

# THE FOOD REVOLUTION IN AN INFLATIONARY ENVIRONMENT

*Webinar*

March 23rd 2022





# The Food Revolution in an inflationary environment

## Sustainable Food Supply for Food Security

Beatrice Conde – Petit, Bühler

March, 23, 2022

**BÜHLER**

# The climate crisis is already impacting food security



## Mycotoxins

25 % of crops affected by fungal poisons

Locust plague in East Africa 2020

Food insecurity: 811 m people suffer hunger

**Wheat**  
Yield down by 6% with every °C

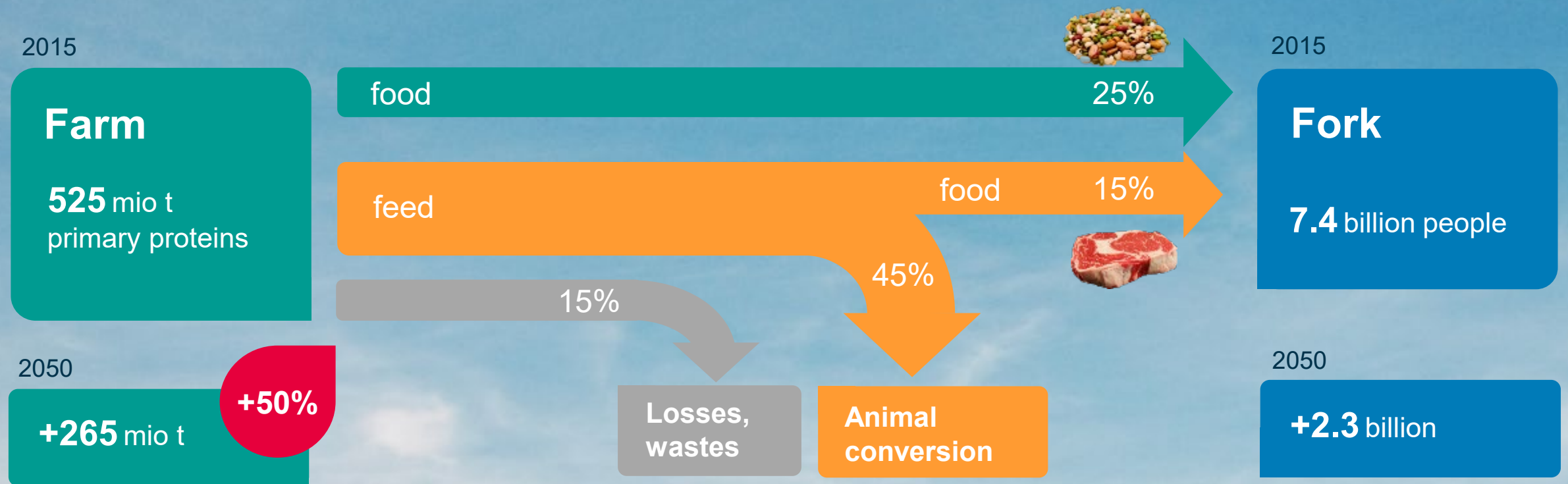
Plant pests & diseases on 1.13 m ha In China 2019

Severe drought hits soy & maize crops in South America 2021

2015–2019


Source: NASA

# Only 40% of the protein from the field land on our plate.



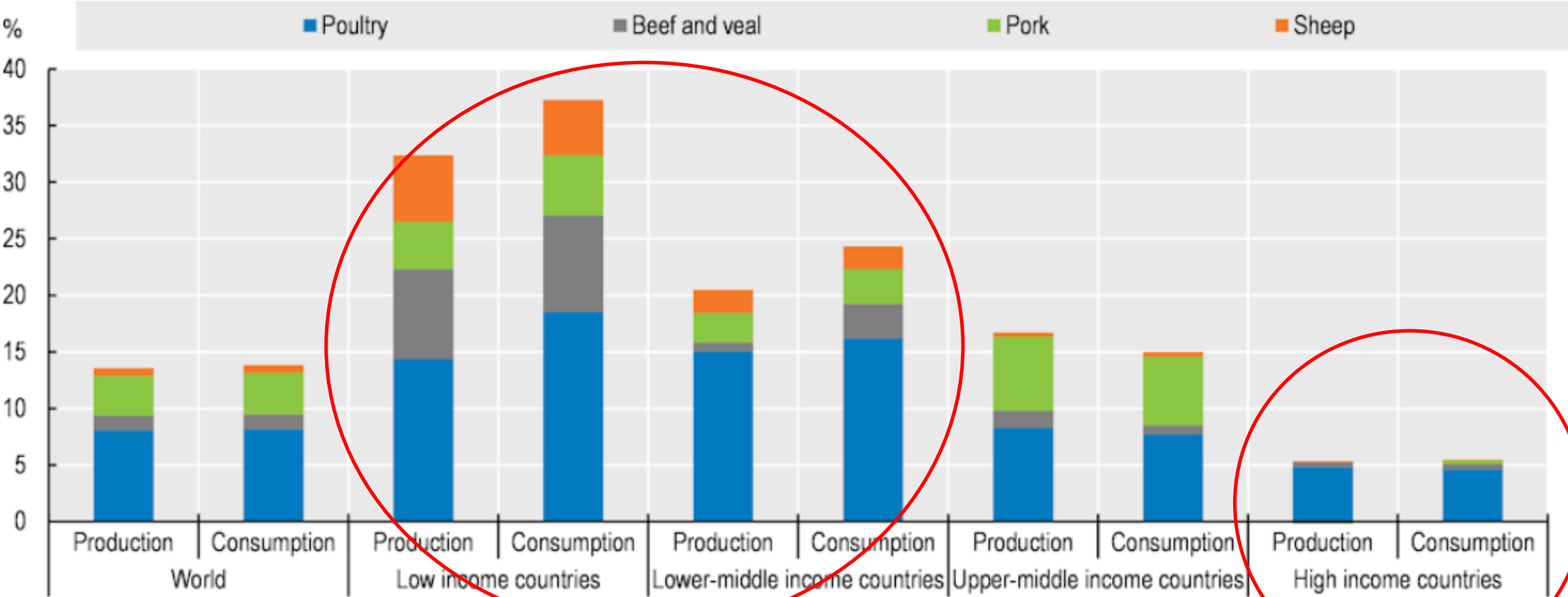
  
No expansion of arable land

Reducing losses & shifting diets are the biggest levers for sustainability

  
today → 2050  
Adequate supply of protein

# Low & middle income countries drive growth in meat demand

Growth in meat production and consumption on a protein basis, 2021 to 2030



OECD FAO Agricultural Outlook 2021-2030

How can we make meat more sustainable?

# Insects: a circular economy approach to close the loop in the food value chain by upcycling waste



# Industrial Insect Plant.

## Feedstock preparation



## Insect rearing



## Insect processing

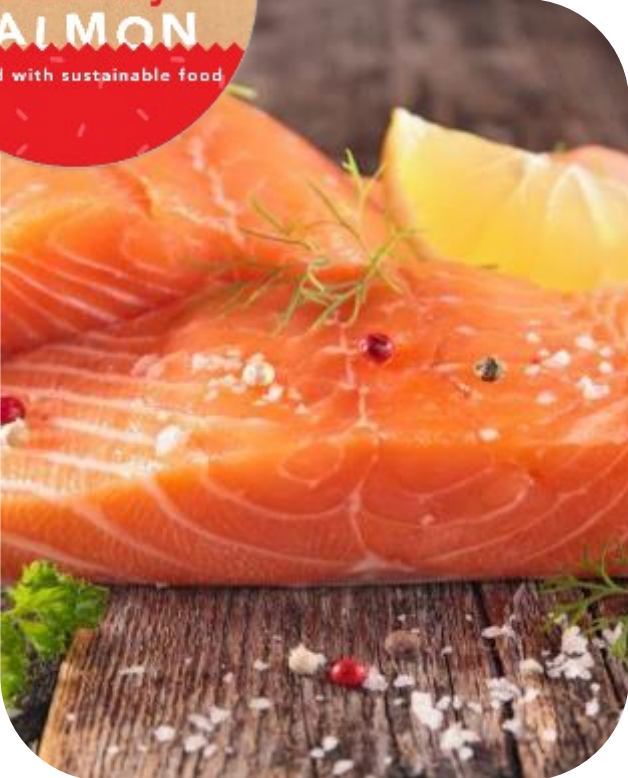




# Market entry for premium feed profits from good nutritional performance.



**Pet food**  
currently main application field  
hypoallergenic label

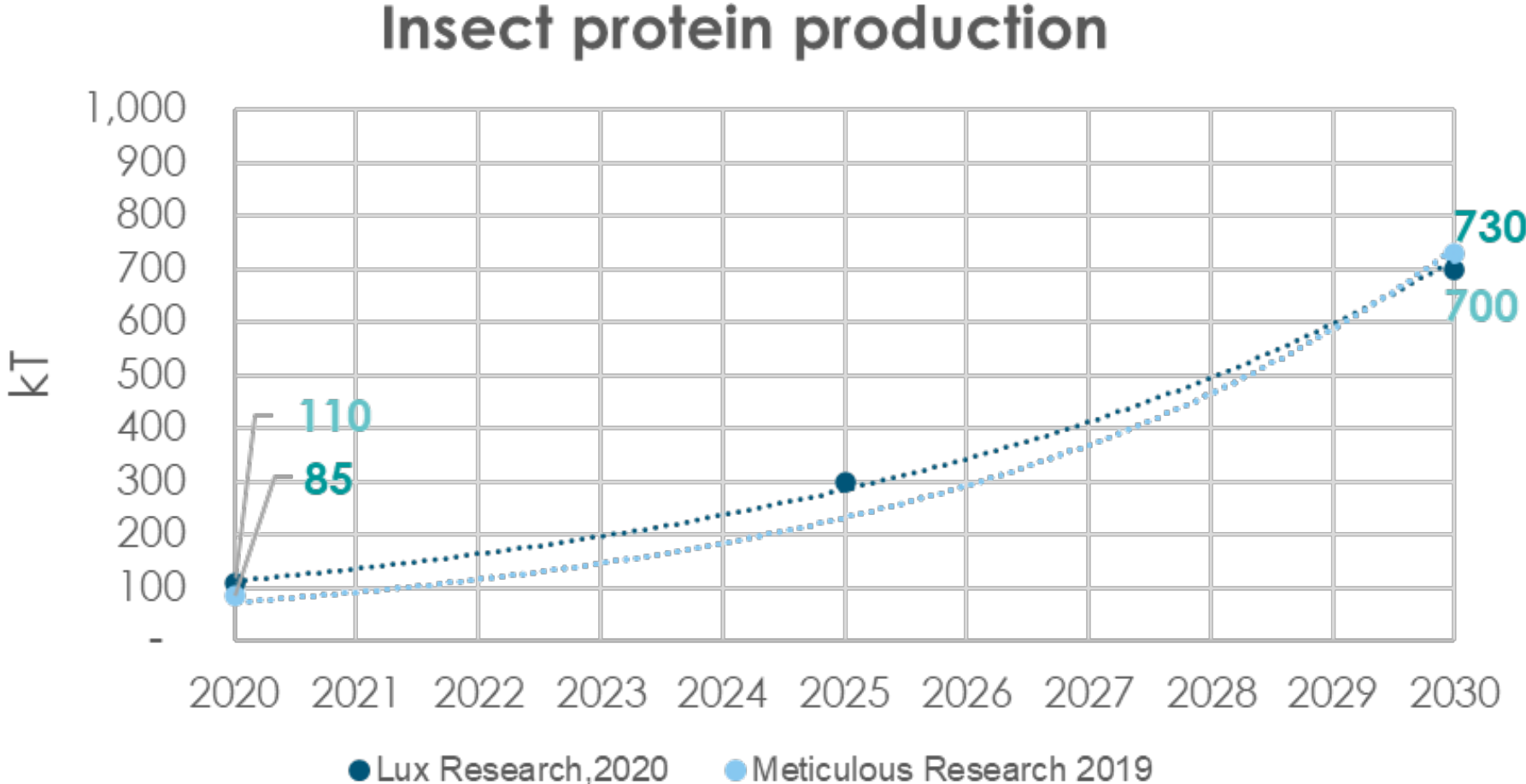


**Aquafeed**  
huge market potential  
fishmeal-free fish



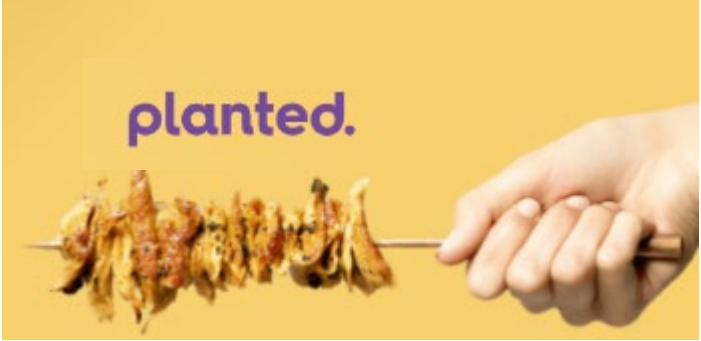
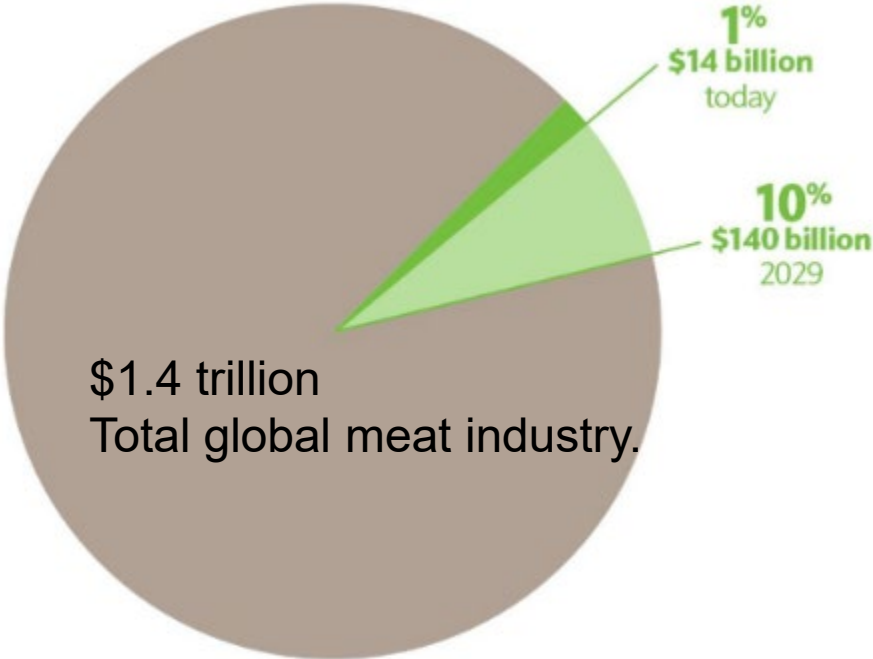
**Laying hen feed**  
local supply of live larvae  
animal-friendly eggs

# Insect protein demand is projected to become a mature market by 2030



How to enable a change in diets ?

# Meat & seafood alternatives exploded in popularity & strong market growth expected



Traditional meat products
  Alternative meat products

[Barclay Research 2019](#)



## Bühler enables the next generation of plant based foods

Unlocking the potential of new protein raw materials

Science & technology for texture, taste & nutrition

Collaborative Innovation with partners

Application labs in Switzerland, US & China

**ETH** zürich

 Innosuisse

 World Food System Center

**FUTURE FOOD**  
A SWISS RESEARCH INITIATIVE

Givaudan<sup>®</sup>

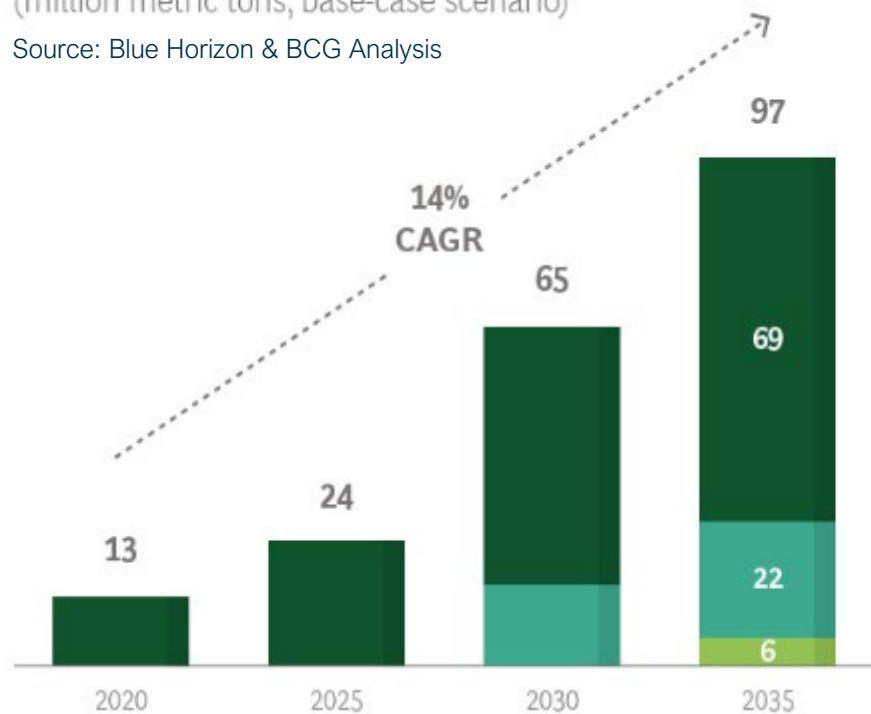
 eit Food




 DIL

# Sustainable protein consumption will grow in 3 waves.

Consumption of alternative proteins by protein source  
(million metric tons, base-case scenario)

Source: Blue Horizon & BCG Analysis



	CAGR 2020– 2025	CAGR 2025– 2030	CAGR 2030– 2035	
	13%	22%	8%	
	12%	16%	7%	 Plant-based
	45%	111%	8%	 Microorganism-based Protein only!
	52% <sup>1</sup>	66%	120%	 Animal-cell-based



CELL-BASED CONSUMER GOODS & RAW MATERIALS

**AIR-BASED PROTEIN**  
CALYSTA Avecom  
Deep Branch  
Spira Sling  
SOLAR FOODS UCDF

**BEEF**  
ALEPH biftek.co  
CELL FARM LABFARM  
MeaTech MIRAI FOODS  
mosa meat Innocent meats

**DAIRY & MICROFLORA**  
CHANGE helios remilk.  
BIOMILQ TurtleTree Labs  
LEGENDAIARY Better Dairy Fynd  
New Culture Perfect Dairy SunVegan CAPSULES

**FATS**  
CUBI A-life  
MISSION BARS  
Peace of Meat

**GELATIN**  
Gelatex  
GELTOR  
JELLATECH  
PROVENANCE

**GROWING MEDIA**  
FURUIQ tiamat  
Heuros TRITON  
SOPHIE'S BIOTRITIERS

**PET FOOD**  
BECAUSE  
SOME PET FOODS  
WILD SPOT

**PORK**  
NEW AGE MEATS  
MEATABLE  
Bio.Tech. Foods.  
FORK & GOODE

**POULTRY**  
ClearMeat  
IntegriCulture  
SuperMeat  
AIR PROTEIN  
GOURMEY  
MeaTech  
VITAL MEAT  
SCHAFFOLDING  
Gelatex  
POLYBION  
Cellivate Technologies  
NOVEL FARMS  
MATRIX WHITEBOARD FOODS  
TECHNOLOGIES  
ecovative  
PROVENANCE  
IntegriCulture  
microbroma  
PROVENANCE  
OSPIN

**SEAFOOD**  
Finless Foods  
avant JShiok Meats UMAMI  
BlueNalu Bhui CAT CELL AG TECH  
Clean Research Cultured Decadence

**MULTI-SPECIES**  
3d bio ARTEMYS FOODS  
ArtMeat CellX GAIA FOODS Moolec  
Vivid Calcular Agriculture FUTURE MEAT JU ST  
Loyal Biotechnologies MEMPHIS MEATS RICCIAN BARS

CREATING NEW PROTEIN

PLANT-BASED CONSUMER GOODS

**MEAT** akua ALGAMA alvego alver amidori anamma AMANI BARBECUE BEAT QeQy Bonguella Bona Concha Constart daiya Dambert  
DAIZ evo fazenda futura FIELD ROAST Fieldure. FRYS garden Garden GREEN&GREAT GREENIS Garden Gourmet GOLD&GREEN  
GRANAROLO greenest. Growth growthwell GUSA heartbest High HARI&CO HERITAGE heura How On Earth VEGAN hilcona HILARYS IKEA  
IMPOSSIBLE INCOGmeato iglo JACKFRUIT Jensen KARAHIA LIFE3 LIKE MEAT liv laga LIDL moiko mealish MIGHTY-MEAT Moolec  
MUSH LABS MushLabs NATURENINI NATURLI neat Nestlé N9 EVIL NotCo NUGOS Odontella Oly OLJICK MD ORAZZI  
OMNI Veg Phufury PRIMAL planted. PLANT POWER REGRAINED R/LBITE ROBIT Rubisco samhoud SWEET EARTH schouten scotland food  
spero Sily STARFIELD SuperSun The's sport Turkey Tyson unslay UNMEAT UNREAL UPTONS Food VEGY VEGY VEGAN CARTEL Vegy  
VerdientFoods Veget Veggie life vegini Wessanen YAMCHIPS YUMYUM WILLAROS WORTHINGTON Yves ZERO MEAT  
alpha NATURAL FOODS ALTERNATIVE MEAT CO BEFORE the Butcher BETTER nature better nature BEYOND MEAT BITE BUNDS BLEND FOODS CRAFT MEAT CO. DARING party F8YD Foked Evolution good good green wise HAY HAY  
MOON MOON JY JACKS JERRY WALL JU JUST VEGAN K INK KAWAII KAWAII KAWAII KAWAII LOVE SEITAN MADE MADE M HARVELOUS MARFRIG MEET JACK MEAT MEAT  
Mister MOUNTAINS MRS. GOLDFARB'S nutrition & nature NEW BREED Ocean Orchards PLANT POWER PLANT CRAFT PRIMA KLIMA PURE PUMPKIN REBELLIUS RIVAL FOODS RIGWALDER MILK  
simple truth THE ABBOT'S BUTCHER MEAT CO. The Protein HAMBURG BITEHIT THE MEATLESS MEAT CO. THE VERY GOOD BUTCHERS THE VERY GOOD BUTCHERS uniliv VEGE VEGE VANTAGGIO VEGIC VER SO VIV VIV  
wholly WICKED HEALTHY WITH 3D PRINTED NOVA MEAT NOVA MEAT Savoria

**EGGS** Clara Foods EVO Moolec Myty nunity nibbles Veggy JU ST JU ST HEART. O ZERO EGG.

**SEAFOOD** Atlas avant BONSAN FRYS garden HOOKED IKEA ima JINKA KULEANA Legendary Vish Marine MIMIC

**MEATI** May Wah New Wave Foods Qam SBESEA Tofuna Fish TESCO TUNO VAN-CLIVE Veggi VEGEFARM

**FUNGI - BASED CONSUMER GOODS** Atlas Bits ecovative FRESHCAP Heba! Loop Foods MEATI MOKU NATURE MushLabs Nelson-Vegetal  
Outstanding Pura SCELTA SMALLHOLD Vegy BACKED ROOTS BOTANIC BITES fable JEWELS OF THE FOREST MOVING MOUNTAINS prime roots OPEN WILD Sel

PLANT-BASED RAW MATERIALS

AAK ABCROOS ALGAMA Algorith ALGENTUITY  
AJINOMOTO CO. Amal AOT ARBIOM Avecom  
Balletic Foods Biomimetic CHICKP Deep Branch  
3FBI DUPLACO ecovative emergy EQUINOM  
GreenFood50 HIFOOD HINOMAN Heba!  
inalve INNOVOPRO iwi kinoko KAWAII  
The Lupin Co LenioBio LEKITHOS Lycored meatless  
MelioBio michroma MIGHTY-MEAT Moolec MushLabs  
MYCORENA MOEJA MycoTechnology MYCOWORKS  
NEXTERA novonutrients novozymes Nutress  
NOBLEGEN NutraNovo NUTRIATI PARABEL  
MD PEVESA phycom plantible peabigin protera  
PURIS BOTEXPRO Synthes seas Symbiotic EnviroTek Inc.  
Tervivo THAI WAH TRITON Vestkarn WealSEA  
ALKION BIO INNOVATIONS Australian Back of the Yards  
CHINOVA BIOWORKS green wise FUMI Fynd AIC  
JACKS BERRY KIVERDI NATURE NATURE NATURE NATURE OCEANUM  
TMRW FOODS RESEARCH SOLUTIONS Rubisco SALT OF THE EARTH SUNBLOOM PROTEINS

SUPPORTING NEW PROTEIN

**PRODUCTION & MANUFACTURING (PARTIALLY SPONSORED)**  
BIOCATALYSTS BUHLER handmann  
SiccaDania VERMAG WENGER BIOREALIZE CNNOPY EXTRACTIS  
FUTURE FIELDS OMVE PAN BIOTECH VERBUFA MD uFraction8

**INCUBATORS**  
BIG IDEA VENTURES BITSxBITES BLU1877 CDAO FOODS Food FoodFORWARD FOOD-X INDIE BIO ivoro  
KITCHENTOWN Leave a Nest brinc EVIAGE MISTA nova PUDUPLAY RebelBio StartLife StartLifeCamp  
The Kitchen Combinator CELL MATE CHOHAMI INCUBATOR EXATABLE ADVENTURES FORWARD FOUNDRY KICKSTART ACCELERATOR PROVEG PROVEG SEEDS OF CHANGE SHAKEUP FACTORY

**RESEARCH & DEVELOPMENT**  
CEFET-MG NUS AOCAS KENT STATE PULUI UNIVERSITY  
SCIENCE INSTITUTE CNTA WPI VT Maastricht University WAGENINGEN UNIVERSITY RESEARCH TRENTON UNIVERSITY  
NC STATE UNIVERSITY MICAL UNIVERSITY OF TORONTO UNIVERSITY OF BATH THE UNIVERSITY OF AUCKLAND UNIVERSITY OF MELBOURNE

FUNDING NEW PROTEIN (SPONSORED)

**VC FIRMS: SEED**  
Vegan Capital CDAO FOODS DISMATRIX  
GOOD SEED VENTURES BIG IDEA VENTURES YAKIMI  
NEW CROP CAPITAL POV Unovis Partners veg capital Veginvest

**VC FIRMS: GROWTH**  
CDAO FOODS BIG IDEA VENTURES  
NEW CROP CAPITAL GOOD SEED VENTURES Unovis Partners Veginvest

**CORPORATE PARTNERS**  
AJINOMOTO CO. alberts ALDI Dalco freedom Heba! Kraft Heinz LALA  
Mondelēz neXtfoods PEPSICO MTG HILTON P/H/W Sainsbury's sodexo SOGLOWEK OLINA  
SYNERGY Strauss STARBUCKS TARGET TESCO Atlantic Natural Foods BIOCATALYSTS GOOD SEED VENTURES General Mills food360

# Cellular ag as new core to address land, GHG and water footprints of food

## Traditional staple foods (top 10) and other main crops



**Maize**  
1'060 Mio T



**Wheat**  
749 Mio T



**Rice**  
741 Mio T



**Potatoes**  
377 Mio T



**Soybean**  
335 Mio T



**Cassava**  
277 Mio T



**Sweet potatoes**  
105 Mio T



**Yams**  
66 Mio T



**Sorghum**  
64 Mio T



**Plantain**  
35 Mio T



**Barley**  
141 Mio T



**Pulses (mix)**  
83 Mio T




**Rapeseed**  
69 Mio T




**Sunflower seeds**  
47 Mio T

Nutrients for food and feed, high added value ingredients with lower land, CO<sub>2</sub> and water footprint

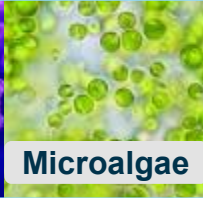
## New comers from cellular agriculture




Yeast



Mycelium

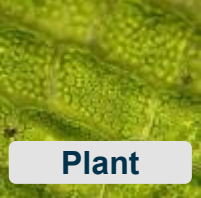


Microalgae




Bacteria

**Microbial biomass potential**  
175-300 Mio T proteins  
(up to 20% protein feed need by 2050).  
2-4 kg protein/m<sup>3</sup>/h



Plant



Animal





INNOVATIONS FOR A BETTER WORLD

We currently experience the third period of major food inflation in the last 20 years...

UN Food and Agriculture World Food Index



The FAO Food Price Index rises to a new all-time high in February

'I'm afraid we're going to have a food crisis':

**Food prices are already at a 10-year high. There's no relief coming in 2022, a grim new report says**

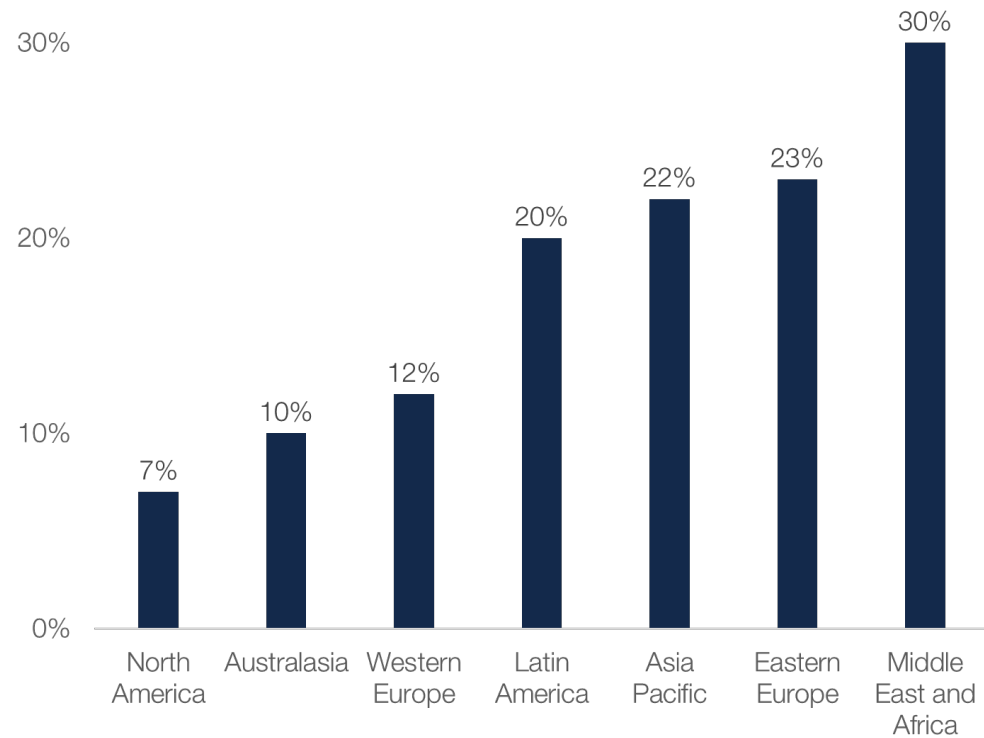
**Soaring food prices threaten emerging-market currencies**

*Rising food prices can be hugely destabilizing.*

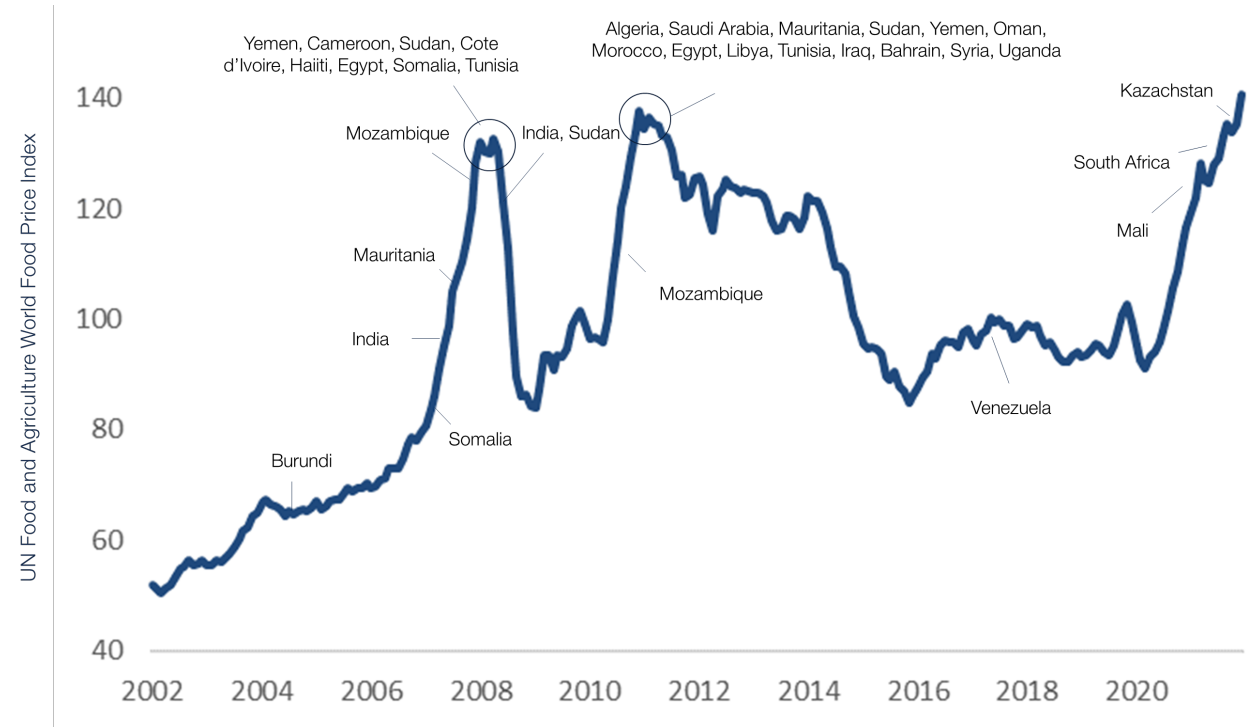
***Food Prices Approach Record Highs, Threatening the World's Poorest***

# ...with explosive social consequences, especially in developing countries

## Percentage of consumer expenditure on food

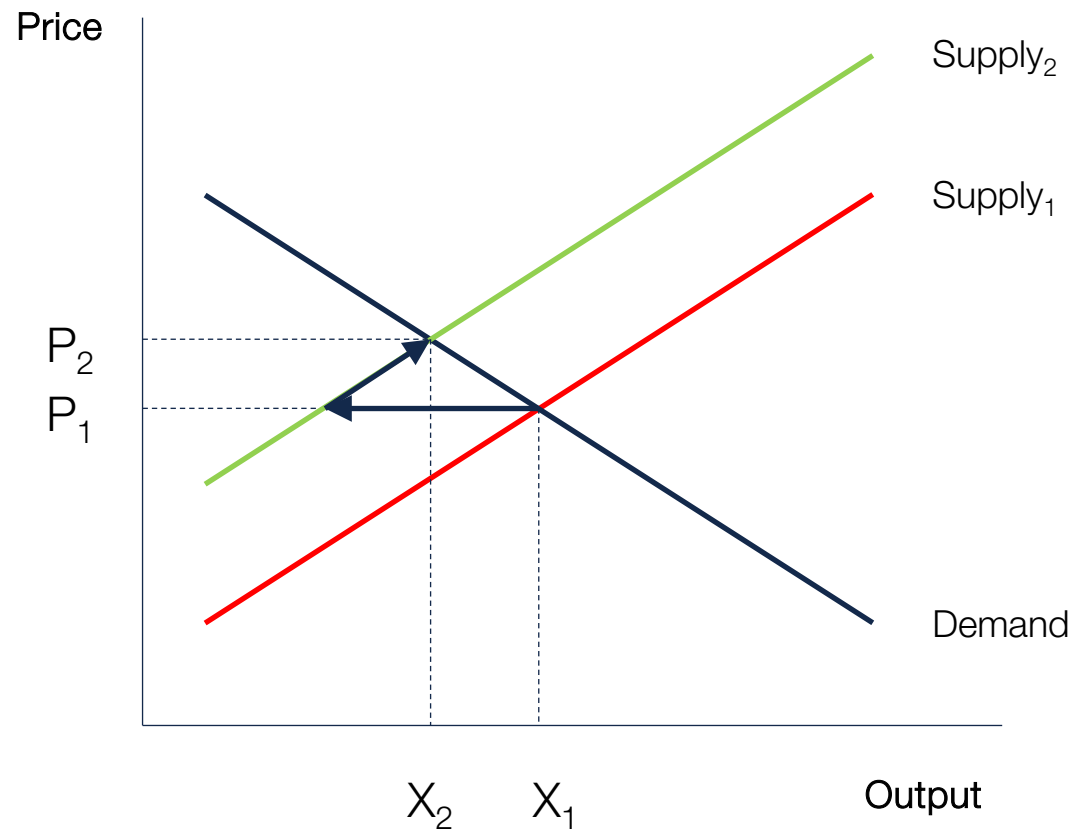


## Food inflation and food riots



# The current food inflation is a classic supply side or cost-push inflation

## Cost-push inflation



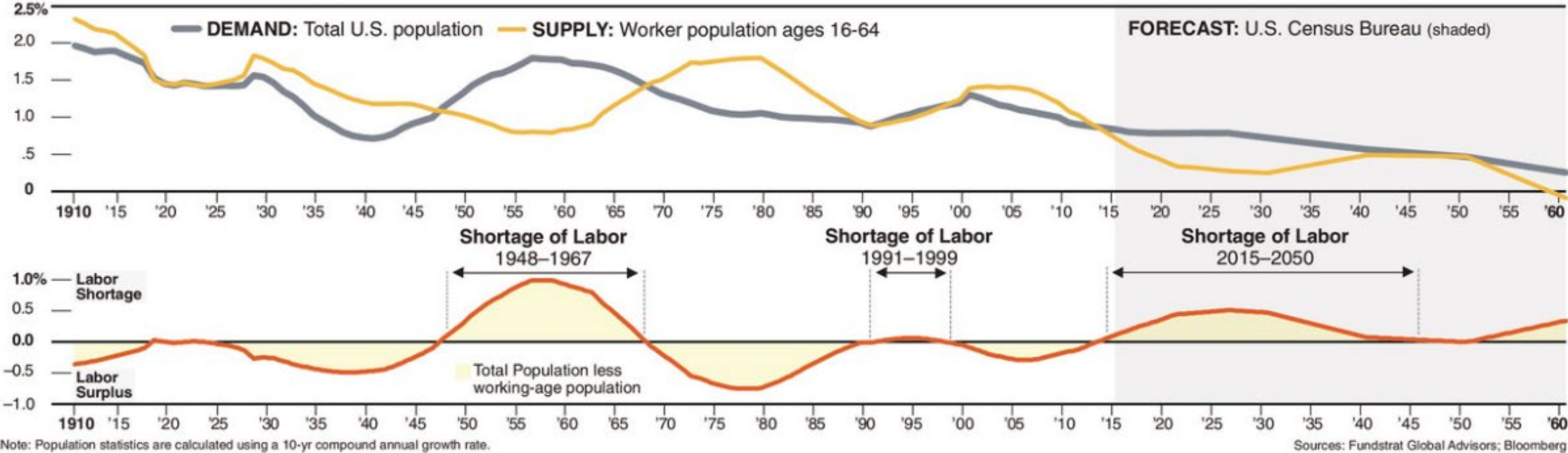
## Drivers of current food inflation

- 1 Labor shortage
- 2 Input cost inflation
- 3 Freight and supply chain disruptions

# There are structural drivers behind the current labor shortage...

## When Labor Shortages Hit, They Can Last Years

As baby boomers retire, the total population is already growing faster than the workforce. That dynamic has happened just two other times in the past 100 years.

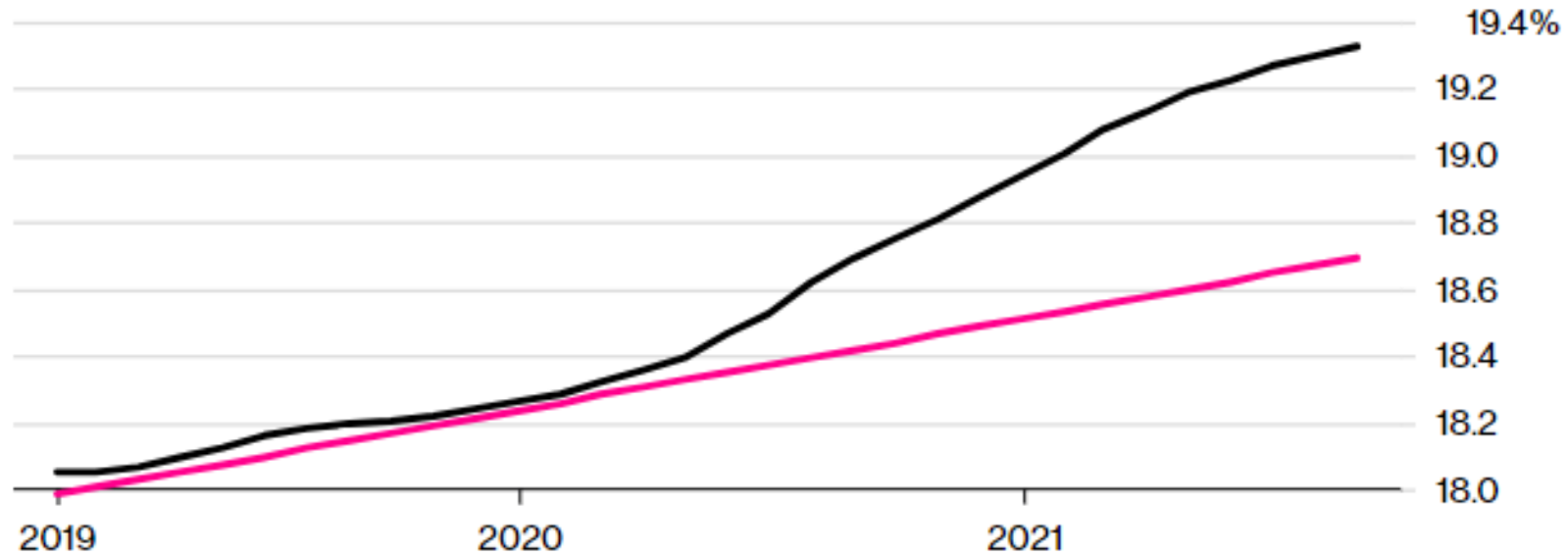


...which have been further fueled by the COVID-pandemic, triggering a wave of early retirements

### Retirement Boom

Rising asset values made it possible for many Americans to retire early

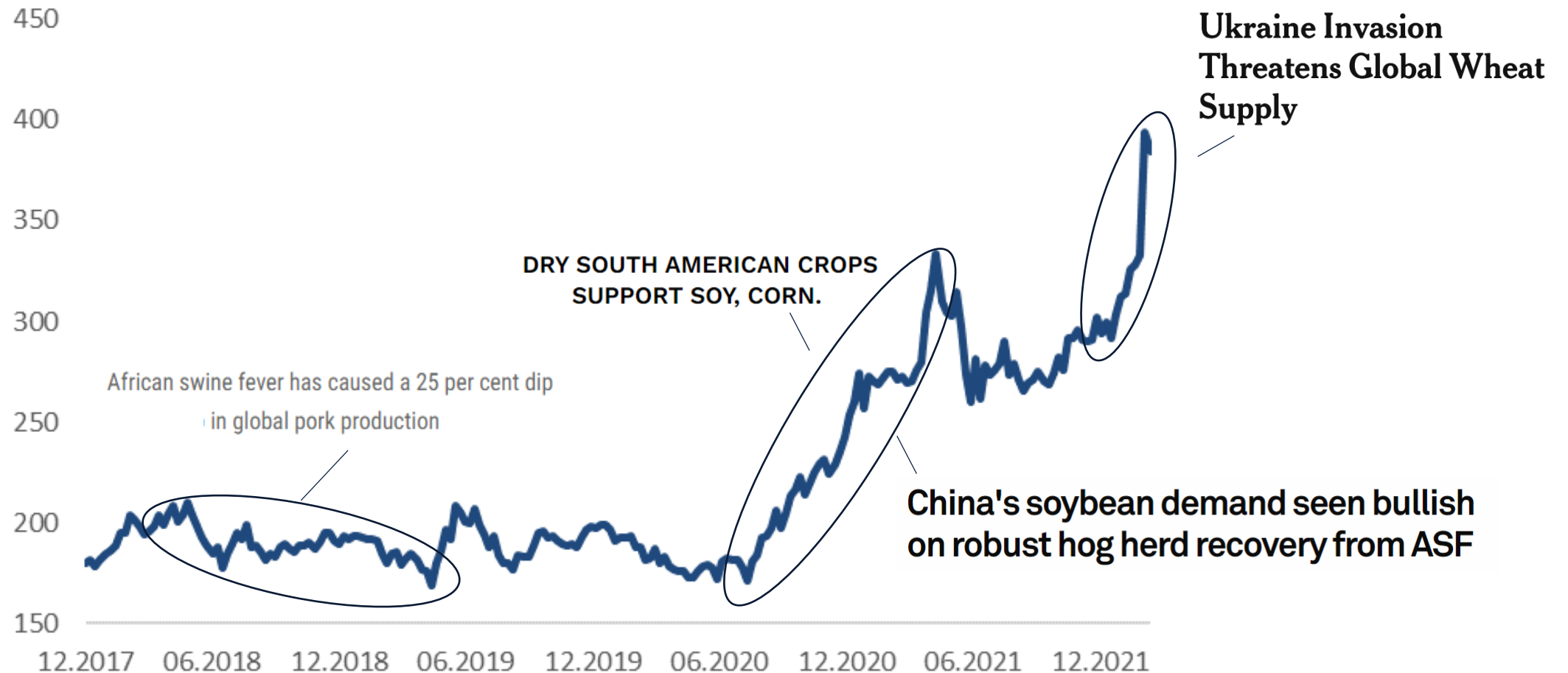
Retirees, percent of U.S. population / Baby Boomer trend



Source: Current Population Survey and calculations by St. Louis Fed economist Miguel Faria e Castro. The figure plots the 12-month moving average and the cubic trend

# Grain prices have been soaring on a number external shocks

Bloomberg Grains Spot Subindex<sup>1</sup>



# Container shortage is one of the drivers behind the current supply chain disruptions

Drewry Hong Kong-Los Angeles Container Rate Benchmark Rate<sup>1</sup>



Reasons for container shortage:

- 1 Reduced number of available containers
- 2 Reduced number of operational vessels
- 3 Congested ports
- 4 Changed flow of goods


<sup>1</sup> The Drewry Hong Kong-Los Angeles Container Rate in USD per full 40-foot container load, excluding terminal handling charge at origin port.



# What needs to be done to address food inflation?

















The **underlying causes** of price increases are stagnant and fluctuating agriculture productivity, **inefficient use of key natural resources** particularly water, and **limited innovation**, as well as weather-related shocks.

The World Bank, November 2021

Upgrading agricultural research for introducing new crops and crop varieties, **more efficient production & climate-smart techniques**, and better control of pests & diseases, would help **relaunch productivity growth.** 

The World Bank, November 2021

# Our “Food Revolution” portfolio has a strong focus on companies offering “deflationary” products and solutions

Sources of food inflation	“Deflationary” solutions	“Part of the solution” companies	% of the “Food Revolution” portfolio
Labor shortage	Automation	   	18%
	Complexity reduction		
Input cost inflation	Input usage reduction	   	27%
	Efficient processing of raw materials	 	
	Food waste reduction		
	Recycling	 	
Freight and supply chain disruption	Smart packaging	  	11%

# Companies offering “deflationary” services and products have performed well during the last two inflationary phases

Performance “Deflationary Basket”<sup>1</sup> and the Bloomberg World Food Index<sup>2</sup>



<sup>1</sup> Equal-weighted basket of companies offering “deflationary” services and products: ADM, AGCO, Bunge, Deere, DSM, Ecolab, GEA, Kerry, Lindsay, Marel, DS Smith, Tomra

<sup>2</sup> The Bloomberg World Food Index is a capitalization-weighted index of the leading 155 food stocks in the World.

# Contact



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“The Food Revolution“

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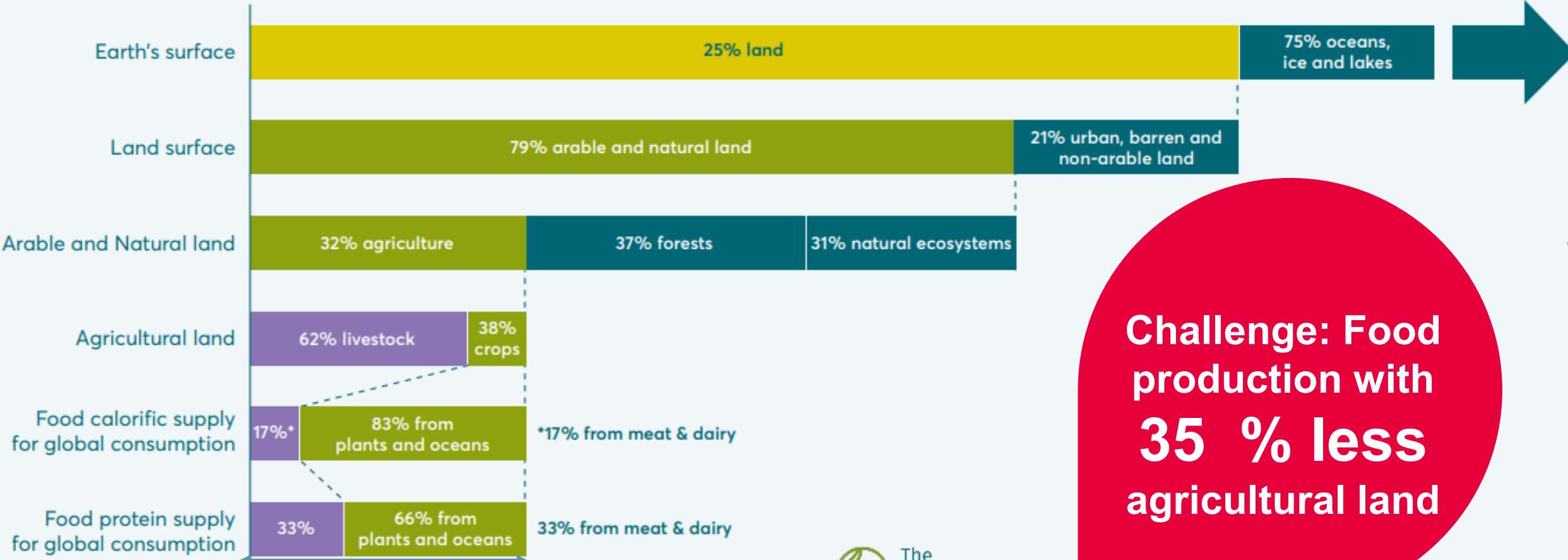
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# By 2050 we need to produce more food with less land.



**Challenge: Food production with 35 % less agricultural land**

Total agricultural land today (2010): 3.27 bn ha

**Better future Scenario (2050): 2.01 bn ha (-35 %)**



Growing Better: Ten Critical Transitions to Transform Food and Land Use. Report 2019



# Bühler is the partner for downstream processing of new food & feed ingredients



Bacteria as protein source for fish feed

Natural blue pigment extraction



Textured protein using algae protein

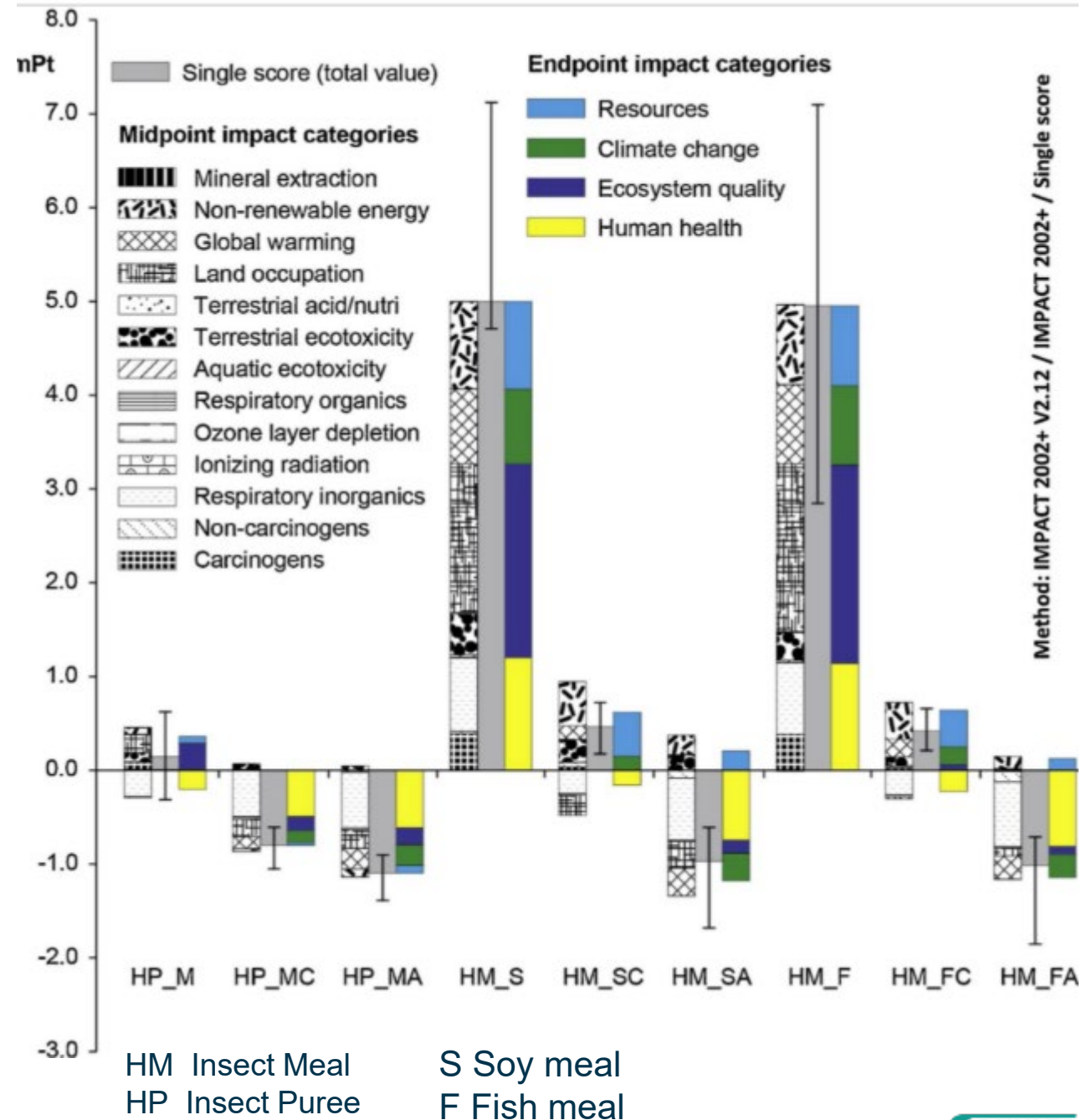
Algae protein enriched pasta



# Industrial insect production offers opportunity for sustainable protein, lipid & fertilizer production

The utilization of non-utilized side-streams is a key factor for sustainability

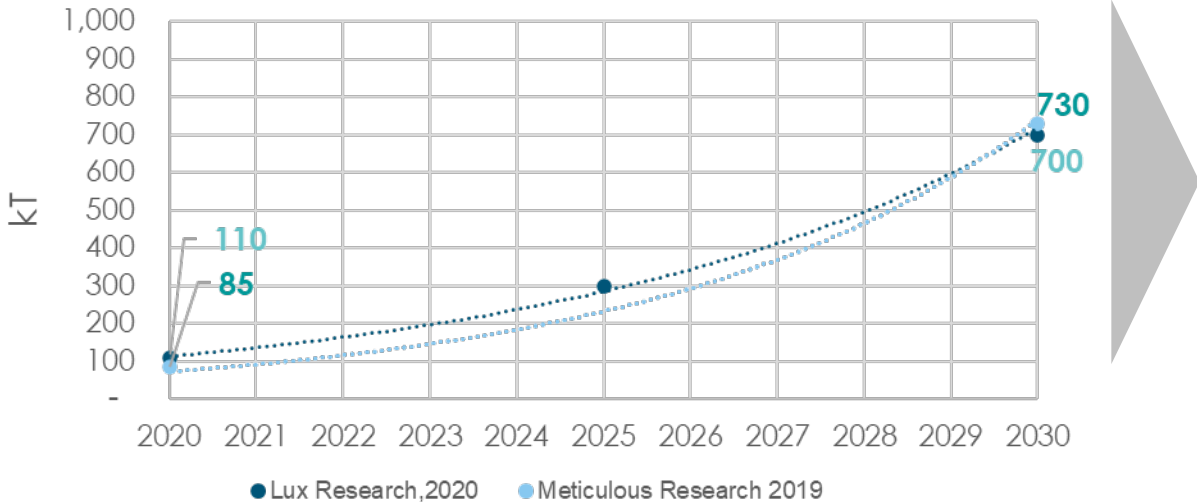
[Smetana, Schmitt & Mathys et al, 2019](#)



# Insect protein market has a promising future.

Insect protein market is projected to grow.

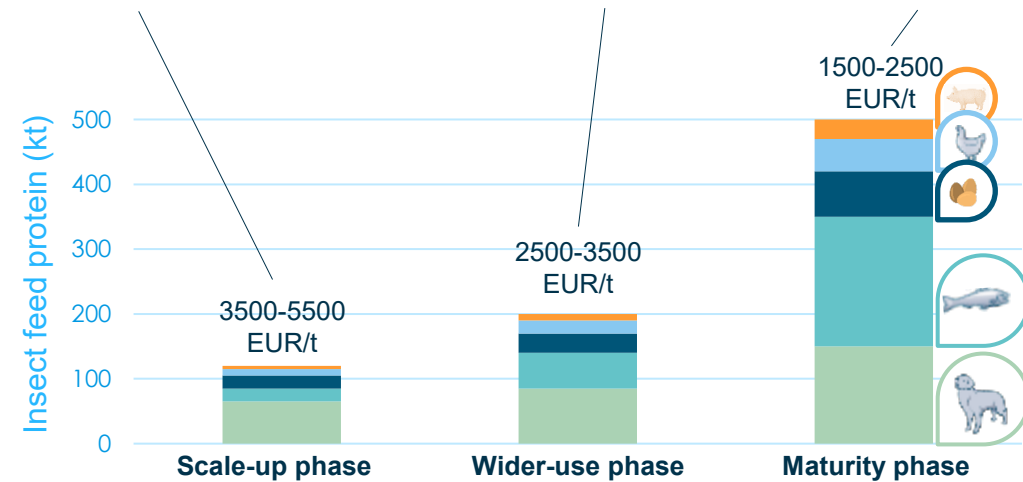
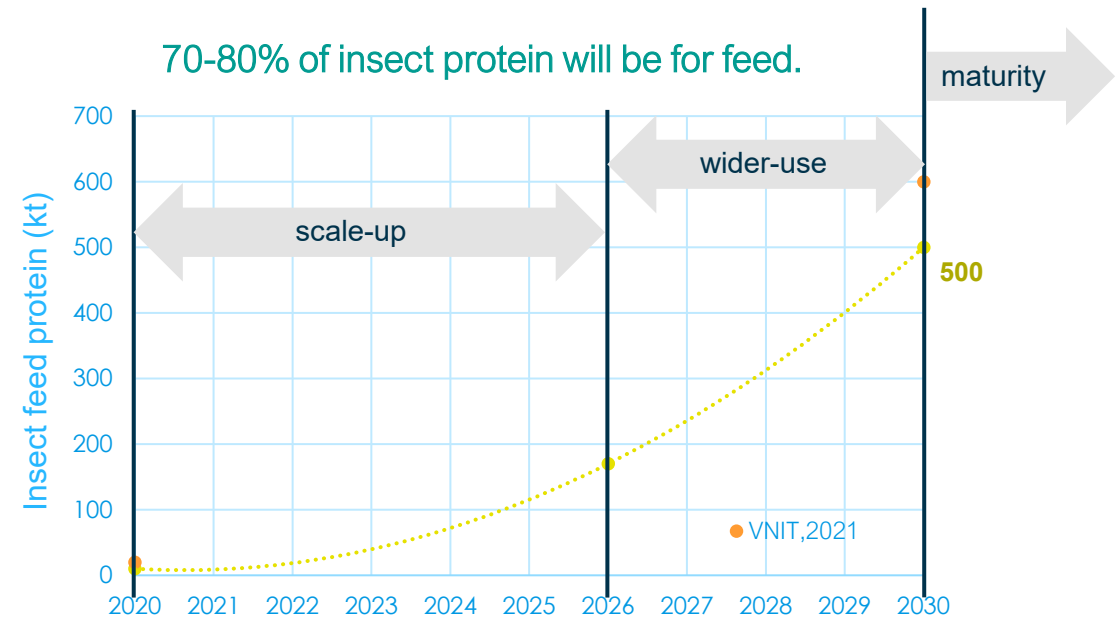
## Insect protein production



## From niche to commodity products

- Until 2025 pet food will dominate the demand for insect protein.
- Until 2030 demand for aquaculture and chicken feed (layers and broilers) will strongly grow.
- Acceptance for insect-based food will increase

70-80% of insect protein will be for feed.







**Agriculture**



**Storage**



**Transportation**



**Mill**



**Food processor**



**Retailer**



**Consumer**



# How to nourish 10 bn people sustainably by 2050