Global Burden of Crop Loss

Approaches to Estimating Factors Contributing to Yield Losses in the Global Burden of Crop Loss Project

Shortened version of the IPRRG presentation

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International Pest Risk Research Group

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The growing challenge of crop loss

Keeping pace with the growing demand for food, under increasing impacts from climate change, is one of the defining challenges of our time.

High levels of crop loss makes this even harder. According to a widely cited FAO figure, around **20-40%** of the world's crops are lost to pests alone.

$25.8 billion

Is spent annually on agricultural research and development*.

If we don’t measure crop loss well, then how do we know if this investment is working or we are spending it in the right ways?

*Cost of expenditure on crop production based on public and private sector estimates from the following sources. Fuglie, K. (2016) ‘The growing role of the private sector in agricultural research and development world-wide’, Global Food Security. 10 pp29-38 Donor Tracker (2021) 'Agriculture'. Available at https://donortracker.org/sector/agriculture

Global Burden of Crop Loss

The Global Burden of Crop Loss (**GBCL**) initiative aims to provide rigorous, authoritative evidence on **impacts**, **causes**, and **risk factors** of crop loss.

Evidence-based estimates of crop loss and its attribution to different causes will help **direct funding**, **policy**, and **research** efforts to reduce crop loss at the farm level.

Learning from human and animal health systems

The Global Burden of Disease in Human Health provides comprehensive, authoritative data on the impact of hundreds of health problems and risk factors and has transformed the health agenda over the past 30 years.

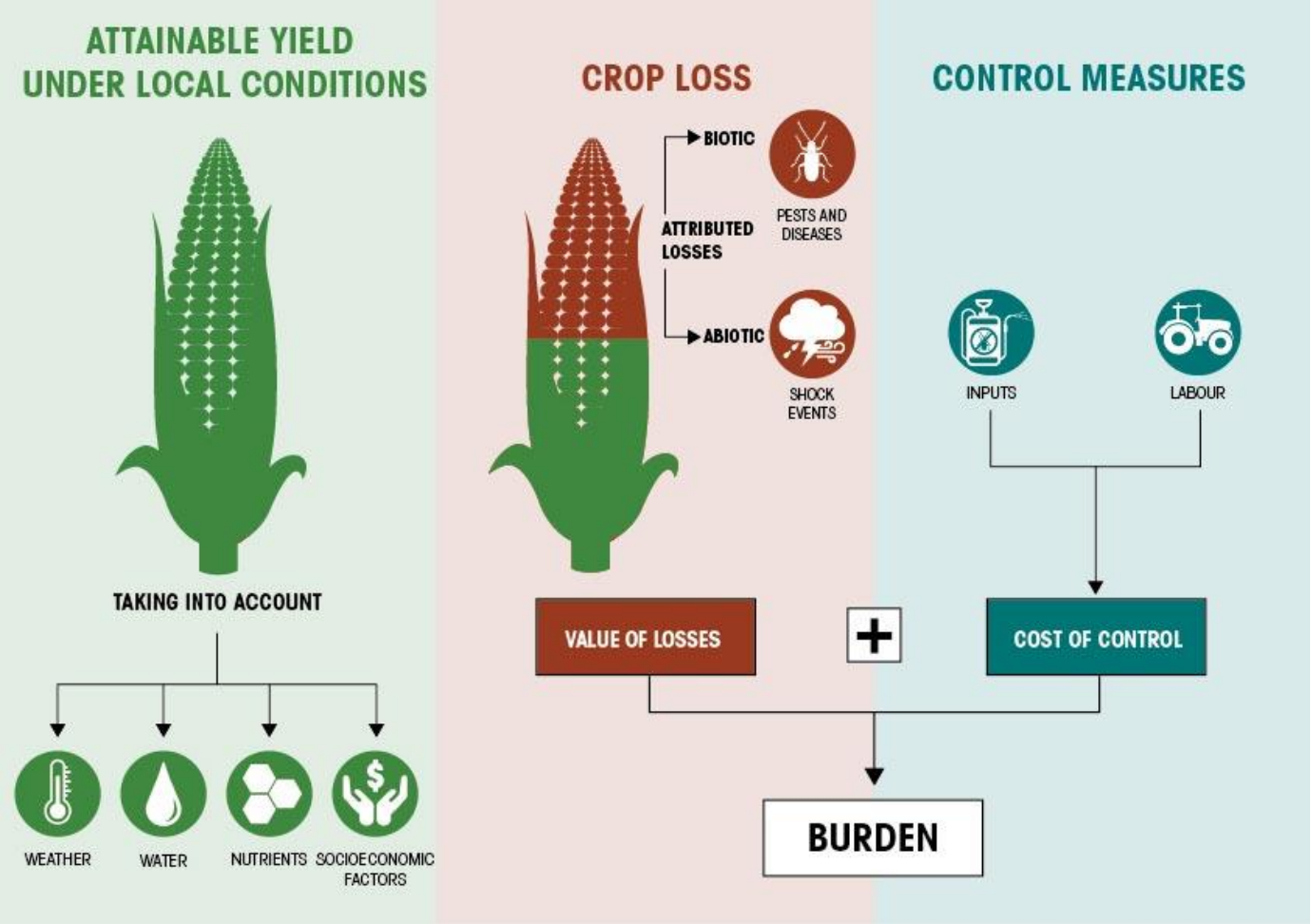
The Global Burden of Disease initiative is led by the Institute for Health Metrics and Evaluation (IHME).

GBADs

The Global Burden of Animal Diseases (GBADs) will produce estimates on the economic impacts of pathogens and animal diseases based on their effect on the mortality and productivity in animals (Rushton *et al.,* 2021).

GBADs is led by the University of Liverpool

Theoretical framework




PROTECTING FOOD SECURITY
DEVELOPMENT OF VARITIES, PRODUCTS + SYSTEMS
LAND USE DECISIONS
SMART AGRICULTURE
BETTER INVESTMENTS + CHOICES
SUPPORTING FARMER LIVELIHOODS
BETTER DECISIONS
BETTER DATA

Our current key data sources

Biotic pressure and key pest identification

Distribution

- CABI Crop Protection Compendia (pest-host pairs, status of the host)
- CABI Pest Distribution Database (linking pest to areas where it is confirmed)
- CABI Plantwise+ Plant Clinics data (frequency of reporting)
- Field trials (multi-pest surveys are rare, temporal gaps, regional gaps, often absences not recorded)
- Survey data retrieved from literature and published datasets (ongoing review process)
- Climate suitability models – published rigorous models are available for a relatively low number of pests – what is the best approach to scale it up?

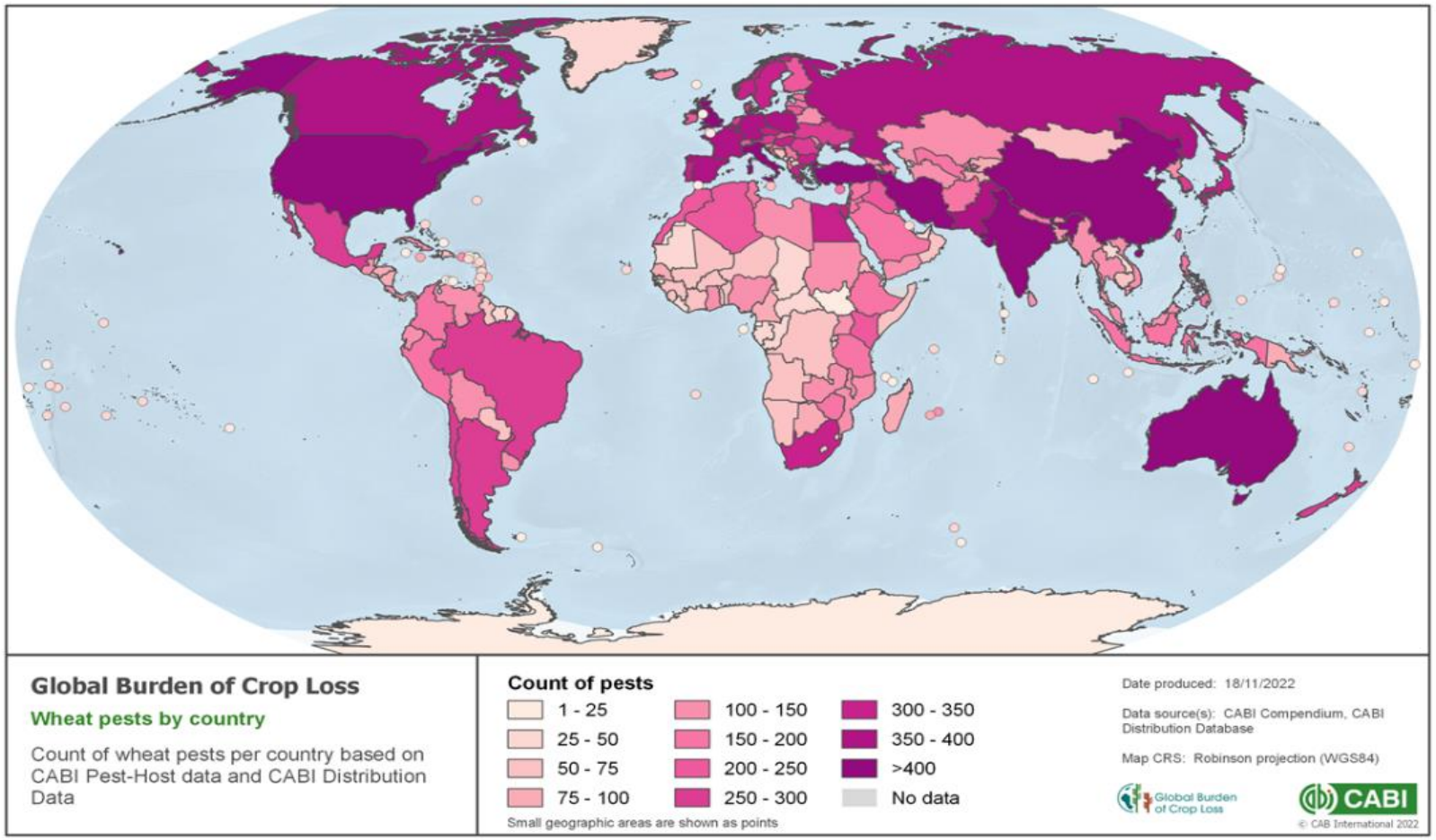
Incidence

- Field trials, literature review, published data
- CABI Knowledge Bank data (from CABI Plantwise+ Plant Clinics)
- CAB Abstracts (geographical and funding biases pertinent)
- Climate suitability models

Impact on yield

- **CABI Plantwise+ Plant Clinics** data
- **CABI historical pest impact surveys**
- **LSMS – World Bank**
- Field trials and pest surveys
- Literature review (manual and automated)

CABI Crop Protection Compendium data



Abiotic impacts
and agricultural issues associated with climate change

Climate Change

- Increase in global temperature
- Increase in extreme weather events
- Changing seasonal pattern of weather

Effects on Agriculture

- Unpredictable growing conditions
- Changes to distribution of pests
- Ecosystem level effects- increase pest outbreaks

Effects to farmers

- Historical practises may no longer be effective
- Potential yield losses
- Increased costs
- Loss and damage to assets

Economic Burden

- Pesticide application rates by crop and country
- Labour cost
- Crop replacement cost
- Irrigation cost

- Environmental externalities: GHG emissions, pollution, freshwater use

What is coming for GBCL

Global – main cereal crops


Wheat


Maize


Rice

Deliverables

- Attainable yield estimates (suite of statistical and mechanistic approaches)
- Crop loss envelope estimates
- High level attribution of crop loss to abiotic/biotic factors
- Economic burden estimates

Regional – tropical crops


Cassava


Banana

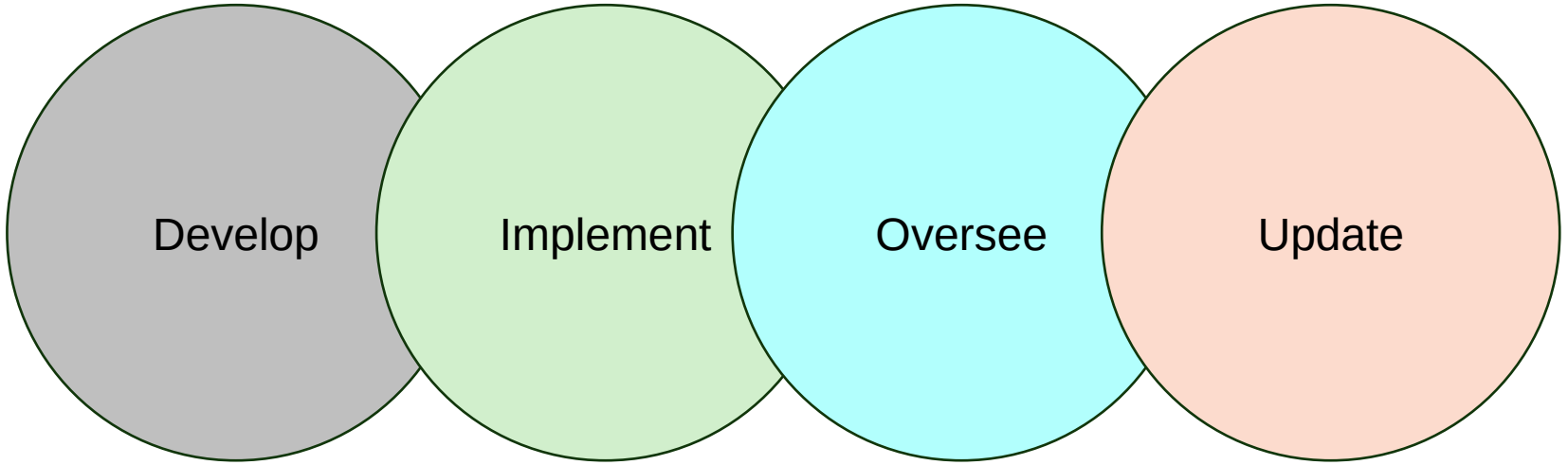
Case studies countries

Deliverables

Three use cases presented where we use granular country level data to **develop methodological approaches** to detailed attribution of losses focusing on biotic factors

Data Management, sustainability plan, dissemination

- Reliable data infrastructure will be built to support data processing, data sharing and burden estimate calculation in line with the FAIR data principles
- Business model & sustainability plan, including governance and financial considerations, to ensure the long-term viability of GBCL.
- Dissemination via dashboard, open access-papers, policy documents,



Our partners and collaborations

CABI is an international intergovernmental organisation, and we gratefully acknowledge the core financial support from our member countries (and lead agencies) including:

Bill & Melinda Gates foundation

The Alan Turing Institute AI UK

UKaid from the British people

Foreign & Commonwealth Office

Ministry of Agriculture and Rural Affairs, People's Republic of China

Australian Government Australian Centre for International Agricultural Research

Agriculture and Agri-Food Canada

Ministry of Foreign Affairs of the Netherlands

Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Swiss Agency for Development and Cooperation SDC