Integrated Vector Management (IVM) for Malaria Control

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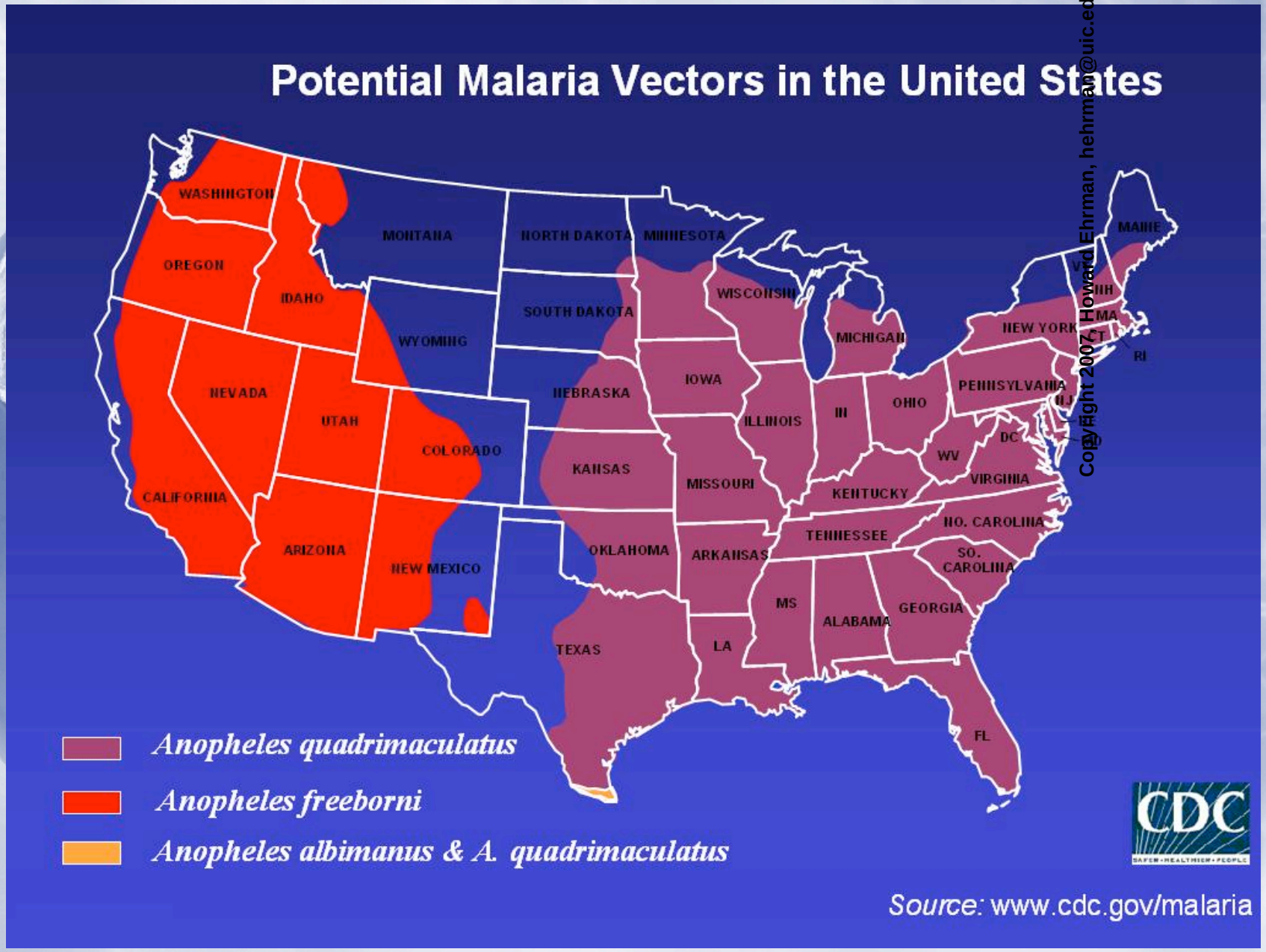

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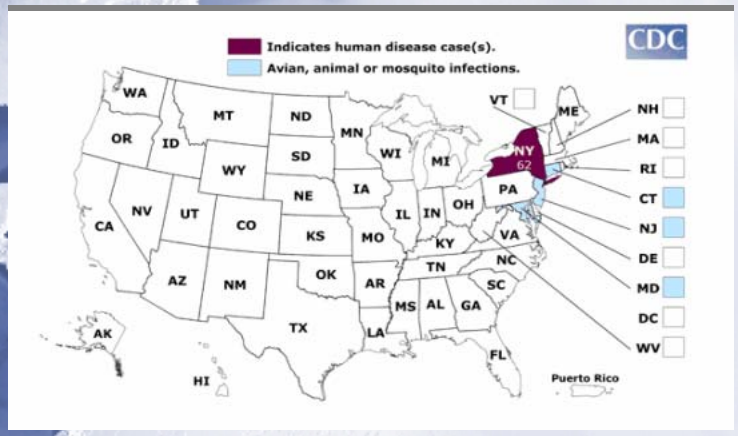
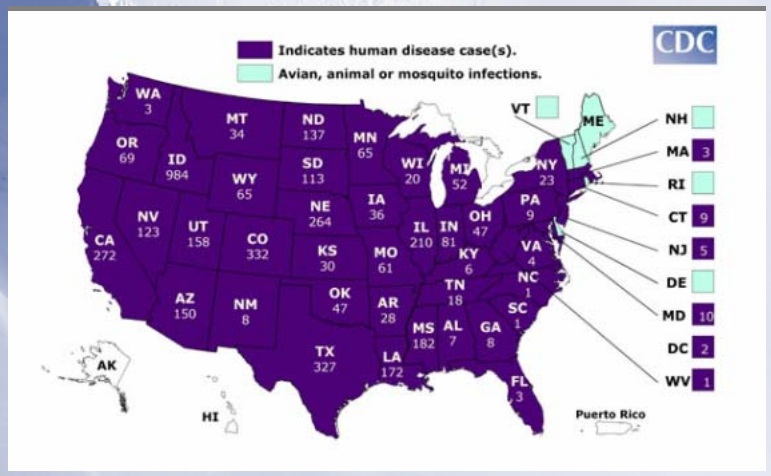
Increased Vector Borne Infectious Diseases

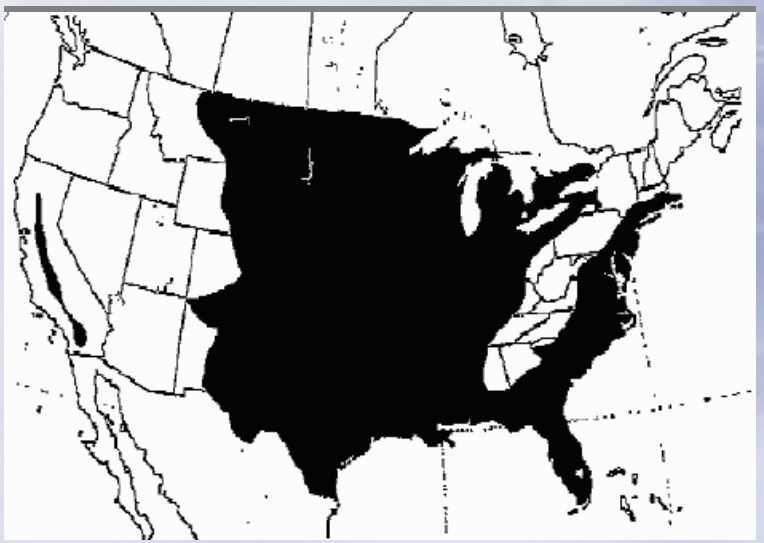
U.S. WNV 1999: 62/7; 2006: 4200/150

Illinois: 1,400/87: 1999-2006

Mosquitoes: die-cold, live-warm: SLE, WNV, Dengue, Malaria







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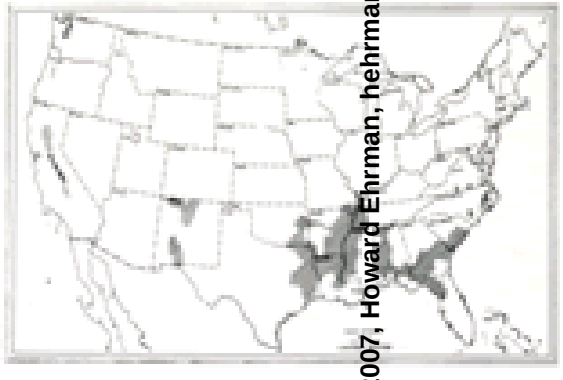
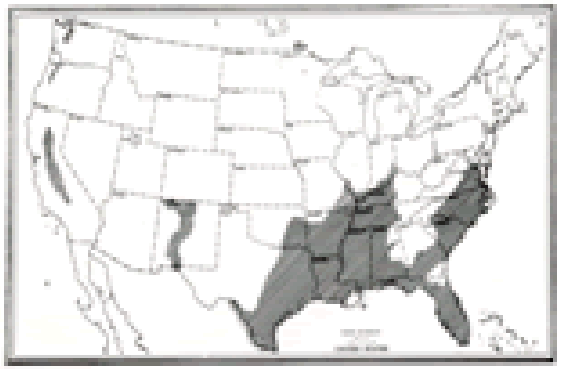
MALARIOUS AREA OF THE UNITED STATES
1882

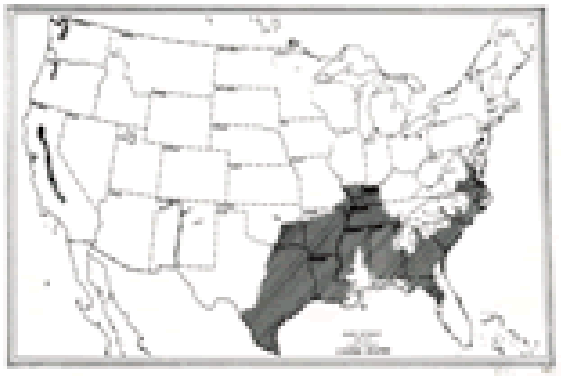
MALARIOUS AREA OF THE UNITED STATES
1932



MALARIOUS AREA OF THE UNITED STATES
1912



MALARIOUS AREA OF THE UNITED STATES
1934-5



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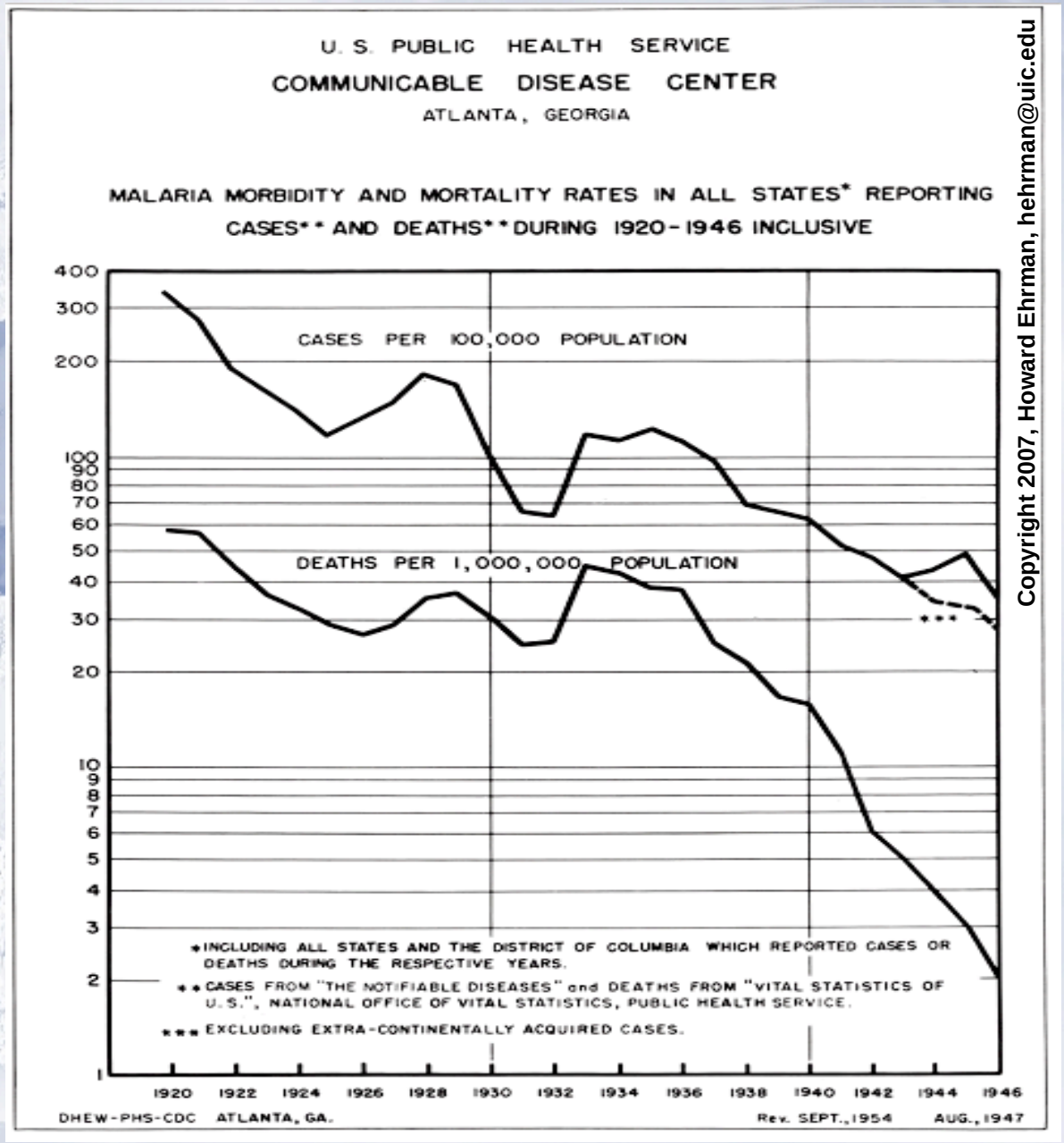

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Malaria had been largely eliminated in the U.S. by the time the Centers for Disease Control (CDC) first used DDT in spray campaigns in 1947.

CDC's four-year spray effort was designed to prevent the reintroduction *of malaria from troops coming home from World War II*

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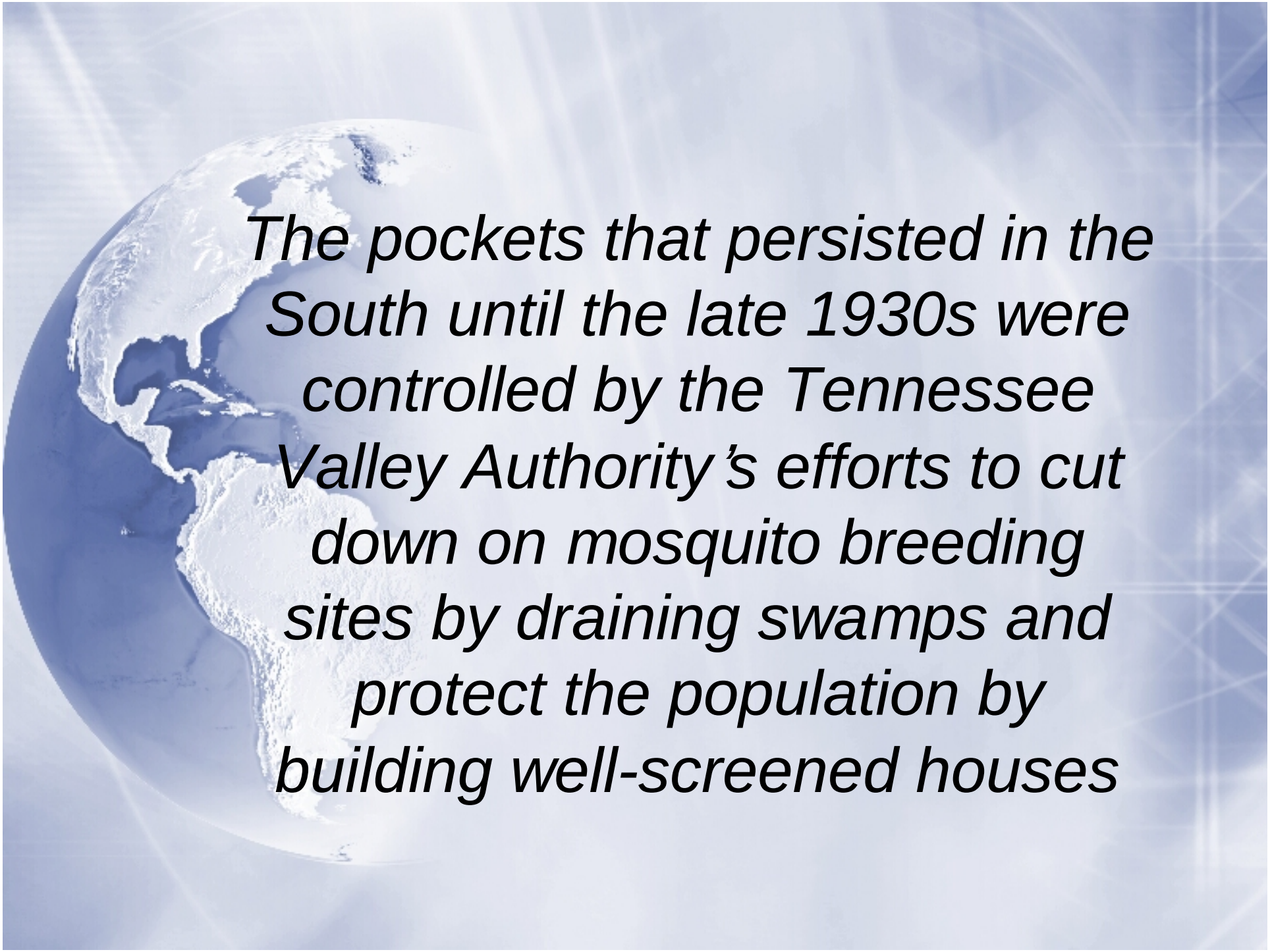

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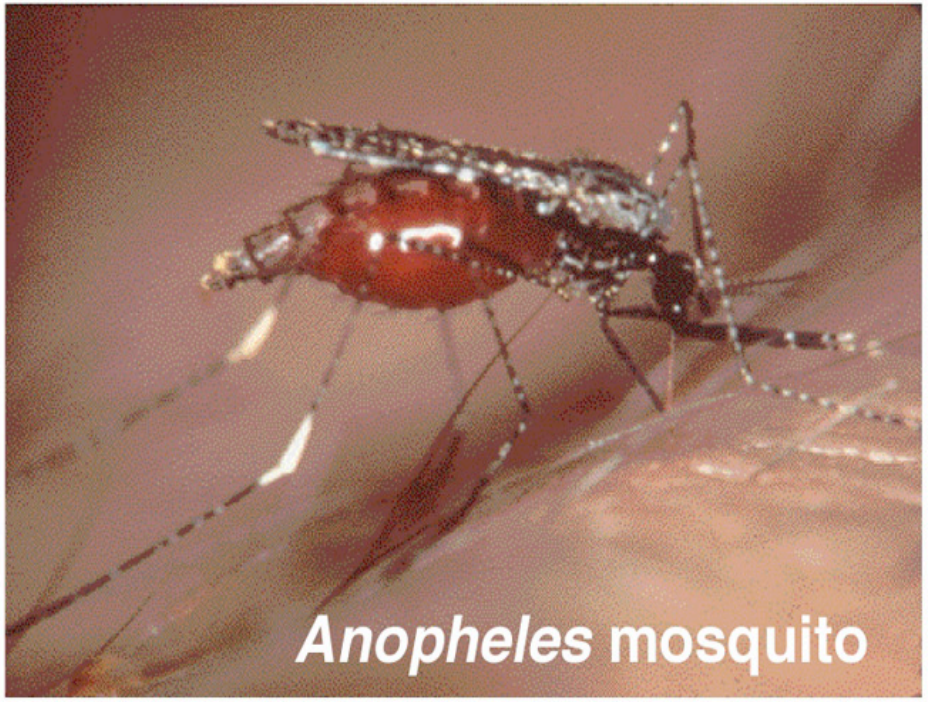
- Drainage activities, Virginia, 1920's

The Global Burden of Malaria



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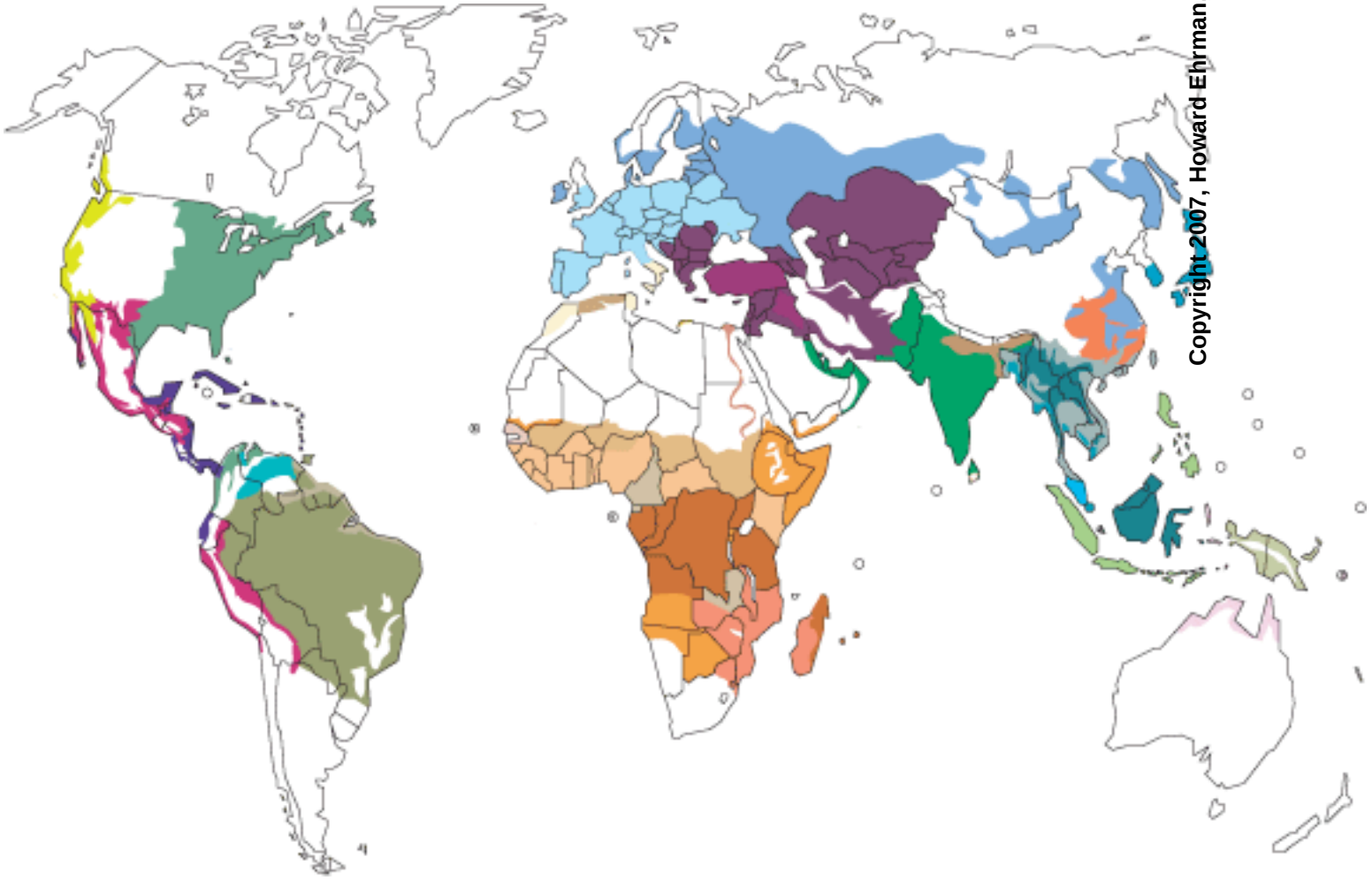
- 1.5 - 2.7 million deaths annually
- 300 - 500 million people infected
- Every 30 seconds, a child dies of malaria

Global distribution of dominant malaria vectors, 2003



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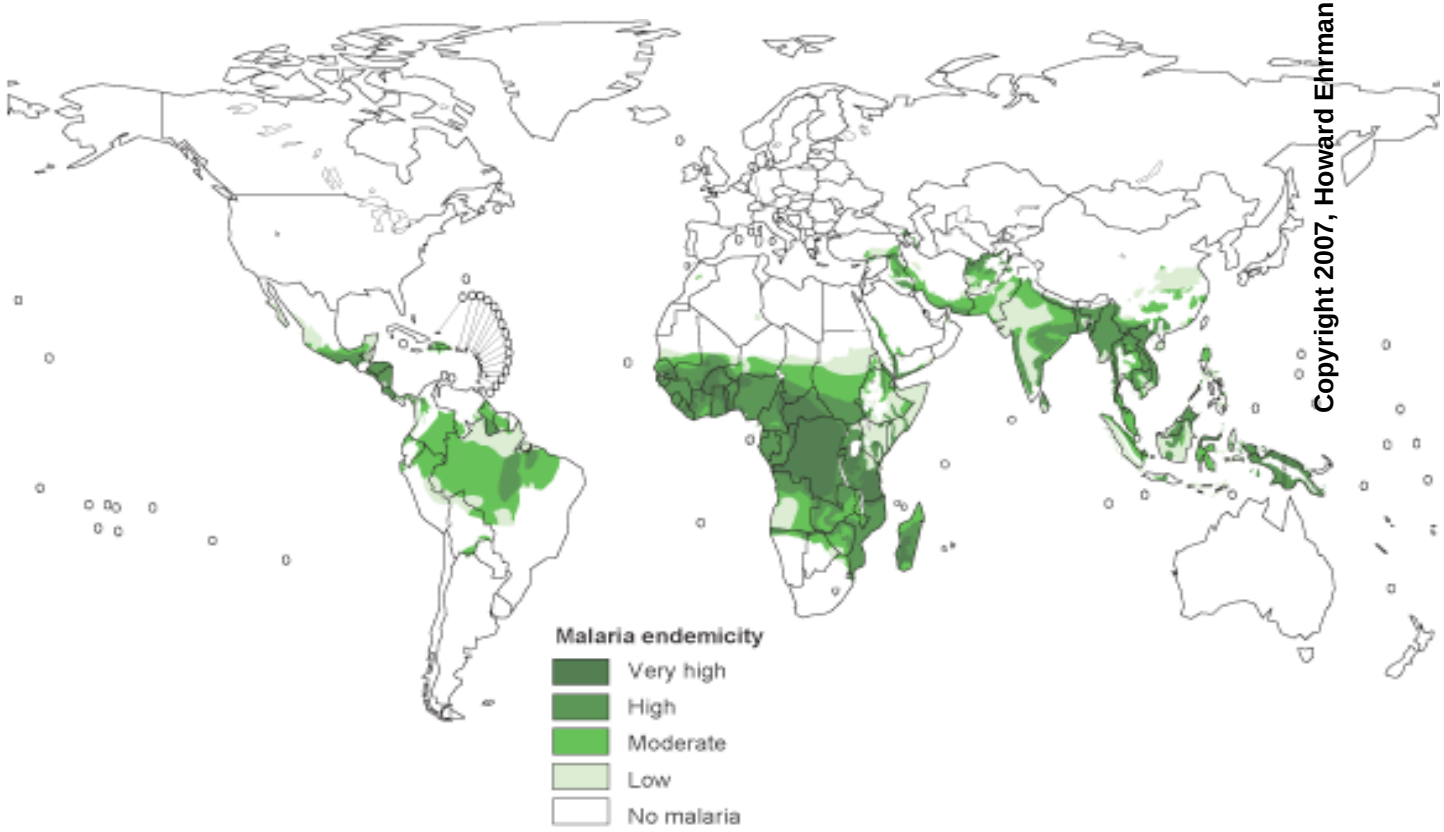
Global distribution of malaria transmission risk, 2003



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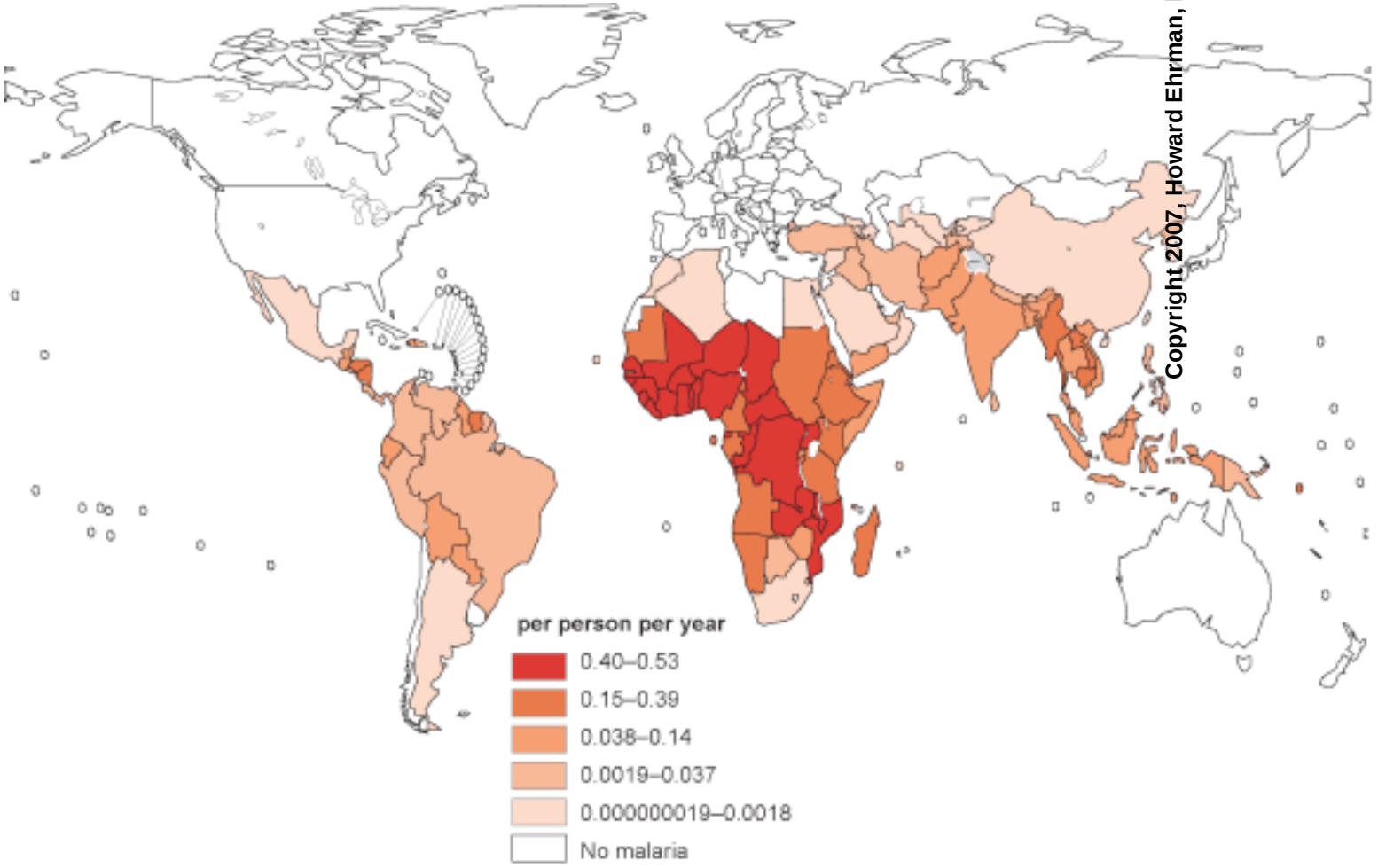
Estimated incidence of clinical malaria episodes-2004



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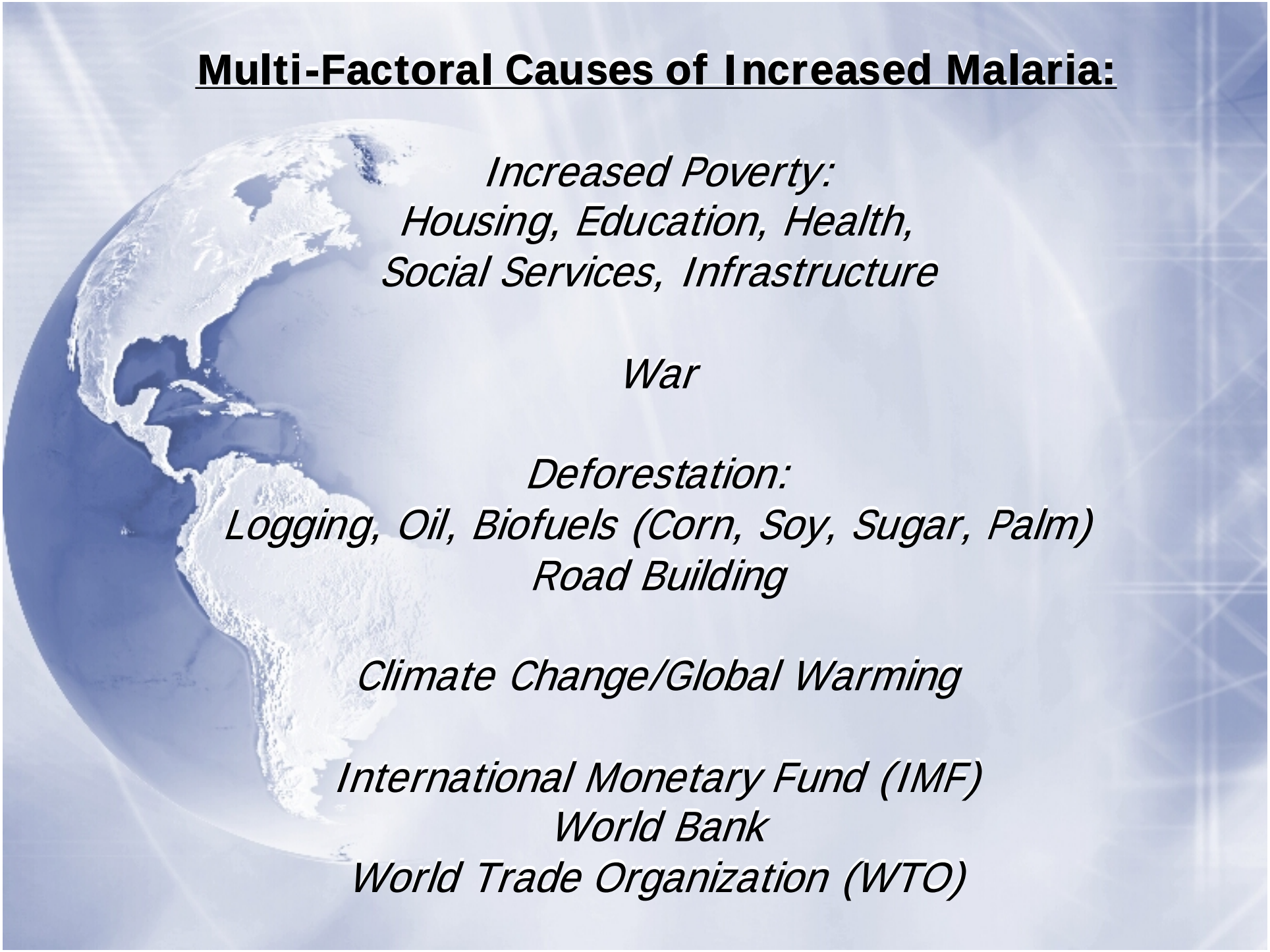
Multi-Factoral Causes of Increased Malaria:



Increased Poverty:
Housing, Education, Health,
Social Services, Infrastructure

War

Deforestation:
Logging, Oil, Biofuels (Corn, Soy, Sugar, Palm)
Road Building

Climate Change/Global Warming

International Monetary Fund (IMF)
World Bank
World Trade Organization (WTO)

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2 studies in the Amazon rainforest have shown a link between deforestation and an increased risk of malaria-

Proceedings of the National Academy of Sciences, 2006

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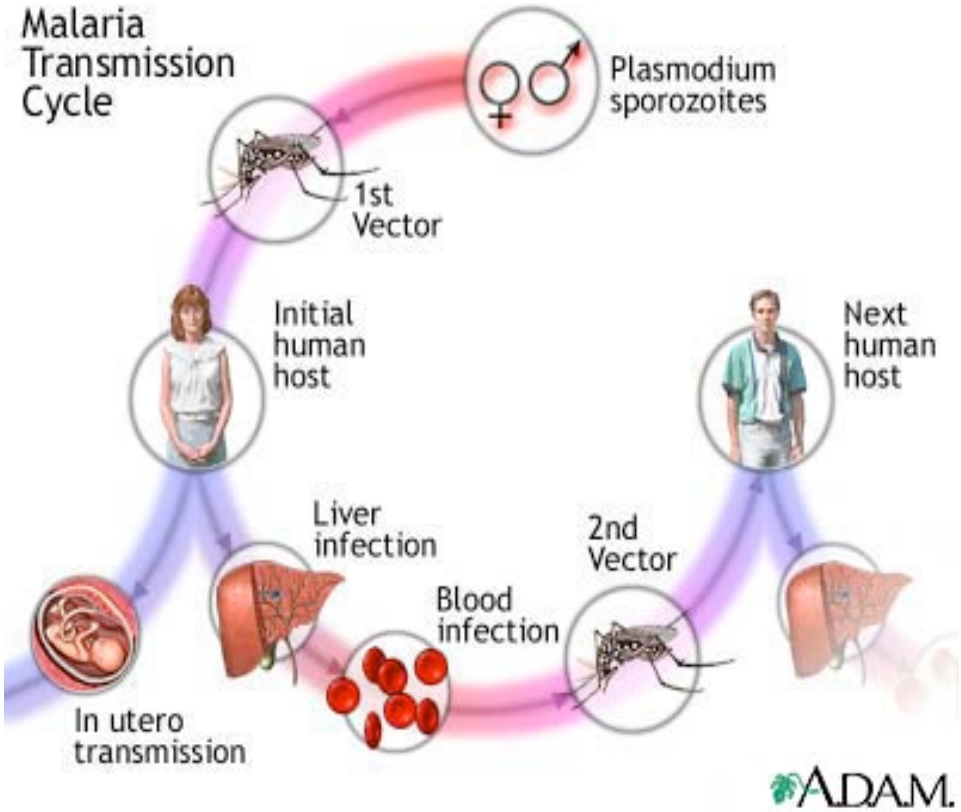

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Integrated Vector Management

- Larvicides
- Drainage
- Clearing Canals/Remove Algae
- Mosquito-repelling calcium hydroxide (lime) on walls
- Screens
- House Cleaning
- Vegetation Clearance
- Mosquito Repellant Trees

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- Historically most effective campaign against African vectors-eradication of accidentally introduced Anopheles gambiae from 54,000 km2 in northeast Brazil: 1938-1947 (Soper)

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- Brazil Eradication Campaign was Repeated in Egypt in 1942-1945

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1929-1947 Zambian Roan Valley Copper Mines: Watson

- Sustained Surveillance: Human cases, larvae and adult mosquitoes
- Larviciding
- Water Management
- Vegetation Clearance
- Drainage
- House Screening
- Quinine Treatment
- Bednets

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- 3-5 years, malaria related mortality, morbidity and incidence rates were reduced by 70-95%.
- 20 years-Averted 4173 deaths and 161, 205 malaria attacks
- The estimated costs per death and malaria attack averted were US$858 and US$ 22.20
- Capital Investment $167/person (1995)
- Maintenance Costs $22-$99 disability adjusted life year (DALY) averted

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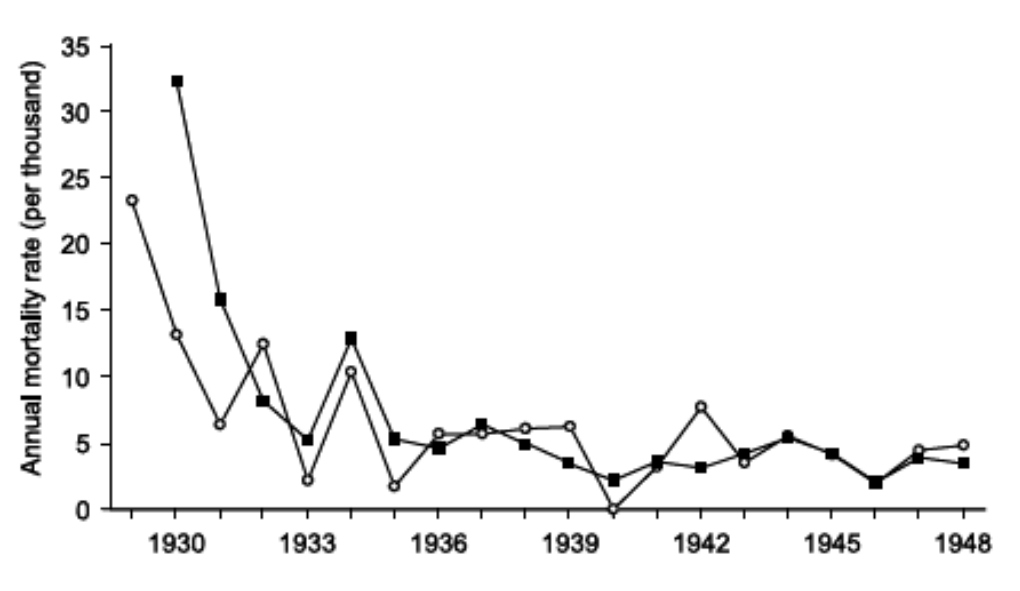
- Initial Population: 6,067
- Grew by 10% a year
- Mortality Rate 32.3-Africans
- 23.4/1000-Europeans
- By 1941: 3.5 & 3.9
- Industry worth $7 Billion (1995



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2005 World Malaria Report

- 1. Treatment policies for Children
- 2. Insecticide-treated nets
- 3. Indoor residual spraying
- 4. Malaria control during epidemics and complex emergencies
- 5. Malaria prevention (IPT) and treatment in pregnant women

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Vector Control

-Is defined by the WHO, Roll Back Malaria, CDC, World Bank, Gates Foundation, U.S. Gov't, Global Fund and most NGO's as insecticides treated nets and indoor residual spraying

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Life Cycle of a Mosquito

Mosquitoes of different species lay their eggs in a variety of water sources, shaded & sunny, that range from small containers to vast expanses of marshland..

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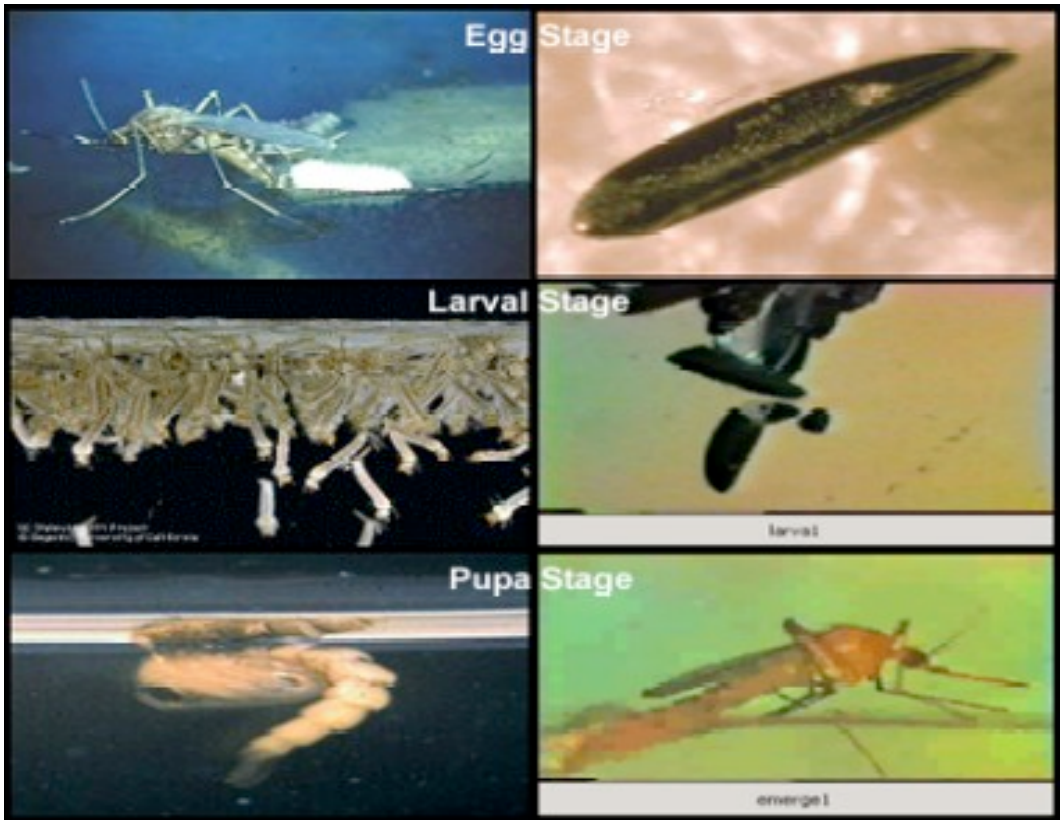

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Community members demonstrate the life cycle of mosquitoes Africa Malaria Day, 2004 on Rusinga Island, Kenya

-W. Richard Mukabana, Gerry Killeen, et. al, Vector Control in Africa, *Malaria Journal* 2.06

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Practicable adult mosquito sampling tools
at Rusinga Island Child and Family Programme/Christian Children's Fund-
Kenya, African Malaria Day, May 2004 on Rusinga

Field Training in Sampling Mosquito Larvae & Pupae

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Successful Community Implemented Drain Rehabilitation
Tanga, Tanzania

Dar es Salaam, Tanzania

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Mbita, Kenya

- *5 yr Program, 4.5 Sq Km, 8,000 People*
- *419 Habitats, 336 Man-Made*
- *Bacillus Sphaericus (long lasting) & Thuringienesis (Prevent Resistance) & Applied*
- *Sentinel Sites*
- *House Sampling of Adult Mosquitoes*
- *Human Bites Reduced by 92%*
- *Malaria Cases Reduced by 91%*
- *Cost $0.85/year per person*

Fillinger & Lindsay, *Tropical Medicine & International Health*, Durham, UK 11.06

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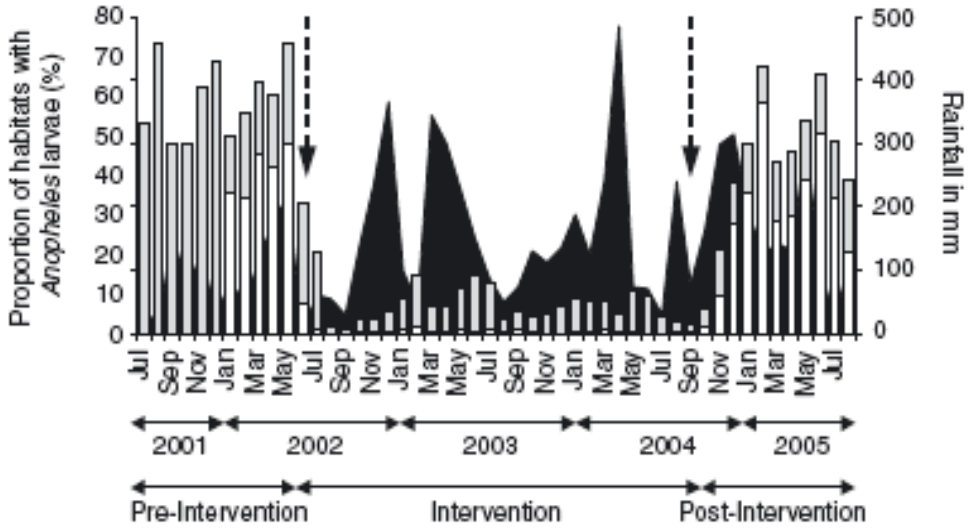

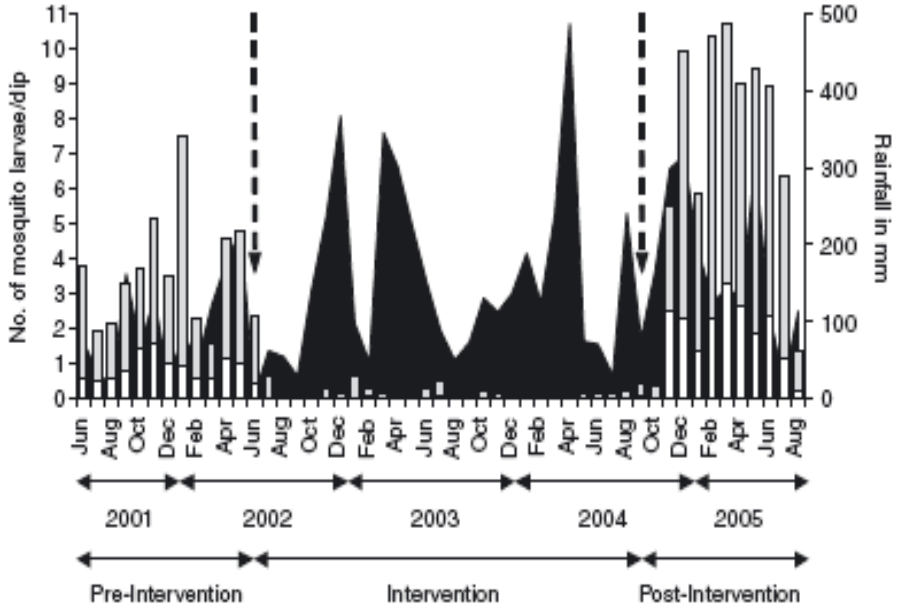

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- The bacterium Bacillus Sphaericus (long lasting) & Thuringienesis (Prevent Resistance) infects and kills mosquito larvae.

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- The larvae feed on Bacilli spores and crystals suspended in the water. Within 10 minutes the spores and crystals enter the gut of the larva and the crystals dissolve.

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- Then, within 2 – 12 hours after the crystals have done their work, the spores escape into the larvae's body cavity and the larvae die.

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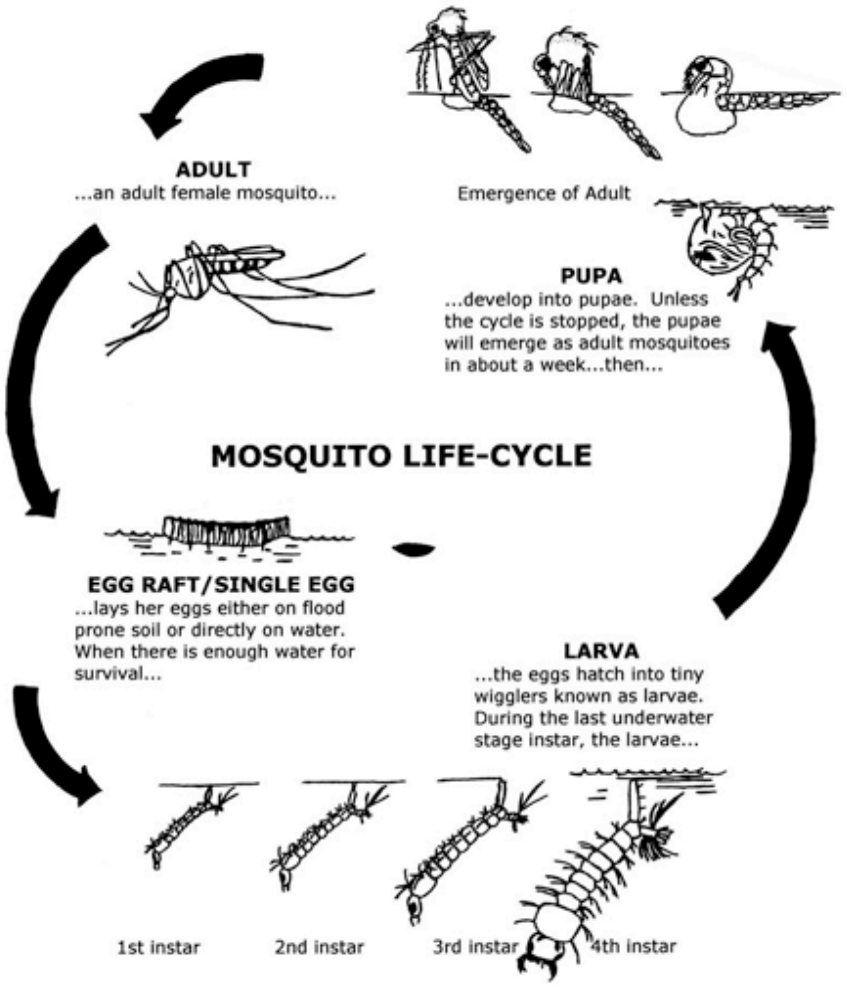

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It is relatively safe and environmentally sound because it is highly selective, killing only mosquitoes

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Malaria-endemic Africa is home to 521 million community members many of whom could be engaged to apply low technology interventions at minimum cost given the basic skills to dip for larvae, trap adult mosquitoes, distinguish Anopheles and spray non-toxic bacterial insecticides.

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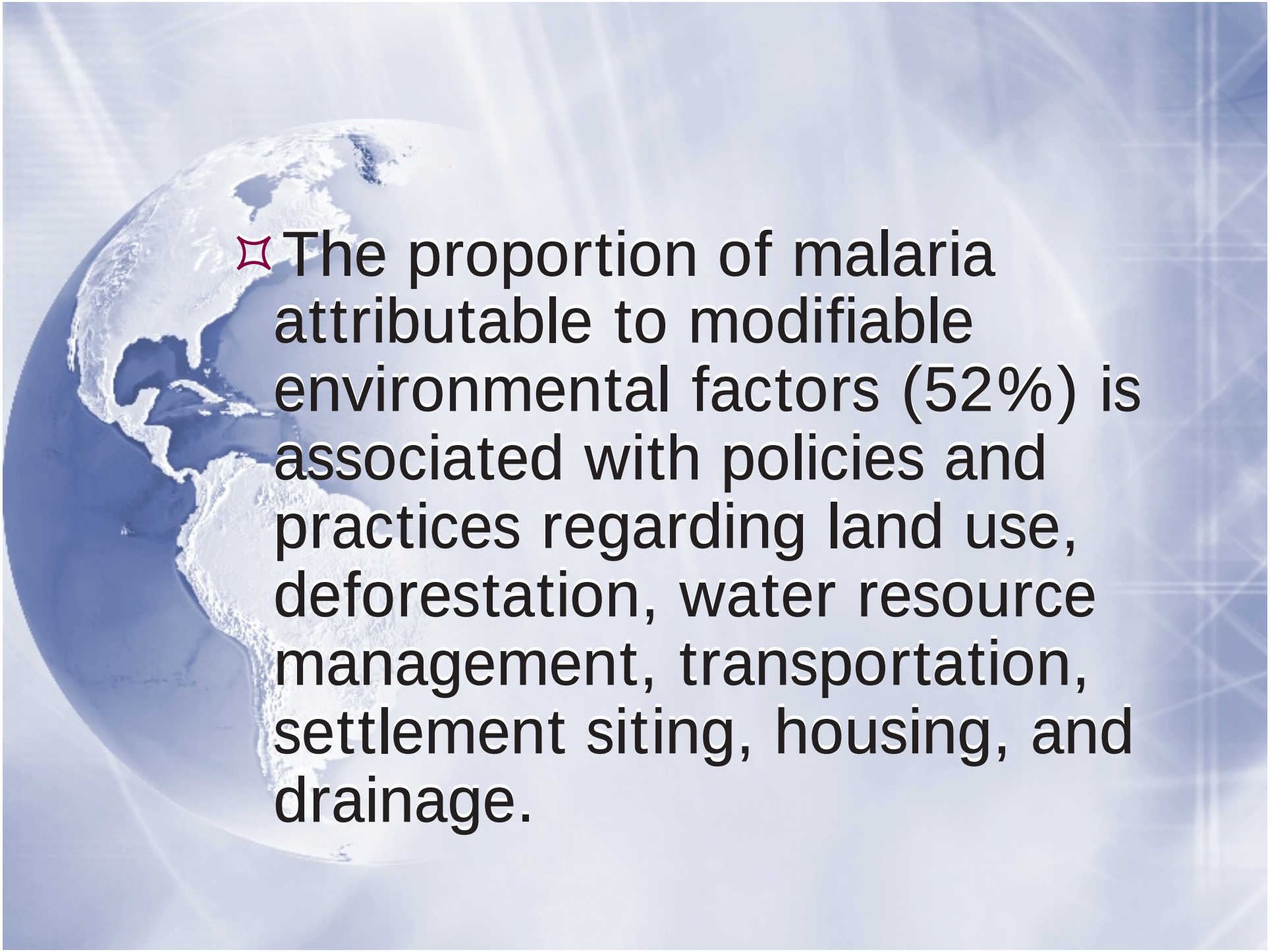

- The proportion of malaria attributable to modifiable environmental factors (52%) is associated with policies and practices regarding land use, deforestation, water resource management, transportation, settlement siting, housing, and drainage.

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Who Decides and How?

- IMF?
- World Bank?
- WTO?
  - Or the People of each community, country and region?

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- And the integration of economic, environmental and social justice

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