Agriculture at the centre of global challenges

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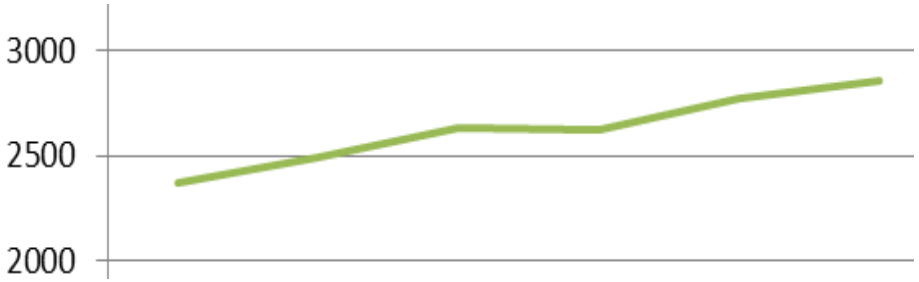
European Commission

Projections towards 2050

Per capita food consumption (kcal/day)



Food demand increase by 60%

1960 — 2015 — 2030 — 2050

Source: FAO 2012

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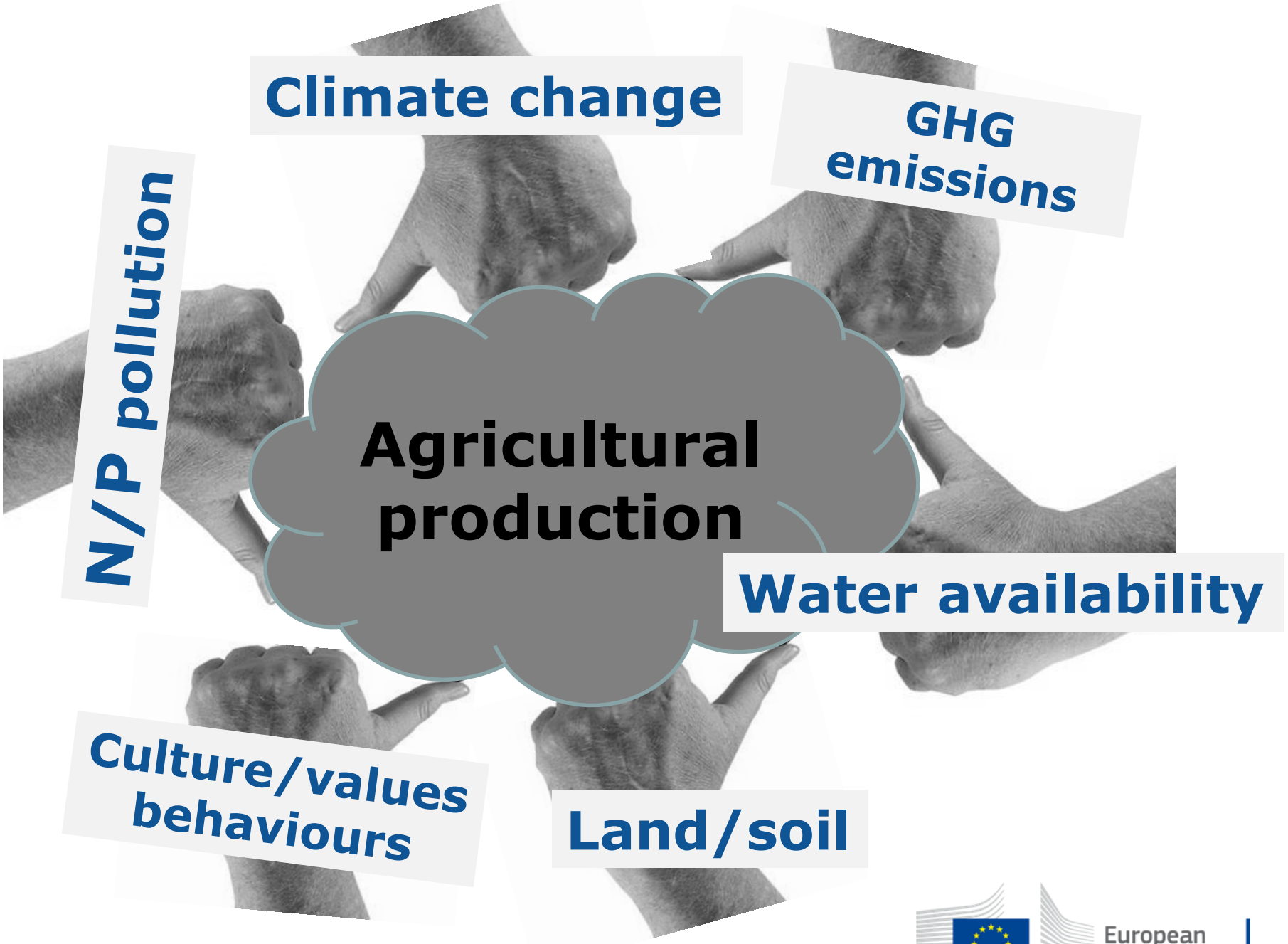
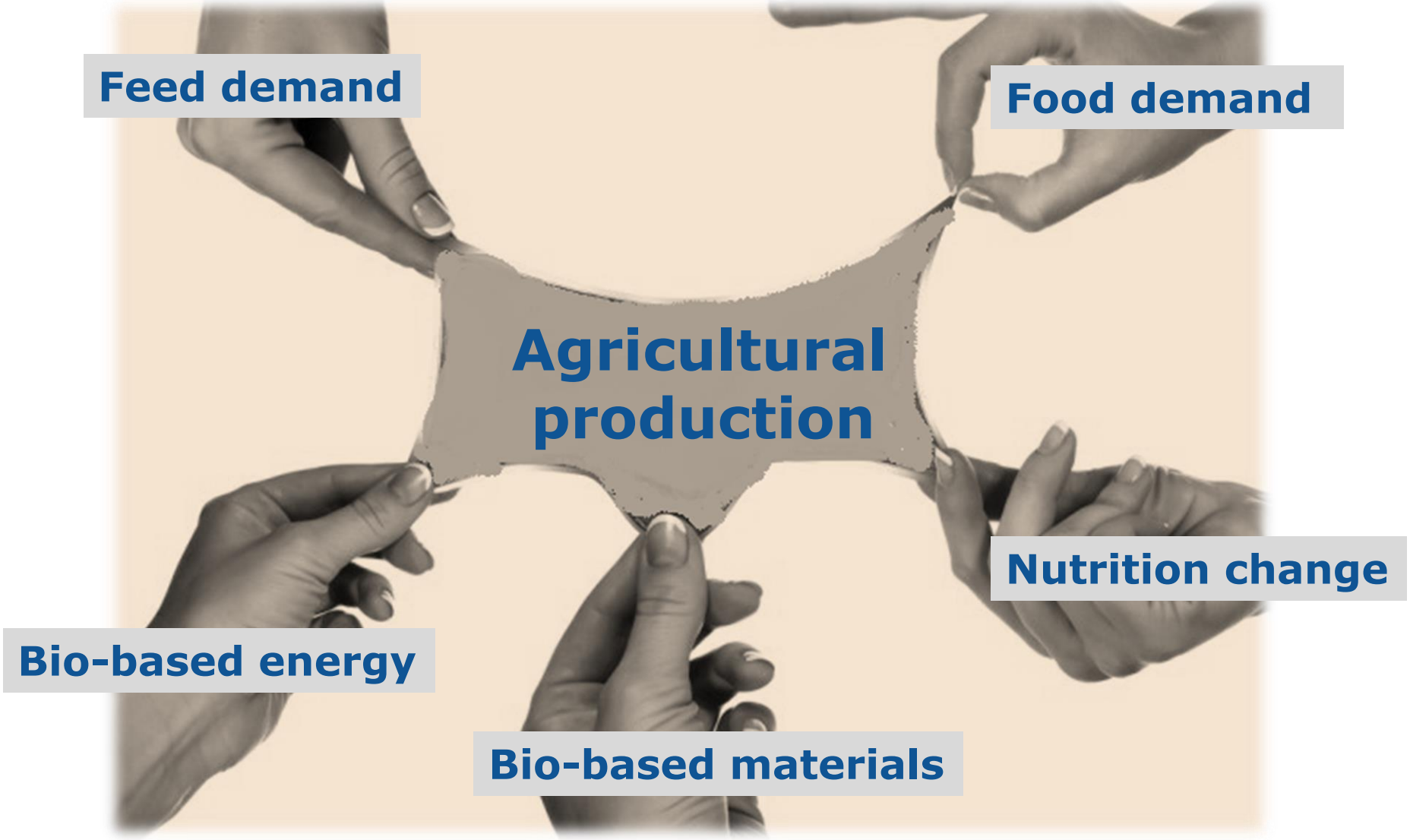
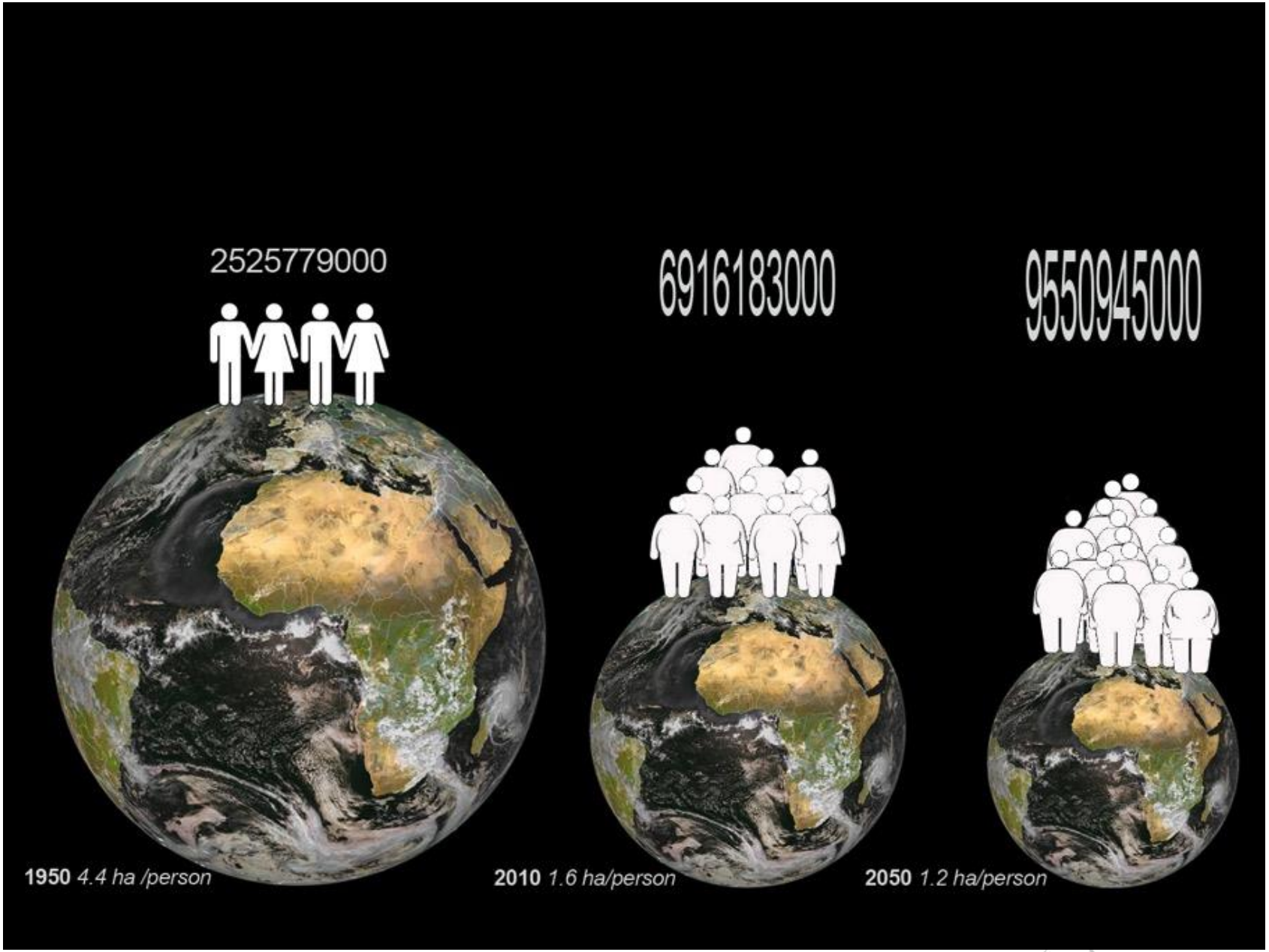


European Commission



European Commission



Source: Population data from UN

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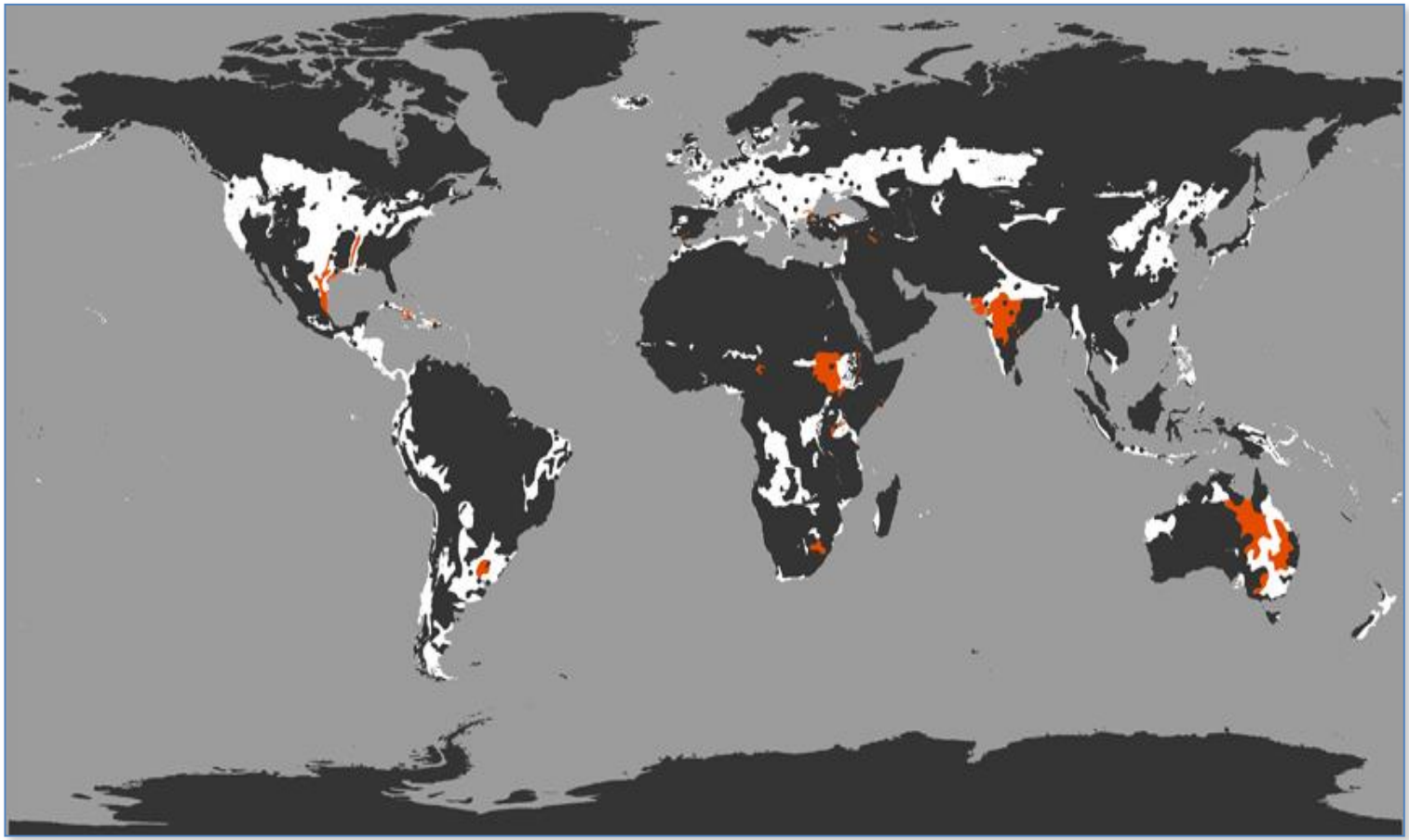
Land availability



- Land produces 95% of the calories
- Only 13-18% naturally highly fertile
- In the EU 25 m2/s degradation rate

Source A.R. Jones JRC
from FAO Map of World Soil Resources 1:25 000 000

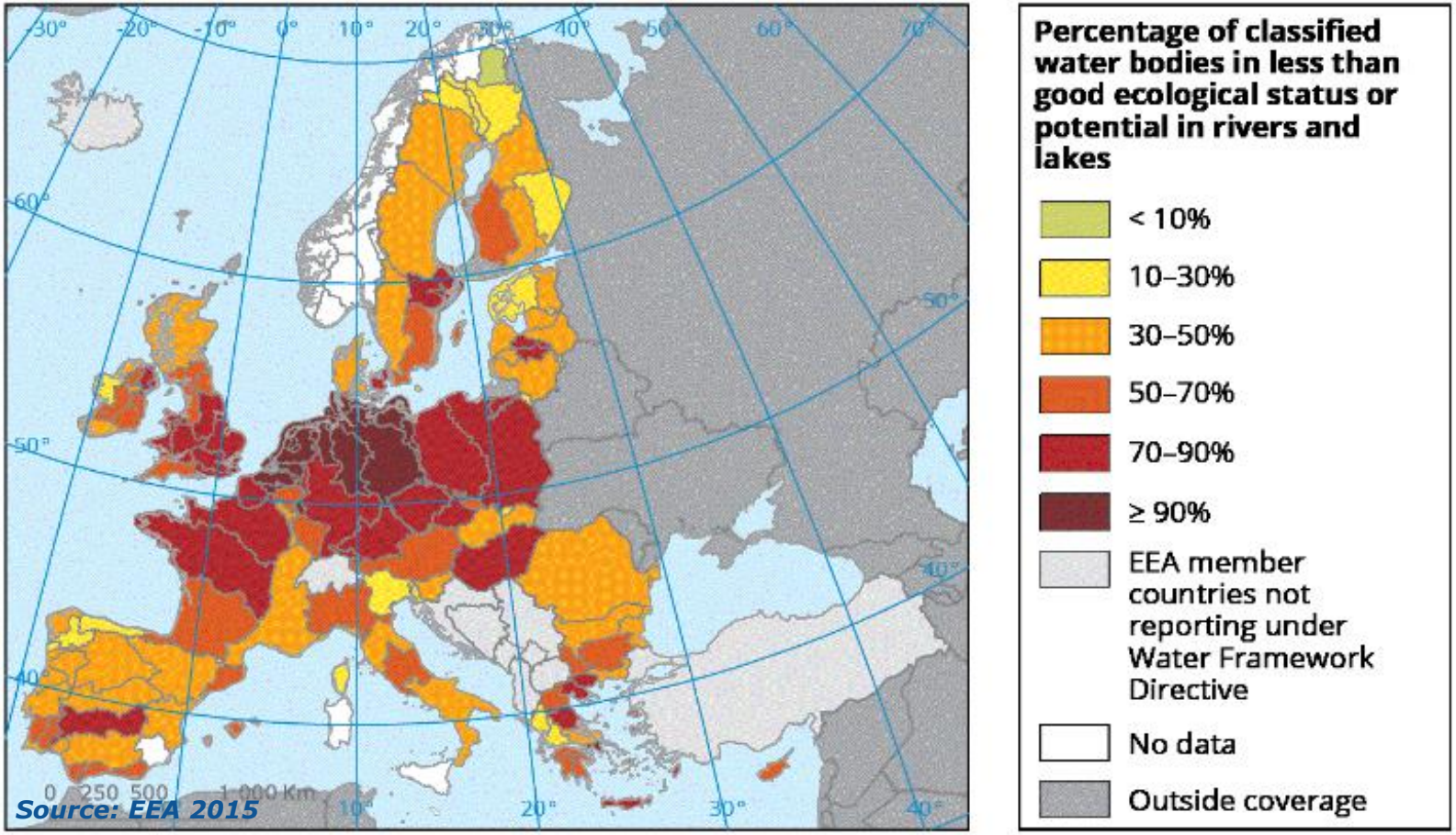
1950: 13.2 ha

2010: 2.93 ha

2050: 1.26 ha

Source: UN population data

The Water Challenge



- **70% of water used in agriculture, 89% in 2050**
- **40% gap between global water demand and supply by 2030**

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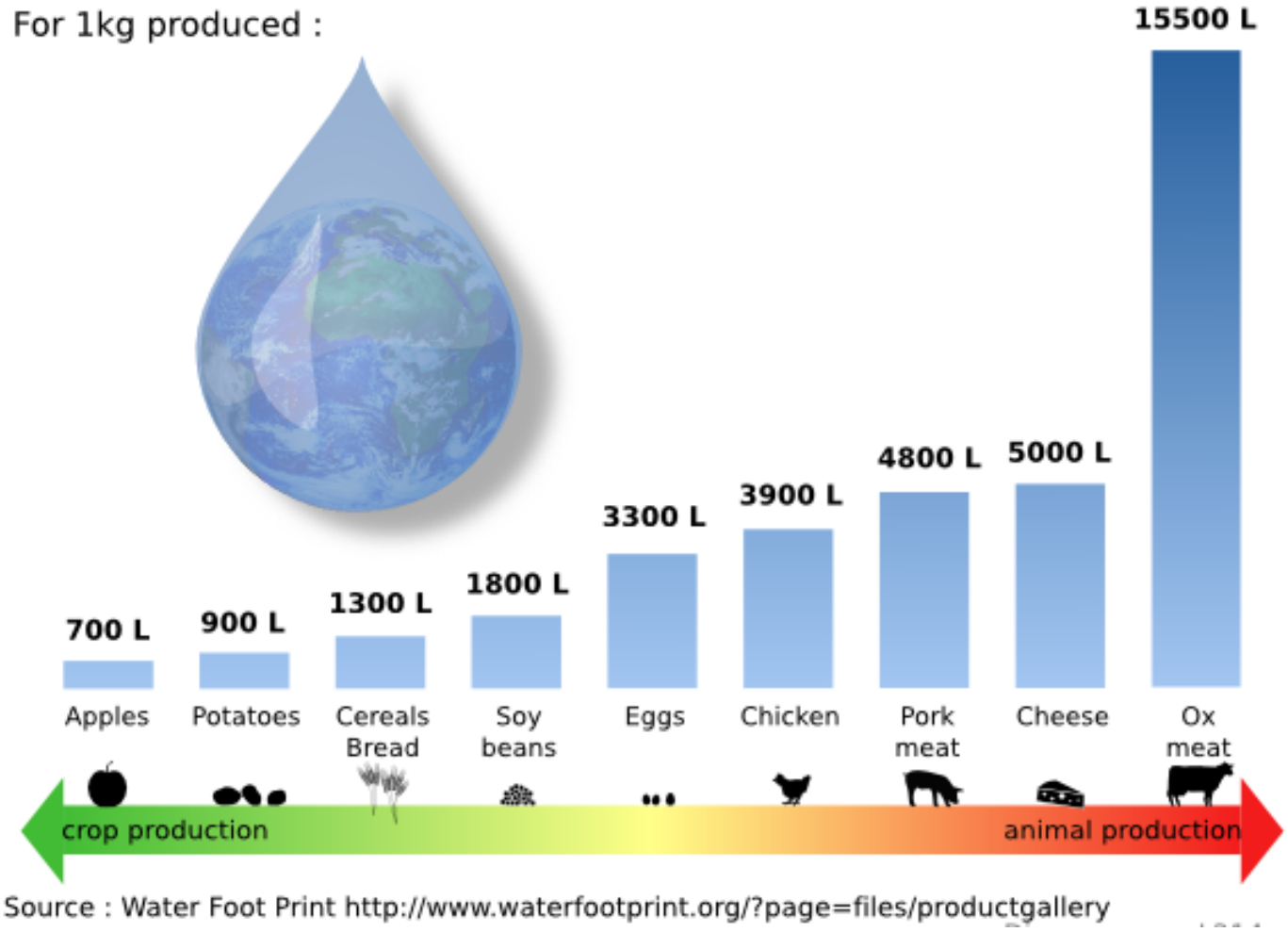
Water need for food

For 1kg produced :



Source : Water Foot Print http://www.waterfootprint.org/?page=files/productgallery

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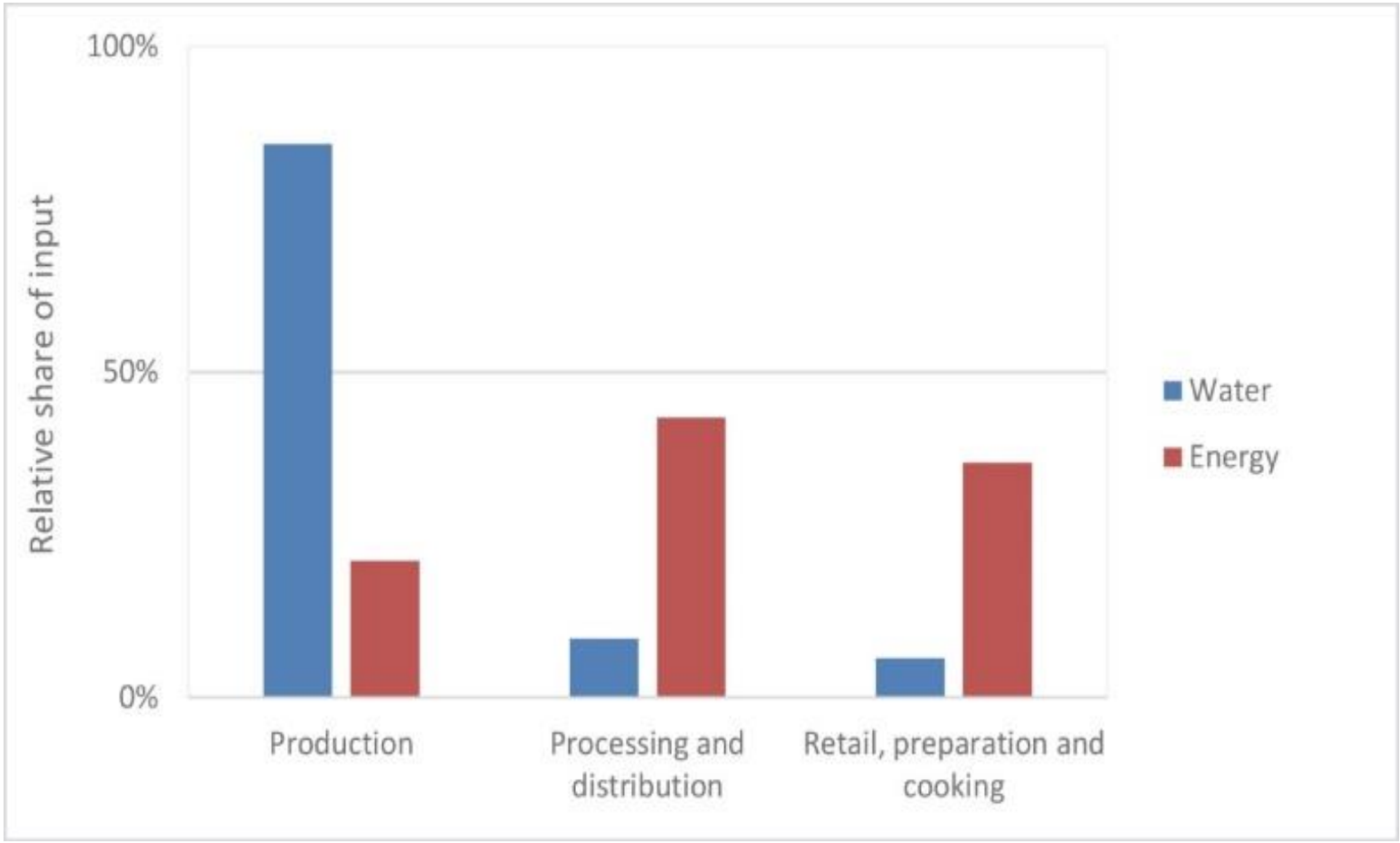
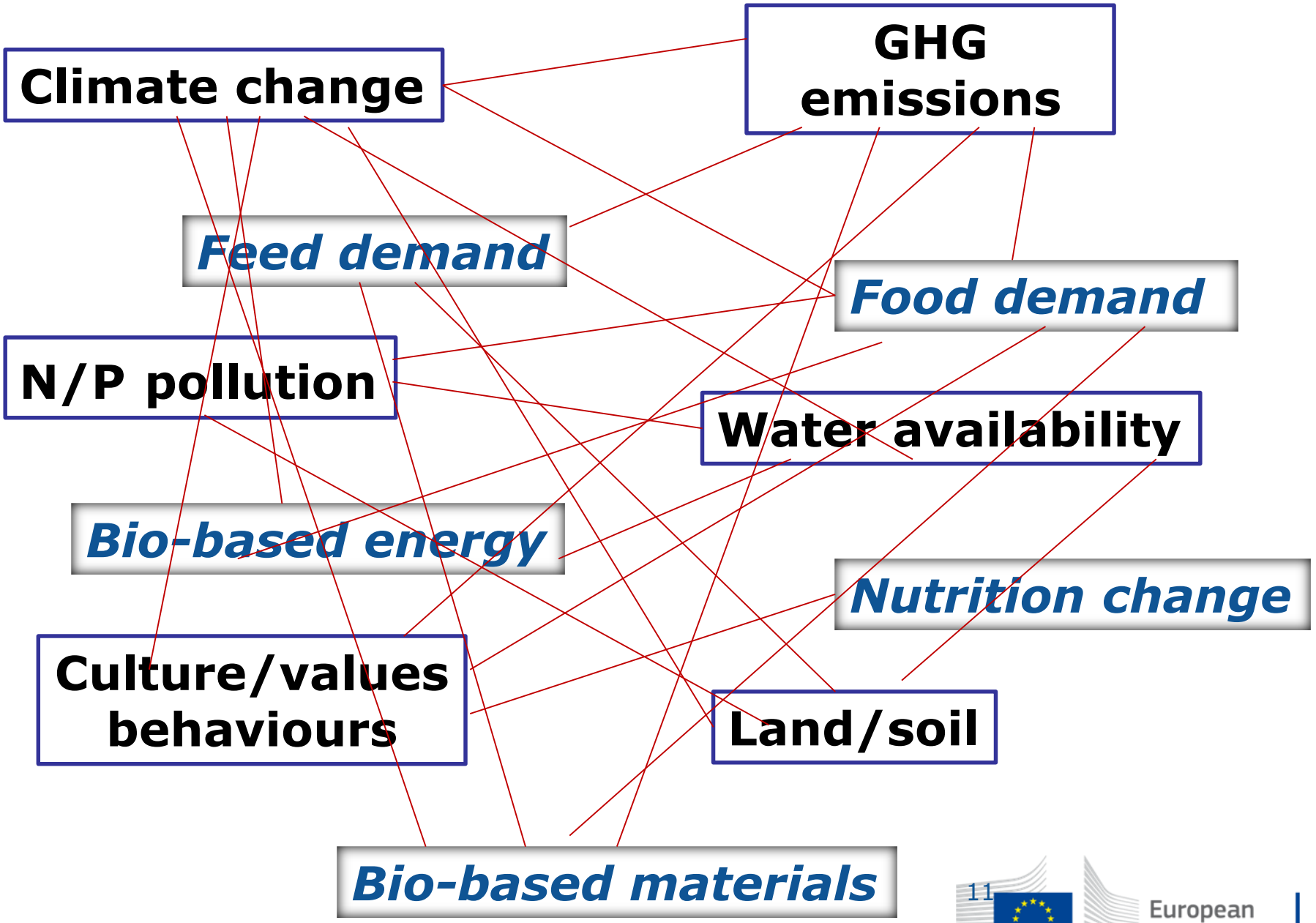
Adding Complexity

Water-Energy



Source: Lundqvist et al., in Water, food security and human dignity (2015), Swedish FAO Committee



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Source: pininterest.com

Solutions

Managing complexity

Nexus principle

Understanding interdependences

Water – Energy – Food – Land - Ecosystem

Holistic modelling platforms

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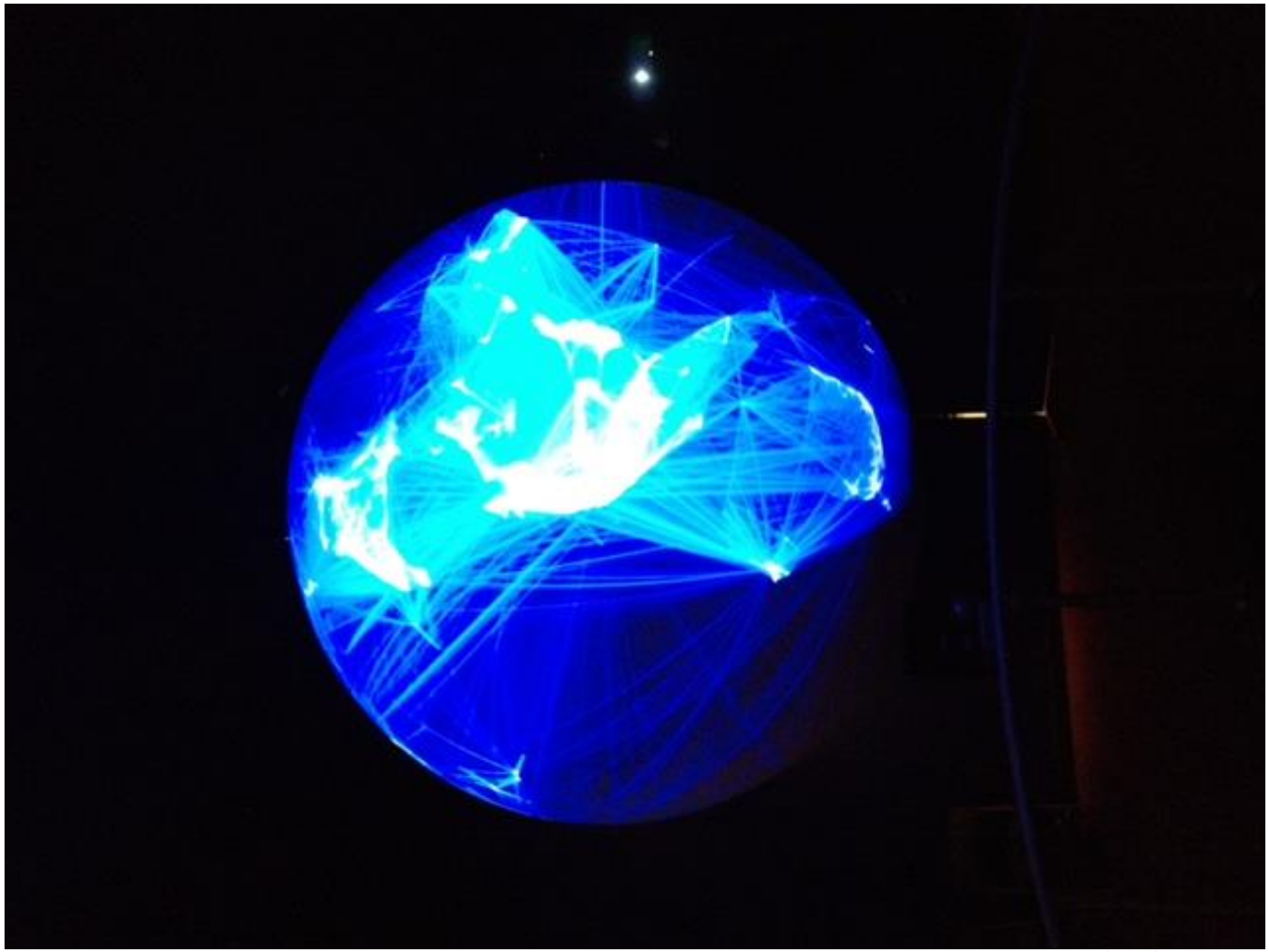
Data analytics and visualisation



Resource efficiency

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Food waste

- **EU = 123 kg/cap/y**
- **Sub-Saharan Africa, S and SE Asia = 6 – 11 kg/cap/y**

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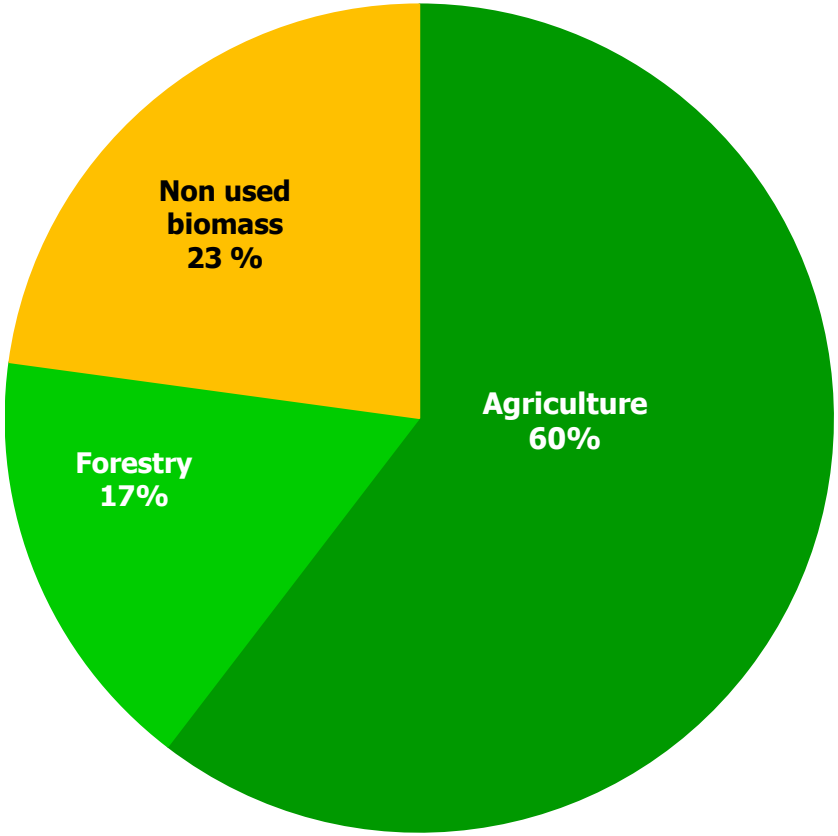
Biomass

Almost ¼ of biomass in EU not used



Source JRC 2015: The bioeconomy in the European Union in numbers – Facts and figures on biomass, turnover and employment

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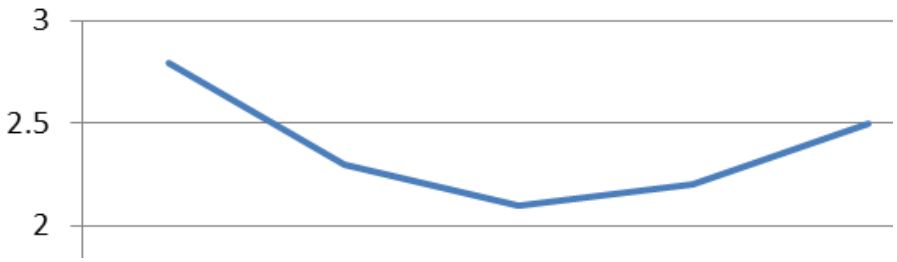
Productivity

Growth in World Agricultural Output (%)



At least 1,7% annual growth in world agricultural output needed

1960 — 2015 — 2030 — 2050

Source: Fuglie (2015) and JRC own calculation

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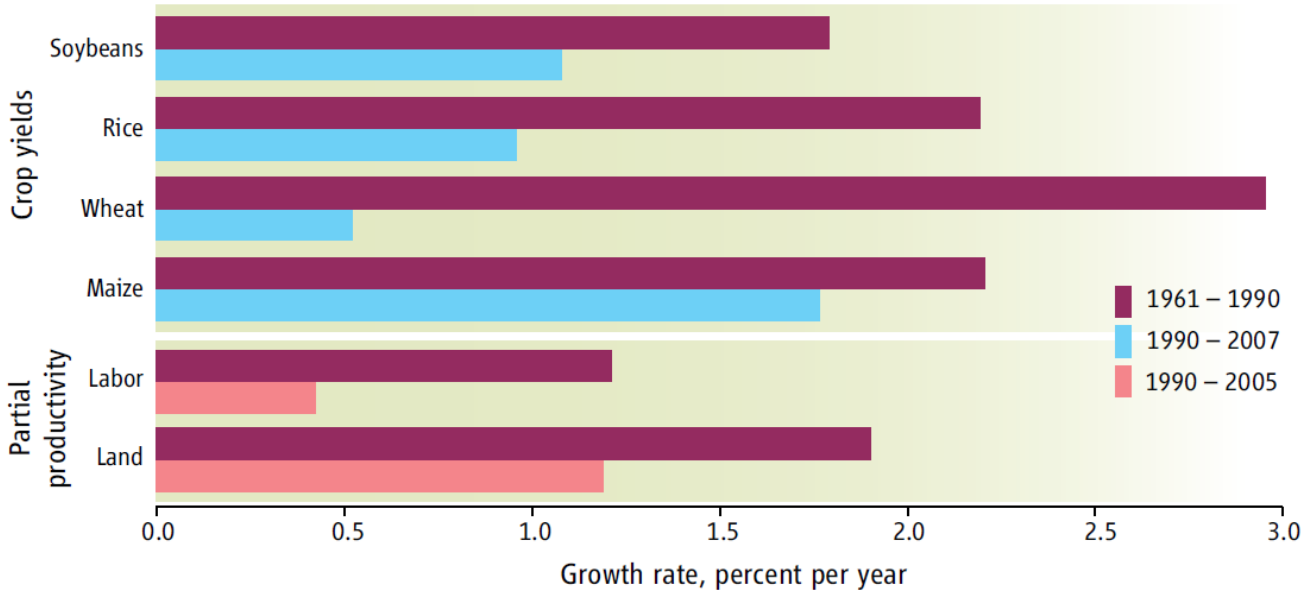
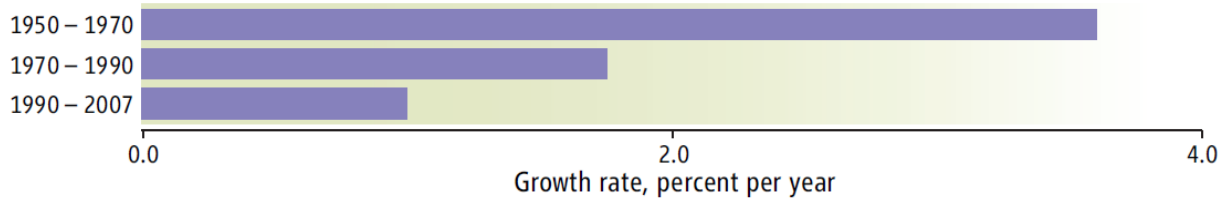
Agricultural productivity and R&D

Slowdown in agricultural productivity after 1990 (Globally)



Slowdown in public agriculture R&D spending (e.g. U.S.)



Source: Science (Alston, 2009)

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Technology uptake and advanced technologies

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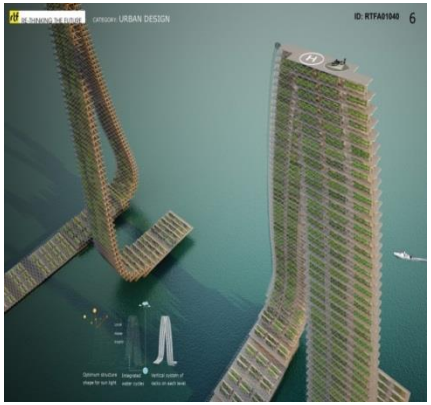
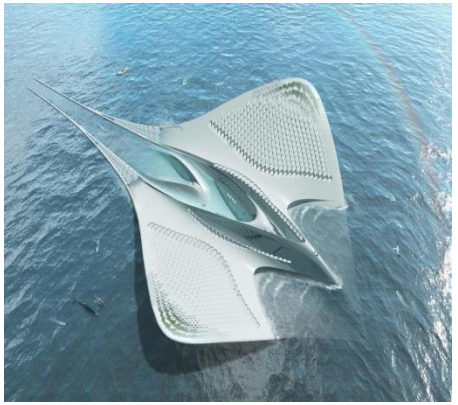
Sustainable solutions for growing more food



http://www.designboom.com/architecture/forward-thinking-architecture-japa-floating-responsive-agriculture-07-18-2014/

http://knowledge-cess.com/tag/future-of-farming/



http://www.businessinsider.com.au/a-french-architect-is-designing-the-worlds-first-international-university-in-the-middle-of-the-sea-2015-9

Floating Farms and Floating Cities

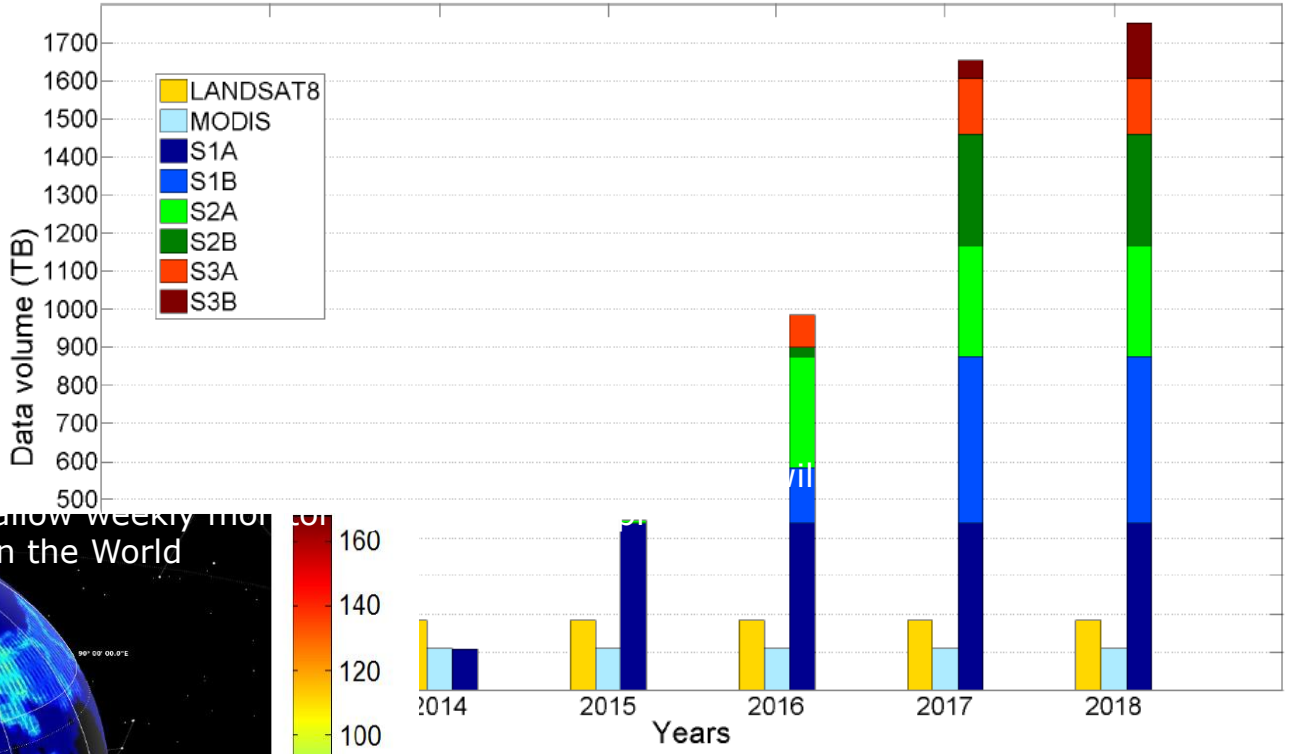
http://plantagon.com/

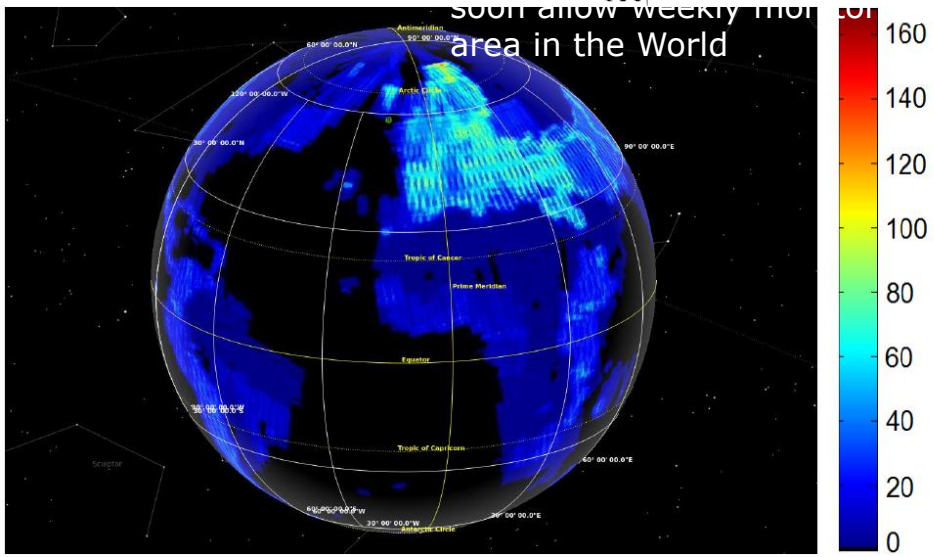
http://www.verticrop.com/

Urban agriculture
Vertical Farm

The Sentinel, Galileo era

Observation Geopositioning





~90,000 images (~80TB). No centralised download (currently ad hoc procedures mainly for maritime, agriculture, and urban)

Source: JRC 2015.
P. Soille, et al. Towards a JRC Earth Observation Data and Processing Platform

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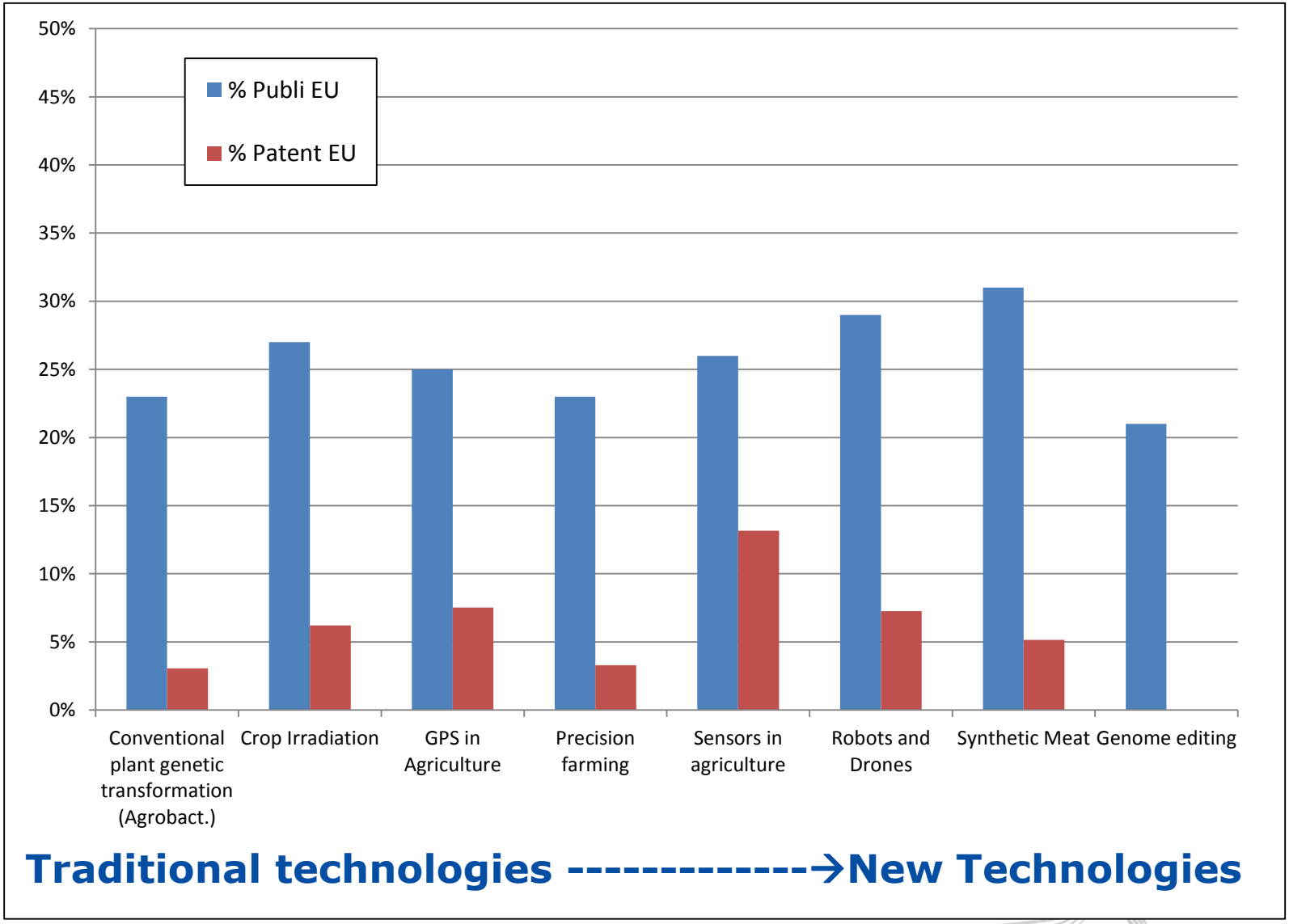
EU in technological innovation



Traditional technologies ----------→New Technologies

Source: JRC cumulative graphs, data based on Scopus and Patstat. 2000 to 2014.

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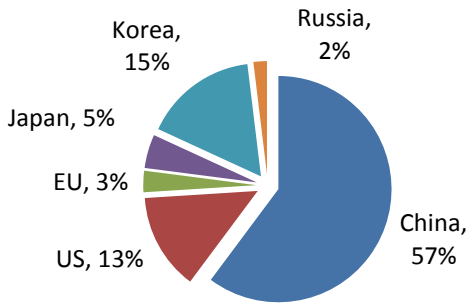
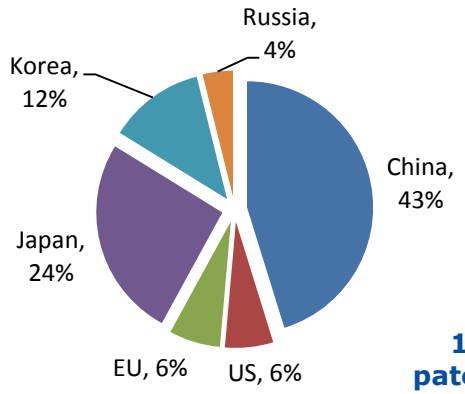
Conventional plant genetic transformation (agrobacterium)



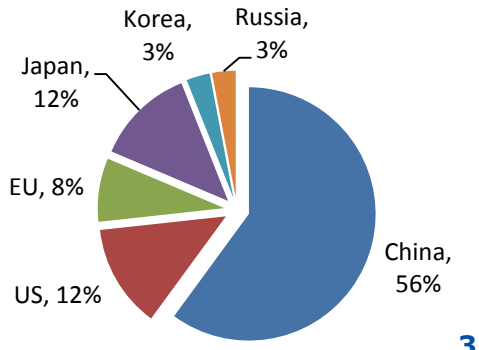
655 patents

Crop Irradiation



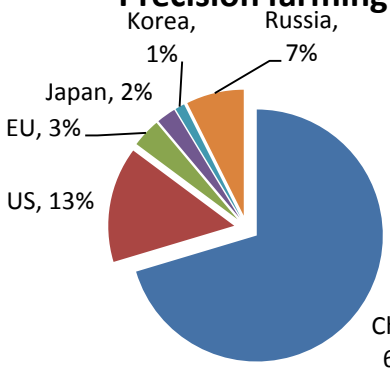
1934 patents

GPS in Agriculture



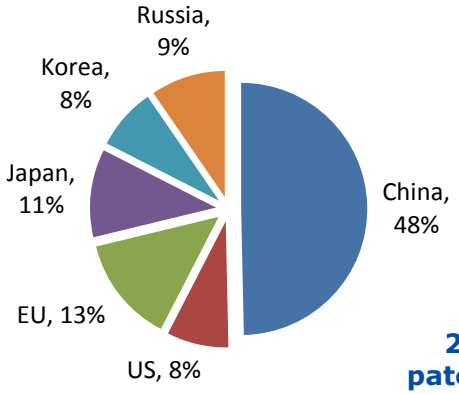
359 patents

Precision farming



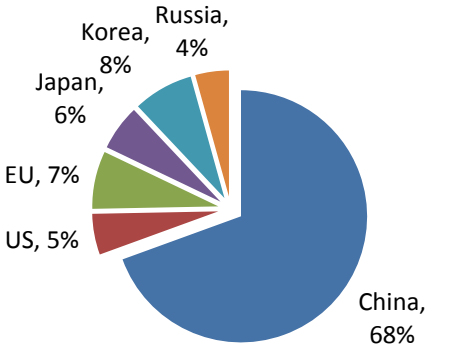
91 patents

Sensors in agriculture



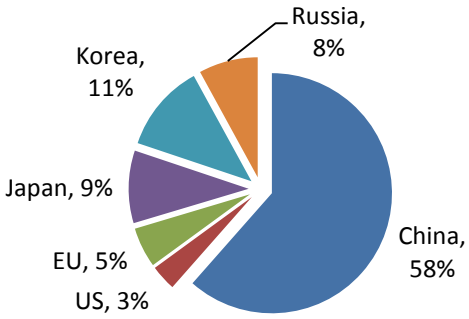
2727 patents

Robots and Drones



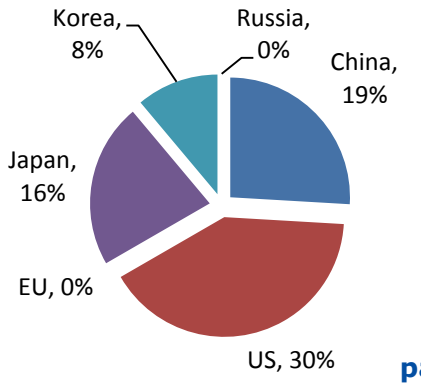
331 patents

Synthetic Meat



700 patents

Genome editing



37 patents

Patenting for main players in 8 agriculture-related technologies

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Source: JRC cumulative graphs, data based on Patstat. 2000 to 2014

Culture and behaviour

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Urbanisation
Middle class growth

2010-2030

+22% Food

+ 33% Animal proteins

Change in the nutrition, consumption pattern

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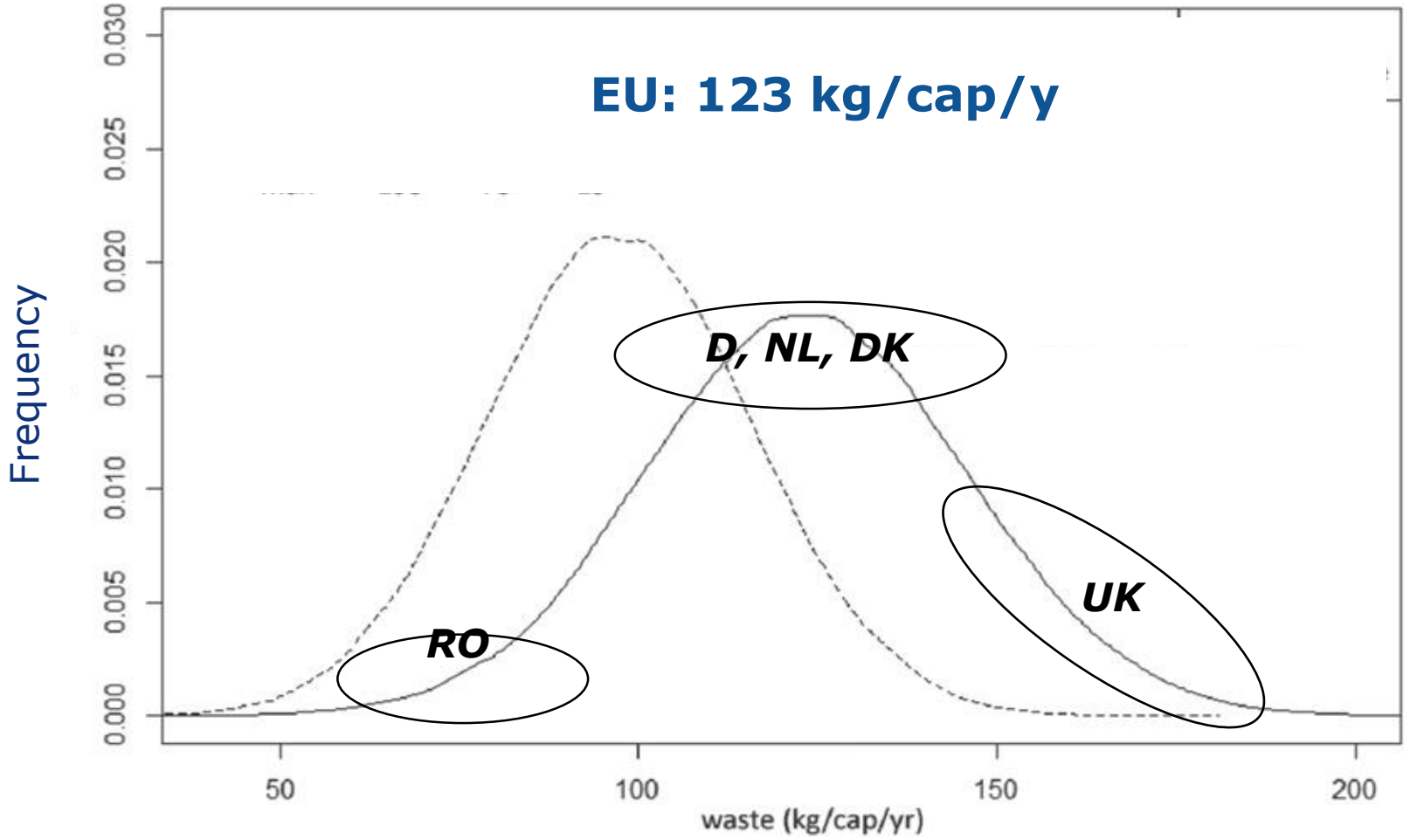
Food waste



Source: JRC Vanham et al. 2015

European Commission

Main Messages

- Land and water becoming critical with collateral consequences for the EU
- We need to manage complexity
- Better use of existing material resources
- Cutting edge technology and technology uptake to increase the productivity
- Social innovation and behavioral change