Floods and standing water - a breeding ground for mosquitoes and other disease vectors

Lagos, Nigeria

Using LCA in Public Health Policy for Adaptation to Climate Change

Lynn Wilson, *SeaTrust Institute* Rita Schenck, *IERE*

Lagos, Nigeria

Climate change models predict
- Increased malaria and other tropical and waterborne disease
- Increased malnutrition as crops fail due to floods and droughts
- Increased violence due to social disruption

Anopheles albimanus mosquito feeding on a human arm.

•Greatest effects in tropical and subtropical areas, such as in Sub-Saharan Africa, South Asia and Central and South America

Two Approaches to the Problem

Conventional Aid Approach
- Aid for Malaria has risen from $51MM/year in 2003 to $2Billion/year in 2009
- Insecticide application
- Donating mosquito nets
- Combat hunger through food donation (plumpynut)
- Disease Treatment
- Relocation to refugee camps

Emerging Self-reliance Approach
- Key roles of health care workers
  - Education at the local level
- Local entrepreneurship
  - Switching to other crops
  - Selling mosquito nets
- Developing transportation infrastructure
- Developing water infrastructure/sanitation

© Tayeh Ahmed
Filtering drinking-water using a fine mesh in Niger.

©WHO/NTD
Space-spraying activity outside a public building during a chikungunya outbreak in Mauritius, 2006

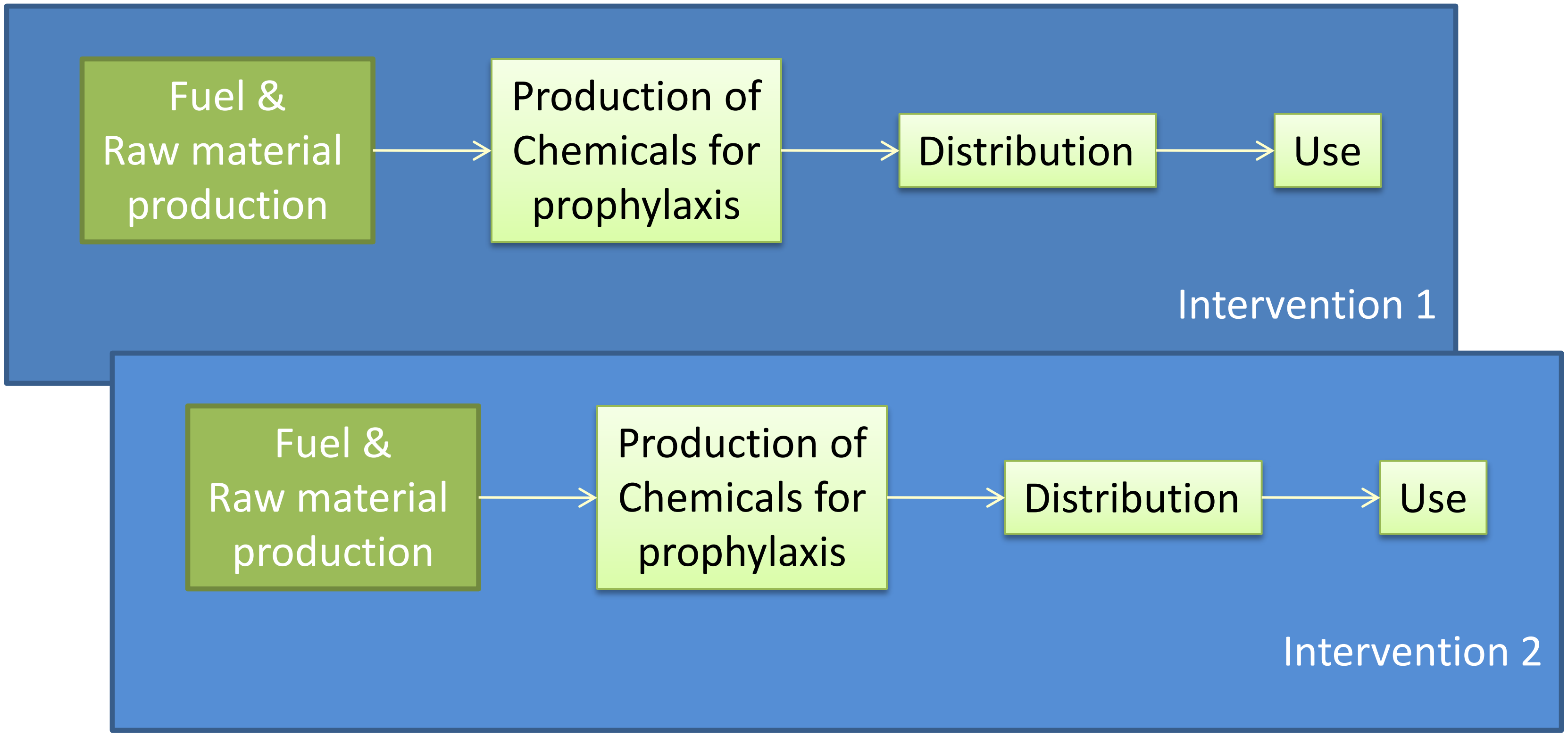
Fuel & Raw material production → Production of Chemicals and Materials for prophylaxis → Distribution → Use

Production of Chemicals and Materials for prophylaxis: Insecticides, Medication, Netting, equipment, Food

Distribution: Centralized, Decentralized, Education

Function: *Protecting the population*
Functional Units:
•Number treated,
•remaining alive in a year
•Infant mortality per year

System for Health Intervention: Chemicals to Combat Malaria



Which intervention system has the lowest environmental impact for the human health outcome it produces?

We do not wish to worsen climate change if it is a causative factor in the disease

Models - Biological and Statistical

How do we use them for adaption choices that leads to greater self-sufficiency?

Reproductive Model for Malaria (all except R and r may be affected by climate/weather)

$$R_0 = \frac{mbca^2e^{-\mu T}}{\mu r}$$

R_0 = basic reproductive number of the disease
m = vector/host ratio
b,c = transmission coefficients
a = human biting rate
μ = daily mortality rate
T = extrinsic incubation period (days)
r = rate of recovery from infection

Combining biological and statistical models for disease, vulnerability and risk

- Biological (explanatory/intensive data use/ dynamic)
  - Disease process
  - Transmission
  - Seasonal variations
  - What the models are good at/ and not
- Statistical (descriptive/ correlations/ static)
  - Climate monitoring
  - Habitat satellite data
  - 4 year herd immunity time scale (malaria specific)
  - Entomological inoculation rates
    - # of bites per unit of time X infection rate
    - Very little data available
  - Distribution of vectors
    - Subspecies of mosquitoes and respective habitats
  - What the models are good at/and not

Integrating other factors beyond data captured in the above models

- Other issues
  - Drug resistance
  - Habitat change other than from climate change (ie land use, war, development/deforestation)
  - Agricultural patterns and proximity to host animals
- Other data
  - Social
  - Economic “cycle of poverty”
  - Role of medical informatics
- Other methods (example models)
  - DPSEEA – correlates with this as it is built on stressors
  - EFA

Climate variability and Dengue Fever in warm and humid Mexico

Felipe Colón, DVM, MSc
F.Colon@uea.ac.uk

Cancún, México

7 December 2010

Tyndall°Centre
for Climate Change Research

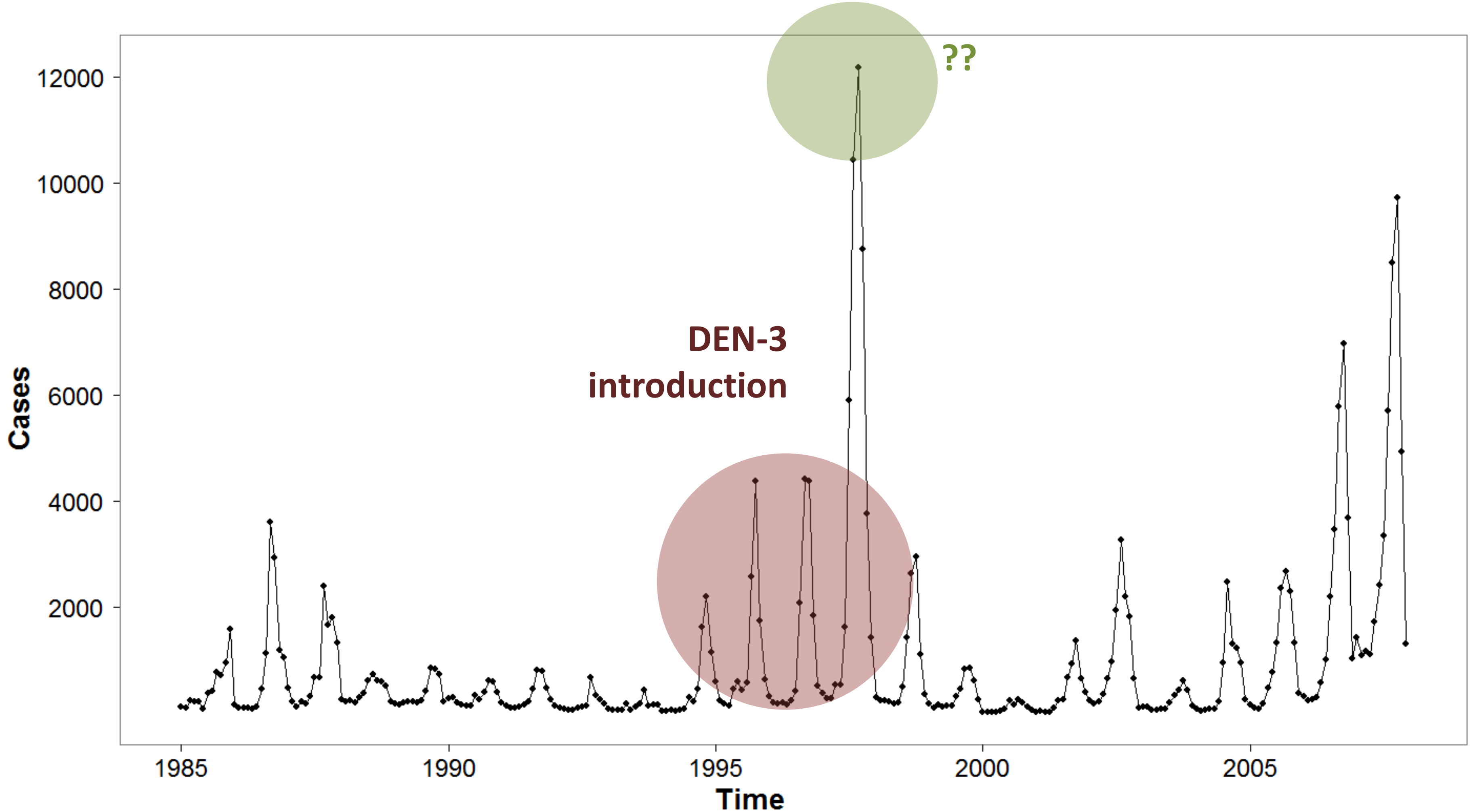
© Felipe Colón 2010

Dengue Fever

- Is the most significant mosquito-borne infectious disease in the world.
- Present in over 100 countries causing about 100 million cases per annum and economic losses for millions of dollars.
- In Mexico, Dengue Fever is present all over the country.
- It is sensitive to changes in climate.

© Felipe Colón 2010

Findings



© Felipe Colón 2010

Tyndall°Centre
for Climate Change Research

Findings…

- Increases in minimum temperature are associated to increases in DF incidence (cool and dry season).
  - Climate change may worsen DF incidence.
- Rising temperatures increase the vector-host contact rate.
- Low temperatures hamper the biology of the vector and the virus
  - Increase the development time and larval mortality (below 16°C).
  - The vector stops feeding at 17°C
  - The virus cannot amplify within the vector below 18°C and low temperatures increase the EIP.

© Felipe Colón 2010

Findings…

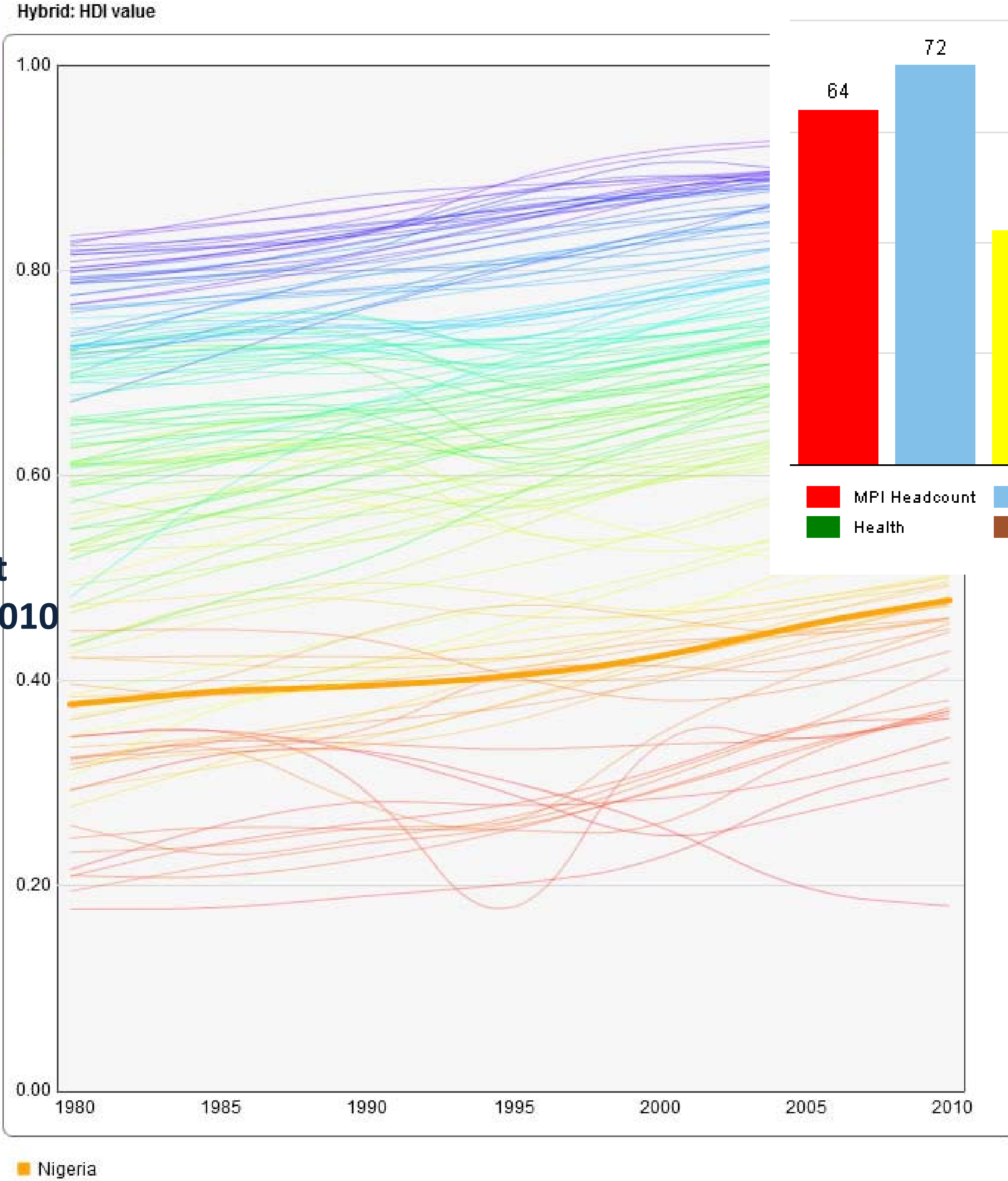
- The risk of infection is 3.4 times higher during the warm/wet season.
- Rainfall was not associated to Dengue incidence:
  - Presence of water all year round.
  - Indoor activity of the vector .
  - Water containers are man-filled.
- Socio-economic and cultural factors.

Final remarks

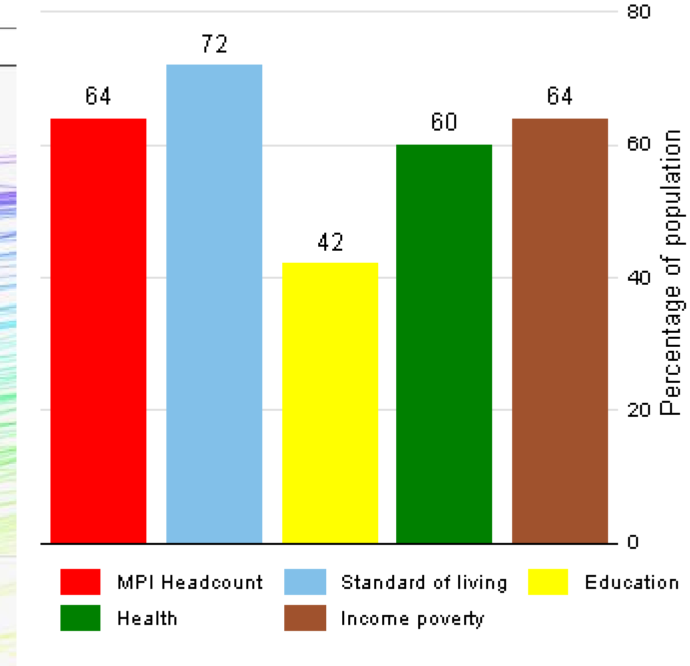
- Climate variability seems to play a key role in the transmission dynamics of DF in the region.
- Climate change (CC) is likely to worsen the burden of the disease.
- CC is only one of multiple influential factors.

© Felipe Colón 2010

Worldwide Trends in the Human Development Index 1970-2010



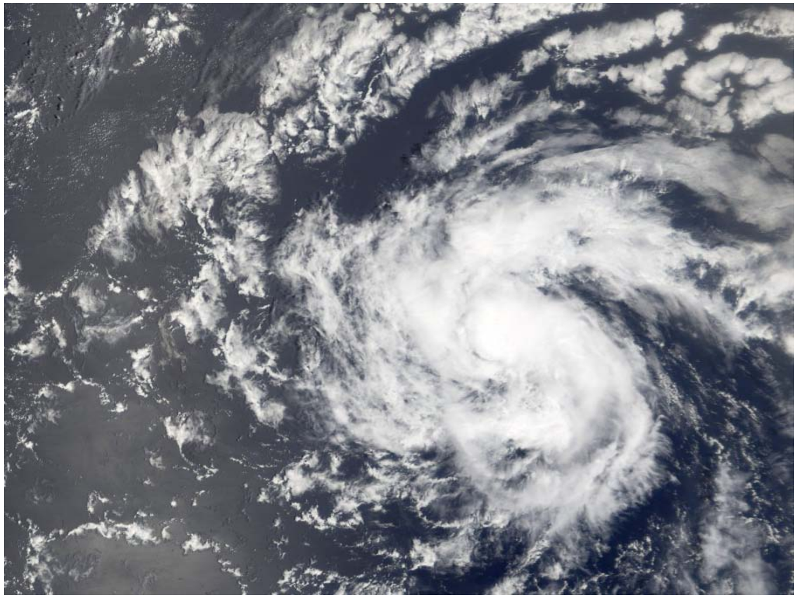
Nigeria's Multidimensional deprivations compared to income poverty



Using LCA in Public Health Policy for Adaptation to Climate Change

- Climate Change models predict:
  - Increased malaria and other tropical and waterborne disease
  - Increased malnutrition as crops fail due to floods and droughts
  - Increased violence due to social disruption

- Greatest effects in tropical and subtropical areas, such as in Sub-Saharan Africa, South Asia and Central and South America



Potential Approaches to the Problem

Conventional Aid Approach

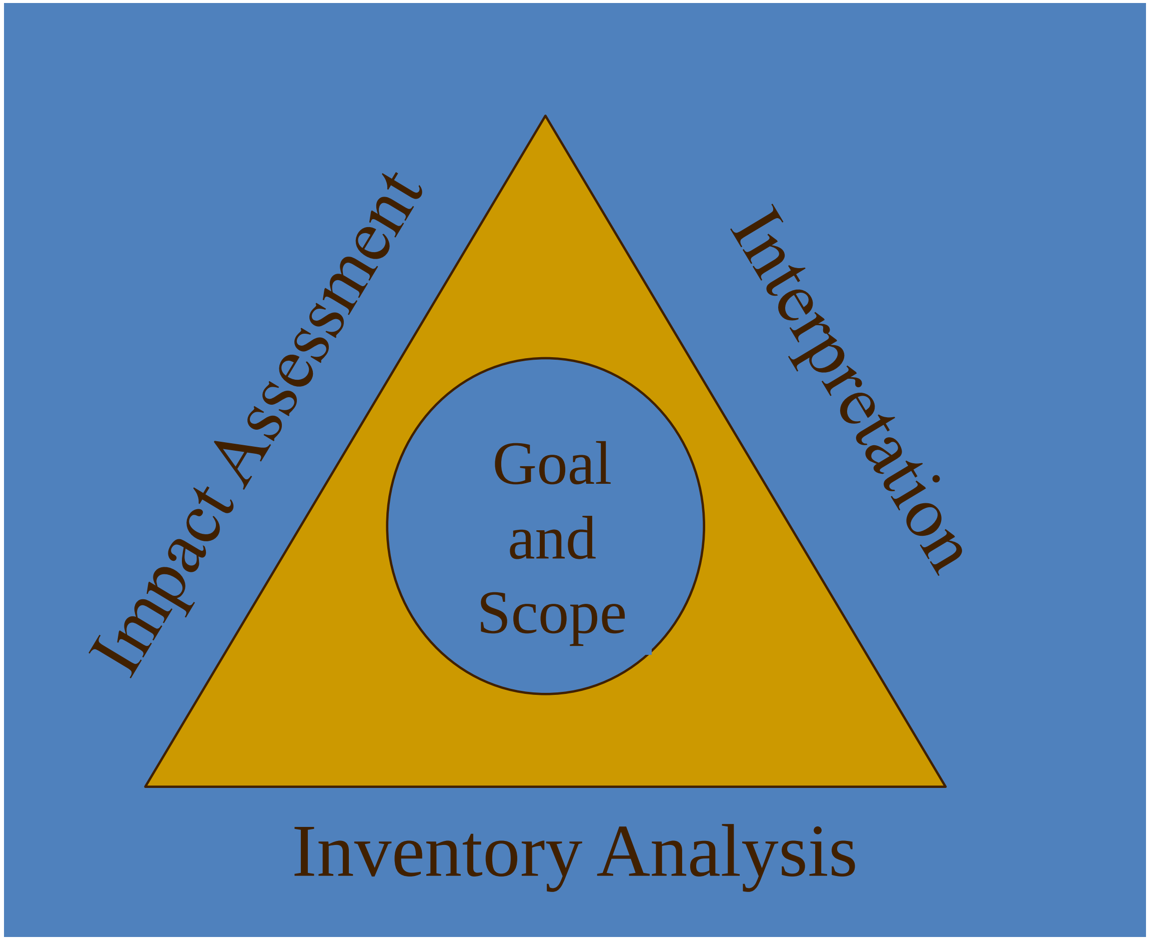
- Insecticide application
- Donating mosquito nets
- Combat acute hunger
- Disease treatment
- Relocation to refugee camps

Emerging Self-reliance Approaches

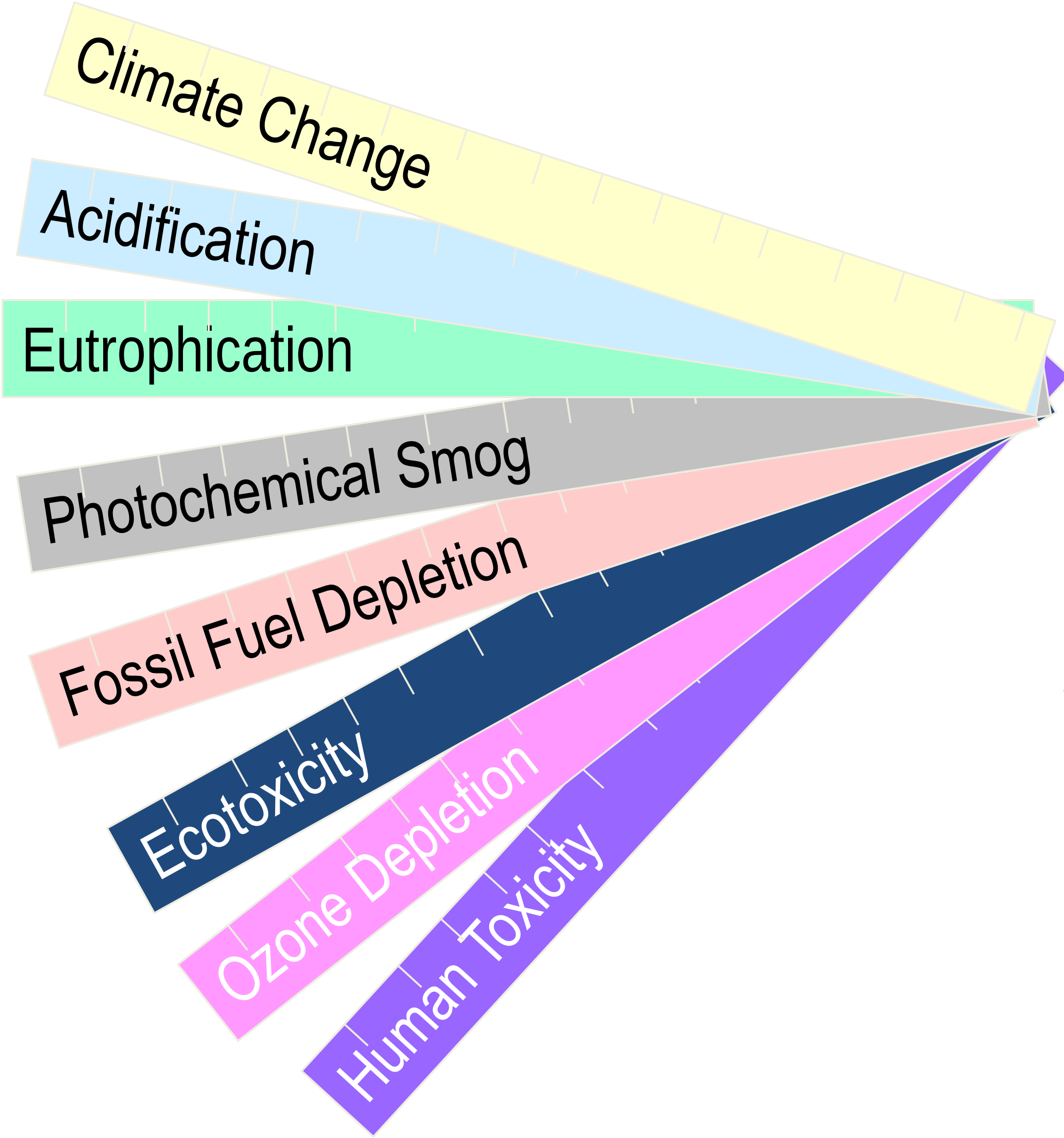
- Key roles of health care workers
  - Education at the local level
  - Engagement in LCA process
- Local entrepreneurship
  - Switching to other crops
  - Selling treated mosquito nets
- Developing transportation infrastructure
- Developing water infrastructure/sanitation


LCA is not being used to measure
human health.

Phases of a Life Cycle Assessment



LCA Measures Indicators of Environmental Impacts



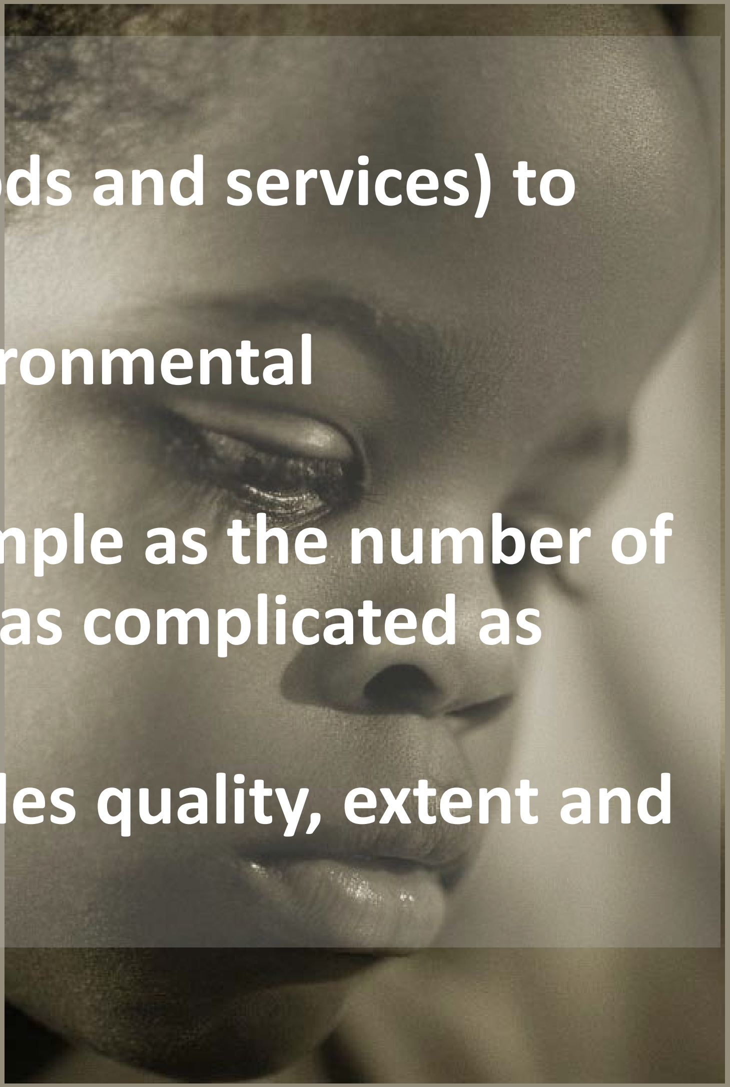
In relationship to the social benefits provided a.k.a the functional unit of The study

In the case of tropical diseases the function is health outcomes And the LCA measures the environmental impacts of different interventions

What we need to scope

- **The System Function and functional unit =**
  Human Health Outcomes
- **Audience/decisions supported**
  Health professionals and funders
- **Environmental impacts being addressed**
  Climate Change and others e.g. ecotoxicity
- **Where to set system boundaries**
  e.g. what time area and processes covered

System Function/Functional Unit



- **Only unique part of LCA**
- **Connects social benefits (goods and services) to environmental impacts**
- **Makes the Market drive environmental improvement**
- **System function can be as simple as the number of infants who die each year or as complicated as governmental function**
- **Functional unit usually includes quality, extent and time components**

Learning:

A) How to identify and select interventions from the models and other sources
B) Scientifically and statistically assess interventions against their environmental impacts
C) Make informed choices that are best for the local area.

Activities at the Local Level:

1) Apply the intervention and assess the outcome
2) Record the geographical coordinates of where it happened
3) List and compare the results of the interventions and locations

How this information is used by Nurses and other Health Practitioners:

•Interpreting Risk
•Adaptation Strategy Development
•Incorporating Current Solutions
•Creating New Solutions – Locally Based
•Put Variable of Local Disease Risk into Early Warning System

Human Health: The Issue of/for Climate Change Adaptation Strategies

Dr. Lynn Wilson – SeaTrust Institute   www.seatrustinstitute.org
+1 360-961-3363 USA

Pastor Peters OMORAGBON – Nurses Across the Borders:
www.nursesacrosstheborders.org +234-805-265-8024, Nigeria,
+44-1438729726 UK

COP16   Cancun, Mexico   7 December 2010