>Disease</b>	<b>Vector(s)</b>	<b>Distribution</b>
Pogosta disease	<i>Culiseta, Aedes and Culex</i>	Finland
Rift Valley fever	<i>Culex, Aedes, Anopheles, Eretmapodites, Mansonia, Culicoides, Coquillettidia spp.</i>	Africa
Rocio	<i>Psorophora ferox, Aedes scapularis</i>	Brazil
Ross River diseases	<i>Aedes vigilax; Culex annulirostris</i> also implicated	Australia, SE Asia
Sindbis	<i>Culex univattatus</i> and <i>Cx. tritaeniorhyncus</i>	Asia, Africa, Australia
Spondweni	<i>Aedes circumluteolus, Armigeres, Culex, Eretmapodites, Mansonia</i>	Africa, Papua New Guinea
St. Louis encephalitis	<i>Culex pipiens, Cx. tarsalis, Cx. nigripalpus, Cx. restuans, Cx. salinarius, Aedes, Sabethes</i>	N and S America



## CONT'D...WORLDWIDE MOSQUITO BORNE DISEASES

<b>Disease</b>	<b>Vector(s)</b>	<b>Distribution</b>
Venezuelan Equine encephalitis	<i>Culex spp, Aedes taeniorhynchus, Psorophora confinnis, Anopheles aquasalis</i>	N and S America
Wesselsbron	<i>Aedes sp., Anopheles gambiae, An. pharoensis, Culex telesilla, Cx. univittatus, Mansonia uniformis</i>	Africa
West Nile virus	<i>Culex univittatus. Cu. pipiens, Cu. vishnui, Cu. neavei, Coquillettidia, Aedes and Anopheles spp.</i>	Worldwide (except Australia)
Western Equine Encephalitis	<i>Culex tarsalis</i>	N and S America
Yellow fever	<i>Aedes, Haemagogus, Sabethes</i>	S America, Africa
Zika	<i>Aedes species</i>	C Africa, SE Asia



# WHAT ARE THE SOLUTIONS?

## ☞ Prevention

### ... Habitat Modification and Structural Barriers

- ☞ Low cost, e.g. proper dispensing of containers, draining ditches
- ☞ High cost, e.g. screens, windows, air conditioning

### ... Pesticides

- ☞ Outdoor and indoor residual spraying
- ☞ Highly effective but temporary, often have toxic or harmful environmental effects, expensive

### ... Non-Impregnated Bed Nets

- ☞ Form a protective barrier around persons using them but provide little protection



*Anopheles*: CDC



# WHAT ARE THE SOLUTIONS?

## CONTINUED

... Pesticide Impregnated Bed Nets

- ❧ Insecticide-treated bed nets (ITNs) and Long-lasting ITNs (LLINs)
- ❧ ITNs have been shown to reduce all-cause mortality by about 20%
- ❧ Has community effect in reducing mosquito populations
- ❧ Become damaged or need reapplication of pesticides
- ❧ Not all family members are protected
- ❧ Some mosquito populations have become insecticide resistant



# WHAT ARE THE SOLUTIONS?

## CONTINUED

### ... ProVector



- ⌘ ~7 people are helped with each ProVector
- ⌘ Used Indoors
- ⌘ Low cost and long lasting (flower – 15 yrs, refill 3/6 months)
- ⌘ Uses non-toxic pesticide to safely kill mosquitoes
- ⌘ Rapidly reduces mosquito population indoors and has community effect
- ⌘ Helps protect family members who:
  - ... do not have bed nets
  - ... when bed nets are damaged or pesticide is degraded
  - ... during the day and evening when family is not under bed nets
- ⌘ **Integrated Pest Management -The ProVector should be used when possible in conjunction with LLIN/ITN, and IRS**



# WHAT ARE THE SOLUTIONS?

## CONTINUED

☞ Medical Prevention and Treatment – Often  $\frac{1}{2}$  of financial resources and staff time goes to treating malaria.

... Prophylaxis

☞ effective

☞ expensive, concerns with chronic toxicity

... Anti-malarial

☞ effective

☞ parasite resistance to some drugs

☞ expensive

... Supportive treatment

☞ Future

... Vaccine

☞ Many years of research, hopefully soon

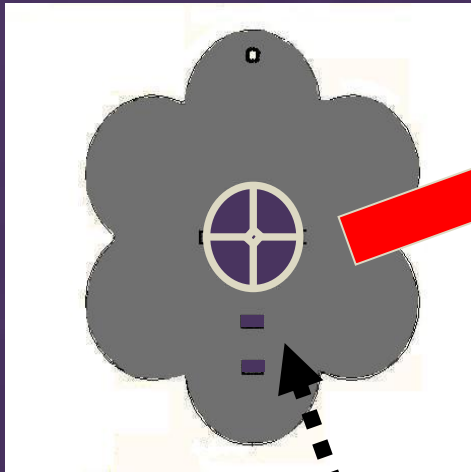
... Sterile male release and genetically modified mosquitoes

☞ Promising research, Hardy-Weinburg Equilibrium may reduce effectiveness beyond initial deployment

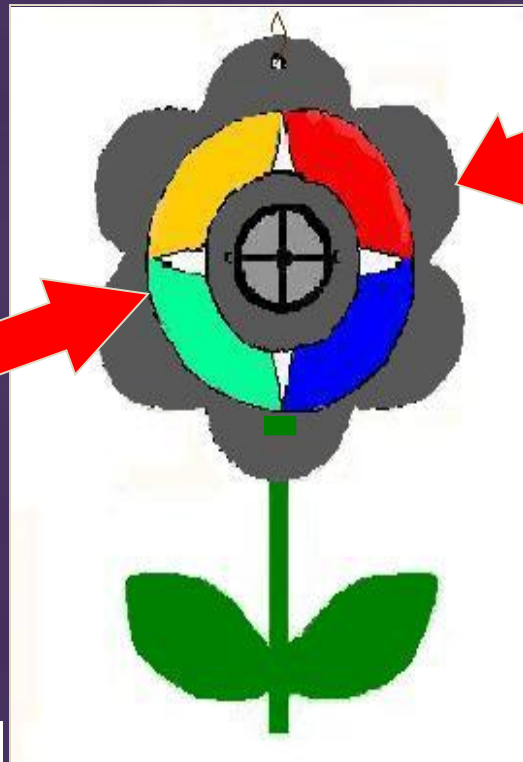
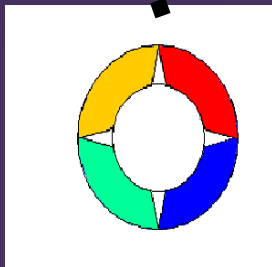


# PARTS AND INSTRUCTIONS FOR ASSEMBLY OF PROVECTOR

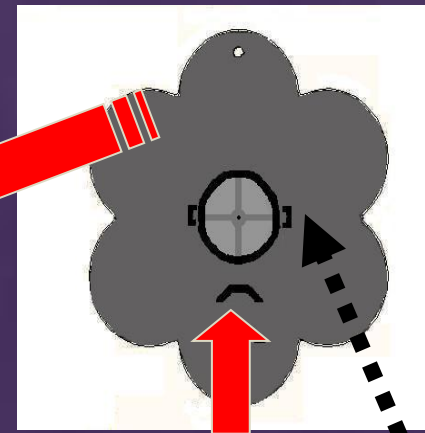
Front Face  
of Flower



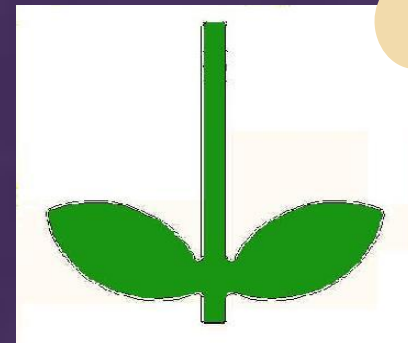
Peel off  
Paper  
Backing



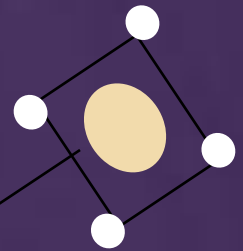
Completed  
ProVector Flower



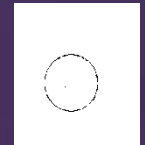
Back Face of  
Flower



Stem of Flower



*Bti* Refill  
(remove from  
bag)



Clear Plastic *Bti*  
Refill Holder

# GLOBAL MALARIA PROGRAMME

## INSECTICIDE-TREATED MOSQUITO NETS: WHO POSITION STATEMENT

*Neither LLINs nor indoor residual spraying (IRS), the other main method of malaria vector control, may be sufficiently effective alone to achieve and maintain interruption of transmission in holo-endemic areas of Africa.”*

### Integrated Pest Management

Insecticide Residual  
Spraying



Photo: RTI International

Bed Net



( WHO/TDR/Crump)

ProVector



# LABORATORY TRIALS, FIELD TRIALS, & COMMUNITY PROJECTS

## Laboratory Trials

BDIDL Georgia Southern  
University

WRAIR Armed Forces Research  
Institute of Medical Sciences  
(Thailand)

## Field Trials

Georgia, USA

Uganda

Dominican Republic

Kenya

Asia

## 25 Community Projects

Asia

Africa

Caribbean

Central America



# WALTER REED PROJECT, KISUMU, KENYA



# SITES ARE GPS REFERENCED FOR GIS ANALYSIS AND MOSQUITO POPULATION MODELING





# PROVECTOR COMMUNITY PROJECTS IN THE AMERICAS AND ASIA

## ☞ Current -

... Afghanistan – US Embassy area reported a noticeable drop in mosquito bites shortly after 300 ProVectors were placed in the compound

... Dominican Republic (Barahona): In village with 60-70 homes, community center, school, and church

☞ Organization: Children of the Nations

... Haiti (Port-au-Prince): homes

☞ Organization: Uplift Help International

... Honduras (Puerto Cortes): Home for abandoned and abused girls

☞ Organization: Eternal Family Project

... Nicaragua (Managua): Orphanage for disabled children

☞ Organization: Mustard Seeds Communities

## ☞ Planned

... Haiti (Port-au-Prince and Anse Pirogue): school, hospice center, and clinic

☞ Organization: Uplift Help International



# LOCAL CITIZENS AND VOLUNTEERS ARE TAUGHT HOW TO ASSEMBLE AND INSTALL THE PROVECTOR IN BARAHONA, DOMINICAN REPUBLIC



☞ The Head Nurse at the Children Of The Nations-DR Clinic enthusiastically reported,

*“After a week of rain, there are mosquitoes everywhere EXCEPT in the homes where the Pro Vector flowers have been placed.”*

Those whom she spoke with from the village of Algodon reported this great news and their gratitude along with their desire for more flowers!



# PROVECTOR COMMUNITY PROJECTS IN AFRICA

## Current

- Guinea: In a village along the coast near Conakry  
Organization: Baptist Missions
- Kenya (Kibera): In an orphanage, a school, and homes with young children  
Organization: St. Peter's Methodist Church
- Kenya (Kibera): In a school and homes with young children  
Organization: Riziki NGO
- Kenya (Kibera): Maternity ward  
Organization: Ushirika Medical Clinic
- Kenya: Hospital Projects  
Organization AEMRN

## Planned

- Ghana (Cape Coast): homes in village  
Organization: Univ. Cape Coast
- Ghana (Greater Accra Region): homes in village  
Organization: Dept. of Agriculture and Ministry of Health
- Kenya (Kabondo): homes in village  
Organization: Kabondo Poverty Alleviation
- Uganda (Kampala): Hospitals and Villages  
MOH Uganda and AEMRN



# IMPACT IN COMMUNITIES ELIMINATING MOSQUITOES IN HOMES, SCHOOLS AND HOSPITALS IN AFRICA, CENTRAL AMERICA AND THE CARIBBEAN

Site	Project Leader	Community, Organization	<1 month for control
Kisumu, Kenya	Dr. C. Barasa	Homes and Pediatric Ward Kisumu District Hospital	90%
Entebbe, Uganda	Dr. L. Mukwaya	Entebbe Slums Uganda Virus Institute Ministry of Health	95%
Kibera 1, Kenya	Cl. C. Mwangi	Maternity Ward Ushirika Maternity Clinic	100%
Kibera 2, Kenya	Mr. K. Kiunga	Riziki Foundation	100%
Nairobi, Kenya	Rev. J. Kithinji	Tusaidie Watoto Elementary School	100%
Puerto Cortes, Honduras	Ms. Allison Alexander	Eternal Family Projects Home for Abandoned and Abused Girls	100%



# BREEDING SITES FOR MOSQUITOES ARE ADJACENT TO HOMES, SCHOOLS AND CLINICS IN THE KIBERA SLUM IN NAIROBI, KENYA



# WOMEN WITH INFANTS RECEIVING INSTRUCTION ON ASSEMBLY AND USE OF PROVECTOR IN KIBERA



Photo: Argonauta Communications 2009

(only 14% of families have at least one bed net)

# INCOMING FEEDBACK FROM COMMUNITY PROJECTS

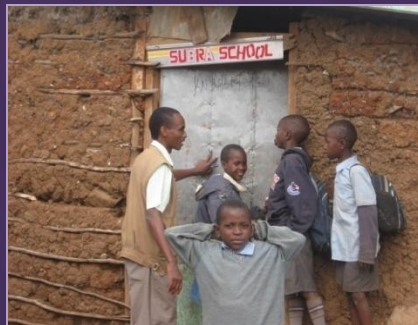
**Port-au-Prince, Haiti** – Sister Dominique Jean – Mosquitoes were attracted to the ProVector and within a week or two all the mosquitoes were gone

**Puerto Cortes, Honduras** – Ms. Allison Alexander, President, Eternal Family Projects, reports the ProVector got rid of the mosquito problem (Home for Abandoned and Abused Girls)

**Nairobi, Kenya** – Rev. Julius Kithinji reports elimination of mosquitoes in his home in less than one week

**Kibera Slums, Kenya** – Clinician Catherine Mwangi has reported ProVector mosquito control in the Ushrika Maternity Clinic

**Kibera Slums, Kenya** – Ken Kethambi, Riziki NGO, has reported a reduction of mosquitoes within 2 weeks and elimination within a month





# SENIOR BISHOPS FROM GHANA BEING BRIEFED ON PROVECTOR EFFICACY

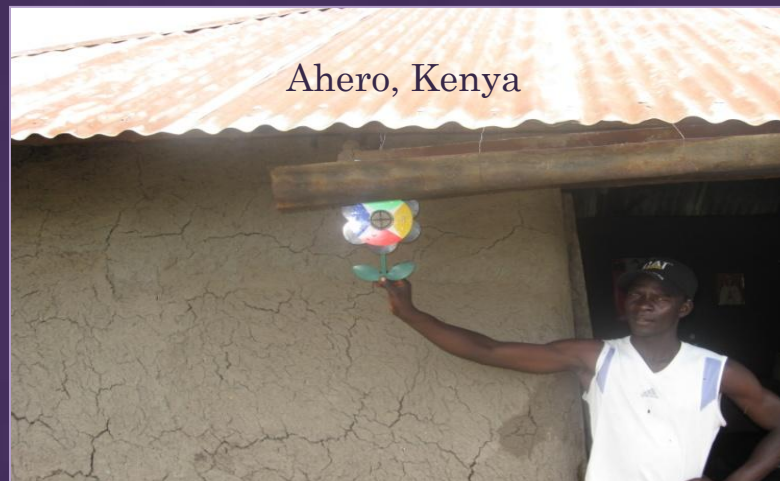
The Presiding Bishop has reported the ProVector is doing well in reducing mosquitoes in Ghana



# THE PHILOSOPHY USED IN THE PROVECTOR COMMUNITY PROJECTS INCORPORATES THE DIFFUSION OF INNOVATION (DOI) THEORY

The ProVector meets many of the attributes which are key determinants of diffusion, speed and extent, including:

- Relative Advantage - low cost, non-toxic, eco-friendly, target specific
- Compatibility - designed to protect all people from MBDs
- Complexity - easily assembled and placed in 5 minutes, instructions for ProVector are written in many languages and are also pictorial
- Trialability - people can easily compare how well ProVector works in homes and have requested additional ProVectors for family members
- Observability - People in the community also see how well it works and have requested ProVectors



# CONCLUSIONS

*The ProVector is a Technological Leap Forward*

The first manufactured device that attracts mosquitoes to feed on a bait

The first Bt formulation that consistently kills adult mosquitoes

The ProVector flower is:

- Safe and Eco-friendly
- Inexpensive and Easy to use
- Effective in diverse habitats around the world

Technology is easily transferred

Helps Protect all Family Members while they are outside of their bed nets

