# Agriculture for Improved Nutrition & Health

**CGIAR Research Program 4**

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# Overview of presentation

- Context: Food safety, informal markets, risk analysis

- Example of risk-based approaches in developing countries.

# Why food safety?

- Up to 1 in 3 people contract illness from food-borne pathogens each year
- 1.5 billion annual cases of diarrhoea in children most due to unsafe food and water. Poor, young, elderly, pregnant women and immune-suppressed most affected
- Aflatoxins cause 70-90,000 deaths of hcc per year; strong association with stunting and immunosuppression
- Multiple burdens of disease: lowered production; trade; environment

# Why perishables?

- High nutrition, high value, high involvement of women, high level of hazards
- Two-thirds of human pathogens are zoonotic – many of these transmitted via animal source food or grey water (salmonellosis, EHEC, *Cryptosporidium*)
- Animal source food single most important cause of food-borne disease. Fruits and leafy vegetables also important
- Recent studies shown pre-harvest stage most important for controlling food-borne hazards

# Why informal sector?

- In poorest countries, informal sector dominates perishables
- Many poor farmers produce staples for home consumption

| Percent milk marketed via informal markets in selected countries in the region | |
|---|---|
| Country | Percent |
| Kenya | 86 |
| Tanzania | 95 |
| Uganda | 90 |
| Rwanda | 90 |
| Ethiopia | 95 |
| Malawi | 95 |
| Zambia | 90 |
| *Source, A. Omore, 2006* | |

# Risk analysis

## a tool for decision-making under uncertainty

# What is different?

- **Risk** > **hazard**
- **Pathway** > **product**
- **Risk**-based ≠ **science**-based

Risk = hazard x probability

# Why a risk-based approach?

**Risk Analysis**:

A process consisting of three components:

risk assessment, risk management and risk communication

**Risk Assessment:**

A scientifically based process consisting of the following steps:

(i) hazard identification,

(ii) hazard characterization,

(iii) exposure assessment,

(iv) risk characterization

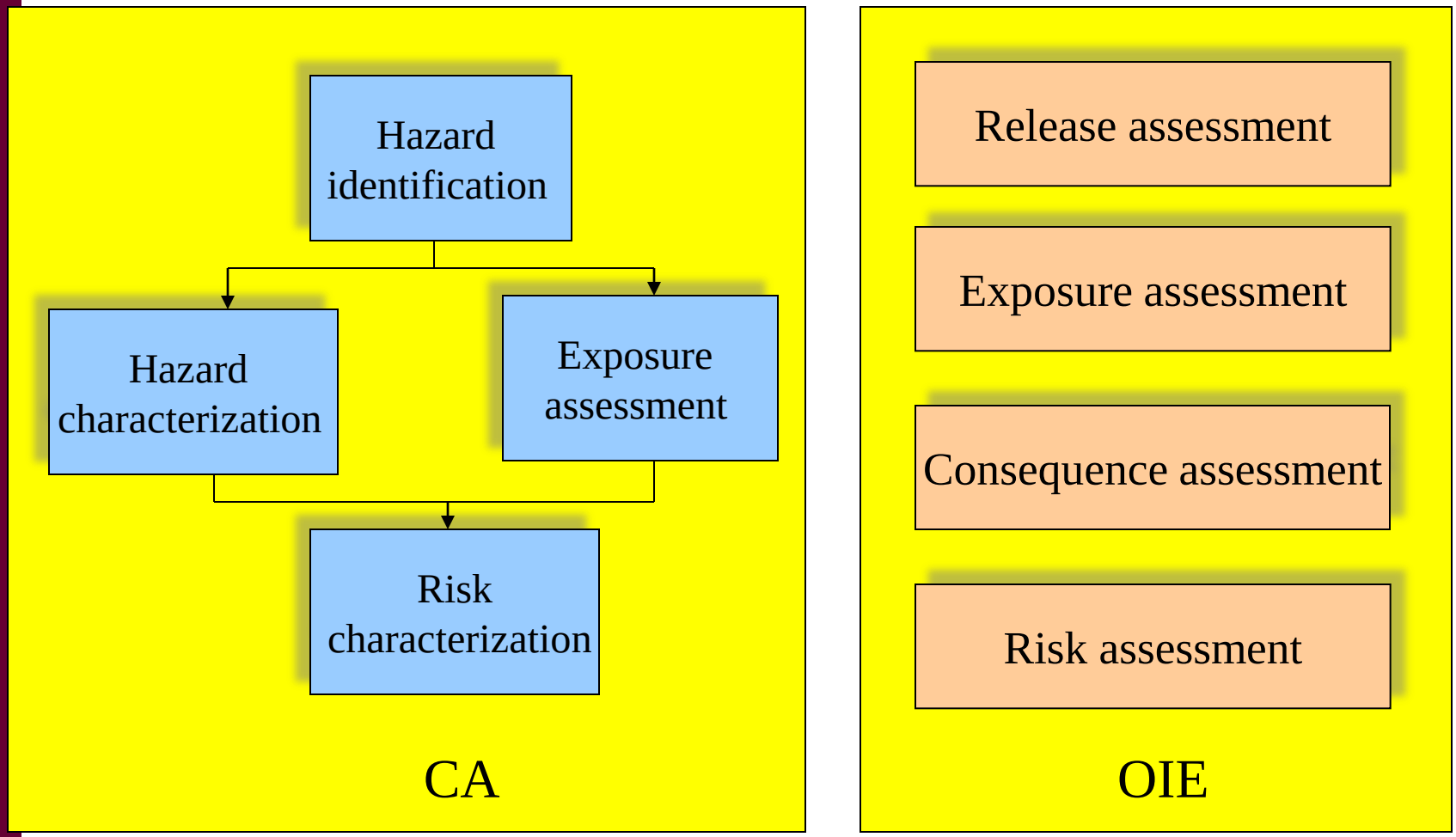
**Risk Management:**

The process, distinct from risk assessment, of weighing policy alternatives, in consultation with all interested parties, considering risk assessment and other factors relevant for the health protection of consumers and for the promotion of fair trade practices, and, if needed, selecting appropriate prevention and control options

**Risk Communication:**

The interactive exchange of information and opinions throughout the risk analysis process concerning hazards and risks, risk-related factors and risk perceptions, among risk assessors, risk managers, consumers, industry, the academic community and other interested parties, including the explanation of risk assessment findings and the basis of risk management decisions

# Two approaches to Risk Assessment



# How risk-based approaches can help decision-makers

- Help identify risks
- Help target the worst risks first
- Reduce risk in cost-effective and flexible ways
- Ensure risk reduction is worth the cost

# Advantages

- Evidence based methodology
  - Transparent, facilitates communication
  - Science-based, reproducible, falsifiable
- Standard for international trade
  - "*Health and safety aspects of Codex decisions and recommendations should be based on risk assessment*"

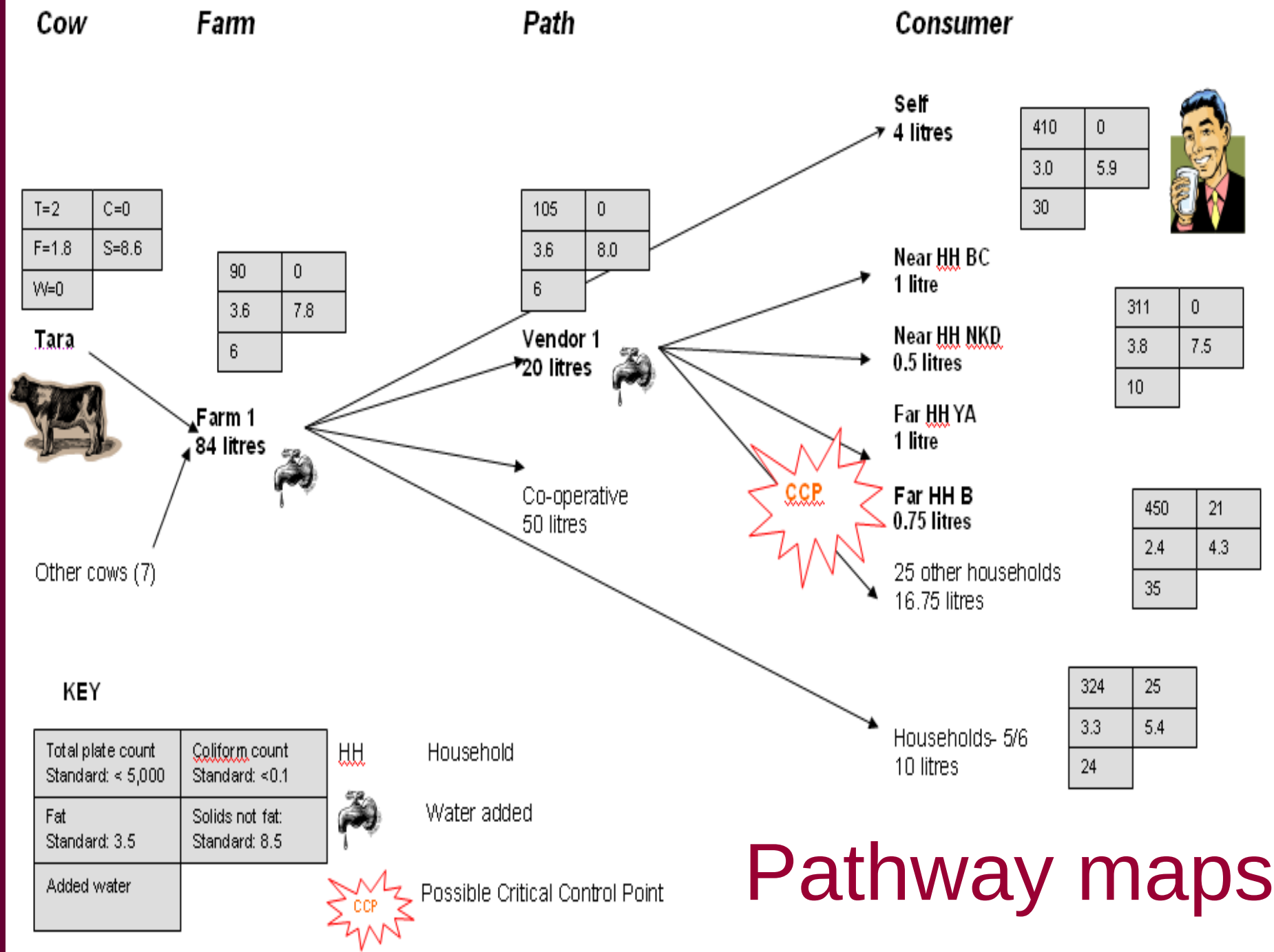
# Challenges to use of risk analysis in local markets in developing countries

## Supply side

- Few risk analysts
- Lack of resources to carry our RA (human, financial)
- Complex systems (self-organised, non-linear, un-regulated, many anonymous actors, high level informal activities)

## Demand side

- Low priority (food security before safety)
- Management culture unfriendly to risk (lack of experience in consuming, value not demonstrated)
- Drivers absent (consumer concern (indignation), large supermarket, fast-food and slaughterhouse chains)

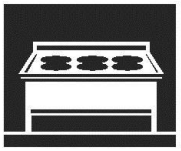
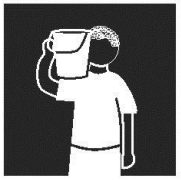
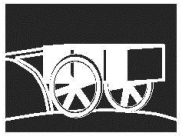



# Pathway maps

# Risk mitigation

**Average of 17.25 risk mitigation strategies used**

**Farmers who believed UA was legal used more strategies**

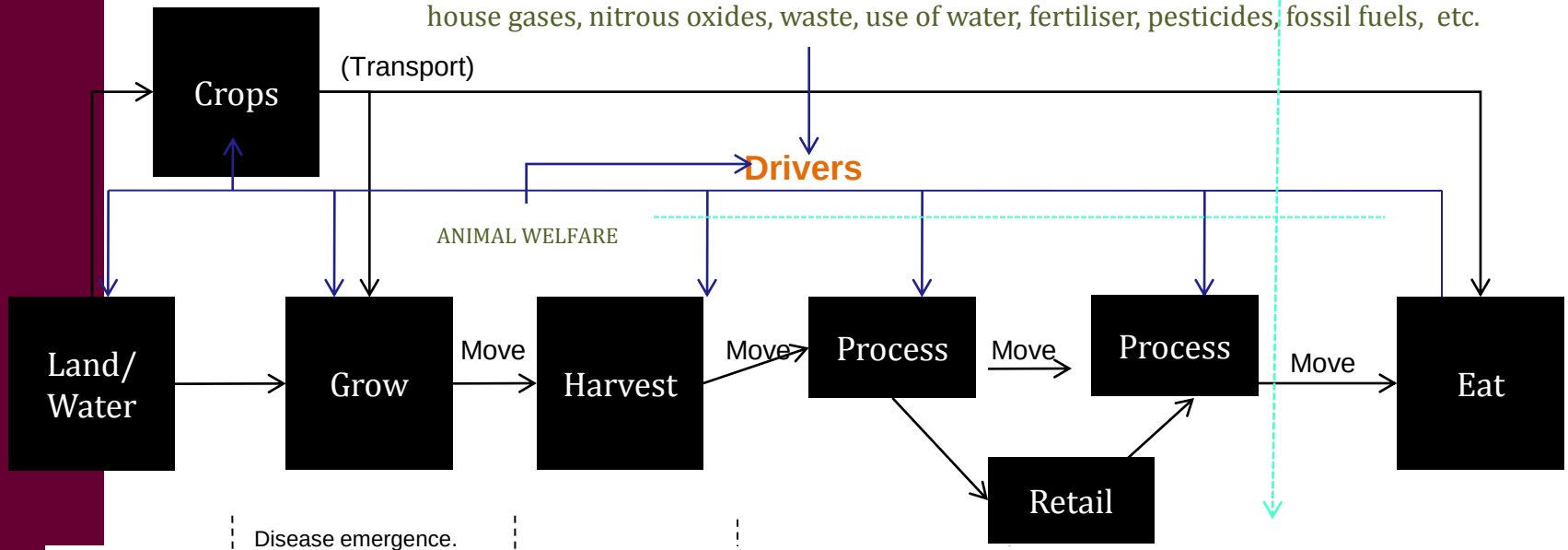
| Hazard Transmission | | Risk mitigation strategies currently practiced (%) | | | |
|---|---|---|---|---|---|
|  | Ecosystem to cow | Keep only one species<br>Zero-graze<br>Use own land only for feed<br>Avoid common grazing<br>Keep local breeds | 29%<br>38<br>41<br>56<br>27 | Treat cattle often<br>Don't keep calves<br>Use Artificial insemination<br>Vaccinate against brucellosis | 31%<br>39<br>44<br>1 |
|  | Milk shed to cow | Use feed/water trough<br>Have concrete/stone floor<br>Use bedding | 94<br>96<br>41 | Stack manure<br>Have a waste disposal strategy | 11<br>96 |
|  | Milk shed / dairy to milk | Have washable shed wall<br>Have metal/tin roof<br>Store containers off floor<br>Keep milk bar dry | 100<br>96<br>29<br>45 | Use just metal/ glass vessels<br>Use piped water<br>Keep premises clean<br>Depose waste >5m away | 19<br>75<br>51<br>38 |
|  | Milk handler to milk | Use hot water to clean<br>Use soap to clean<br>Wear protective clothing<br>Wash hands with soap before handling milk | 18<br>81<br>1<br>59 | Have no discharges/ wounds<br>Have clean hands<br>Have clean/short nails<br>Access to latrine<br>Good personal hygiene | 97<br>79<br>81<br>98<br>49 |
|  | Transport to milk | Don't drink unsold milk | 10 | Don't sell/store unsold milk | 90 |
|  | Milk to consumer | Treat milk<br>Avoid drinking raw milk<br>Check milk quality by smell/taste | 50<br>93<br>48 | Sell milk quickly (=6 hrs)<br>Don't consume milk until withdrawal period passed | 82<br>64 |

# Understanding perceptions

- Livestock take away death
- Some diseased meat gets a higher price
- Livestock not a cause of disease
- Bad smells a cause of disease

Regulatory and institutional framework that drives, enables or hinders changes

ENVIRONMENT: Change in land use, climate, loss of biodiversity, $CO_2$, production green house gases, nitrous oxides, waste, use of water, fertiliser, pesticides, fossil fuels, etc.




Foodborne hazards

Contamination of feed and water

Disease emergence.
Disease introduction, transmission & spread.
Vet biologicals, farm chemicals, heavy metals.

Handling: Mixing, partitioning, removal, x-contamination
Biological: Growth & inactivation

FOODBORNE HAZARDS - Probability of contamination

Nutrient content

Alternative uses
Feed/food/fuel.
Soil minerals.

Feed: type, timing, amount
Species, breed, age, sex
Growth promoters
Production system, etc

Seasonality.
Frequency.
Age at slaughter
Stress hormones.

Combination with other ingredients.
Fat to lean ratio.
Deterioration.
Adulteration.
Supplementation.

Combination.
Deterioration.
Adulteration.
Packaging.

NUTRIENT CONTENT - Probability of nutrient loss (quantity, quality)

Economic Value

Soils, climate, social

Crops/fodder losses; costs inputs DA

Contamination feeds/fodder

Feed production

Market access, price
Income generation

Breeds, feeds, housing, husbandry

Failure to meet standards (organol, bio, chem, process)

Composition
Failure to meet

COSTS - Probability of economic loss or failure to add value along value chain

Nutritional and safety quality at retail

**Consumer knowledge, attitude, practice**

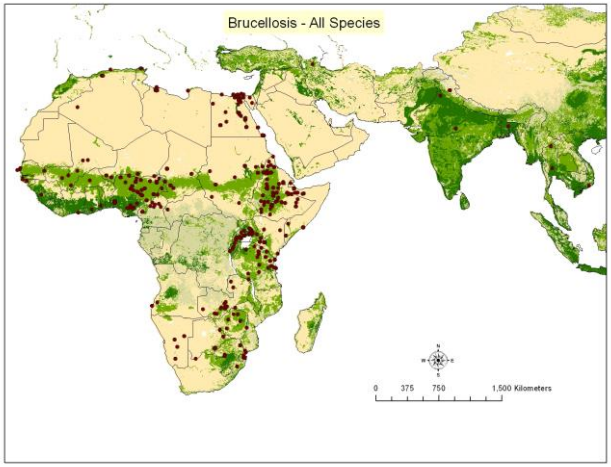
Energy, nutrient, hazard intake
Vulnerability

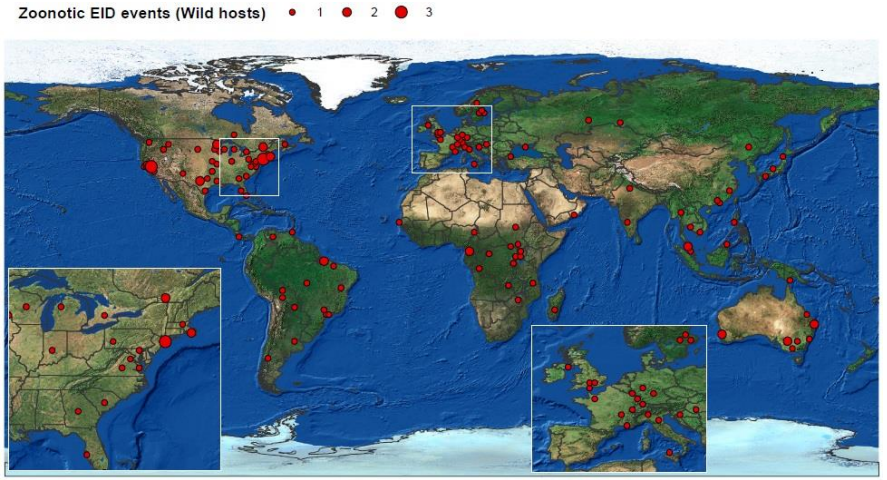
**HUMAN HEALTH**

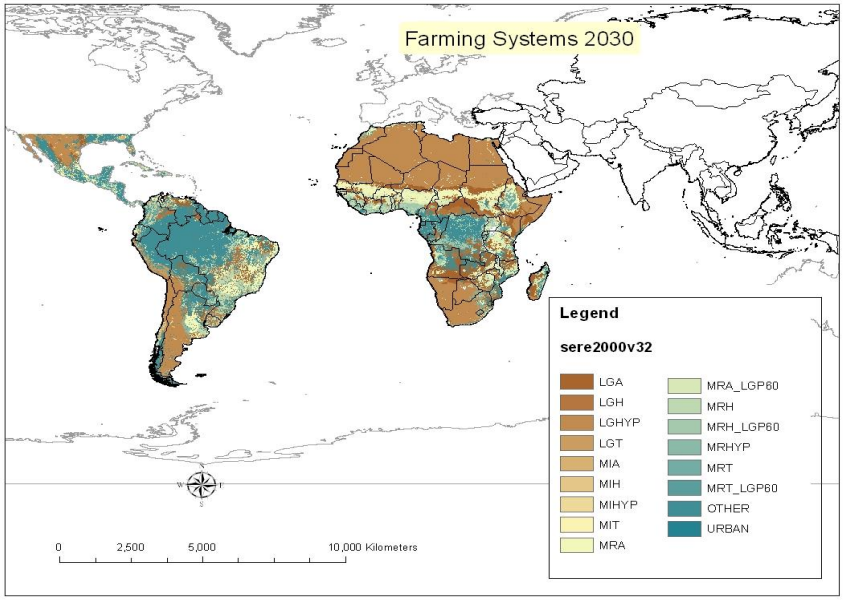
**WELLBEING**

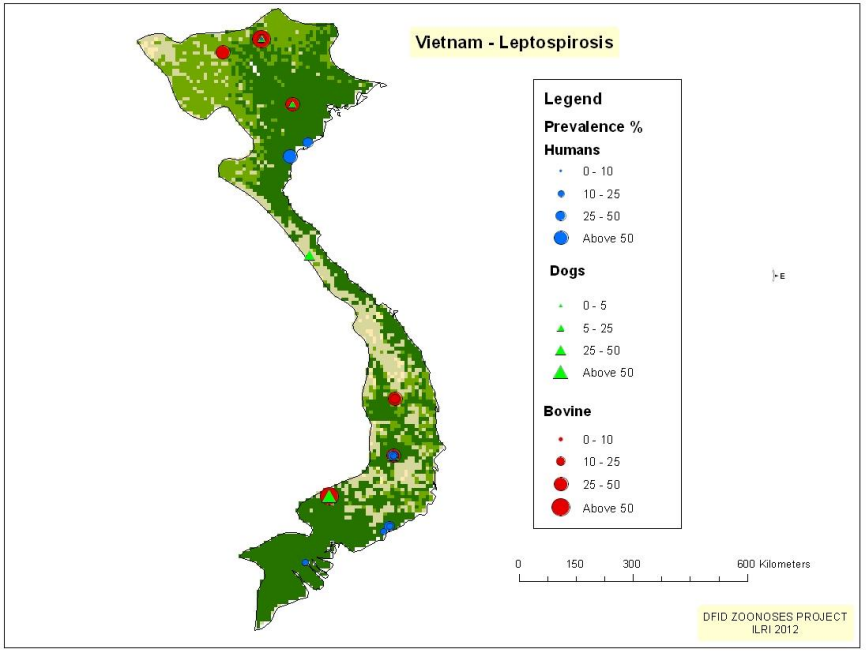
- Situational analysis of FS; policy analysis
- Systematic review published and grey literature
- Rapid integrated assessment food safety & nutrition
- Integrated economic assessment
- National stakeholder workshop
- Support task force; platform; association
- Risk management studies: RCT
- Up-scale and out-scale tested studies

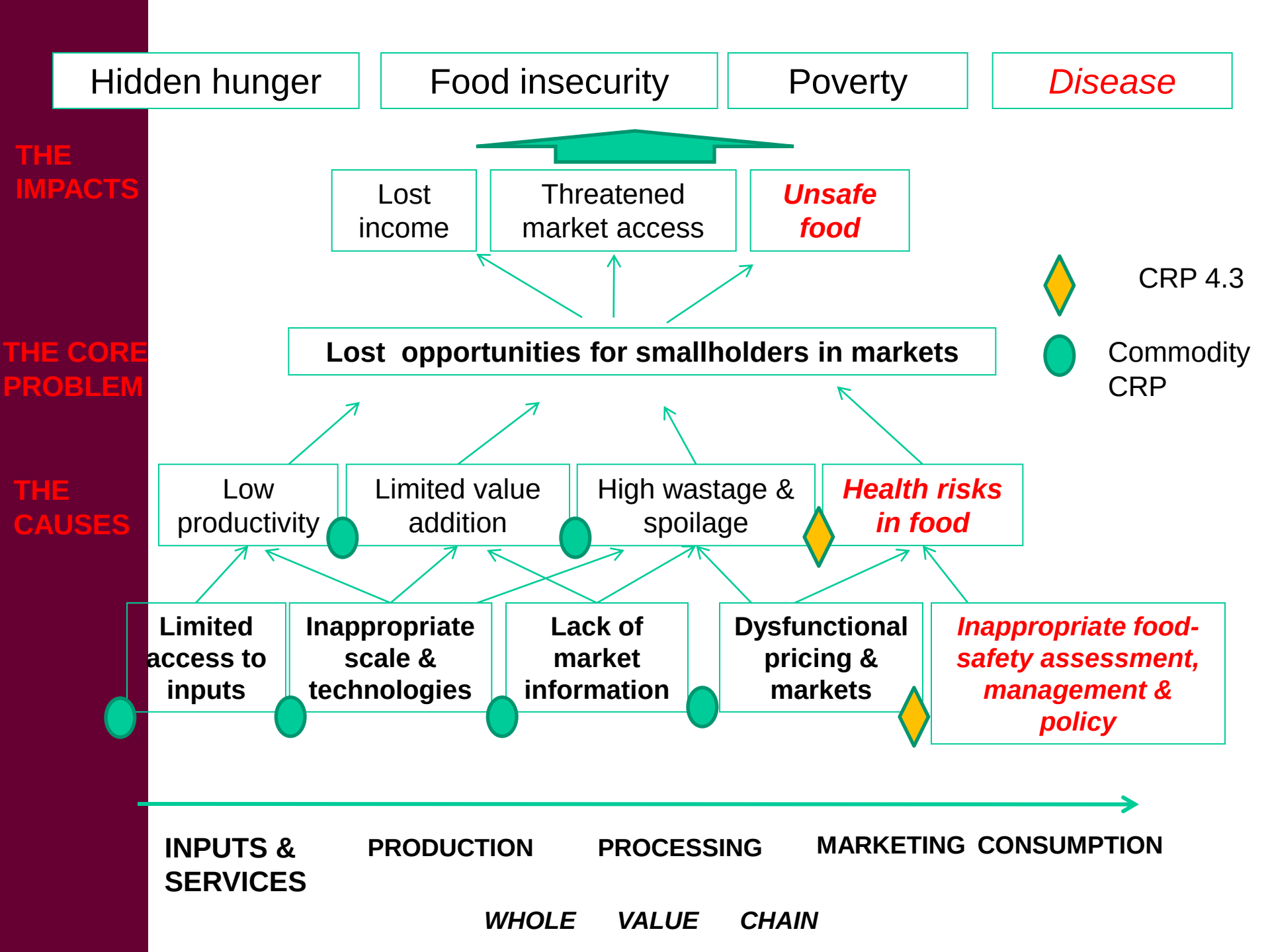
# Mapping & measuring the multiple burdens of disease

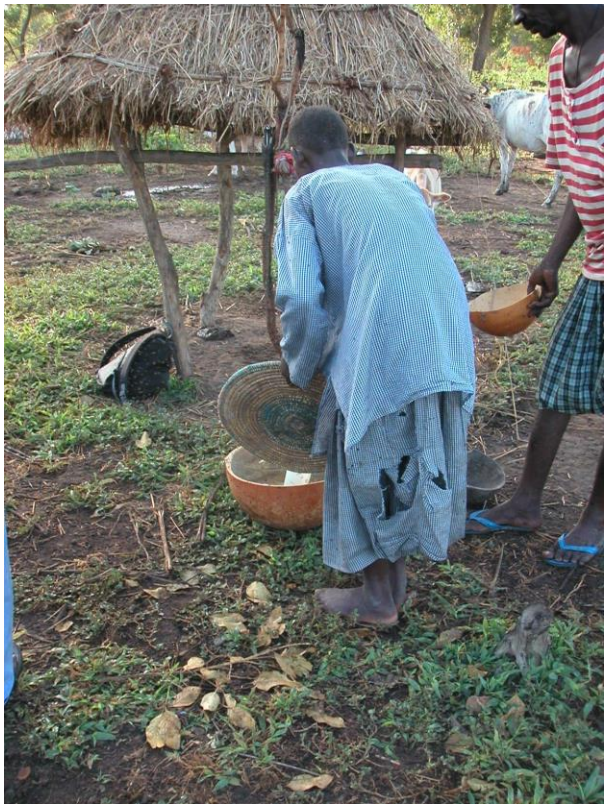



Hidden hunger
Food insecurity
Poverty
Disease
THE IMPACTS
Lost income
Threatened market access
Unsafe food
CRP 4.3
THE CORE PROBLEM
Lost opportunities for smallholders in markets
Commodity CRP
THE CAUSES
Low productivity
Limited value addition
High wastage & spoilage
Health risks in food
Limited access to inputs
Inappropriate scale & technologies
Lack of market information
Dysfunctional pricing & markets
Inappropriate food-safety assessment, management & policy
INPUTS & SERVICES
PRODUCTION
PROCESSING
MARKETING
CONSUMPTION
WHOLE VALUE CHAIN



Thank you for your attention