Crop Science ESG Investor Webinar

Sustainability Update: Biodiversity & Crop Protection

October 23, 2023

4:00 - 5:30 pm CEST
2:00 - 3:30 pm UTC
10:00 - 11:30 am EDT

Cautionary Statements Regarding Forward-Looking Information

This presentation may contain forward-looking statements based on current assumptions and forecasts made by Bayer management.

Various known and unknown risks, uncertainties and other factors could lead to material differences between the actual future results, financial situation, development or performance of the company and the estimates given here. These factors include those discussed in Bayer's public reports which are available on the Bayer website at http://www.bayer.com/.

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Commercialization is dependent on multiple factors, including successful conclusion of the regulatory process. The information presented herein is provided for educational purposes only, and is not and shall not be construed as an offer to sell, or a recommendation to use, any unregistered pesticide for any purpose whatsoever. It is a violation of federal law to promote or offer to sell an unregistered pesticide.

Agenda

1

Prepared Remarks

Welcome and Introduction **1**

Dr. Klaus Kunz

Head of ESG External Engagement & Performance Reporting

Biodiversity & Regenerative Agriculture **2**

Jessica Christiansen

Head of Sustainability & Business Stewardship, Crop Science

R&D and Stewardship in Crop Protection **3**

Robyn Kneen

Head of Global Regulatory Scientific Affairs, Crop Science

Environmental Impact Reduction of Crop Protection (“CP EIR”) **4**

Daniel Glas

Sustainability Venture Lead, Crop Science

2

Q&A with all Speakers and additional Experts

Transparency as integral part of our sustainability efforts

Enhanced transparency efforts accompanied by engagement to regain and strengthen trust

Transparency on Bayer safety studies

2017

2018

Raising the bar on safety standards / Transparency on Bayer safety standards

2019

Introduction of "Bayer Societal Engagement (BASE) principles"

Launch of Bayer Science Collaboration Explorer in Germany

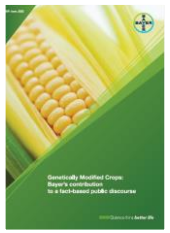
2020

Published Operator Safety Standard

Publication of 1st Report on Neonicotinoid Insecticides

Publication of 1st Climate Lobbying Report

2021



Publication of Reports on GMOs and UNGC Compliance / Investor Webinar

Update Webinar on Biodiversity and Crop Protection

2022

Launch of Open Labs 360°

2023 results

#5 / 350 in Food and Agriculture Benchmark
#4 / 350 in Nature & Biodiversity Benchmark

2023

To be published soon:

// Report on Crop Protection R&D and Stewardship
// 2nd Crop Science Sustainability Progress Report
// Bayer Political Advocacy Report

Our Global Food Systems are Under Increasing Pressure

Demand for Sustainably Sourced Food and Renewable Fuels Never Greater

GROWING POPULATION

+2.2bn
people on the planet by 2050[1]

+50%
more food and feed required to meet growing demand [2]

>3bn
people live in agricultural areas with high to very high water shortages[3]

>70%
of all available freshwater is used in agriculture[4]

90%
of all soils are expected to be degraded by 2050[5]

-20%
loss in arable land per capita by 2050[6]

PRESSURE ON ECOSYSTEMS

-17%
harvest losses from climate change[7]

[1] UNDESA 2017 (United Nations Department of Economic and Social Affairs, Population Division (2017). World Population Prospects: The 2017 Revision)
[2] FAO 2017, (FAO Global Perspective Studies)
[3] FAO, 2020 (Water Scarcity | UN-Water (unwater.org))
[4] UN-Water, 2021 Water Scarcity | UN-Water (unwater.org))
[5] FAO Saving our soils by all earthly ways possible | FAO Stories | Food and Agriculture Organization of the United Nations
[6] FAOSTAT (accessed Oct 30, 2018) for 1961-2016 data on land, FAO 2012 for 2030 and 2050 data on land, and UNDEDA 2017: World Population Prospects for world population data
[7] Nelson et. al, (2014); FAO 2016 “Climate change and food security”

Our Vision

for Sustainable & Regenerative Ag Solutions

“Producing more with less and restoring more”

… based on **system-based approaches,** amongst others enabled by

our **Biodiversity strategy**,

responsible R&D and Stewardship, and

ongoing **Environmental Impact Reduction**

Jessica Christiansen

- Head of Sustainability & Business Stewardship, Crop Science

Biodiversity & Regenerative Agriculture

Vision | ***Health for all, hunger for none***

How serious is Biodiversity decline?

According to the 2019 IPBES[1] Report more than 1 million species of plants and animals are facing extinction

What does it mean for agriculture?

The average abundance of **native species** in most major land-based habitats has fallen by at least

20%

mostly since 1900

90%

of all **soils** are expected to be degraded by 2050[2]

Currently, **land degradation** has reduced productivity in

23%

of the global terrestrial area

It is estimated that about

10%

of **insects** are being threatened

Many countries report declines in populations of birds, bats and insects that contribute to **pest and disease regulation**[3]

>75% global food crop types rely on animal **pollination**

9 out of 6.000 crop species

account for

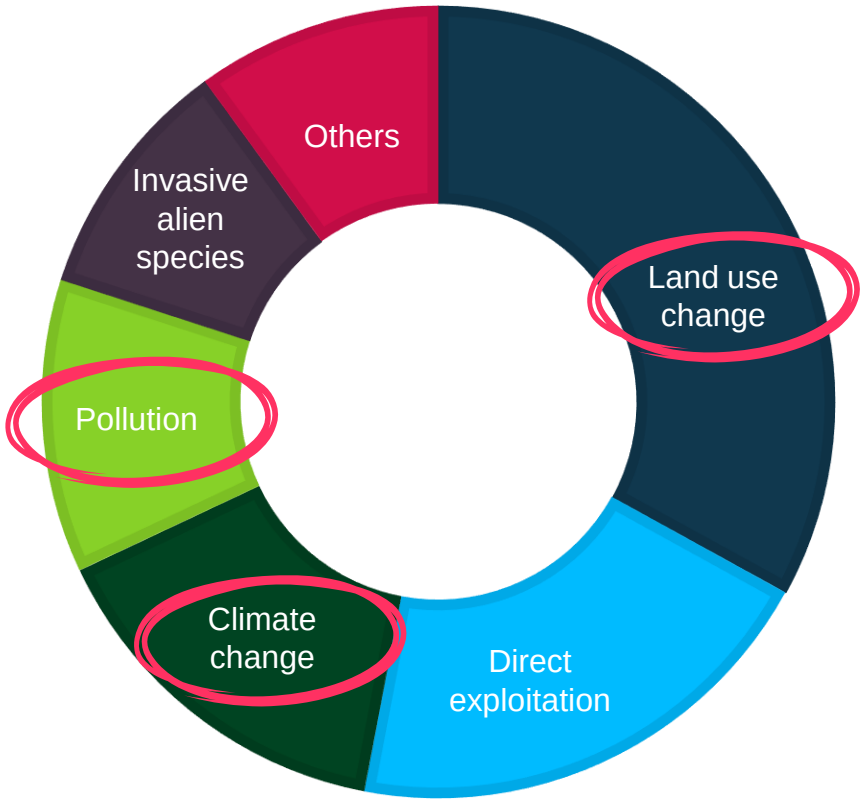
66% of total crop production[3]

Reductions in the diversity of cultivated crops, crop wild relatives and domesticated breeds mean that agroecosystems are **less resilient** against future climate change, pests and pathogens

[1]IPBES = Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services
[2] FAO Saving our soils by all earthly ways possible | FAO Stories | Food and Agriculture Organization of the United Nations
[3] The State of the World Biodiversity for Food and Agriculture – in Brief (fao.org)

What are the main drivers of terrestrial biodiversity decline?

… and what needs to be done to bend the curve of biodiversity decline?



// **Pollution:** Crop protection application is not the major contributor to loss of biodiversity: nitrogen over fertilization (eutrophication) is likely to play a much bigger role (78 % of global eutrophication).

CP EIR

// **The impact of climate change might increase in the future:** it can also contribute to habitat degradation

GHG

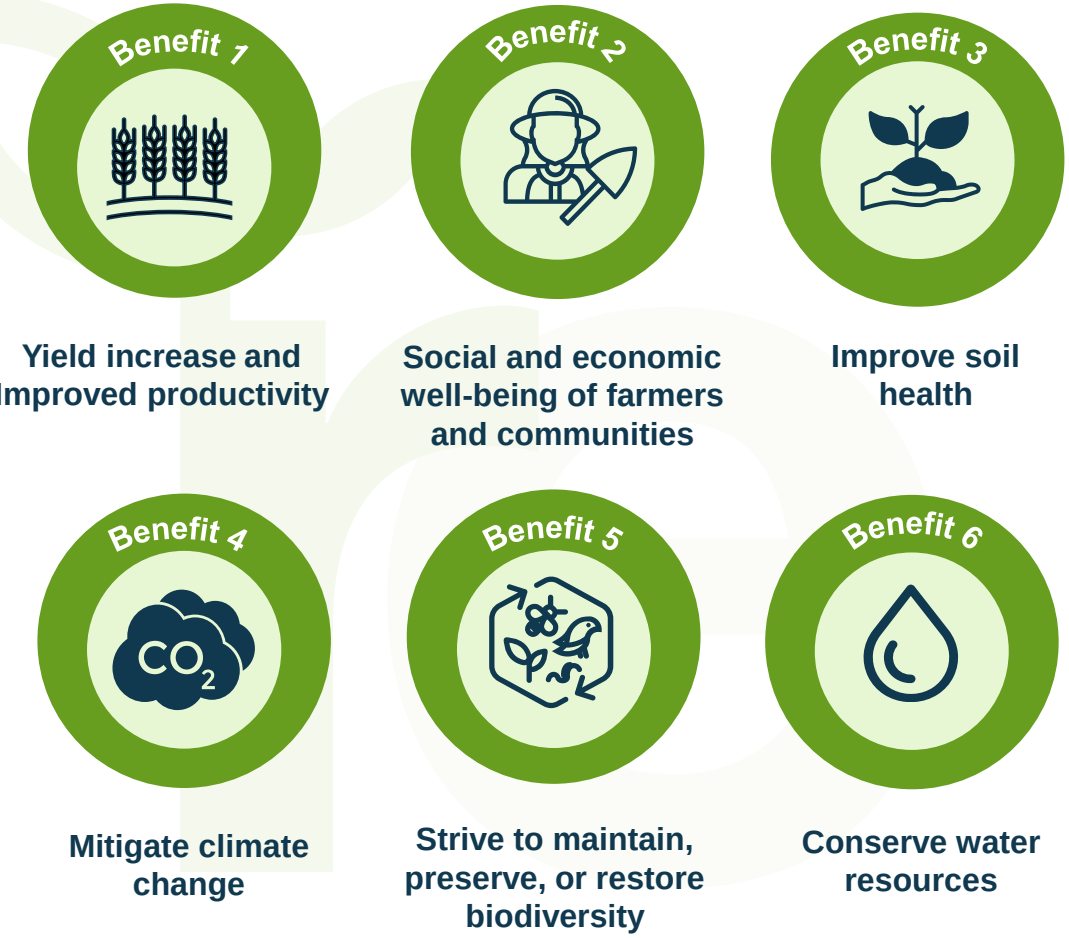
// **Land use change:** habitat loss, degradation, fragmentation and land-use intensification are the major drivers

→ Agriculture is one of the major contributors
→ Need to better balance production and conservation
→ Implement more sustainable/ **regenerative**/ biodiversity friendly, nature positive cropping systems which generate benefits for the farmer (and Bayer) while increasing yield

CP EIR = Crop Protection Environmental Impact Reduction

Bayer advocates for an outcome-based definition of Regenerative Ag to drive a solution-oriented approach

Providing a flexible framework that adapts to local field conditions, does not compromise productivity and increases yields



To achieve these ***benefits***, ***Bayer*** supports the following ***principles***:

- **Principle A: Keep the soil covered**
- **Principle B: Diversify rotations**
- **Principle C: Minimize soil disturbance**
- **Principle D: Optimize inputs and reduce impact**

For more details see https://www.bayer.com/en/agriculture/regenerativeag

Future of Farming

Broadening our sustainability approach with a regenerative focus

re generating growth

Sustainability
Focus

“Producing more with less”

We’re supporting food security while reducing agriculture’s impact on nature

- We’re committed to: (1) minimizing the climate footprint of farming, (2) reducing the environmental impact of crop protection, (3) enabling smallholder farmers and (4) improving water use

Reducing and mitigating:

Increasing productivity while reducing the impact on nature

Regenerative
Focus

“Producing more and restoring more”

We’re supporting food security and securing farm incomes while delivering net benefits to nature

- We’re committed to: **(1)** minimizing the climate footprint of farming, **(2)** reducing the environmental impact of crop protection, **(3)** enabling smallholder farmers and **(4)** improving water use

+

- We’re delivering nature-positive outcomes **by improving soil health, restoring and protecting habitats**, **conserving water** and sequestering carbon
- We’re helping farmers increase productivity and incomes with climate adaptation solutions and new sources of revenue

Adapting and regenerating:

Increasing productivity and incomes while renewing nature

For more details see https://www.bayer.com/en/agriculture/sustainable-agriculture

[4]Internal estimate via DirectAcre program in India | [5]TRP Water Use: Kyenetec Panel Survey Data 2020, IRRI (2009), Bouman et al. (2002) | Water Savings from TRP to DSR: Bayer Sustainable Rice Initiative Pilot, Singh et al: (2015) | [6] Carbon emission - IPCC (2006/2019) |

Direct Seeded Rice Cropping System Approach

Providing Sustainability Benefits to Rice Production for Farmers and the Environment while Improving Farmer ROI

regenerating growth

Ramesh

Location: India
Size: 3 acres
Crops: rice

Current Needs

- **Managing rice production with scarce and increasingly expensive labor**
- **Gaining more know-how on new & better technologies and practices**
- **Increasing productivity while keeping costs manageable**
- **Adapting to climate change with expected water scarcity**

Bayer's Unique System of Solutions

Core Portfolio

- non-GM herbicide tolerant hybrid rice
- Seed treatment
- Herbicides
- Nematicide
- Next Gen insecticides
- Next Gen fungicide

Digital Solution

- FarmRise

Agronomic advice

- Better Life Farming

Effect on subsequent crop in rotation

Features, Benefits, and Outcomes

ECOLOGICAL

- Reduced GHG emissions during cropping cycle & post harvest (up to 45 %) [6]
- Reduced water use (up to 40 %) [5]
- Carbon farming opportunities
- Optimal & responsible crop protection and fertilizer use
- Better soil health (tbc via Soil Health Index)

SOCIAL

- Improved food security and climate resilience
- Enhanced farmer health & safety
- Expanded gender-smart interventions

ECONOMICAL

- Higher yield output using less labor, inputs, and time vs transplanting (16 % lower costs) – Improved farmer incomes [4]
- Additional incentives from verifiable carbon credits
- For FarmRise and Better Life Farming – access, know-how, & expertise on new technologies and practices, plus agricultural & financial service providers

Certain products and potential features, benefits, and outcomes on this slide are aspirational and may be subject to regulatory approvals and final verification

Generating benefits for growers through the preservation of biodiversity and enhancement of eco-system services

We work along 3 pillars to build out the corresponding elements

SOIL HEALTH BENEFITS

- // Yield stability
- // Drought resilience
- // Nutrient availability
- // Water quality, retention & availability
- // Carbon sequestration
- // Disease suppression

Examples:
Long-term sustainability trials over entire crop rotation in Argentina, US, and India

HABITAT BENEFITS

- // Land use optimization (e.g., enrolling unproductive land or existing farmland habitats in incentive schemes)
- // Benefits from ecosystem services such as protection against run-off and erosion, pollination, natural pest control

Examples:
Latin America (ProCarbono commodities program), North America (habitat initiatives, RoI map), Bayer Forward Farming to showcasing flower strips etc.

GENETIC DIVERSITY BENEFITS

- // Access to better crop genetics
- // More resilient crops (climate change & resource efficiency)
- // More diverse and regenerative crop systems (incl. cover cropping & intercropping)

Examples:
Collaboration with World Vegetable Center and other gene banks, CoverCress, Intercropping with Moraleda bean (India); Product concepts in biotech (e.g. breeding for cold tolerance to enable no till)

PRECEON SMART CORN SYSTEM | shapers of rice | PRO Carbono | Bayer Forward Farming | CoverCress

Also see
- Group positions on insect decline, deforestation and forest degradation, and protection of biodiversity
- Biodiversity website

Measurement of Biodiversity as ongoing challenge

Leverage internal and external knowhow by actively participating in diverse global associations

Driver	Target	Measurement
Pollution	Crop Protection Environmental Impact Reduction	Treated area weighted environmental impact / ha
Climate change	GHG reduction	Carbon intensity (CO_{2eq}/t)
Land degradation	Soil Health Improvements (no target set)	Soil health Index etc.
Land use change	Habitat protected/ restored (no target set)	Area (e.g. via remote sensing)
Agriculture	Increased biodiversity (no target set)	Number of species (e.g. e-DNA, metabarcoding)

Challenges

- // Identify scalable and affordable metrics
- // Define easy to quantify output targets- taking into consideration local and regional conditions
- // Biodiversity is influenced by many factors – not only agriculture

wbcsd

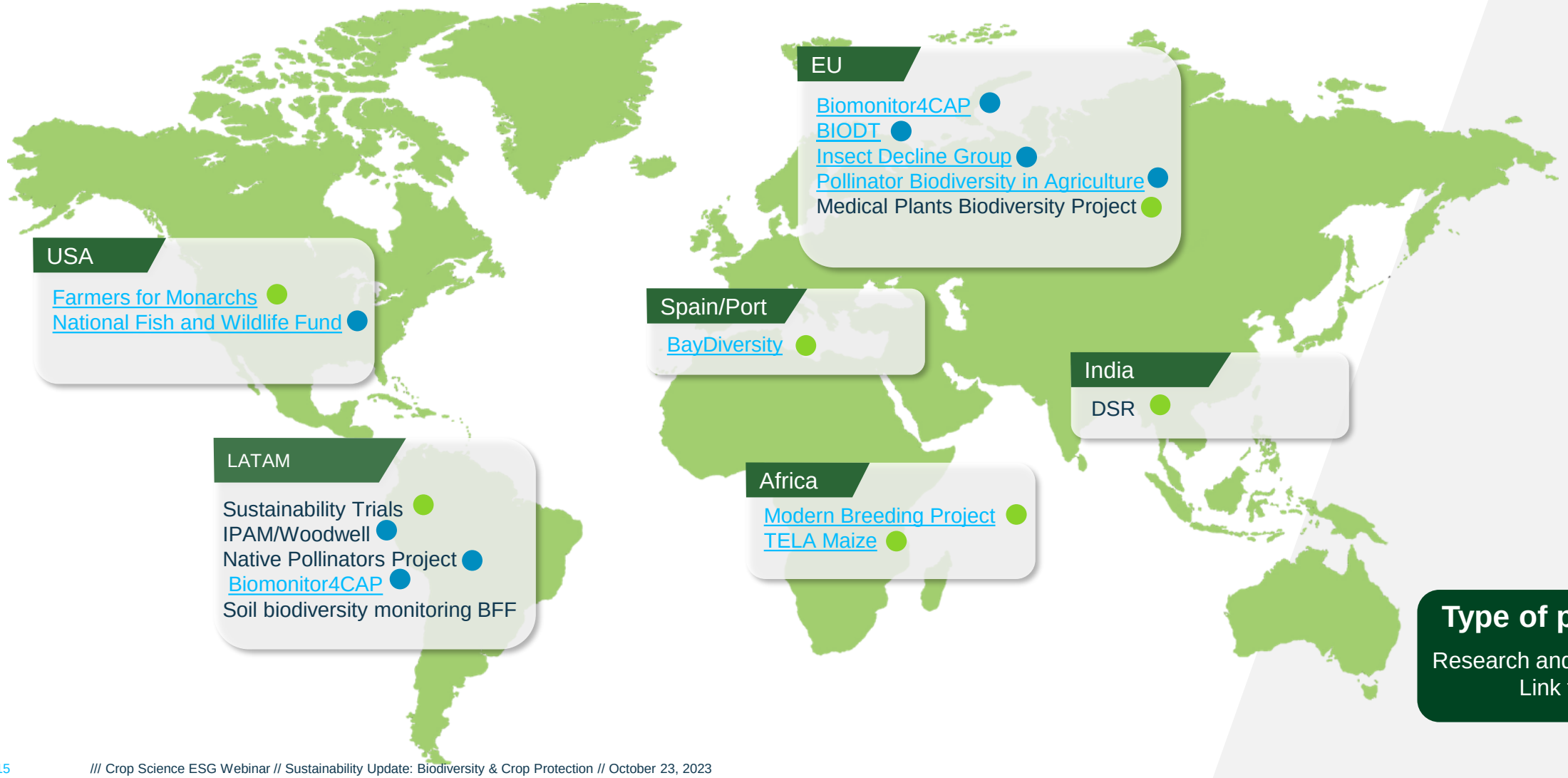
TNFD Taskforce on Nature-related Financial Disclosures

SCIENCE BASED TARGETS

TOGETHER FOR SUSTAINABILITY

Joint efforts help us to be more impactful

Partnerships and Collaborations to effectively address biodiversity decline



Type of partnerships

Research and Development

Link to Commerical

Robyn Kneen

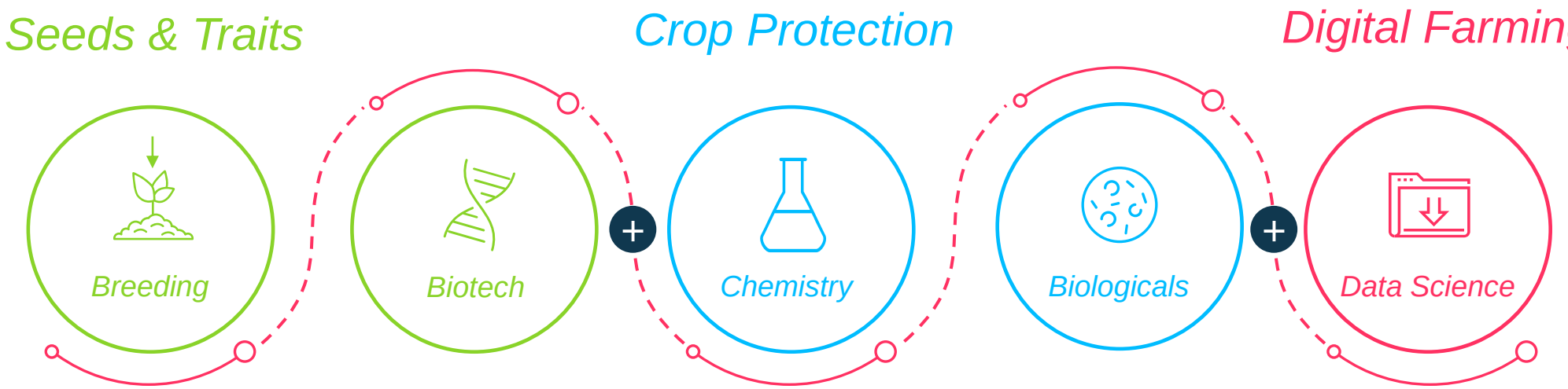
- Head of Global Regulatory Scientific Affairs, Crop Science

R&D and Stewardship in Crop Protection

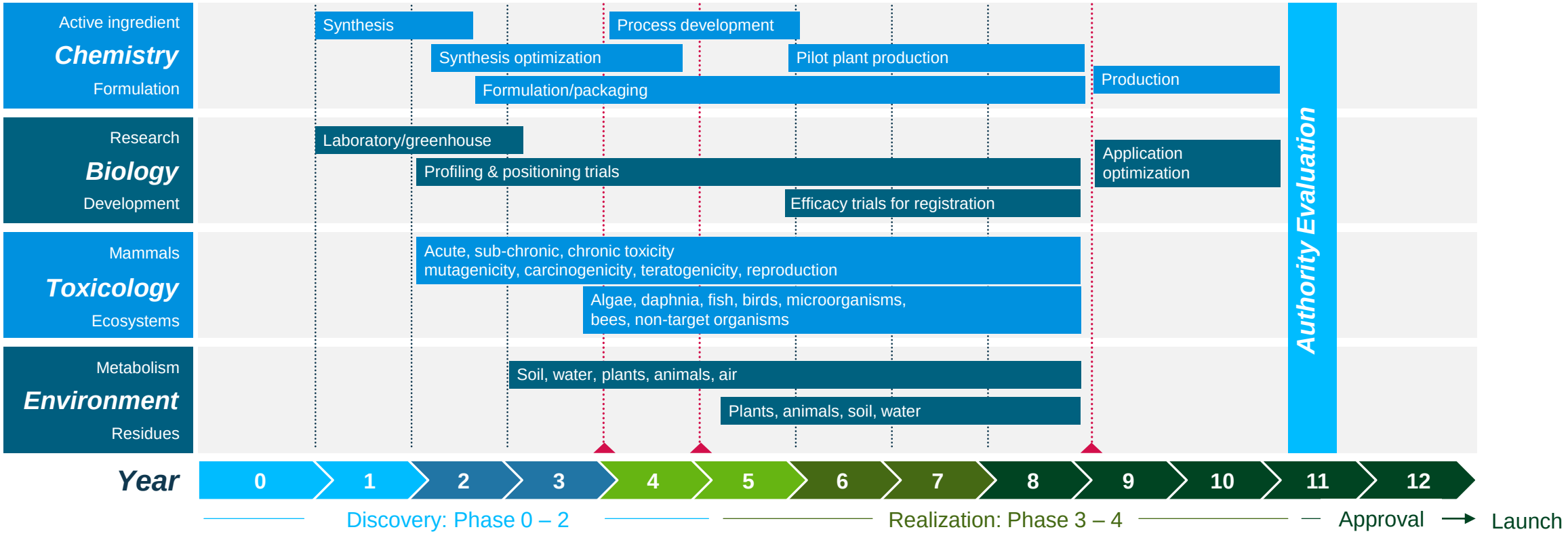
Vision | ***Health for all, hunger for none***

Leading R&D Agriculture Platforms

Extensive Germplasm and Biotech foundation, combined with strength in Chemistry, Biologicals and Data Science Optimization, serves as Innovation Engine to discover, combine and tailor solutions for farmers.



Chemical Crop Protection – From Idea to Market



After 10 to 14 years and an average investment of about €250m, one compound reaches the market

CropKey Approach to Open Uncharted MoA & Chemical Spaces

Serving the Needs of Farmers & Society

Advanced Discovery Engine

Computational Target Discovery
Discover selective and safe MoA by proprietary algorithms & omics

New Paradigm in Screening
Gain deep knowledge on biological systems by **Machine learning approaches** & virtual screening and docking

Digital Chemistry
Explore unlimited virtual chemical spaces by **AI supported** selection, design & synthesis

Predictive Early Safety
Focus on registrability & sustainability supported by early *in vitro* tests & ***in silico*** **predictive models**

What do we plan to deliver?

From incremental innovation on traditional chemistry **to disruptive innovation towards next generation of sustainable chemistry:**

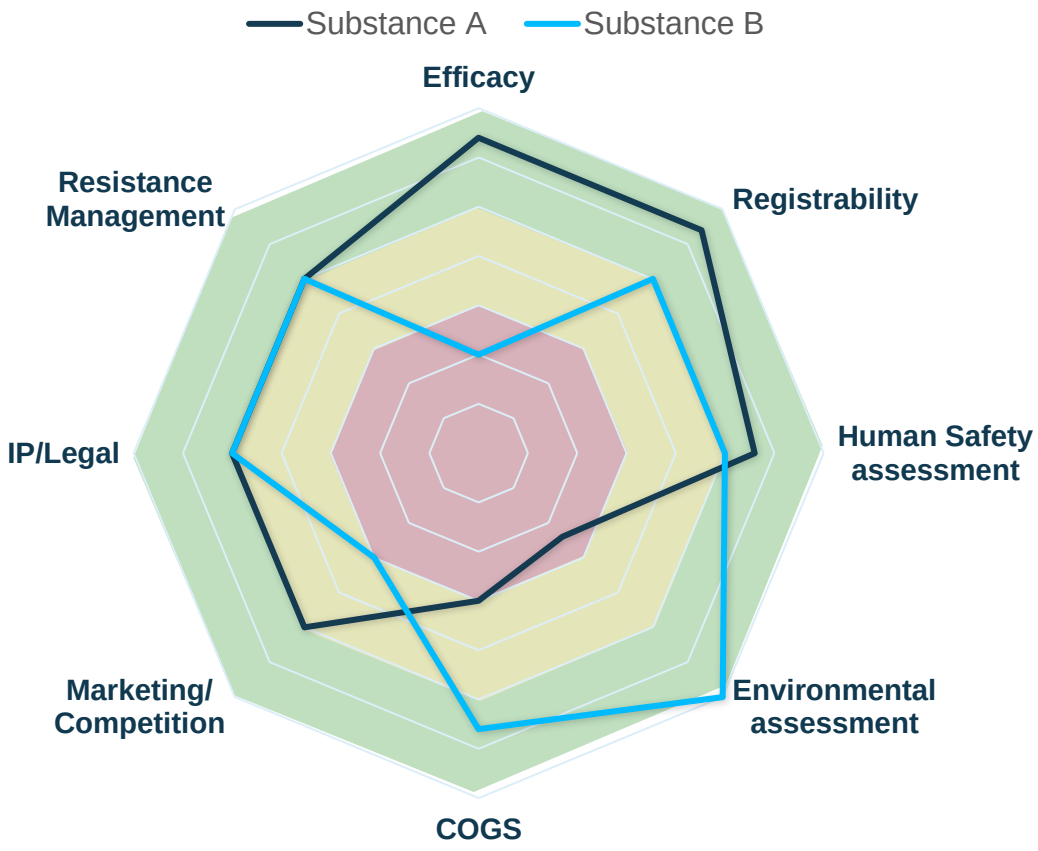
- Highly effective and precise
- Breaking resistance
- Unprecedented sustainability and safety profile

MoA = Mode of Action

Product Development is based on a holistic assessment covering efficacy, human & environmental safety, economic factors and more

- There is no one size fits all solution.
- Each product/substance has its unique characteristics.
- Scores regularly depending on uses.
- It is key to include all relevant metric into product and substance development to enable informed decision making.

Example for Illustration



Risk Assessments as fundament of most regulations

Crop Protection Products should not pose unacceptable risk to human or animal health or the environment

What is a Risk? **Risk = Hazard x Exposure**

E.g.: watching a shark from the beach doesn't present a risk to your health

We conduct extensive hazard and exposure assessments:

Environmental Risk Assessment incl.

- Ecological Hazard Identification
- Exposure Analysis

Human Health Risk assessment incl.

- Mammalian Hazard Identification
- Exposure Analysis

Ecotoxicology Team

Environmental Sciences Team

Toxicology Team

Hazard & Exposure Assessment

What effects are caused by the substance?

Toxicology

- Acute “6-pack”
- 28-day and 90-day
- Chronic tox and/or carcinogenicity
- Developmental toxicity
- 2-generation reproduction
- Genotoxicity
- Acute & subchronic neurotoxicity
- Endocrine disruption
- Mode of action
- Absorption, distribution, metabolism and excretion

Similar studies are conducted in the areas of

Ecotoxicology

Environmental Fate

Efficacy & Product Chemistry

Metabolism & Residue

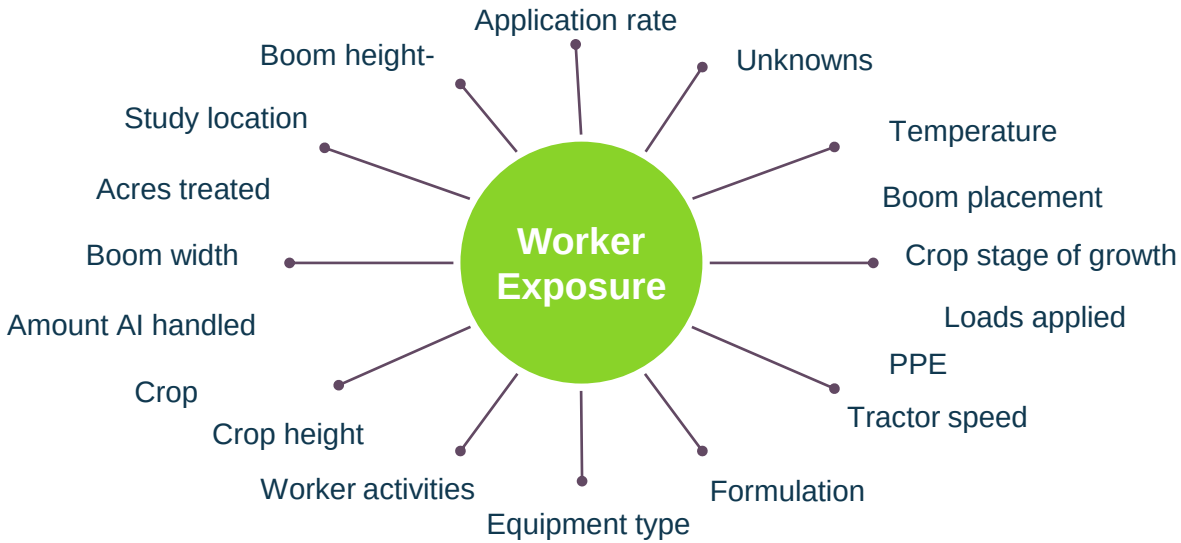
How does the exposure occur, how much is the exposure, for how long?

Human Health

- Exposure during **application**
- **Residues** in food and feed – establishment of MRLs
- Estimation of **dietary exposure levels** from food and drinking water

Conduct of Exposure Studies:

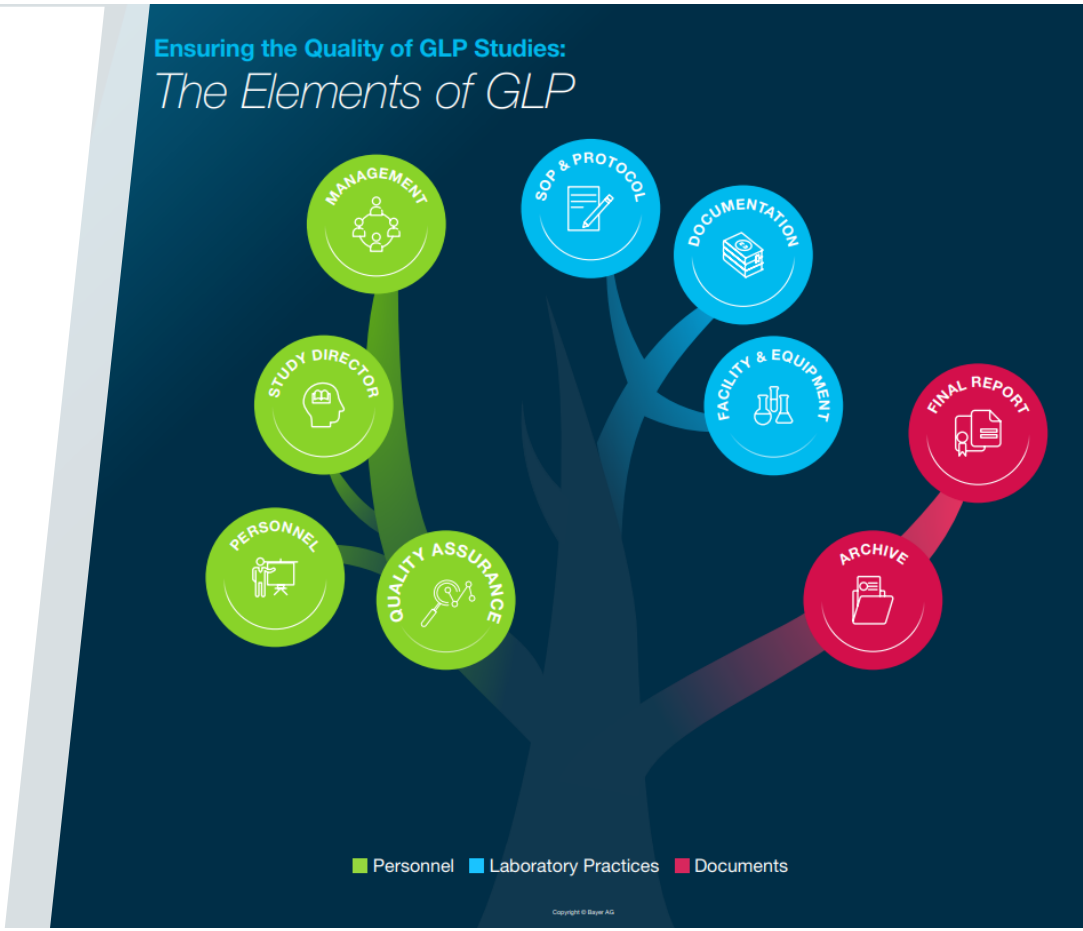
- Dermal Exposure
- Inhalation Exposure
- Dislodgable Foliar Residues (DFRs)



Good Laboratory Practice (GLP)

Ensuring study data is reproducible, reliable, traceable and credible

- Principles outlining how safety studies are planned, performed, monitored, recorded, reported and archived to maintain quality and integrity of study data that support regulated products:
  - Qualified **personnel** to ensure GLP compliance
  - Studies must be **clearly planned, conducted, reported and monitored**, with **reviews and quality assurance checks**
  - **Documentation** has to ensure each step is retraceable, reliable and transparent
- Regulatory authorities conduct independent **audits** on companies' processes, test facilities, and studies to confirm GLP compliance
- **Sponsorship** is disclosed on the cover page of the study reports that are part of the regulatory dossier that is submitted to authorities.



https://www.bayer.com/en/agriculture/article/good-laboratory-practices

Heterogenous Regulatory Landscape in Crop Protection

Regulatory requirements are continously evolving and increasing

North America: Risk-based regulation

- High and **increasing regulatory requirements**
- Complex and **sophisticated risk assessment**
- Export orientation requires **global registration strategies**

Europe 27: Hazard-based regulation

- High and **increasing regulatory requirements** and new guidelines
- **Green Deal and Biodiversity** expected to drive future requirements
- Complex and resource demanding regulatory system

Trade:

Global standards *at risk due to* ***national deviations*** *(EU, China, Korea, USA, Brazil....)*

Latin America: Very diverse requirements

- **Brazil:** Move towards risk-based regulatory framework
- **Many countries:** low but increasing regulatory standards driven often by export requirements
- Export orientation requires **global registration strategies**

Asia Pacific: Very diverse requirements

(Eastern Europe, Middle east and Africa similar patterns)

- **Many countries:** Standards increasing due to growing food safety and environmental concerns
- China introduced a **unique barrier for acceptance** GLP OECD international studies
- **No or limited data protection** in many countries

Bayer Raises the Bar with our own Safety Standards

Bayer safety standards reflect those of IGOs, regulatory authorities and the latest scientific developments (example: Operator Safety Standard)

Standards and guidelines of (IGOs)

Food and Agriculture Organization of the United Nations

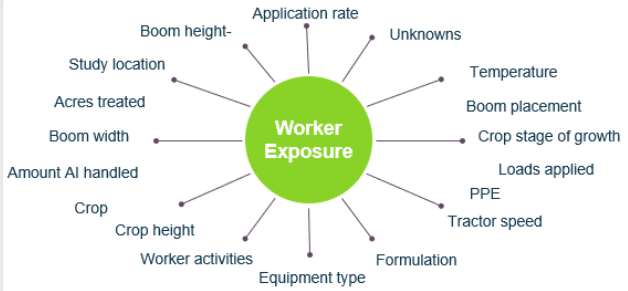
World Health Organization

The International Code of Conduct on Pesticide Management

OECD

OECD guidelines

Latest scientific developments in Risk Assessment



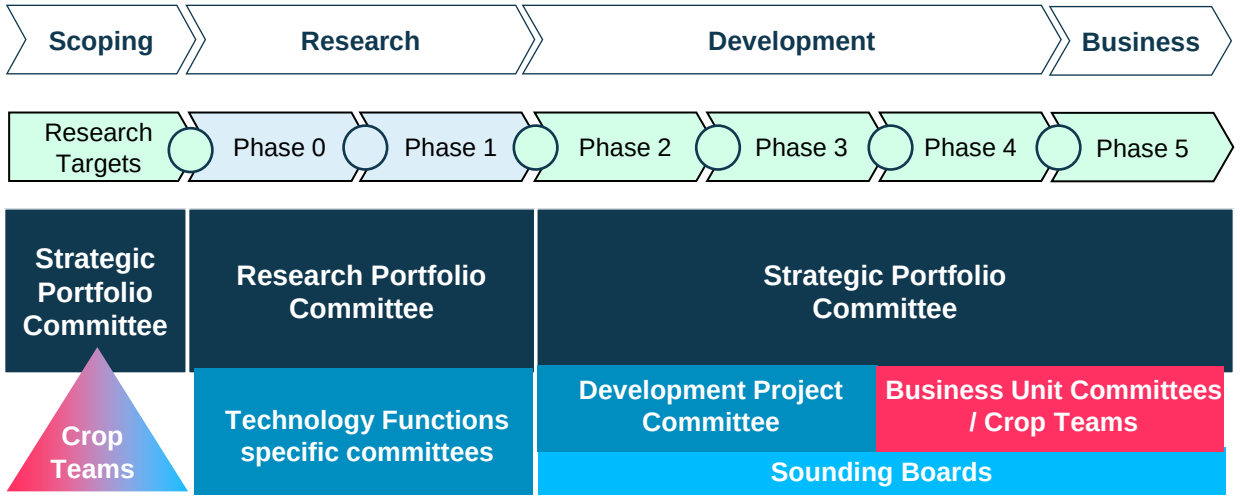
Standards of reference regulatory authorities

Independent 3rd party validation

Bayer safety standards

IGO = International Governmental Organization

Strong organizational Governance setup



CS R&D Governance

Overarching Product Safety Governance

LtO: license-to-operate

Product stewardship along the product lifecycle

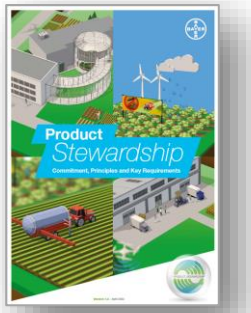
At Bayer, we adhere to the FAO-WHO International Code of Conduct on Pesticide Management

External voluntary standard

FAO-WHO International Code of Conduct on Pesticide Management

(accessible here on FAO's website)

Bayer stewardship policy



Bayer's Product Stewardship Commitment, Principles and Key Requirements
covers CP and S&T

(accessible here on our website)

Product Stewardship is the responsible and ethical management of a product, throughout its life cycle, from invention through ultimate use, and the final disposal of any waste

1. Research & Development
2. Production
3. Packaging, Storage & Transport
4. Marketing, Branding, Intellectual Property, Sales and Distribution
5. Integrated Pest Management & Resistance Management
6. Responsible Use
7. Container Management
8. Product Discontinuation/ Disposal of Obsolete Stocks

Our Crop Protection Stewardship Highlights

In the commercial phase

SAFE USE TRAINING

SAFE USE AMBASSADOR PROGRAM

SUSTAINABLE PESTICIDE MGMT FRAMEWORK

EMPTY CONTAINER MANAGEMENT

ASSET SPECIFIC STEWARDSHIP

INCIDENT MANAGEMENT

Daniel Glas

- Sustainability Venture Lead, Crop Science

Environmental Impact Reduction of Crop Protection (“CP EIR”)

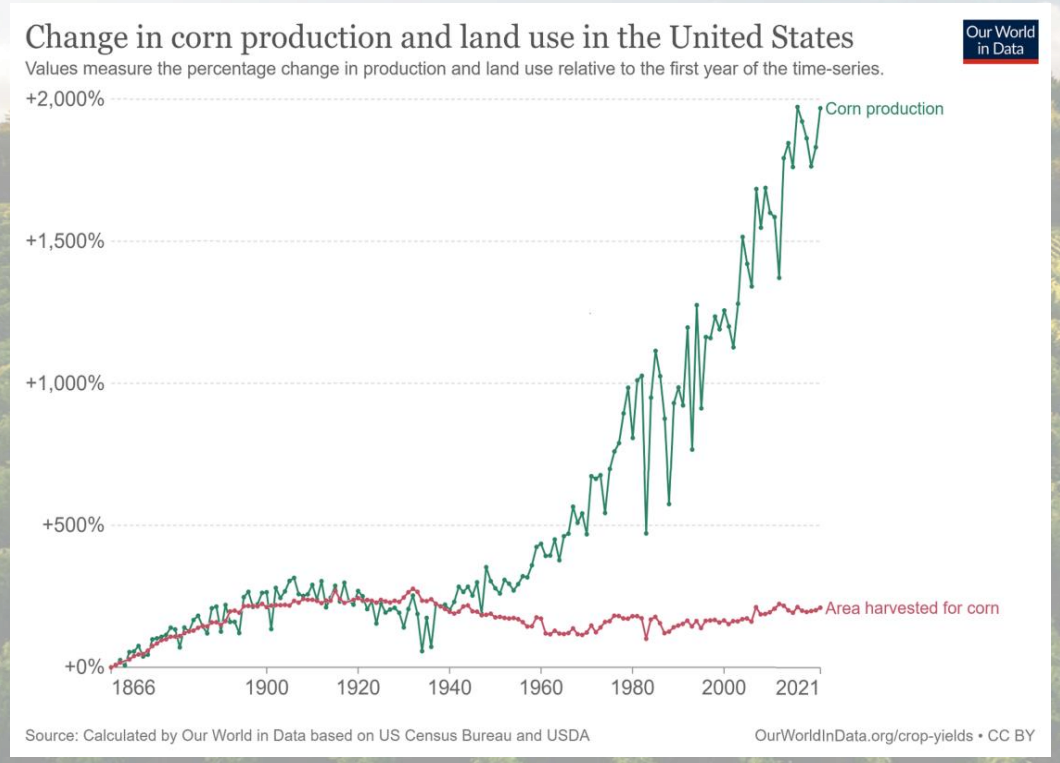
Vision | ***Health for all, hunger for none***

Crop Protection's contribution in sustainable ag systems

Maintaining CP benefits while reducing its contribution to the environmental impact of agriculture

Crop protection helps farmers to **secure or increase yields**, thereby helping to

- // feed a growing population, and
- // reduce pressure to bring additional biodiverse land into production



Source: Our World in Data

"Land use for agriculture is inevitably related to loss of biodiversity.

***Management techniques such as the use of plant protection products have by definition a negative impact on biodiversity*, but this loss is by far surpassed by the higher land use in extensive production systems."**

Panel for the Future of Science and Technology (STOA): In-Depth Analysis: Farming without plant protection products (04-03-2019)

Bayer Crop Protection Environmental Impact commitment

Covering all Bayer crop protection applied on a customers' field globally

Scope of our efforts

All Bayer crop protection applications on field during crop production

Reduction by CP EI per hectare (treated area weighted)[2]

$$\frac{EI}{ha} = \frac{\sum(EI/kg)_i \cdot dose_i \cdot ha_i}{\sum ha_i} = \frac{\sum EI_i}{\sum ha_i}$$

Even though our 30% progress is measured on our own portfolio, we will continue to track market CP EI and Bayer's contributions to reducing that

Baseline

All Bayer crop protection products applied globally and their respective environmental impact (average 2014-2018)[1]

1: Bayer CP products applied according to AgroWin data. Environmental impact calculated on product level with PestLCI/USEtox® models based on their current scope.

2: Formula calculates overall CP EI/ha for the Bayer crop protection portfolio

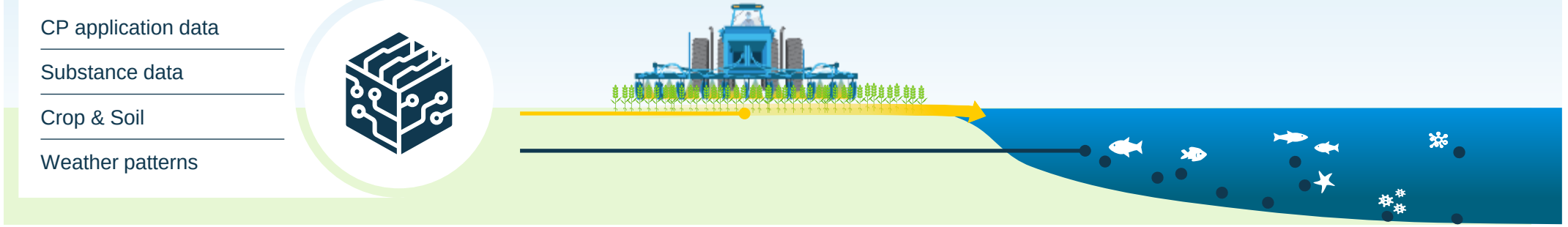
Building on a state-of-the-art methodology combining two renown models, PestLCI and USEtox

Developed by Crop Science together with the Technical University of Denmark

Environmental Impact (EI) of crop protection = ***Emissions into the environment*** *(PestLCI)* **X** ***Potency of all substances applied on a field (USEtox®)***

Input data processed by the models

- CP application data
- Substance data
- Crop & Soil
- Weather patterns



Transparency & credibility

- // All models are ***freely available***
- // Validation of approach via ***external panel***
- // Uses ***publicly available data*** for substance specific properties
- // ***Quantifiable*** crop protection environmental ***impact assessment*** enabling farmers and consumers to ***compare different agricultural systems***

State-of-the-art science

- // Models are being ***updated on a regular basis***
- // Scientific ***consensus-based*** models
- // Can accommodate ***future advancements in science***

Scalability

- // ***New technologies*** can be added
- // Scalable to ***all major crops and countries***
- // ***Globally applicable*** crop protection impact ***assessment tool***

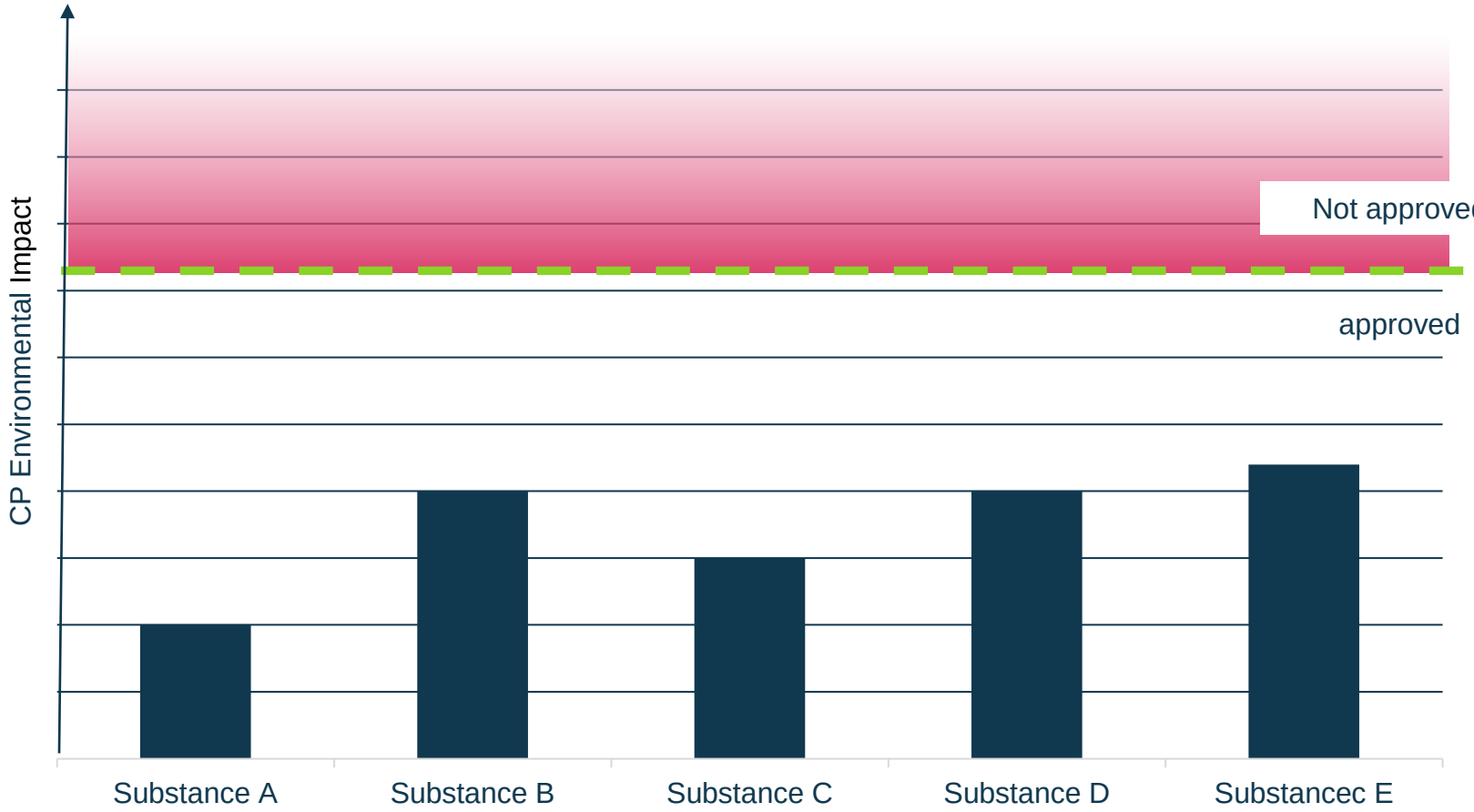
Today, methodology focused on measuring EIR on freshwater. Expansion planned to also included soil and pollinators

PestLCI
used by (examples)

USEtox®
used by (examples)

Bayer runs a comparative environmental impact assessment of crop protection products approved by regulatory authorities

Extensive testing and risk assessments ensures that all products have no effects on human health and only acceptable environmental effects if applied according to label



Below a threshold determined by the respective regulator a substance is deemed safe

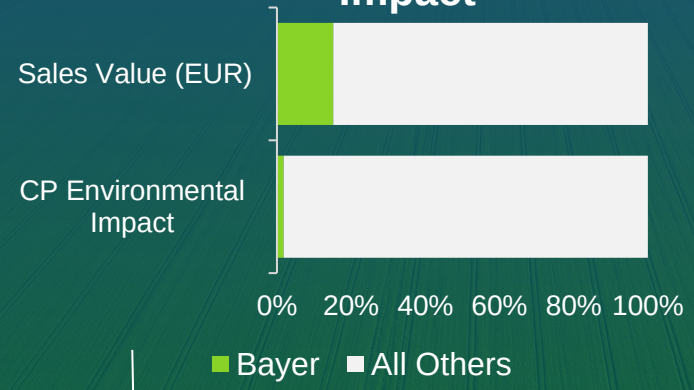
The CP EIR commitment strives for a relative improvement against the baseline

Graph only intended for demonstration purposes.

What is Bayer's Impact?

Baseline and progress

2021 Crop Protection Industry Environmental Impact



Bayer products accounted for only

of the environmental impact from crop protection in 2021

Preliminary impact assessment has been conducted by Technical University of Denmark (DTU) based on the PestLCI/USEtox® models. PestLCI secondary distributions currently out of scope. Impact assessment limited to current scientific consensus of USEtox®: aquatic organisms and the substances which can be characterized in USEtox®. Terrestrial and pollinator impact assessment is currently not included in USEtox®. CP application data mostly from third parties such as Kynetec/Kleffmann in some countries based on Bayer estimates.

We're reducing Crop Protection's Environmental Impact

Our goal: We will reduce the environmental impact of our global crop protection portfolio per hectare **by 30%** against a 2014–2018 baseline by 2030

2017-2021 vs 2014-2018

We reduced the global environmental impact of our crop protection products by

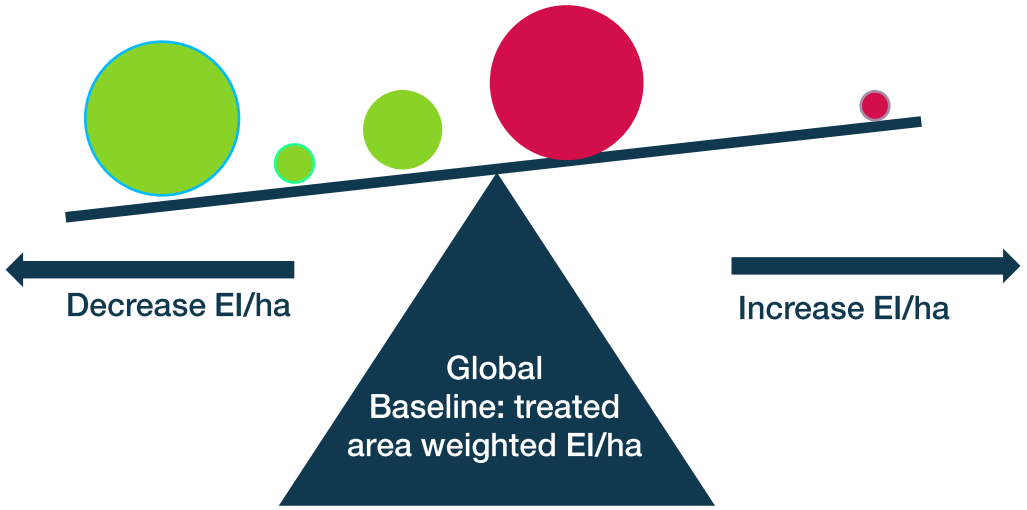
14%

For more details see Bayer Sustainability Report 2022, page 53

Bayer’s major CP blockbusters with low Environmental Impact

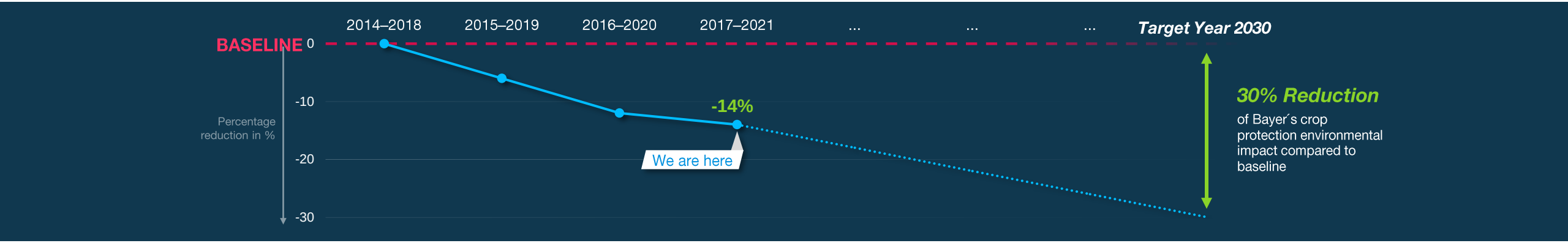
High product development standards as key driver also for future crop protection sales

- CP EIR criteria is embedded in the development process
- Relative improvement of the portfolio



We are on the path to reduce our environmental impact

Enablers and way forward



Main contributors to the 14% reduction

- The criteria we use internally governing how we develop new crop protection products
- Which products/active ingredients we in-license or acquire through acquisitions
- Which products/active ingredients we decide to phase-out or divest
- How the products are used by the farmer and how they are embedded in a crop system approach

Innovations helping us to progress in line with our 30% commitment

Crop Protection Products:

- Xivana Fungicide
- Plenexos Insecticide
- Delaro Complete
- Iblon Fungicide
- Incelo Herbicide
- New Biological Seed treatment in Corn

Seeds &Traits:

- ThryvOn Cotton
- Bollgard 4 Cotton
- Next Generation Insect Control Traits in Corn and Soybeans

We support advancing the science behind Crop protection Environmental Impact Assessment

Advocating for broader application

2023

- **Pollinator research partnership launched** in May 2023 with The Ohio State University, Technical University of Munich and Technical University of Denmark
- **1st publication expected making the global CP application pattern data set public** (submission)

2024+

- **Strive to include models into a Regenerative Agriculture metrics set** (e.g. OP2B, WBCSD, SAI Platform)
- **Contribute to public calculator** intended to be developed by academic consortium

2025+

- **Pollinator impact assessment methodology** expected to be published
- **Soil impact assessment methodology** expected to be published

Recap & Preview

Q&A

Crop Science ESG Investor Webinar

Sustainability Update: Biodiversity & Crop Protection

October 23, 2023

// ***Video recording will be available soon***