INSECTINOV 2:

ADEBIOTECH \ AGROPARISTECH

Paris 10,11 & 12 Octobre 2017

FARMING INSECTS for FOOD and FEED;

a global overview on opportunities and constraints

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Global **FOOD** & FEED production

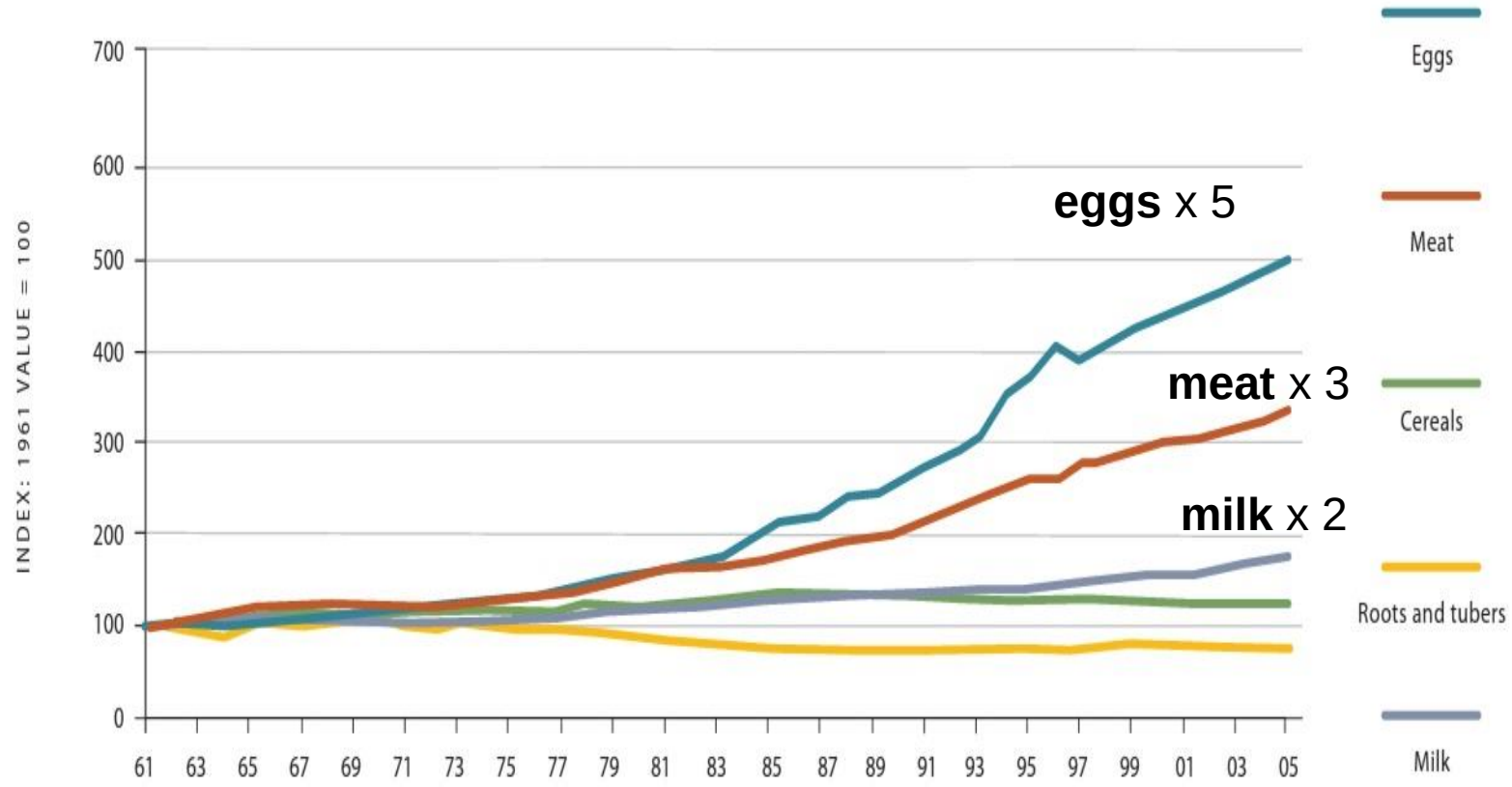
- **FOOD** **for direct human** consumption, including food ingredients like colorants, flavours, flagrances, spices, thickeners, etc:

8.4 b tons (fresh)/year (source FAOSTAT 2015)

(1,12 tons fresh weight by person\ year)

Pressure: more PROTEIN !

- Per capita consumption of major food items in **developing** countries (1961-2005) → increasing demand for meat and other animals products



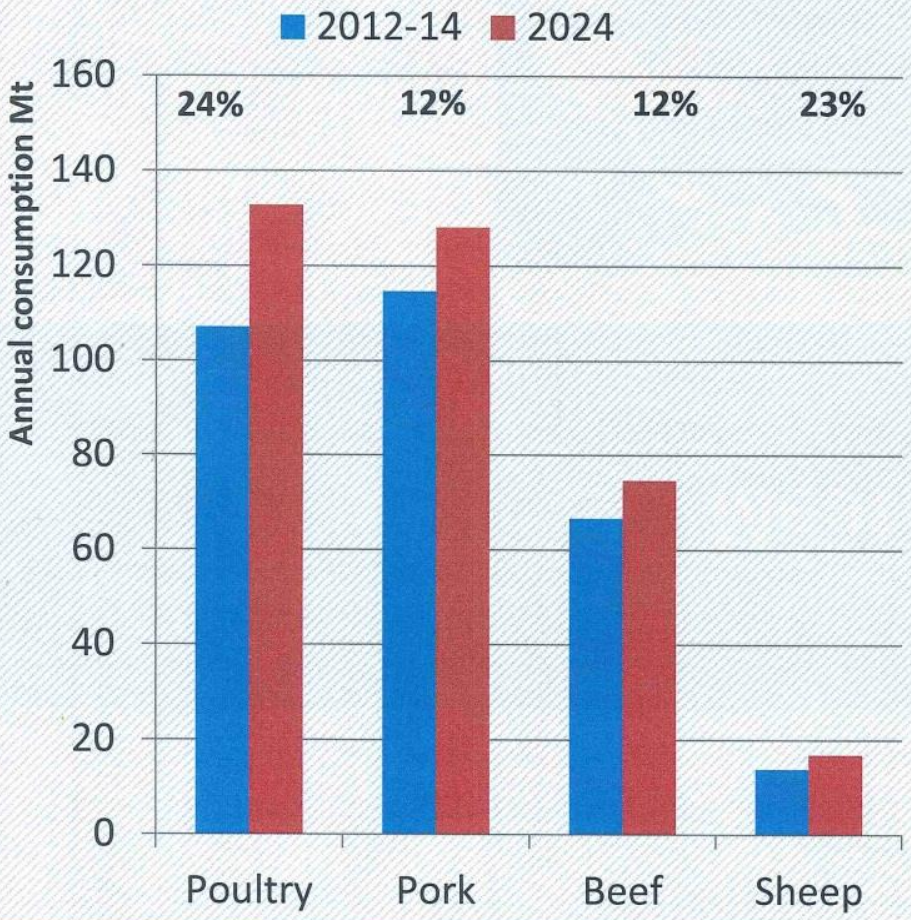
FAO, 2009

Revolution in our Meat and Fish consumption!

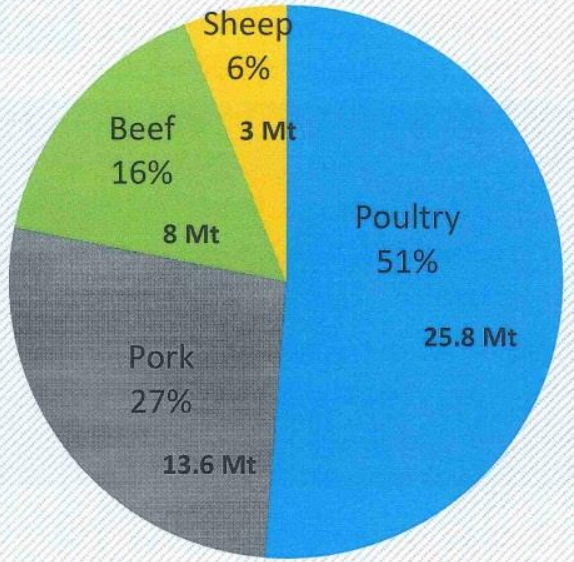
- global meat production has grown 25-fold since 1800
  due to population growth ↑ and per capita consumption ↑
  → global trend: **from occasional luxury to centrepiece of every meal !!!!**

- Farmed fish: fastest growing sector !
  Fish Shortage foreseen by 2030 everywhere

Global meat consumption

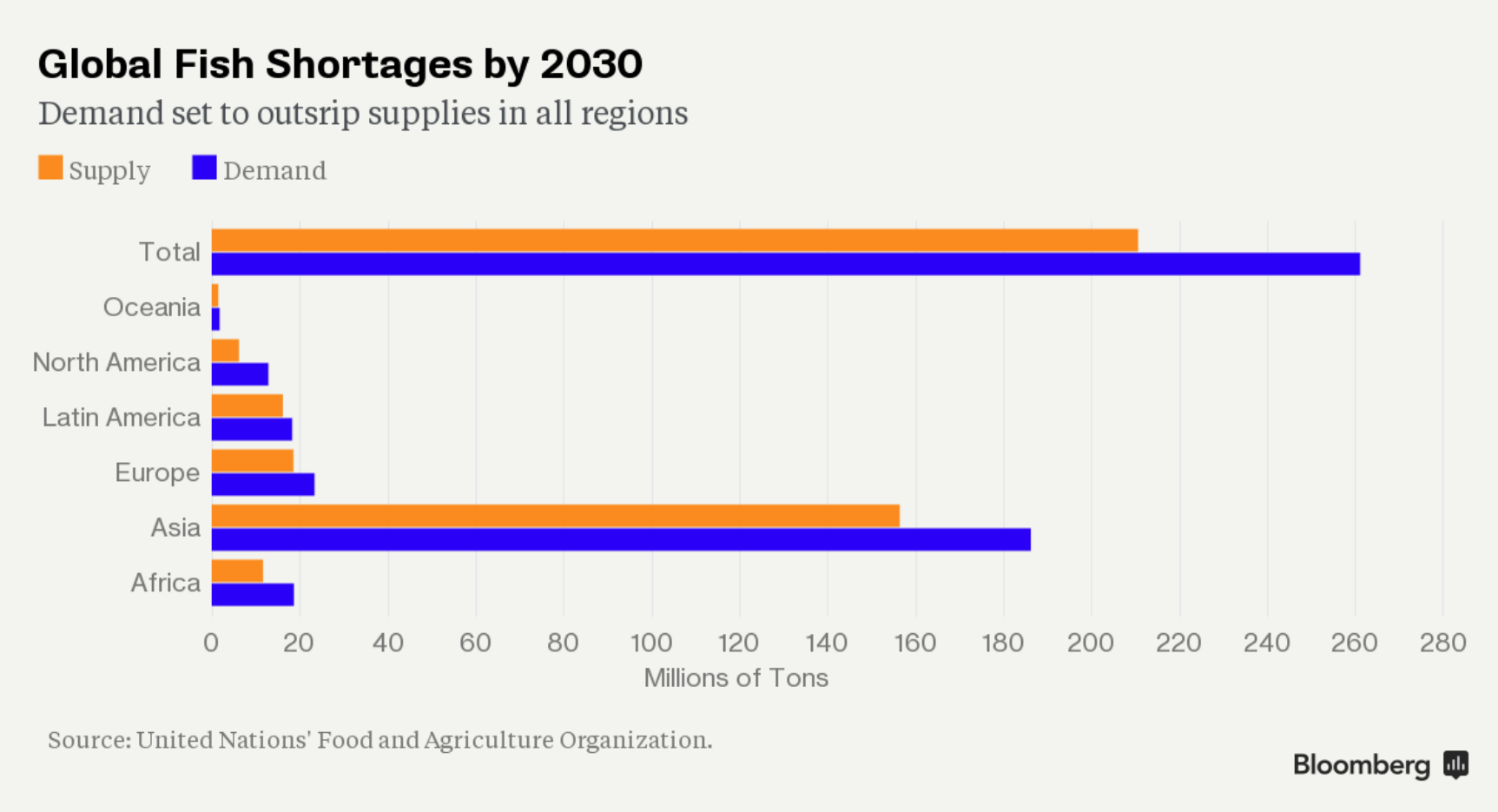


50 million tons additional meat consumed by 2024



OECD-FAO Agricultural Outlook 2015-2024

Global Fish Shortages by 2030



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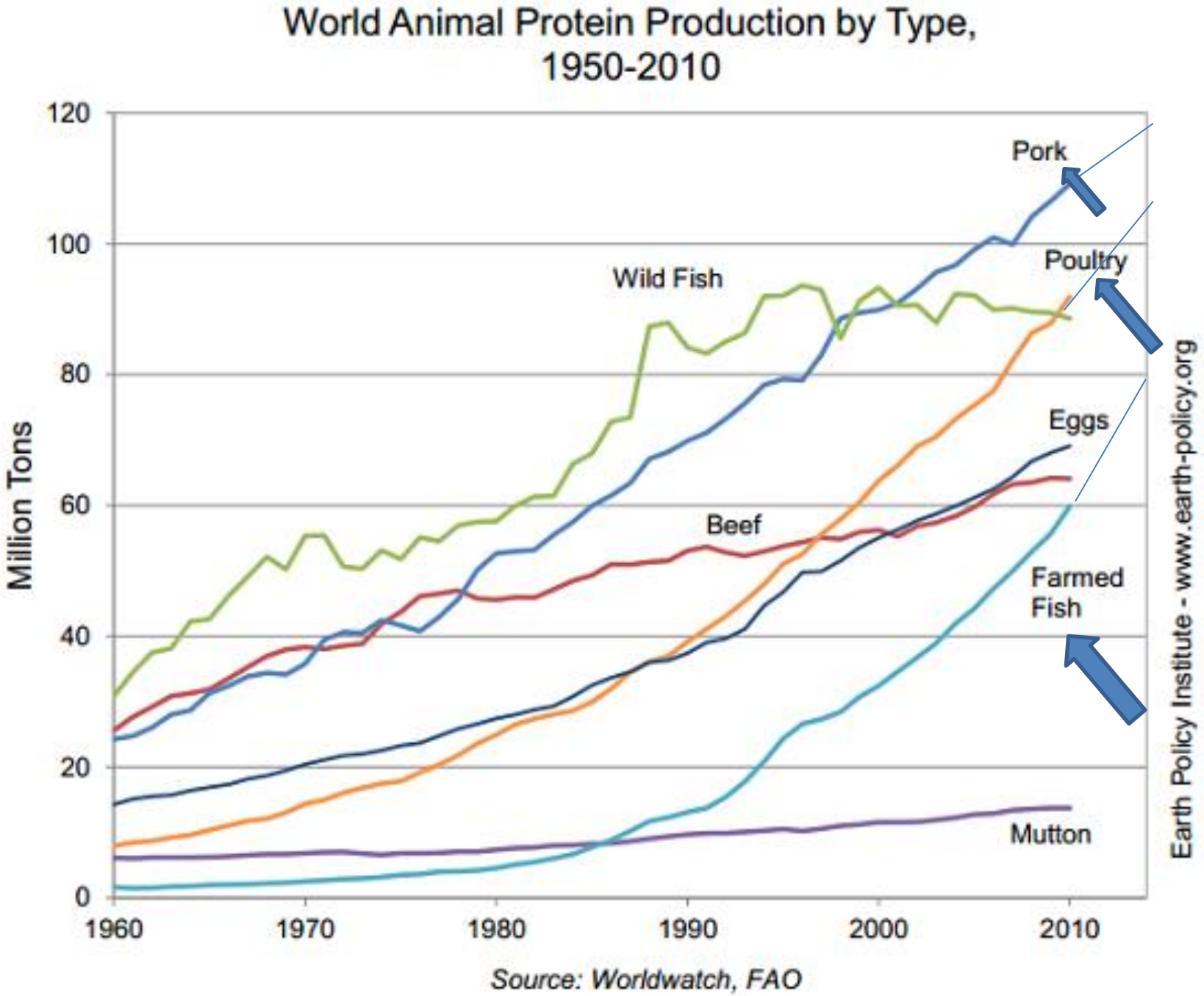
- **FEED for our animals** (feed, fodder, ingredients,…)
  1. Livestock, farmed animals for human consumption
  2. Pet animals (cat, dogs, race horses, zoo animals,…..):

  6.4 b tons dry matter/year (source GLEAM 2014)


World Animal Protein Production by Type, 1950-2010
Million Tons
120
100
80
60
40
20
0
1960
1970
1980
1990
2000
2010
Pork
Poultry
Wild Fish
Eggs
Beef
Farmed Fish
Mutton
Earth Policy Institute - www.earth-policy.org
Source: Worldwatch, FAO

To feed our animals

In 2013
795 million tonnes of cereals (1/3 cereal production)

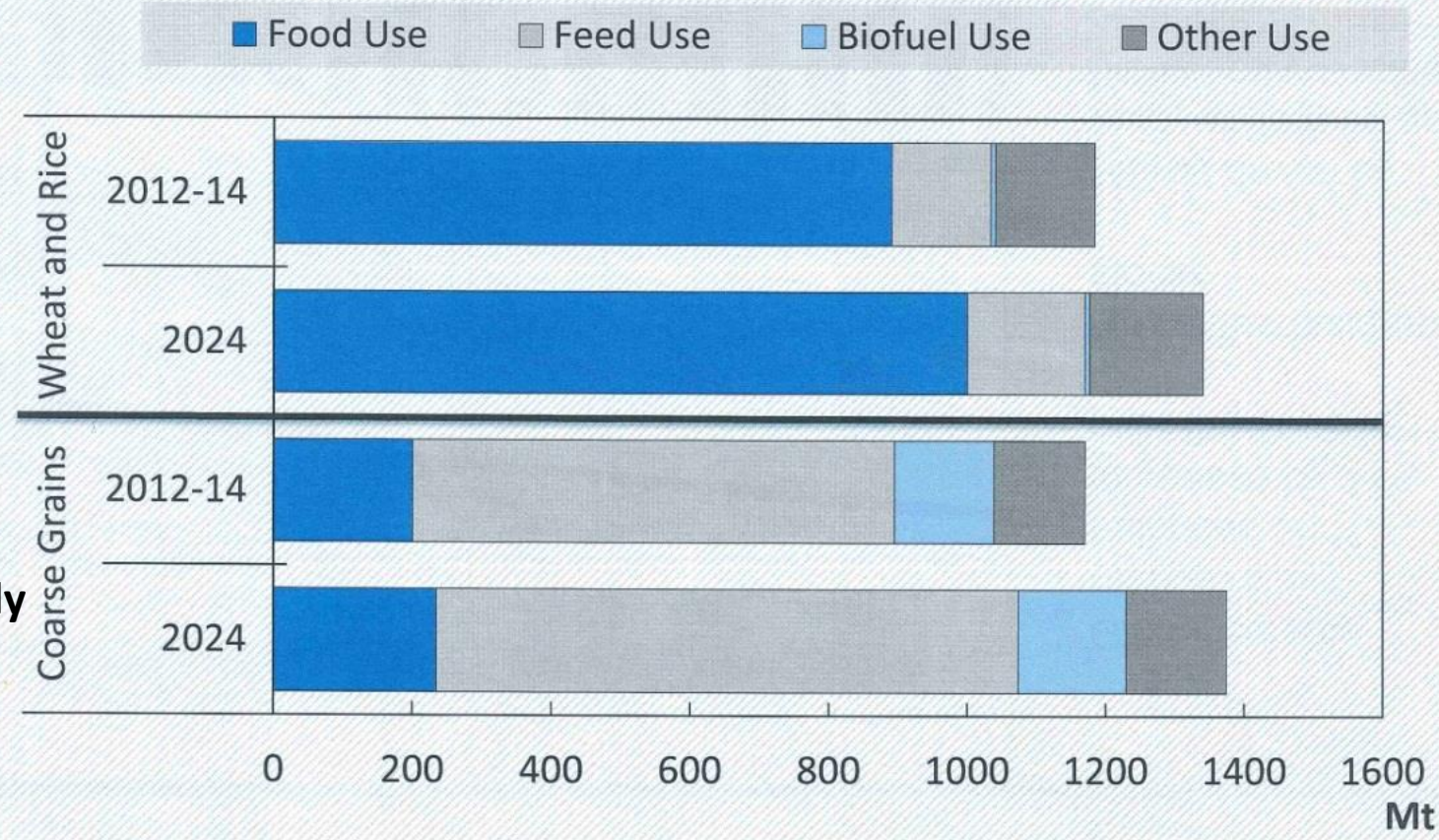
By 2050
an additional 520 million tonnes (1/2 cereal production)

Monogastric sector (chickens, pigs, aquaculture,.)
In 2013
Consumed 155 million tonnes of feed protein (mainly Soy)
In 2050
Additional 110 million tonnes of feed protein (50% from cereals/soy and rest from alternative protein sources)

In 2013
110 million tonnes of course grains used for bioethanol

FOOD - FEED - ENERGY (+bioplastics) COMPETION
60% 30% 10%

Cereals utilisation



Soy
Corn mainly

OECD-FAO Agricultural Outlook 2015-2024

Protein alternatives....

in addition to improve existing protein production and consumption practices

- **Capture** more out of oceans: Medusae, Jelly fish, krill,...
- **Farming** the sea: macro, micro **Algae** (Spirula – High tech)
- **Artificial** proteins(Ap): meat (120.000$/kg), synthetic AAs (6-16 $/kg)
- More out of **Agro-industry processing(Aip)** byproducts: corn gluten, brewers grains, yeasts, potato protein concentrate, DDGS, ...
- Farming more **plant protein** sources: oil seeds; legumes, forages, trees, duck weed, (Moringa leaves),.....

OR Compete for land, water, fertilizers, farm inputs OR High capital/tech (AP,Aip, spirula, ….)

potential: regional- niche markets

Can we produce *enough*, *safe* food, *responsibly* for 9 billion people (and 100+ billion animals) by 2050 ?

Global agriculture production **tripled** in last 50 years with only 12% increase in farmed area

(population doubled during the last 50 years!)

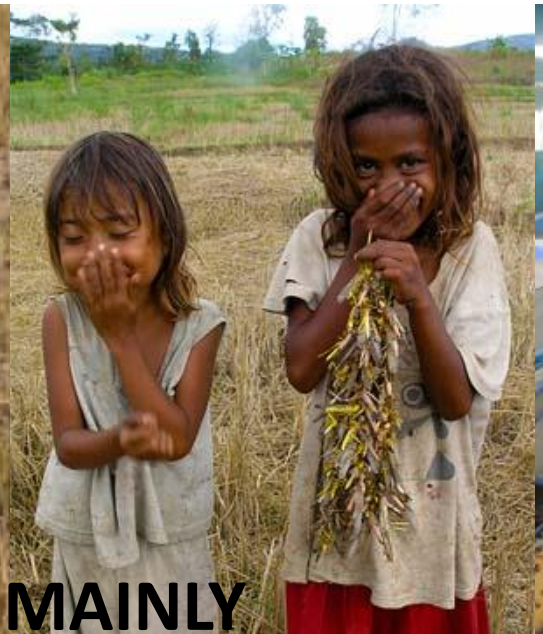
Water consumption growing **twice** as fast as population growth

Food loss and waste at **1.3 billion** tons/year (out of the 8.4b). Net food availability: 1 ton/ person/ year…….

can **Insects** help Feed the planet ?

Global Insect Supply

- mostly by **gathering in nature** (2000+ species)
- some 20+ species by semi domestication (bees,bamboo worms)
- and now by farming (fly larvae)

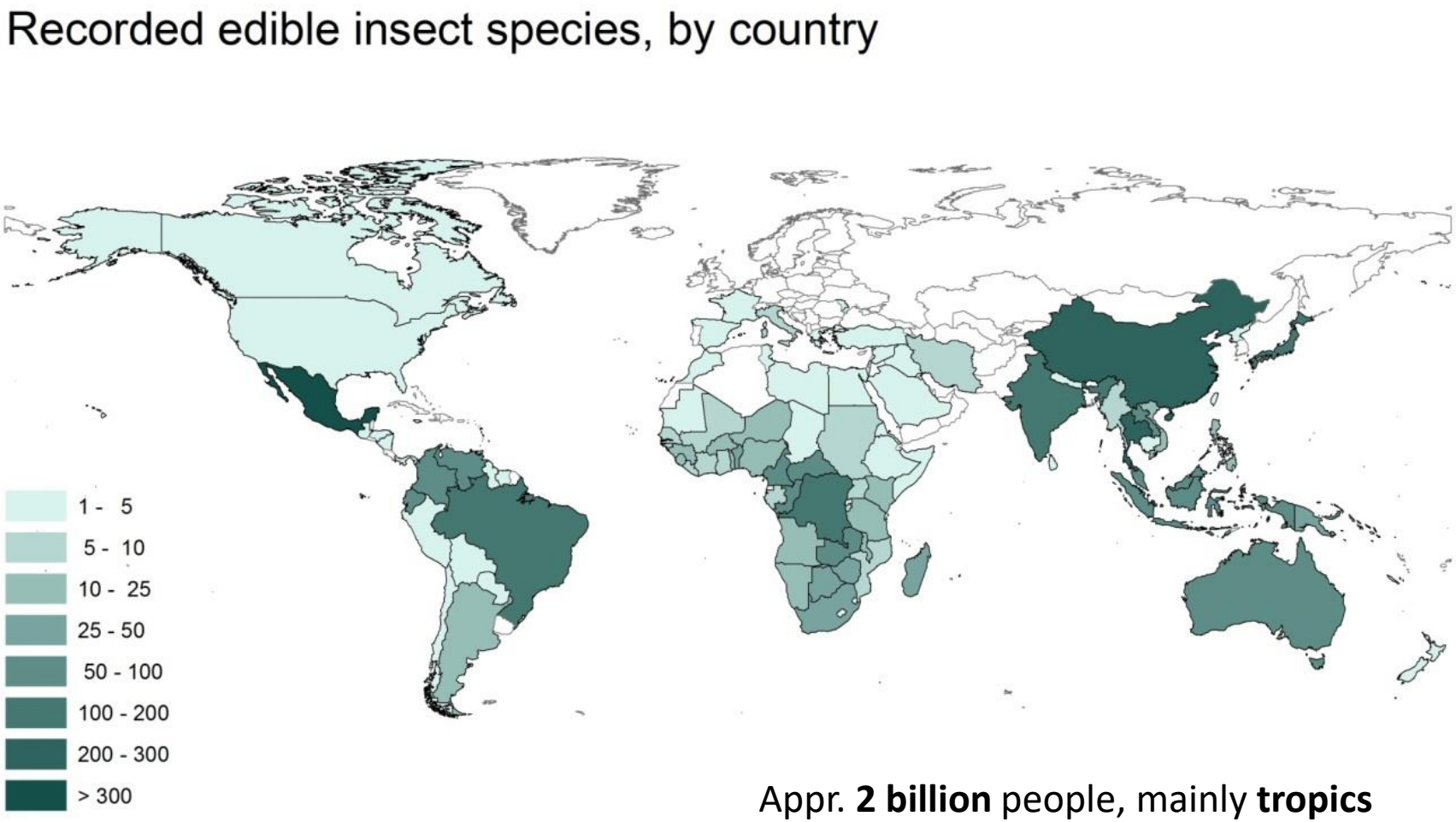


FOR FOOD MAINLY

Insects as animal feed

- Chicken feed:
  - Silk worm pupae: from Europe to China
  - Termites: Africa, Laos,
- Fish feed: # species

1. Consumption of Insects



Appr. **2 billion** people, mainly **tropics**
some **50 Countries** (with at least 5 species)

Source: Centre of Geo information by Ron van Lammeren, Wageningen University, based on data compiled by Yde Jongema, 2015

version: 150518

Opportunities for farming Insects

Food – Feed – Non Food - Pharma

- Proteins
- Fats
- Chitin
- Enzymes, peptides and other products
- Services (IPM, pollination, ...
- Waste management.....


27.10.2014

Farming - **Substrate**

Wide variety of different types of organic materials :

- # insect species
- Species have specific feed requirements
- sequential species on same substrate + interaction with others: earthworms, nematodes, fungi, yeasts (fermentation).....for waste disposal or for non-food/feed uses

For <u>FEED</u> mainly , less relevant for rearing insects for food

- **Competing** with the human \ farm animal food chain: for example rearing crickets with commercial chicken feed **NO EFFICIENCY GAINS !**
- **Not Competing**: low value rest streams, for example: food\feed\farming and animal processing wastes (manure) **HIGHEST EFFICIENCY GAINS !**

Phasing Out Certain Antibiotic Use in Farm Animals

- CAN INSECTS HELP US TO REDUCE LEVELS OF ANTI-BIOTICS IN FARMED ANIMALS ?





Antimicrobial Peptides (AMPs)

Torino Creaa VII Convegno 29 may 2014 VANTOMME FAO.pptx - Microsoft PowerPoint

Ratcliffe N Insect Natural products as Potential modern day medicines 6th May 2014.pdf - Adobe Reader

Hindawi Publishing Corporation
Evidence-Based Complementary and Alternative Medicine
Volume 2014, Article ID 904958, 21 pages
http://dx.doi.org/10.1155/2014/904958

Hindawi

Review Article

Recent Advances in Developing Insect Natural Products as Potential Modern Day Medicines

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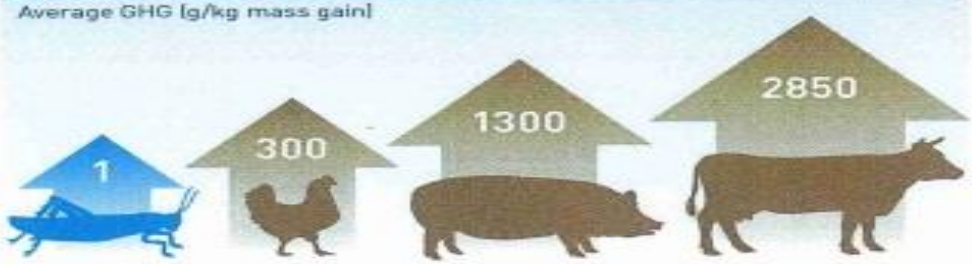
ENVIRONMENTAL BENEFITS

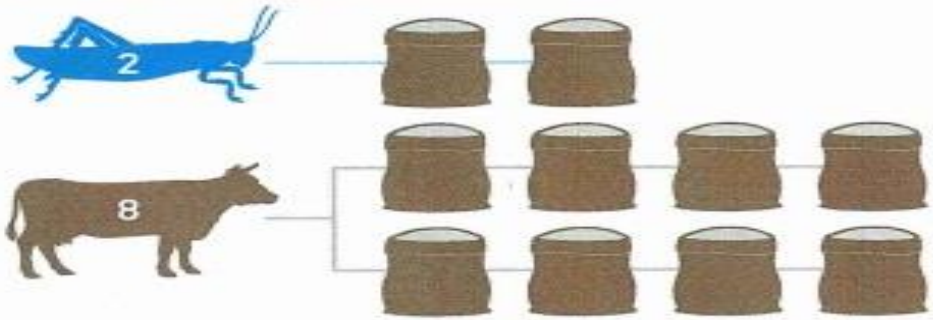
GREENHOUSE GAS PRODUCTION

Average GHG [g/kg mass gain]



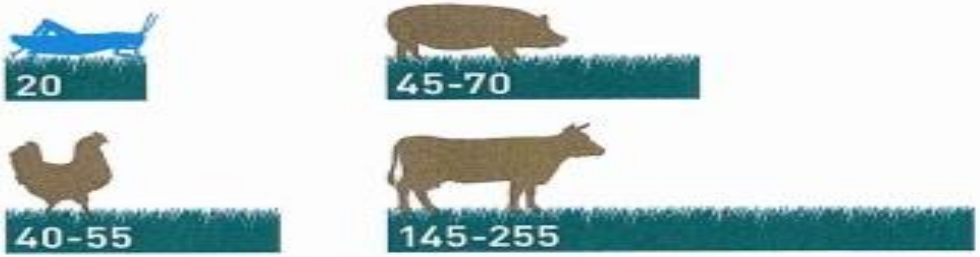
FEED CONVERSION EFFICIENCY

kg of feed required to produce 1kg of edible weight



LAND USE

Land use m² for 1 kg of protein



10 to 100 times less <u>WATER</u> as compared with cattle

Insect farming contributes to a closer, **local circular economy** in livestock rearing

- Locally produced side-streams from agriculture, agro-industries, food and waste management available to local insect farmers to produce proteins, fats ..... as feed ingredients for livestock, meat & fish producers in the same region
- Improving local farming economies (including for small farm operators! .....power of the numbers !)

Insects are Socially more accessible

Farming insects does NOT require high investments Knowledge – Capital - Land - Resources :

- also possible for the ***poor*** to farm insects, improve their diets and gain cash income
- Farming insects is possible **at any scale** of commercial undertaking , **everywhere** around the world and **during the full year**.
- Good for the **local economy**

  and **jobs** for the young !

Black Soldier Fly larvae production

MiLLiBETER

www.millibeter.be
Belgium

Supermarket waste

1 ton fresh vegetables
(13 % Dry Matter)

~1 Million BSF eggs

17 days @ 25°C

Frass

100 kg fresh
(70% DM)

Larvae

160 kg fresh
(~40% DM)

62 Kg dry

- Protein (30 kg)
- Lipids (24 kg)
- Chitosan (5 kg)

Black Soldier Fly larvae production

bioflytech

Alicante, Spain

100 Kg brewery waste

+

0,4 kg seed larvae

Bio digester

10 days
25ºC

33 kg fertilizer

+

33 kg larval biomass

=

12 kg fly meal

Examples from around the world

Global stakeholders : 1000+… and fast increasing

- http://www.fao.org/forestry/edibleinsects/stakeholder-directory/en/

An example from China (feed):

- http://foris.fao.org/static/edible_insects/China_pig_farm_manure_treatment_larvae.pdf

Examples from the US (Food\feed): Chapul, Exo, Tiny Farms, Enviroflight….. https://www.exoprotein.com/

https://www.youtube.com/watch?v=cpol2d0c820

ENVIROFLIGHT **USA**

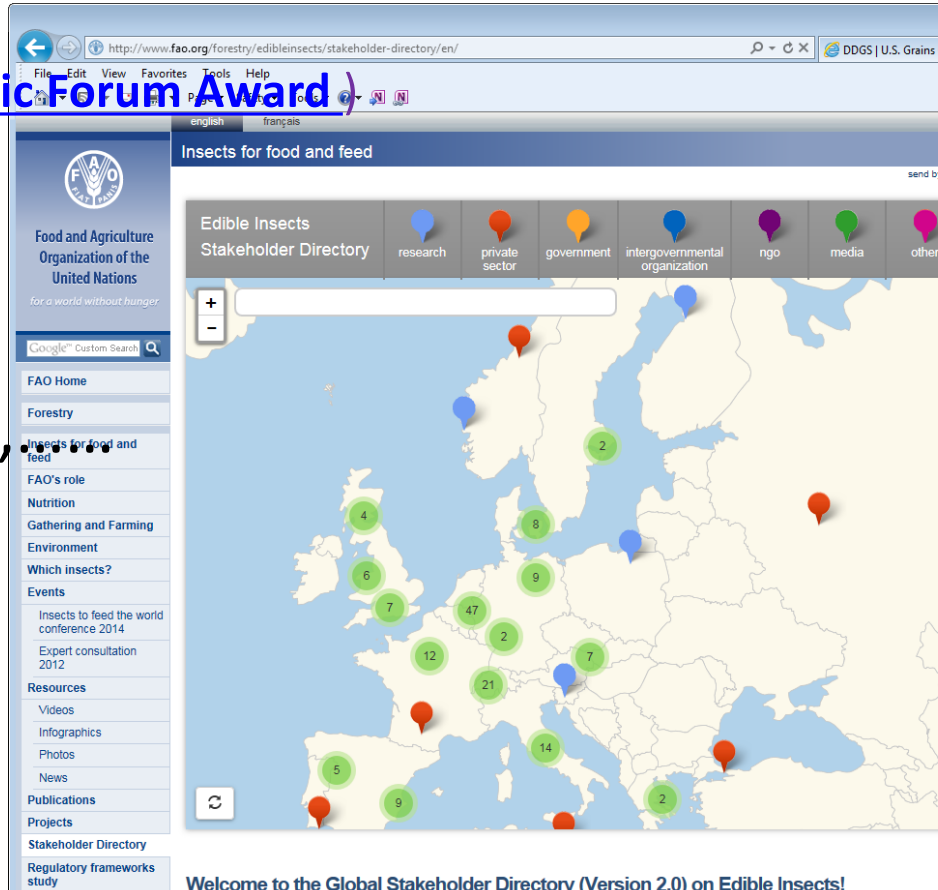
- uses co-product from breweries, ethanol production, and pre-consumer food waste as feedstock for Black Soldier Fly larvae
- cost-effective production of complete diets for aquaculture species, with reduced reliance on fish meal and fish oil

http://www.enviroflight.net/

From Europe

- Proteinsect EU project: http://www.proteinsect.eu/
- Greeinsect Denmark : http://greeinsect.ku.dk/

- Protix – NL (**Davos World Economic Forum Award**)
- Bioflytech - Spain
- Hermetia – Germany
- Millibeter – Belgium
- Ynsect, Micronutris, Jiminis, ... France
- .....



Insects ? **YES !!!!** , but……

- Biggest challenges:
  1. **Yuck factor**: more for food than for feed !
  2. **Legal framework** (in progress: US, EU (Novel Food, fish feed), CH, China, Thailand, RSA, Mexico, South Korea,…….)
  3. Use of "**Waste**" to feed insects (Tech + Legal)
  4. Product **innovation** and **scaling up**

……no validated production and trade data by countries are yet available!

Product innovation for FOOD


Contains 20% cricket flour, a superfood that's rich in proteins, omega 3, vitamin B12
CRICKET
PASTA
bugsolutely
NET WT. 350 gr (12.3 OZ).
bugsolutely
datasheet
Cricket Pasta
Cricket pasta is a superfood and a very innovative product, the only pasta containing 20% cricket flour in the world.
This unique food is part of the fast growing edible insects market and features great nutritional values, including high levels of protein, calcium,
28.05.2016 01:43

Way Forward

- Improve and focus awareness (Media, sectors: food, feed,… ….
  - Events, projects, gastronomy.. → Consumer acceptance

Academia

- Increase knowledge generation, dissemination, networking…. (incl. protection of (indigenous) knowledge, nutrition data, environmental benefits, LCA, socio-economic contribution, jobs, ….

Policy makers

- Legislation and regulatory frameworks (food, feed, waste disposal, insect inclusive nature conservation strategies, habitat protection, gathering, processing, trade, consumer protection, health, ….. (Codex Alimentarius, production and trade stats,…)

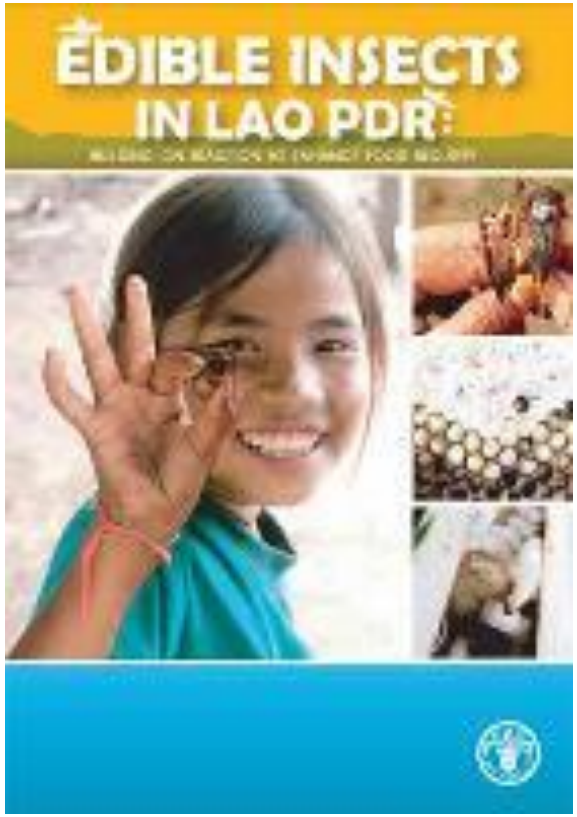
Private sector

- Economic's and technology: reduce costs, improve efficiencies, automation, business innovation and new products, …….

help structuring this emerging sector (organizing expert meetings – Chiang Mai 2008, Rome 2012, International Conferences – Wageningen 2014 , ….Wuhan, China 2018,…..)

FAO's role

Sharing Information among Countries



TRAINING 1000 INSECT FARMERS IN KINSHASA

LAOS	THAILAND	CONGO

Insects for food and feed

Food and Agriculture Organization of the United Nations
for a world without hunger

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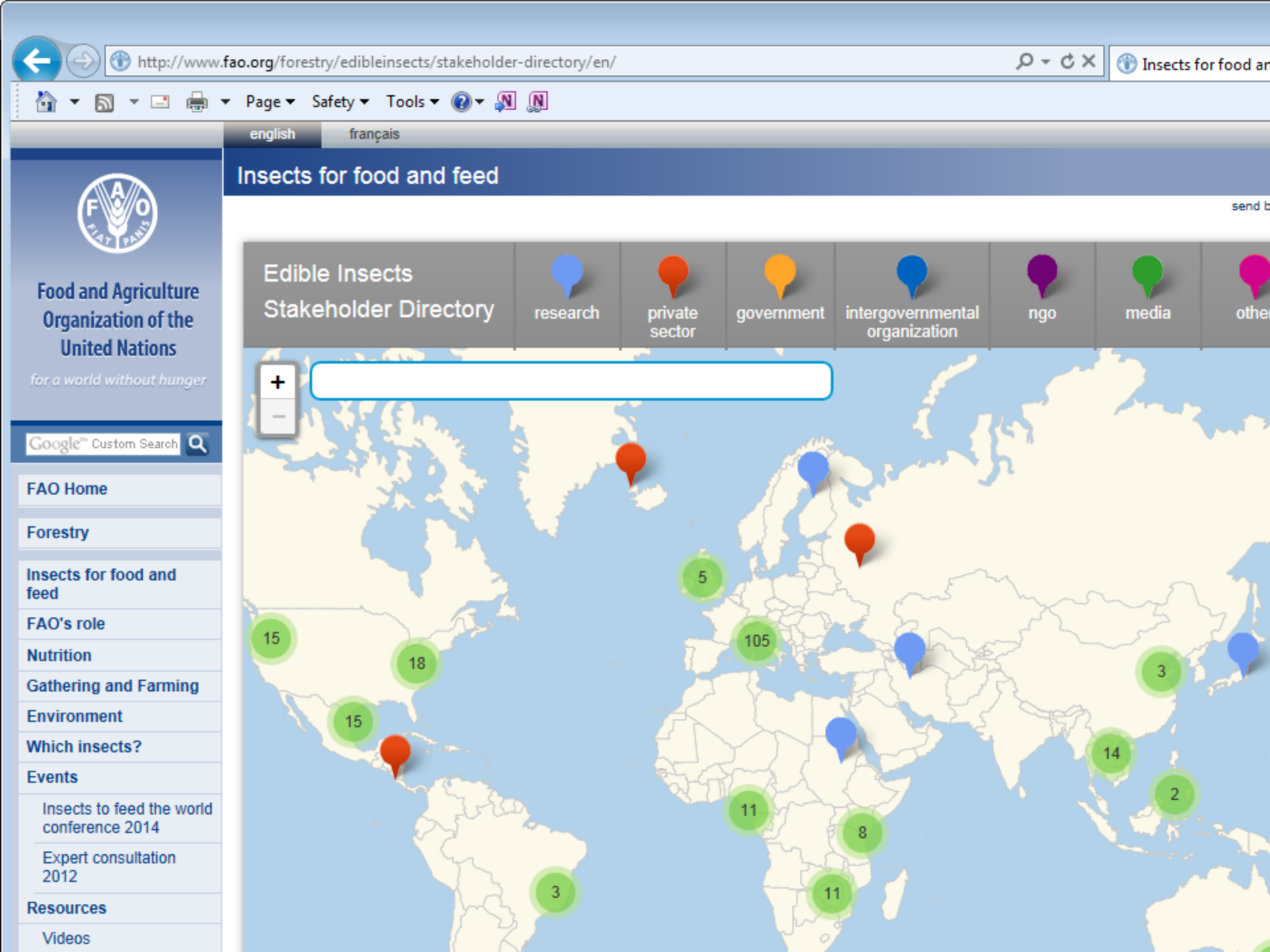
Which insects?
Events
Insects to feed the world conference 2014
Expert consultation 2012

Trends towards 2050 predict a steady population increase to 9 billion people, forcing an increased food/feed output from available agro-ecosystems resulting in an even greater pressure on the environment. Scarcities of agricultural land, water, forest, fishery and biodiversity resources, as well as nutrients and non-renewable energy are foreseen.

Edible insects contain high quality protein, vitamins and amino acids for humans.

Journal of Insects as Food Feed
Share

Related sites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FAO support to Food and Animal Feed Regulations

- **Country driven**
  regulations, standards, codes for feed (ingredients) and animal health

  Feed industry HACCP/ **OIE**/....

- **CODEX ALIMENTARIOUS**

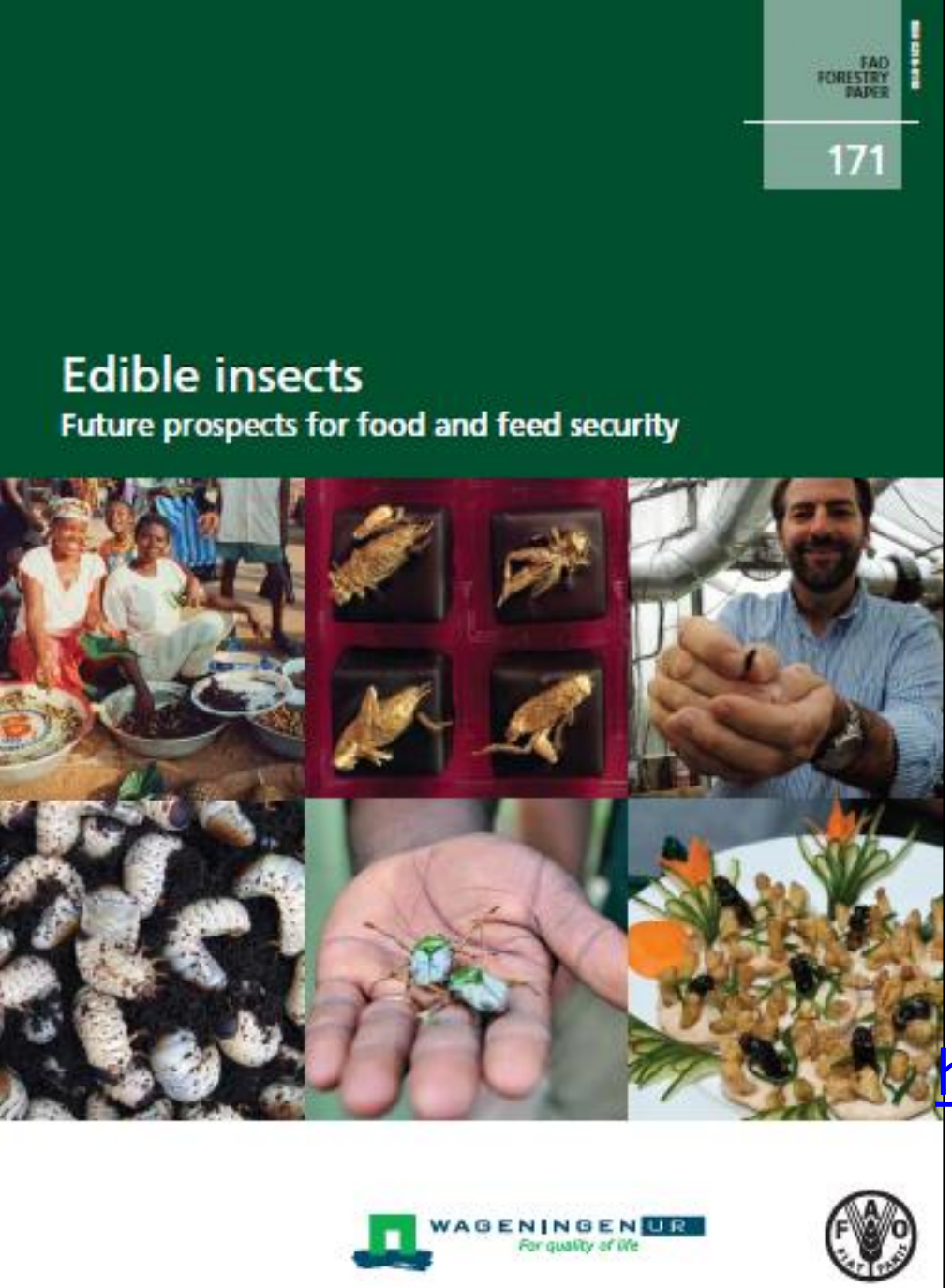
Ad Hoc Intergovernmental Task Force on ***Animal Feeding*** (TFAF)

(Aflotoxin b1).

(Laos, crickets)

- **FAO Guidelines**

  - Good practices for the Food/Feed Industry



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(since may **2013**)

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+10 million tweets !

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Free available at :

http://www.fao.org/docrep/018/i3253e/i3253e.pdf

also in FRENCH, KOREAN, ITALIAN, CHINESE

MANY THANKS !