

Inception Workshop

University of Liverpool in London, Finsbury Square, London, UK

26th-27th September 2019

Attendees



L-R: Dr Shoki Al-Dobai (FAO), Dr Andrew Moore (CSIRO), Dr Laura Doughty (CABI), Dr Dick Shaw (CABI), Professor Serge Savary (INRA), Cambria Finegold (CABI), Dr Laetitia Willocquet (INRA), Dr Jeff Ried (Luma Consulting), Alex Ferris (Stanford/University of Cambridge), Dr Richard Stutt (University of Cambridge), Ralf Lopian (IYPH), Dr Roger Day (CABI), Professor Katherine Denby (University of York), Dr Ben Huntington (University of Liverpool/GBADs), Dr Sarah Harvey (University of York), Professor Senait Senay (GEMS, University of Minnesota).

Not pictured: Dr Christina Owen (Bill and Melinda Gates Foundation), Professor Molly Brown (University of Maryland), Professor David Pigott (IHME), Professor Richard Pywell (CEH), Professor Martin Van Ittersum (Global Yield Gap Atlas), Dr Anna Szyniszewska (University of Cambridge), Dr Dan Bebbler (University of Exeter), Dr Rachel Wade (CABI).

See full list of attendees [here](#).

Aims

The Global Burden of Crop Loss (GB Crop Loss) is an ambitious initiative to transform evidence-based decision making in plant health, beginning with an 18-month project funded by a Bill and Melinda Gates Foundation Grand Challenges Call to Action grant. This initial phase lays the groundwork for developing a long-term initiative to generate up-to-date data that enable a comprehensive understanding of global crop loss, modelled on the well-respected Global Burden of Disease in Human Health (GBD). The initiative is currently administered by a collaboration between CABI, The Universities of York and Exeter and Luma Consulting; one of the aims for the first phase of the project is to find further partners and collaborators who will actively contribute to the initiative's success.

Background to the project

Worldwide there are significant losses to crops due to a range of biotic and abiotic factors. Losses of staple cereal and tuber crops directly impact food security and nutrition, while losses in key commodity crops such as banana and coffee have major impacts on both household livelihoods and national economies. Furthermore, the threat of plant pests is increased by climate fluctuations, hindering progress in several of the UN's Sustainable Development Goals.

Despite these impacts, data on the scale, scope, and trends of the problem are sparse and outdated. This initiative will capture and measure the global impacts of crop pests, putting a much needed spotlight on crop health and ensuring that resources and policies are directed towards the real, evidence-based, causes of crop loss. This project has the potential to transform global agriculture and serve as a cornerstone for agricultural policy decision-making.



The FAO reports that between 20-40% of crop yield is lost to pests and disease (left and [here](#)). Reducing crop loss contributes to several of the UN's sustainable development goals (above).

Call to Action Aims

The current funding will enable the team to analyse the feasibility of delivering the vision for the GB Crop Loss. The team are investigating the existing data landscape, collaborative networks and analytical methods to deliver the GB Crop Loss initiative. To deliver this analysis we will begin to build the collaborative network and define a proposed scope, approach, and structure for the delivery of the first iteration in close partnership with stakeholders, contributors, and other key players.

Workshop aims

- Begin to develop a community of collaborators
- Discuss experiences and lessons learned from the Global Burden of Disease (GBD) and Global Burden of Animal Diseases (GBADs)
- Map the current landscape and identify interfaces with ongoing programmes
- Identify key stakeholders and interested parties in the broader plant health community
- Initiate the data ecosystem mapping exercise
- Discuss the proposed approach and way forward

This workshop was an opportunity to gather ideas and feedback from stakeholders and experts. The views captured during the workshop and reported here are valuable inputs towards defining the scope, approach and framework for the first round of the GB Crop Loss. We foresee that during the development of the initiative we will be engaging regularly with the workshop attendees for input, feedback, and validation of the identified approaches, which will be further developed at our final workshop in Helsinki.

Outputs and timescale

We aim to formally launch GB Crop Loss in 2020, which has been declared the International Year of Plant Health by the UN.

Towards the culmination of the current 18-month phase, ending in October 2020, the initial findings will be summarised to provide a clear vision of what will be delivered in the next phase (2020-2025), subject to funding. A stakeholder workshop in November 2020 in Helsinki will provide an opportunity to meet with a wider net of collaborators, present the outputs from the Call to Action, and continue building on the network of stakeholders in preparation for the next steps of the project.

Workshop outputs

Users

A key aspect of the first phase of this project will be defining the users of the GB Crop Loss (and their needs) and ensuring that they are at the forefront of any developments and decisions about coverage and scope. Discussion on potential users generated a wide-ranging conversation and the resulting list (below) comprises a varied set of institutions and bodies. The graphic below illustrates the ways in which the data may be used by those in the table.

Potential Users of GB Crop Loss Data and Products (*key users of the first iteration as discussed at the workshop)

Policymakers* NGOs Farming Co-ops

Development Banks* Agricultural Insurers Public Health Institutions Funders*

Regional Bodies Extension/Advisory Services Regulators* (IPPC, NPPOs)

Farmers Buyers/traders

National agricultural research Institutions

Industry Research organisations

Plant breeders Research Councils

Recommendations and key questions



We plan to take a use-case driven design approach and in the next stage of the project, we will be using human centered design approaches to engage with potential users from different user groups. This will help us to understand their workflows, information barriers, decision-making criteria and data needs. This process will inform the final selection of target users and use cases that underpin the design stage.

In the discussions, the group felt that it may be best to focus on user groups that make policy, regulatory and funding decisions, as they exercise a significant influence on the rest of the plant health system by shaping structures and incentives at the level of the system itself.

Scope

Among the key tasks to be undertaken during this initial phase is to define the initial scope of the initiative. We held a brainstorm with workshop participants, capturing key questions to consider in defining the initial scope of GB Crop Loss.

Defining the scope

- We will start by defining a total loss envelope, followed by breaking down the losses by cause, e.g. type of pests and disease, etc. The level we reach will be determined by the availability of supporting data. We are likely to have broad groupings and a large “other” category in the first iteration: what level of granularity do we need for the product to be useful?
- Should we aim for global geographic coverage, at a level defined by data availability, in the first iteration and refine coverage quality throughout the life of GB Crop Loss, i.e. start with large-scale, high-level data (country/agricultural climatic zones (ACZ)?) and work towards regional/local over time?
- Should we focus our efforts on pests that are causing most damage now or emerging threats that may cause damage in the future?
- Do we need to include weeds and abiotic factors in addition to pests and disease? If so which weeds (the most damaging by crop?) and which abiotic factors?
- How do we determine which crops to include at the start? The most important food or economic crops? By ecoregion/crop type?
- Should we focus on production losses, or also include post-harvest loss?

Other considerations

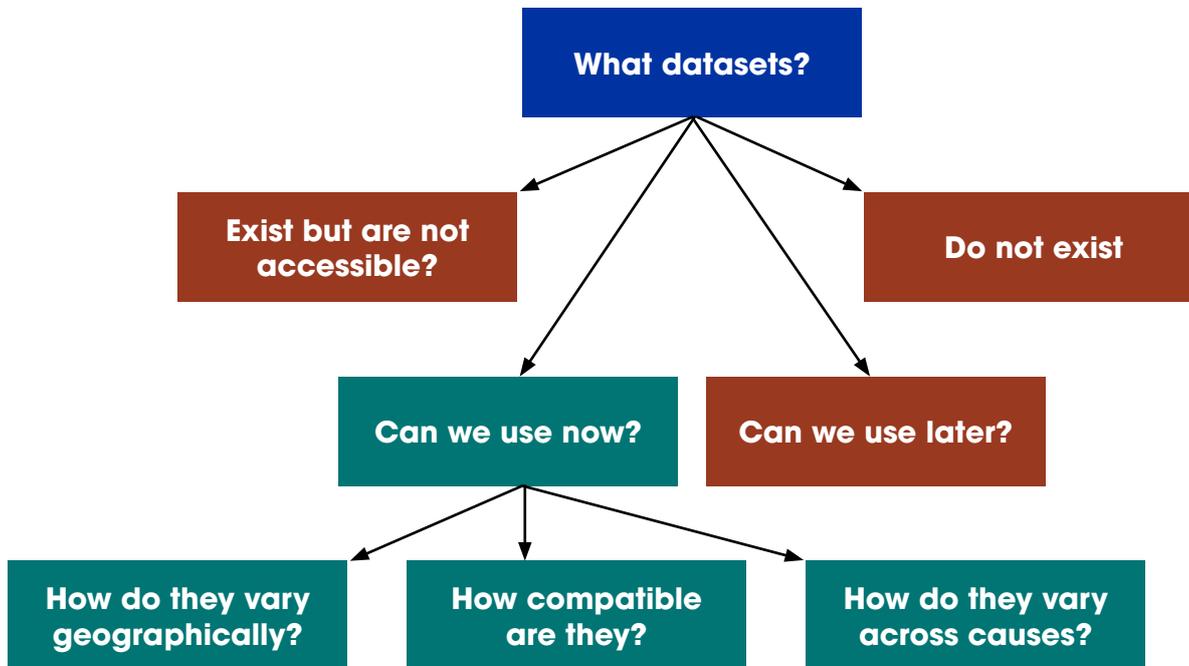
- Factors that we need to consider in crop health include the variety of crops grown, production systems, soil type, environment, and crop genetics.
- Optimum conditions for crop growth will move due to climate change, in addition to crop growing areas expanding due to deforestation and human-mediated habitat change. Global and local economic fluctuations and currency effects will make economic assessments difficult; we will need to involve economists in order to build a true picture of the economic effects of crop loss.
- Satellite data will be an important source of land use data but will need to be ground-truthed in order to be reliable.
- How will we ensure that we are capturing and using all available data? Ontologies in agriculture will be critical to sharing and reusing datasets; we will need to define categories, relationships, and properties of the data we collect.

Data and links to other programmes

We need to understand what data are available, how to assess their quality, whether and how they can be used, and identify the data gaps. An important consideration from the beginning is to document and plan how the GB Crop Loss will cope with increased levels of granularity as it scales up.

Key questions

A key component of the work planned for the Call to Action scoping phase of the GB Crop Loss is to start a data inventory and data ecosystem map to better understand:



Key data considerations: access, trust, autonomy & functionality

Data policy

We need to understand sensitivities around data use and sharing (See GBD GATHER guidelines and FAIR data principles). Additionally, the analysis of threshold data quality needs to be investigated to determine minimum standards that allow us to build a rigorous platform. But, we must ensure that the standards are not overly restrictive as there is value in using data of a lower quality to encourage the creation of better data.

Recommendations

We should think about linking existing models from islands of excellence and building upon them using existing data from across the data ecosystem.

Discussion: specific considerations for pest/disease data

- Should we collect primary data or should it be a data amalgamation exercise?
- What types of data should the project include?
- How should we deal with data gaps?
- How do we manage pest presence/reports and trade sensitivities that might impact on countries?
- It was noted that organizations such as the FAO are already monitoring pest outbreaks in many countries and the cost of prevention is significantly smaller than dealing with an outbreak.

- How do we manage changes to nomenclature (including local names) and a wide variety of races?
- How to account for the wide diversity of crop injuries?
- Will we measure productivity at harvest and post-harvest?
- How to give an indication of monetary value – at the farm gate, market or retail?
- How to include information on economic (including effort and practices) input to production costs?
- Yield for some crops is well studied and standardised for particular geographies and/or inputs (e.g. wheat in the USA) but for other crops and geographies less so. How can we account for these discrepancies?
- How will we access data held by private organizations that might only be available at a cost?
- We need socio-economic data on who and what kind of people are growing/consuming different crops – is this available?
- Field data will be necessary for ground-truthing satellite data and for use as training data in models.

Data - Next steps

Working with the Open Data Institute, the team at CABI will begin to address these questions, with a view of providing an extensive overview of the data landscape as part of outputs of the Call to Action. To help get the team started, a group exercise was used to start to list known data sources (listed here). These outputs provide a strong basis on which we can build our data inventory and start to map links, barriers, and gaps in the data.

Metrics

Metric development is going to be a key area in the inception, and forward trajectory of GB Crop Loss. However, defining metrics that are meaningful but also realistic in terms of the availability of data is going to be a challenge. The following section briefly outlines ideas for metrics that were discussed:

General comments:

- Should we start by thinking about food security SDGs and develop a food security score?
- Recommendation to initially aim for simple metrics that are overarching and can be benchmarked
- Agreement that uncertainty should be reported on
- Attainable yields are very site-specific, should we consider a benchmark maximum per crop that can be to start with, and then adjust using bioclimatic variables?
- Measuring loss in yield terms is appealing due to its relative simplicity, and would be a first step towards calculating any sort of more sophisticated metric. Economic or nutrition-based metrics arguably provide a more comprehensive picture of the burden caused by crop loss (e.g. economic metrics reflect costs of management).

Metrics - Next steps

Metrics definition will come downstream of identifying users, understanding use cases, to ensure they are meaningful to our target users, and once data availability and the data ecosystem are better understood to ensure they can be defined based on the data that are available.

Themes

As a group, we started to define different focal areas that would need to be addressed in GB Crop Loss in order for us to begin to carve up the work into themes. Breakout groups listed the expertise required and known organizations and individuals that should be approached for a number of the themes (see [appendix II](#)).

Themes

- Crops and production systems
- Geospatial data and Earth observation
- Crop injury and damage
- Data system and infrastructure
- Data science
- Food security
- Nutrition
- Economics
- Engagement
- Programme management
- Governance structure

Themes - Next steps

Using the information gathered in this exercise, we aim to continue defining core themes for the delivery of the first iteration of GB Crop Loss. The definition of themes will be at a high level, and will not necessarily follow the structure outlined above. The resulting themes in GB Crop Loss will naturally evolve and grow in complexity as the programme moves forward. From theme definition, we will define work packages as we build the governance structure.

Collaboration

A key component of the work plan for the call to action is to develop a collaborative network and structure. In the initial stages, it is going to be important to find partners in target countries, still to be identified, and to engage with in-country organizations, institutions, and governments.

Insight from GBD: “The network for the initial iteration was small, but it led to increased interest and a growth in the number of partners who wanted to get involved”

This inception workshop was a starting point. Going forward, we need to engage more widely with target users, potential collaborators and develop a tiered network of key players for the delivery of the iteration of GB Crop Loss. We will continue to liaise with the teams from the GBD and GBADs to utilise the expertise of these partner projects and identify other complementary initiatives from which we can learn.

Comments on GBD collaboration incentives

GBD has publication incentives: anyone who contributes to the process is an author in a publication that uses their work, they are also asked to contribute comments on any outputs using their data/work. Collaborators are also encouraged to write their own papers using outputs from the GBD.

For more information see pages 15-17 of the GBD Protocol.

GB Crop Loss Governance

The current core team should be thinking about governance and how to build it around the themes identified. GBD has an established governance structure that centres around a management team, scientific council and an independent advisory committee.

Next steps

The core team will drive the following steps

- We need to develop a **clear message** on **why GB Crop Loss is needed** and **how it is possible**
- We need to secure **more funding**
- Identify **key user groups** and conduct user interviews to develop **use cases** and identify **pain points**
- We need to **develop a framework** of everything we should be thinking about and highlight what we can do at this stage
- The **data inventory** and **ecosystem mapping** will start to bring what people are already doing together. We will start coarse and demonstrate how it can increase in granularity over time
- With increased knowledge of the data landscape, we can start to define **work packages** and engage **workgroups** for the first iteration of GB Crop Loss
- We need to **develop a global profile**.
 - CABI is developing marketing materials: see www.croploss.com
 - Write opinion pieces – short communication/respond to the paper in Science?
 - There was a discussion about writing a short communication/respond to the paper in Science Events
- Develop a **governance structure** and begin developing a global community of collaborators
- Develop plans for a side event at the **IYPH conference**, Nov 2020, Helsinki.

Appendix I: Data sources listed in the workshop

[The Global Yield Gap and Water Productivity Atlas \(GYGA\)](#) provides robust estimates of untapped crop production potential on existing farmland based on the current climate and available soil and water resources

[Atlas AI](#) uses high-resolution datasets at continental scale on economic wellbeing, agricultural productivity, and infrastructure quality to provide global economic and agricultural insights

The databases within FAO cover a broad spectrum of topics related to food security and agriculture:

[FAOSTAT – FAO’s corporate database](#)

[CountrySTAT](#)

[Agricultural market information system \(AMIS\)](#)

[Global Information and Early Warning System \(GIEWS\)](#)

[The commodity price database](#)

[Platform for big data in agriculture](#)

[The Global Agricultural Research Data Innovation & Acceleration Network \(GUARDIAN\)](#)

[The Global Agricultural Trial Repository and Database \(AgTrials\)](#)

Household surveys

Individual CG centre data (open data on Dataverse)

Agricultural Incentives

[Agricultural Sciences & Technology Indicators \(ASTI\)](#)

[Food security portal](#)

[Regional Strategic Analysis and Knowledge Support System \(ReSAKSS\)](#)

Agriculture for Nutrition and Health

[GEMS](#) – led by University of Minnesota

Data-Driven Agricultural Innovation

Genetics – Environment – Management – Socioeconomics

[HarvestChoice](#) generates knowledge products that focus on productive and profitable farming in sub-Saharan Africa

Plantwise network and [Planwise Knowledge Bank](#)

CABI global plant clinic records

CABI Other (distribution maps etc.)

[Market Analysis and Reporting Services \(MARS\)](#)

Earth Observation data [NASA](#); [SENTINEL](#)

Appendix II: Institutions and experts with relevant skills identified at the workshop, organised by theme

Crops and production systems

Expertise Known organizations / individuals

Agronomy [Global Yield Gap Atlas](#) (abiotic focus); Plant physiologists; Grower organizations; Regional agricultural research bodies such as [FARA](#) (Africa) and [APAARI](#) (Asia Pacific), etc.

Micro-economy University research groups; [IFPRI](#); Development banks; [FAO](#); INGO's Socio-economics [IFPRI](#); FAO; InSTePP

Geographers / spatial analysts Crop specific specialists

[GEMS](#); Molly Brown CG centers

Geospatial / Earth Observation

Expertise Known organizations / individuals

Data & modelling USGS; Agricultural Research center, Hays; GEMS; CHIRPS; ICRISAT; Harvest choice / InSTePP / IFPRI; SAGE Project (Wisconsin); CRU climate data; Hijman lab (University of California, Davis); CSIRO; Digital Agriculture sources (AU); NASA (Planet, NOPA, UKMO, ABM); Critical zone Observatories (Prof. Banwart – Leeds); UAUs; Sensor data and networks (Gates projects: David Kramer; GEMS: Bryan Kunck); ESA (digital globe); INGO's Socio-economics IFPRI; FAO; InSTePP

Geographers / spatial analysts Crop specific specialists GEMS; Molly Brown CG centres

Crop injury and damage

Expertise Known organizations/ individuals

Plant pathologists INRA; CABI; N8 AgriFood; Many more...

Entomologists ICIPE

Weed scientists CSIRO; CABI; CG centres

Agronomists IICA

Modellers Prof. Gilligan, Cambridge; Dr. Bebber, Exeter; More other universities...

Data systems/infrastructure

Expertise Database architects; subject experts – logic and verification; IT professionals; software engineers; Project management, financial expertise; Legal advice

Data science

Expertise Known organizations/ individuals Statistics FAO; College of Agricultural Sciences, PENN state; IFPRI; SAGE; STARS

Processed based INRA; Wageningen University and research; Cambridge; DSSAT; APSIM; EPIC; STICS; AQUACROP

Mathematical Gilligan Lab, Cambridge; Dr. Bebber, Exeter Geographical Faculty of Geo-information Science and Earth Observation, Twente; ECMWF; UK Met Office;

NOAA; NASA; Centre for Ecology and Hydrology

Spatio-temporal interpolation CSIRO

Protocols GEMS; SCRIPTORIA

Themes that were not investigated in detail: Food security, nutrition, economics, engagement, programme management & governance structure.

Appendix III: Participant List and contacts

Name Affiliation Contact

Dr Shoki Al Dobai FAO Plant Production and Protection Division Shoki.AIDobai@fao.org

Prof. Molly Brown University of Maryland mbrown52@umd.edu

Dr Dan Bebber University of Exeter D.Bebber@exeter.ac.uk

Dr Roger Day CABI r.day@cabi.org

Prof. Katherine Denby University of York & N8 AgriFood katherine.denby@n8agrifood.ac.uk

Dr Laura Doughty CABI l.doughty@cabi.org

Alex Ferris University of Cambridge & Stanford University af674@cam.ac.uk

Cambria Finegold CABI C.Finegold@cabi.org

Dr Sarah Harvey University of York sarah.harvey@york.ac.uk

Dr Ben Huntington Global Burden of Animal Disease, University of Liverpool b.huntington@liverpool.ac.uk

Ralf Lopian International Year of Plant Health, Ministry of Agriculture and Forestry of Finland
ralf.lopian@mmm.fi

Dr Andrew Moore CSIRO andrew.moore@csiro.au

Dr Christina Owen Bill and Melinda Gates Foundation Christina.Owen@gatesfoundation.org

Prof. David Pigott Global Burden of Disease, IHME, University of Washington pigottdm@uw.edu

Prof. Richard Pywell Centre for Ecology and Hydrology rfp@ceh.ac.uk

Dr Jeff Ried Luma Consulting jried@luma-consulting.com

Prof. Serge Savary INRA, Université de Toulouse serge.savary@inra.fr

Prof. Senait Senay University of Minnesota ssenay@umn.edu

Dr Dick Shaw CABI r.shaw@cabi.org

Dr Richard Stutt University of Cambridge rs481@cam.ac.uk

Dr Anna Szyniszewska University of Cambridge ams293@cam.ac.uk

Prof. Martin Van Ittersum Global Yield Gap Atlas & University of Wageningen martin.vanittersum@wur.nl

Dr Rachel Wade CABI r.wade@cabi.org

Dr Laetitia Willocquet INRA, Université de Toulouse laetitia.willocquet@inra.fr