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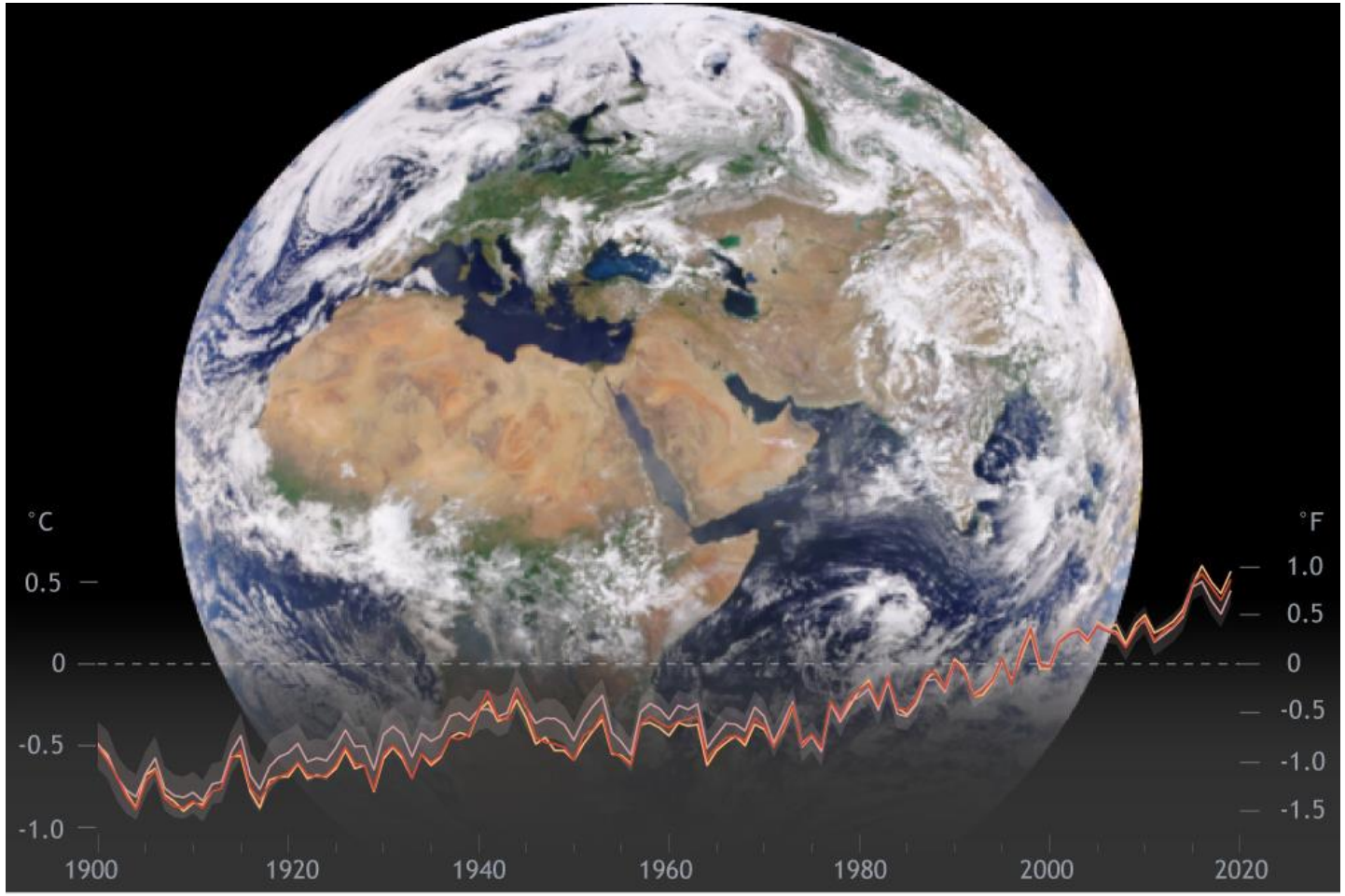
SIMPLE & SUSTAINABLE FOOD SOLUTIONS

Sustainable and efficient value chains
are crucial for a sustainable food consumption

Global temperature is rising



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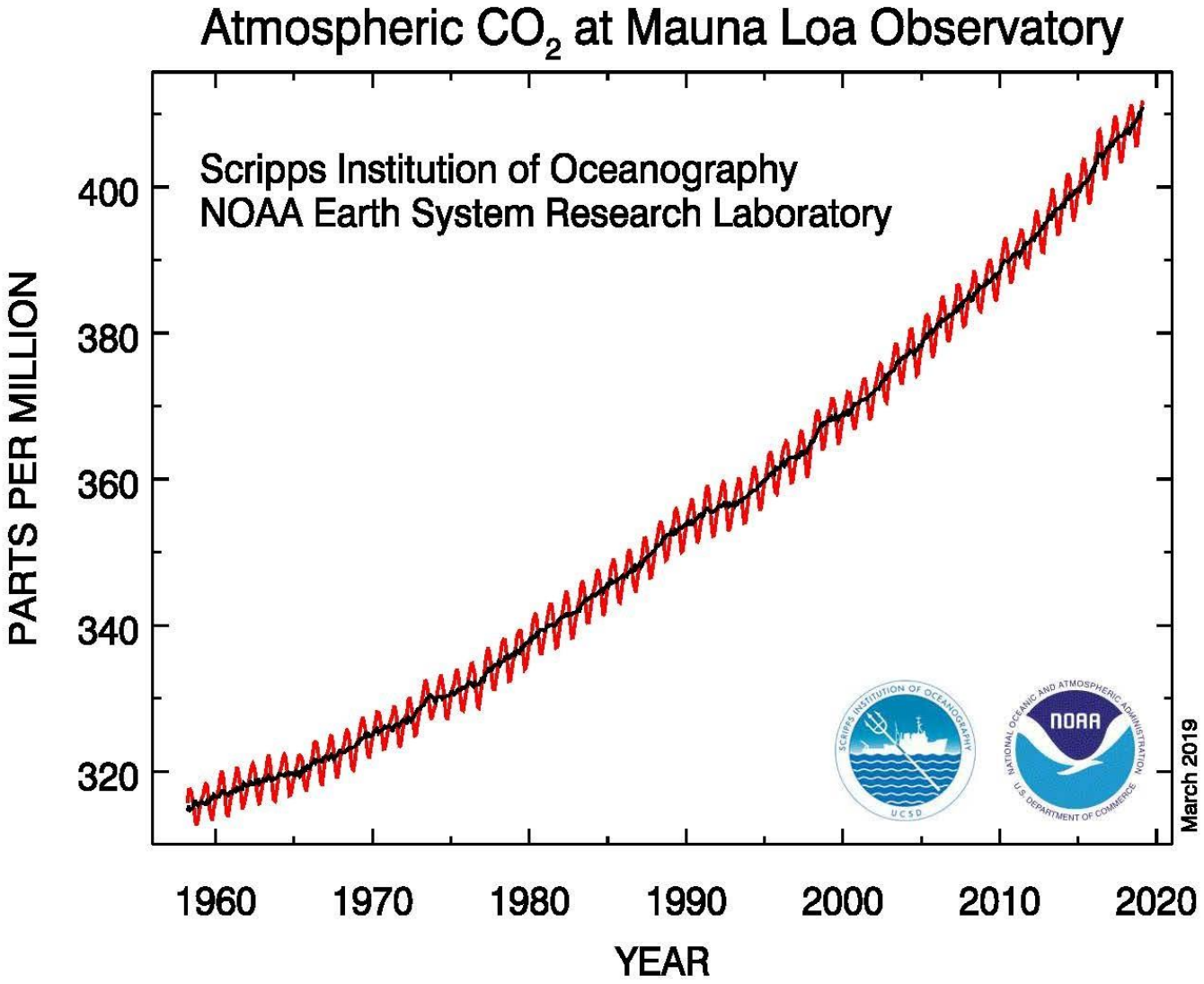
Atmospheric CO2 concentration increase



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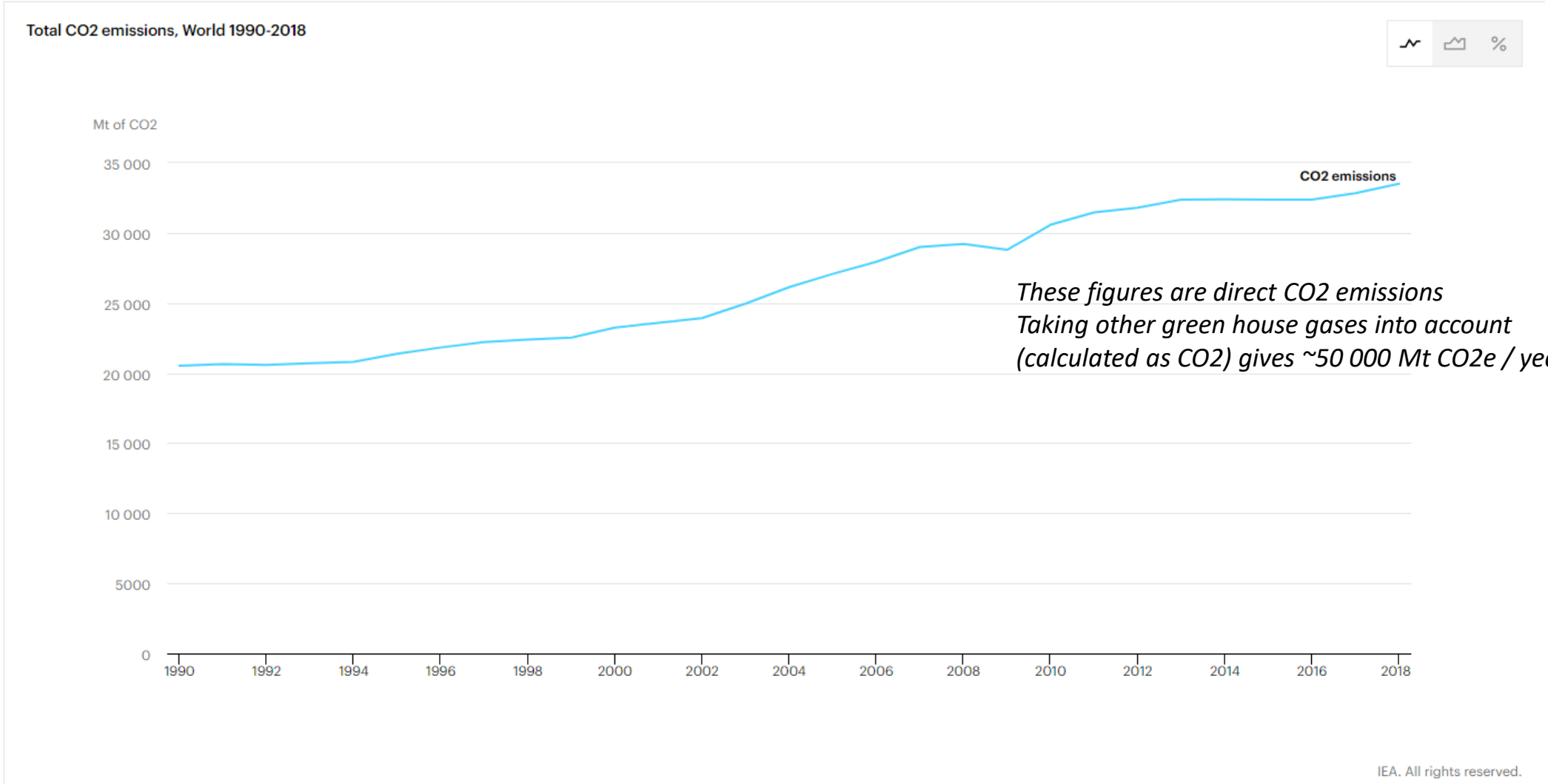
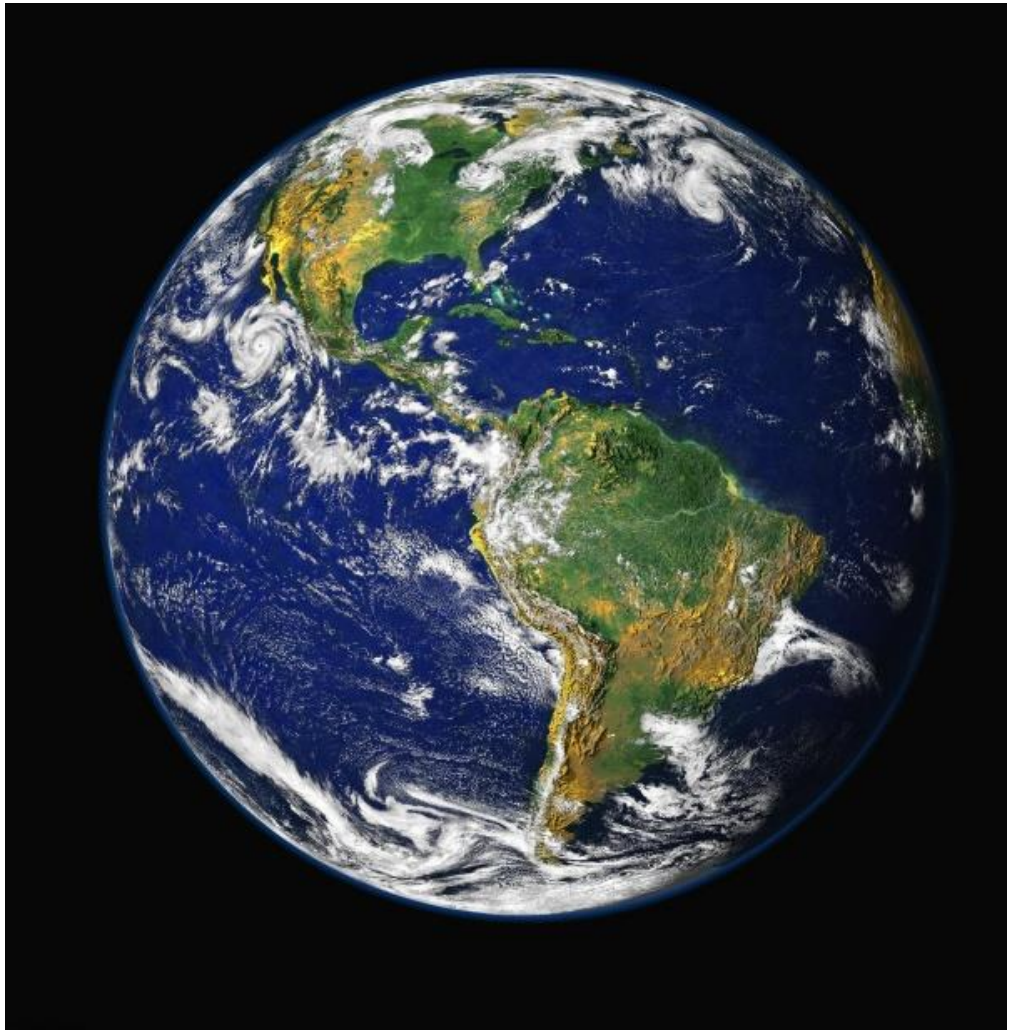
Global CO2 emissions continue to increase



The world is in desperate need of change and time is running out

Mother Earth

Home to 7,8 billion people



Consisting of:

- 71 % oceans
- 29 % land
  - 10 % Agriculture
  - 8 % Forests

Source: FAO

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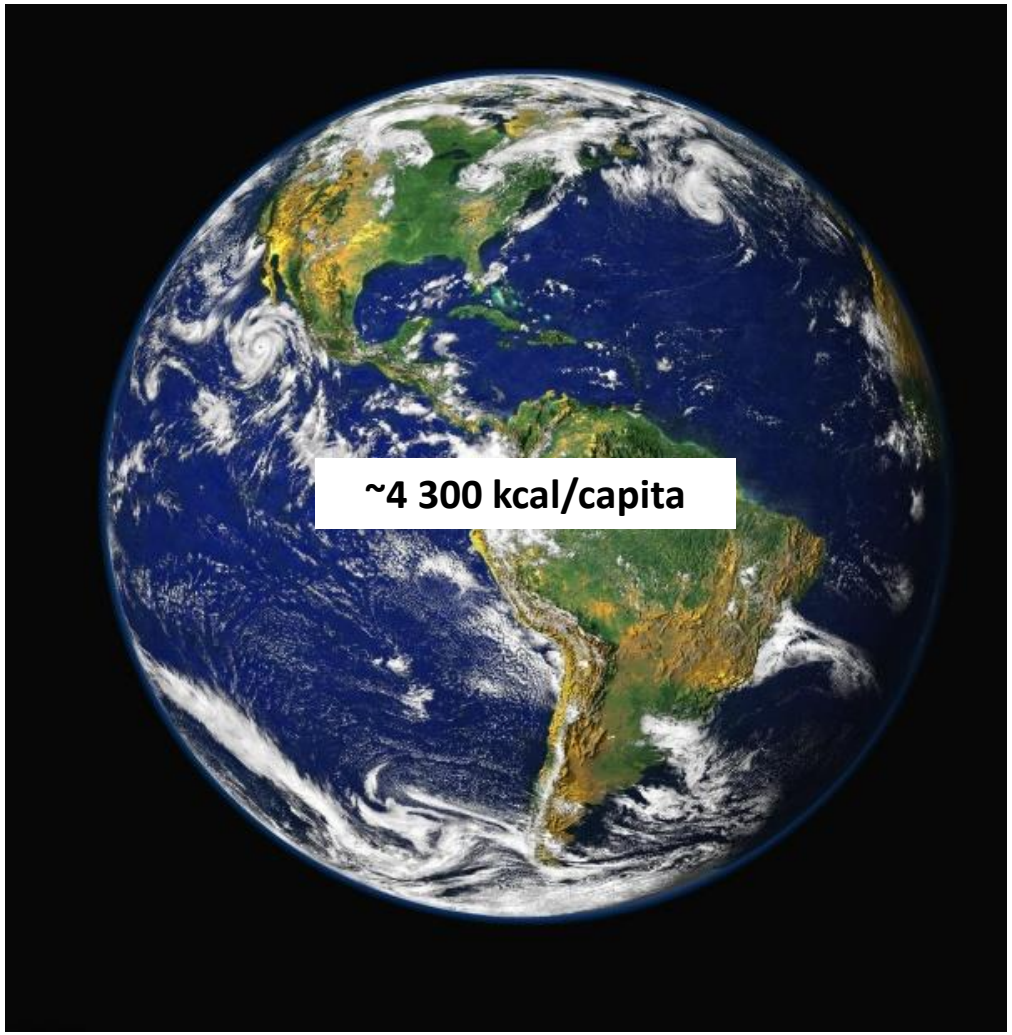
Global production:

Grains and oil seeds:
3,2 billion tons

Sugar cane and -beets:
2,2 billion tons

Fruit, vegetables & others
3,7 billion tons

Source: FAOSTAT



Food consumption:
2 950 kcal/capita

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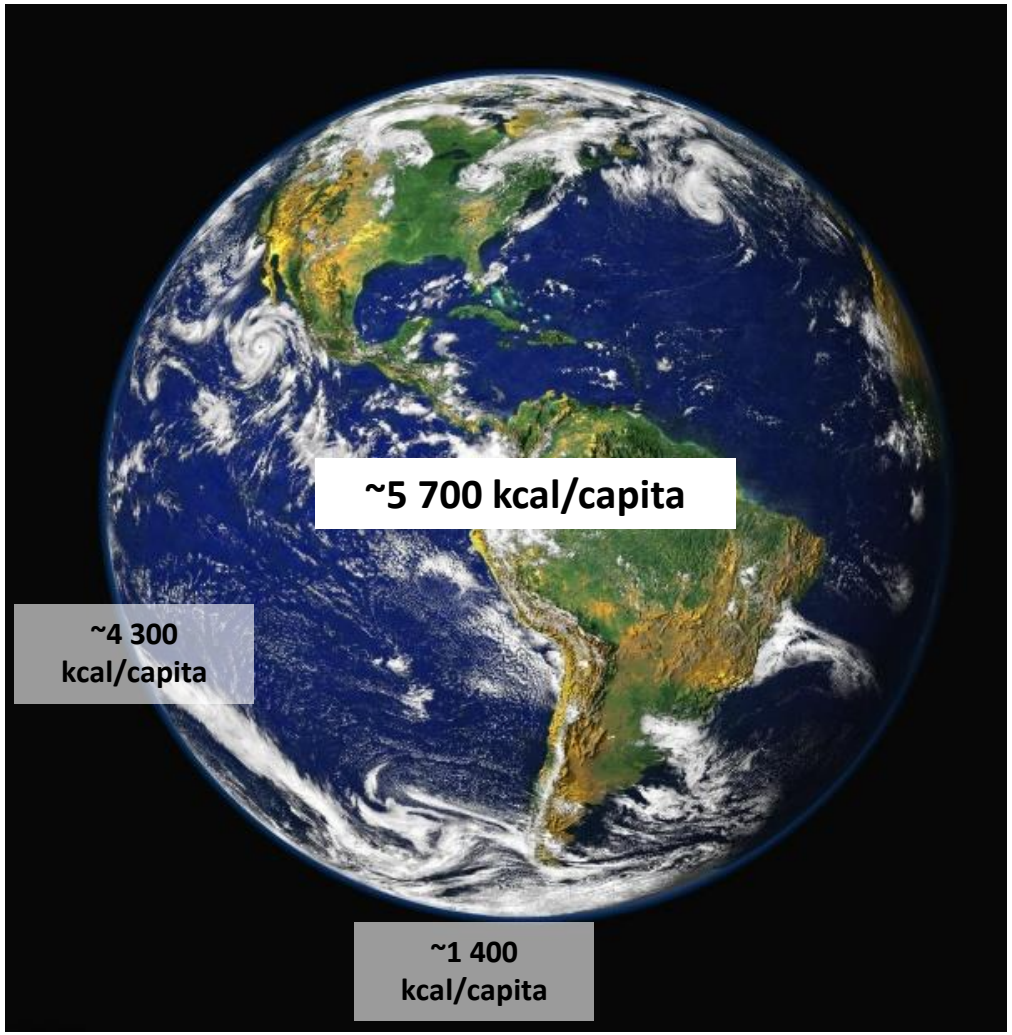
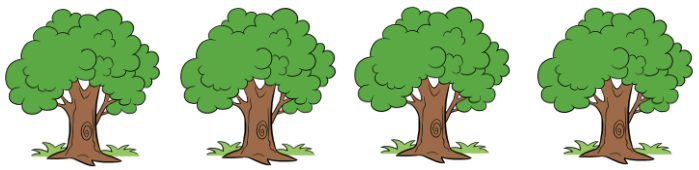


Forestry:
3,9 billion m3



Source: FAO

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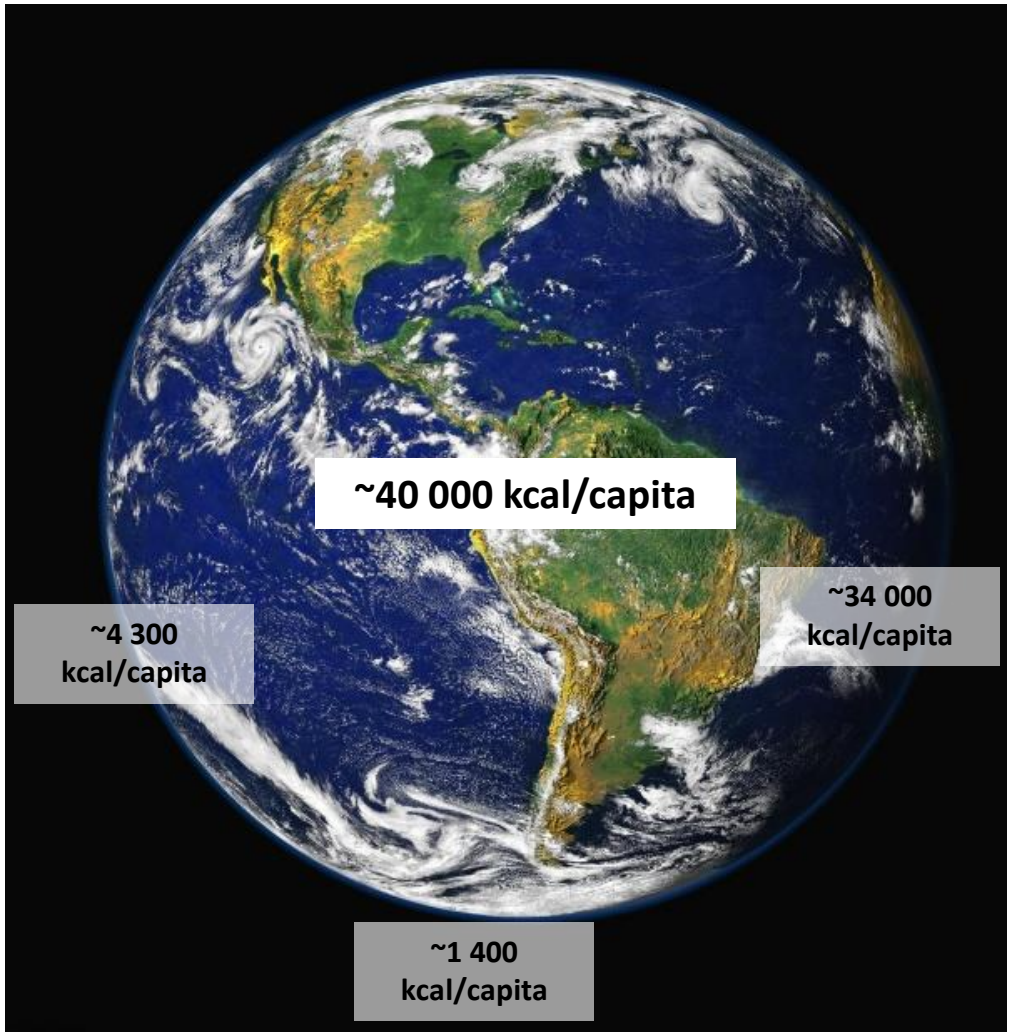

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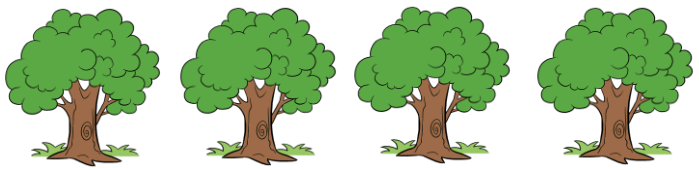
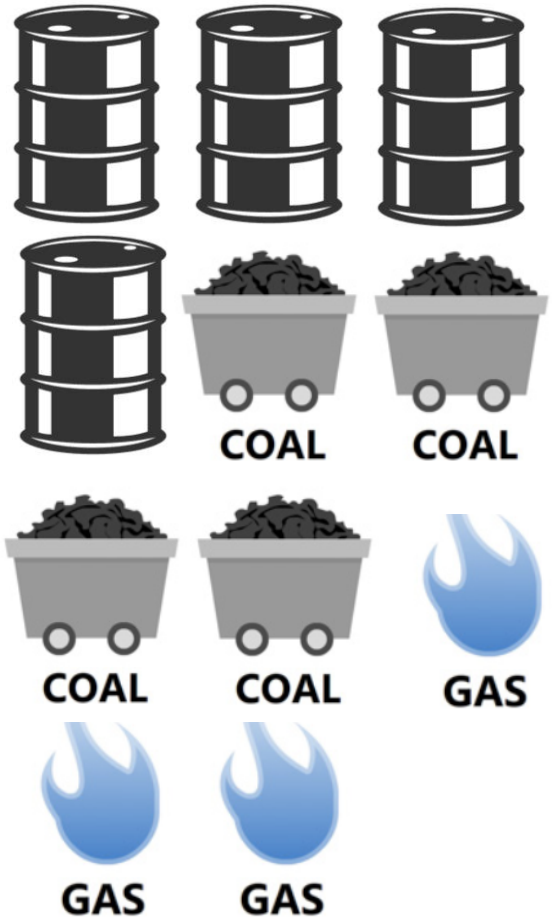


Source: FAO

Fossil raw material:
11,5 billion tons



Source: IEA

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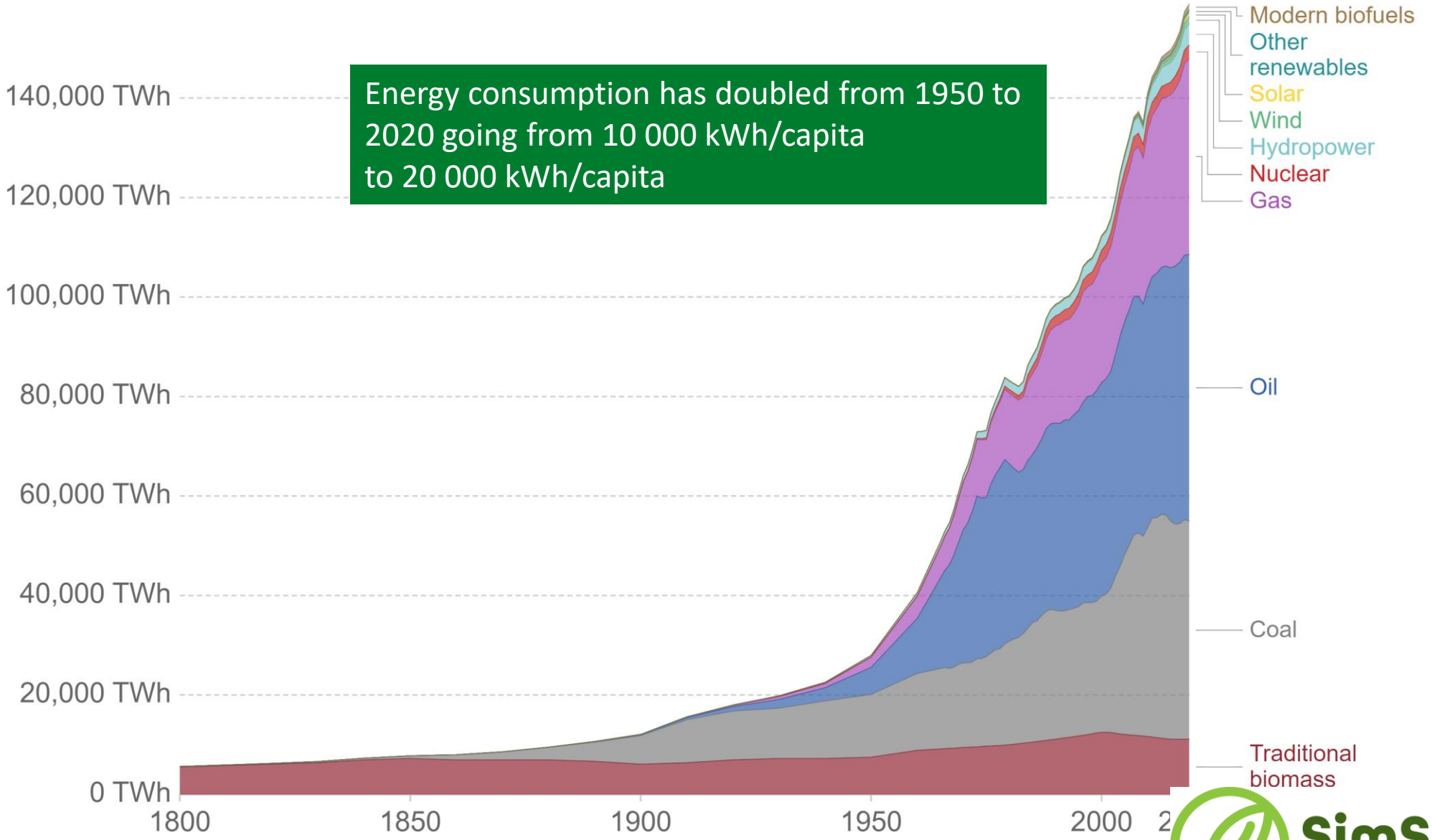
Global direct primary energy consumption

Direct primary energy consumption does not take account of inefficiencies in fossil fuel production.

Our World in Data



Source: Vaclav Smil (2017) and BP Statistical Review of World Energy

OurWorldIn

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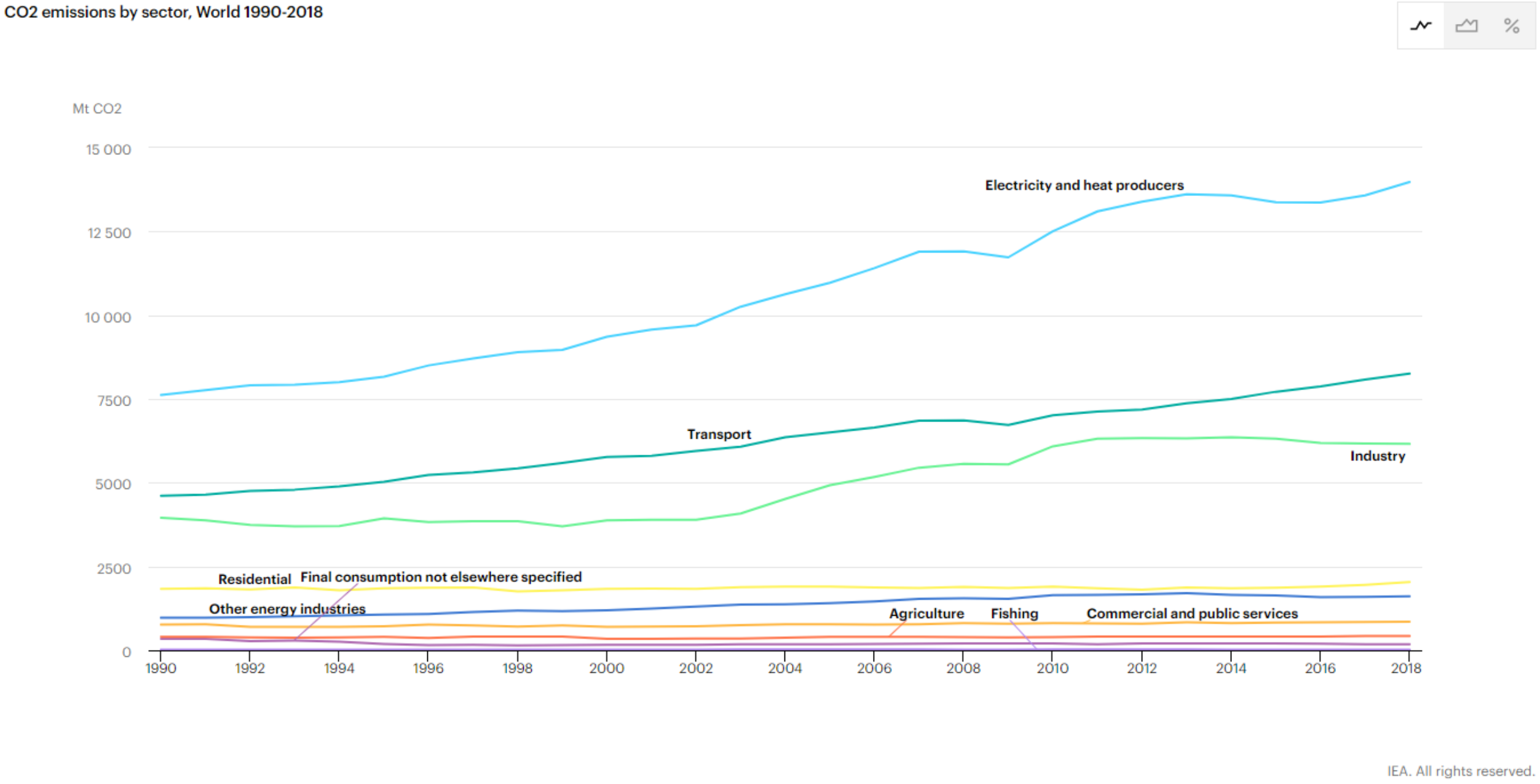
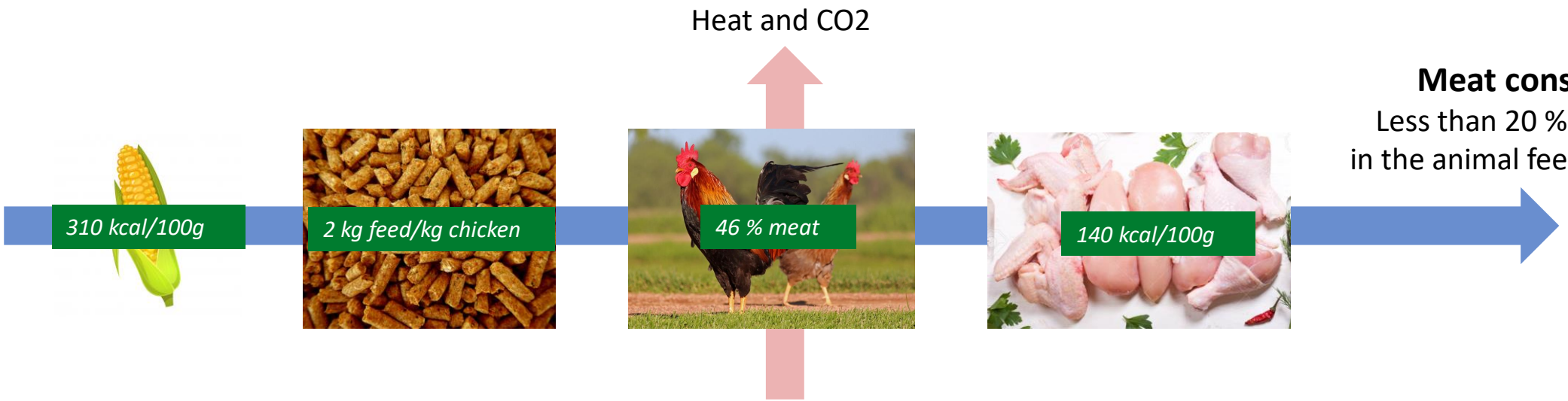


Energy consumption must decrease and fossil raw materials replaced with renewables

Value chain efficiencies



45 % of global grain production is used for animal feed

most favoured option

least favoured option

prevention

minimisation

reuse

recycling

energy recovery

disposal

Bread waste SE
80 000 ton/year

Waste Hierarchy – How to lower the raw material consumption

Example of efficient value chains

Bread waste

Cultivation of filamentous fungi

Vegetable meat like products

UNIVERSITY OF BORÅS

CHALMERS UNIVERSITY OF TECHNOLOGY

Department of BIOLOGY AND BIOLOGICAL ENGINEERING

Lantmännen Agroetanol

STEINBRENNER & NYBERG

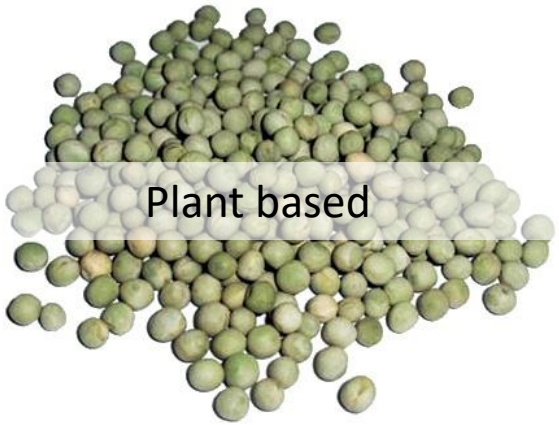
INNOVATUM

RI. SE

tillväxt verket

EUROPEISKA UNIONEN
Europeiska regionala utvecklingsfonden

Alternative proteins – Reducing meat consumption



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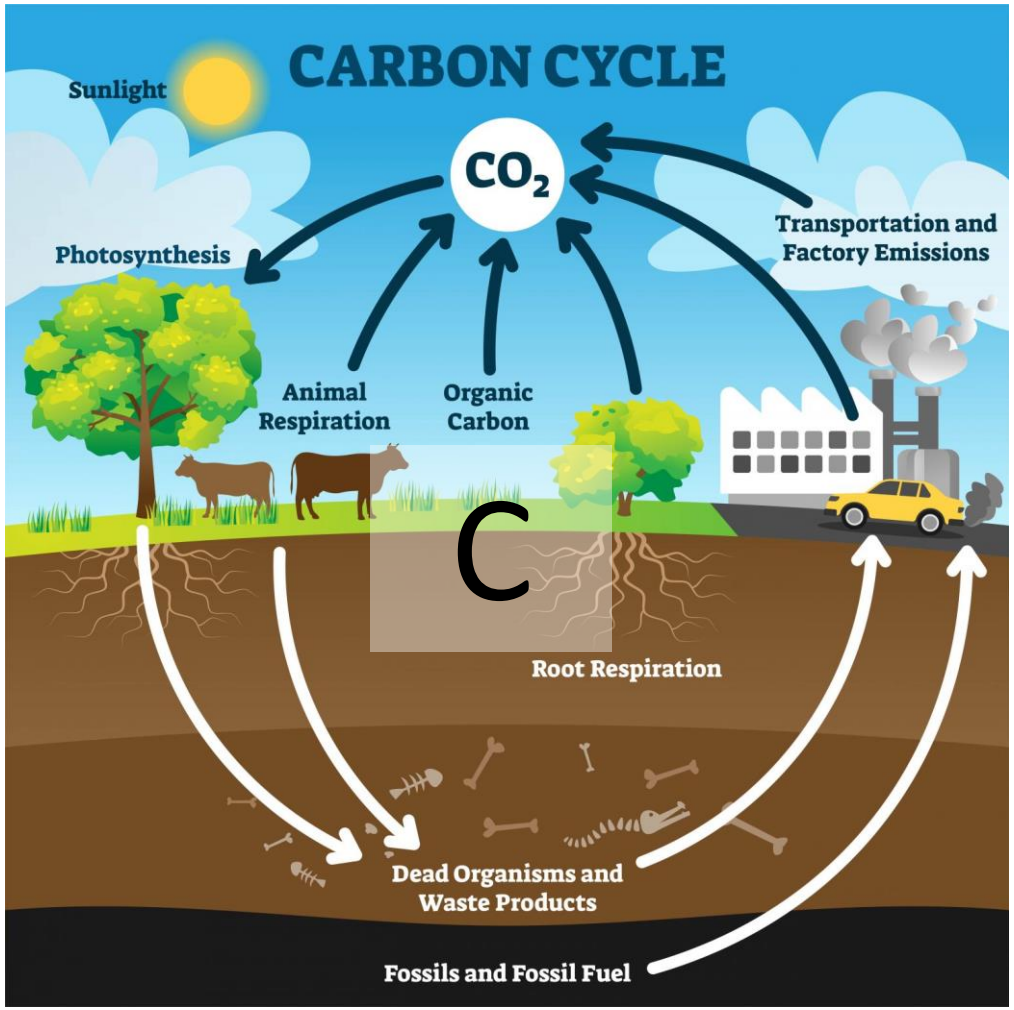
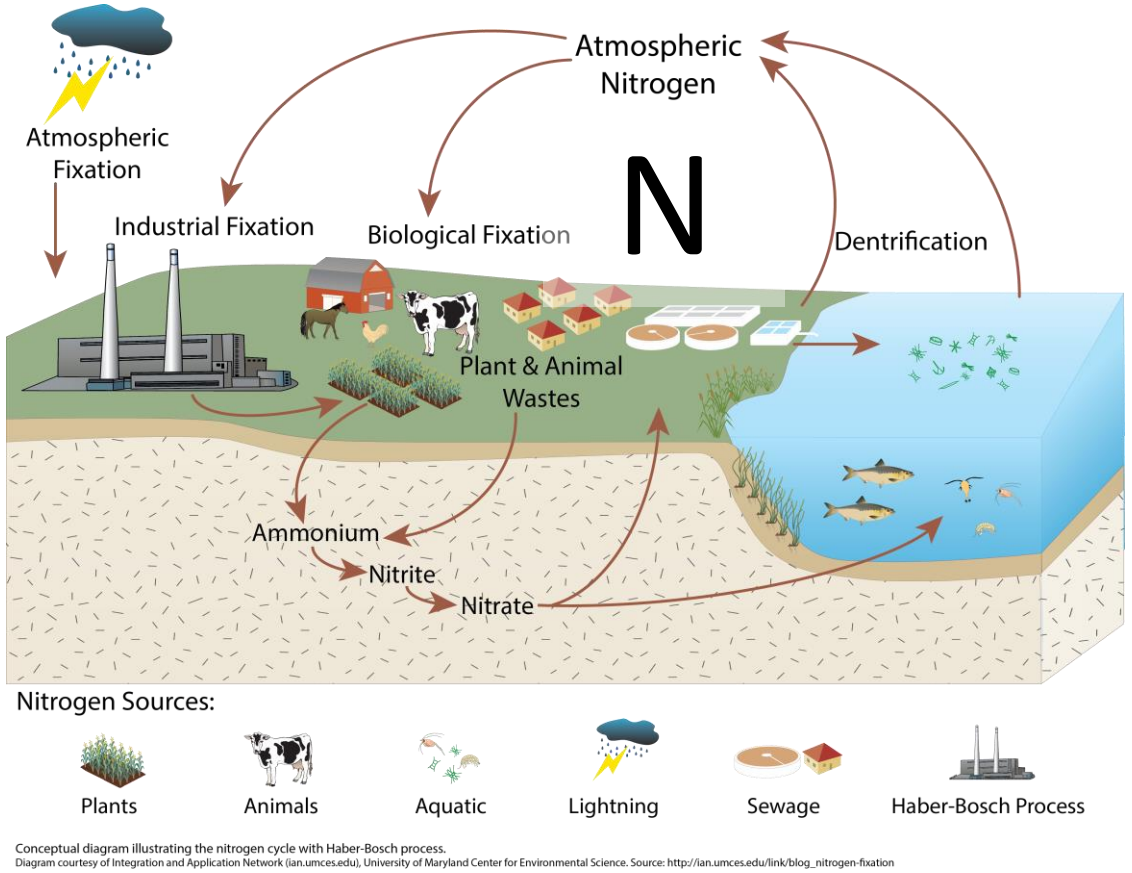
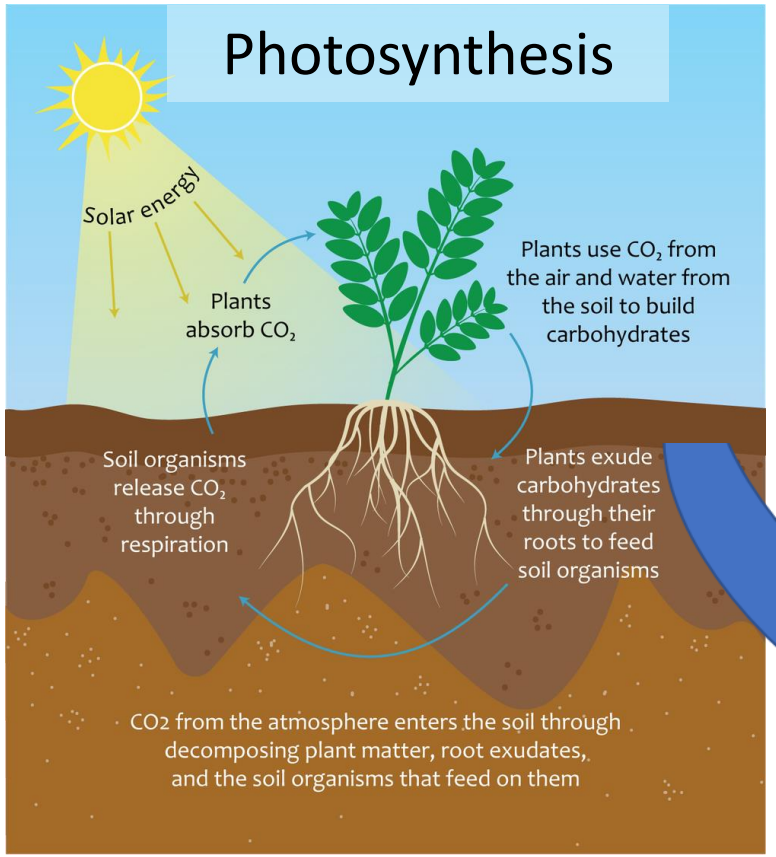
Two important cycles to keep in mind





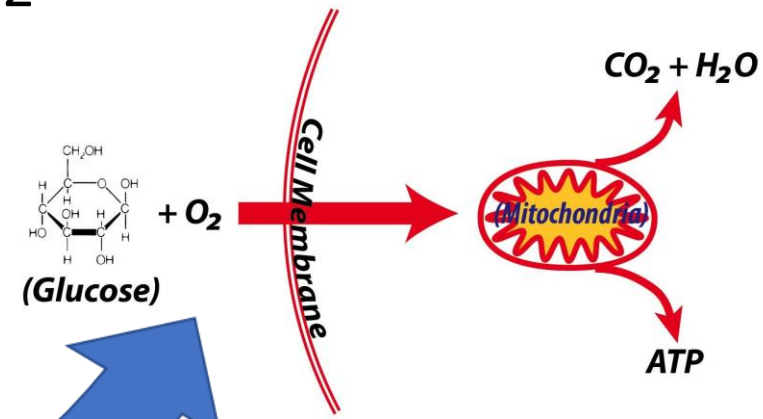
Conceptual diagram illustrating the nitrogen cycle with Haber-Bosch process.
Diagram courtesy of Integration and Application Network (ian.umces.edu), University of Maryland Center for Environmental Science. Source: http://ian.umces.edu/link/blog_nitrogen-fixation

Carbon cycle - plants



CO2

Starch = Energy source of many plants



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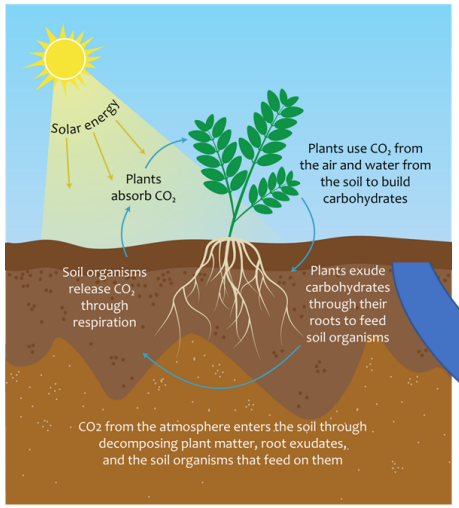
Carbon cycle - animals



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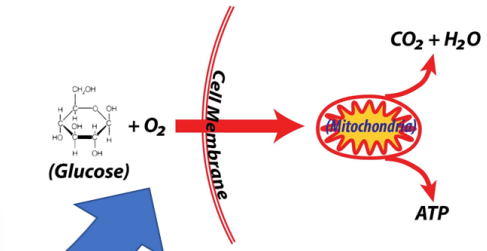
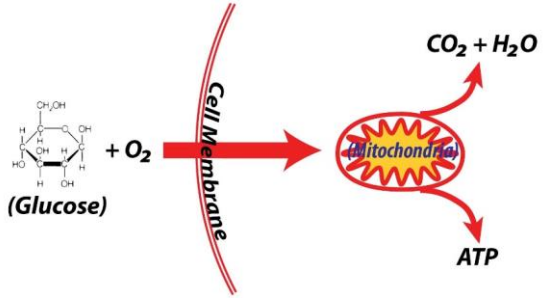


CO2

Animal respiration

CO2

Human respiration



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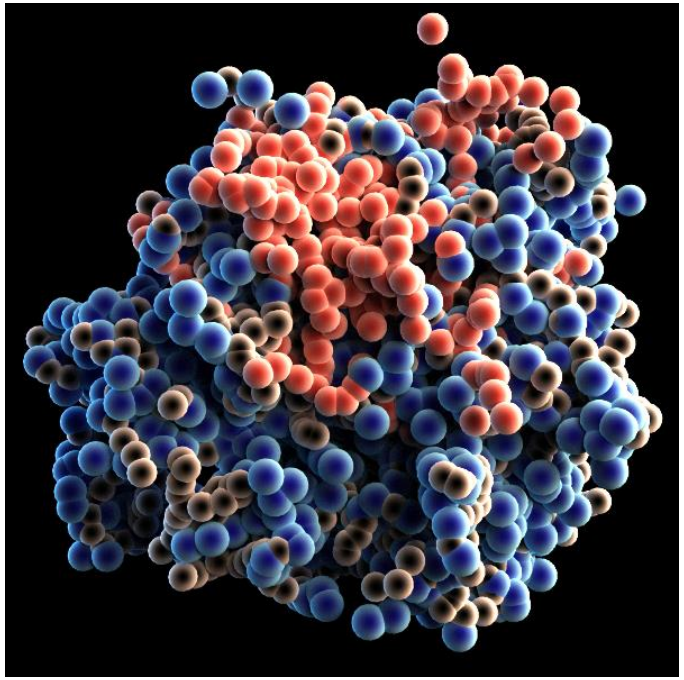
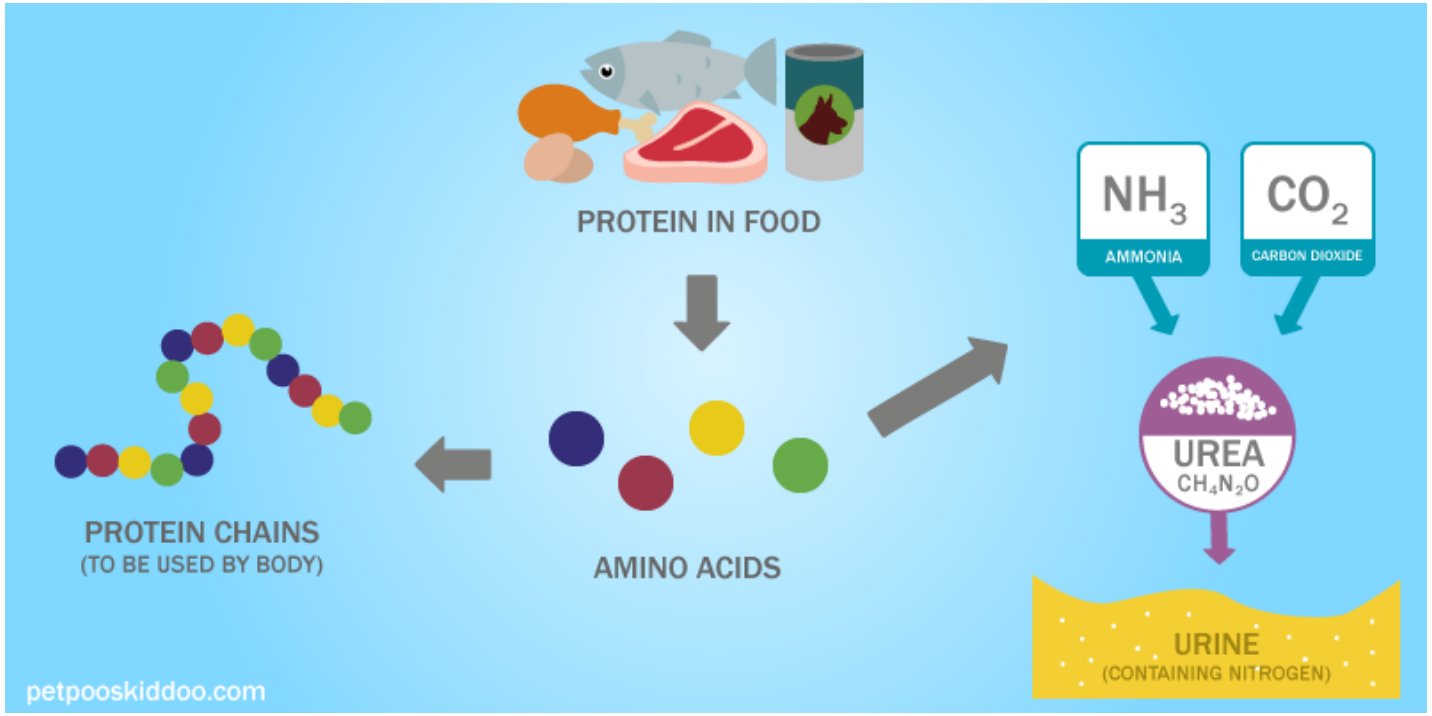
Nitrogen – Essential component in proteins

Proteins – Large molecules acting as micro factories within the body (ex enzymes)



20 g protein per 100 g meat consist of about
3 g nitrogen per 100 g meat



Protein/Nitrogen cycles

Chicken

Protein
(100 %)

Muscle build up (meat) to act as protein source for humans
(20 %)

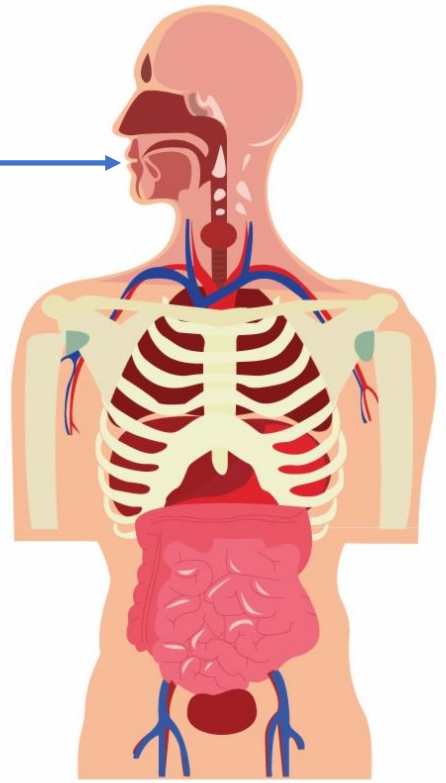
Nitrogen in urin

Nitrogen in feces

Organic nitrogen (fertilizer)
(80 %)

Adult human

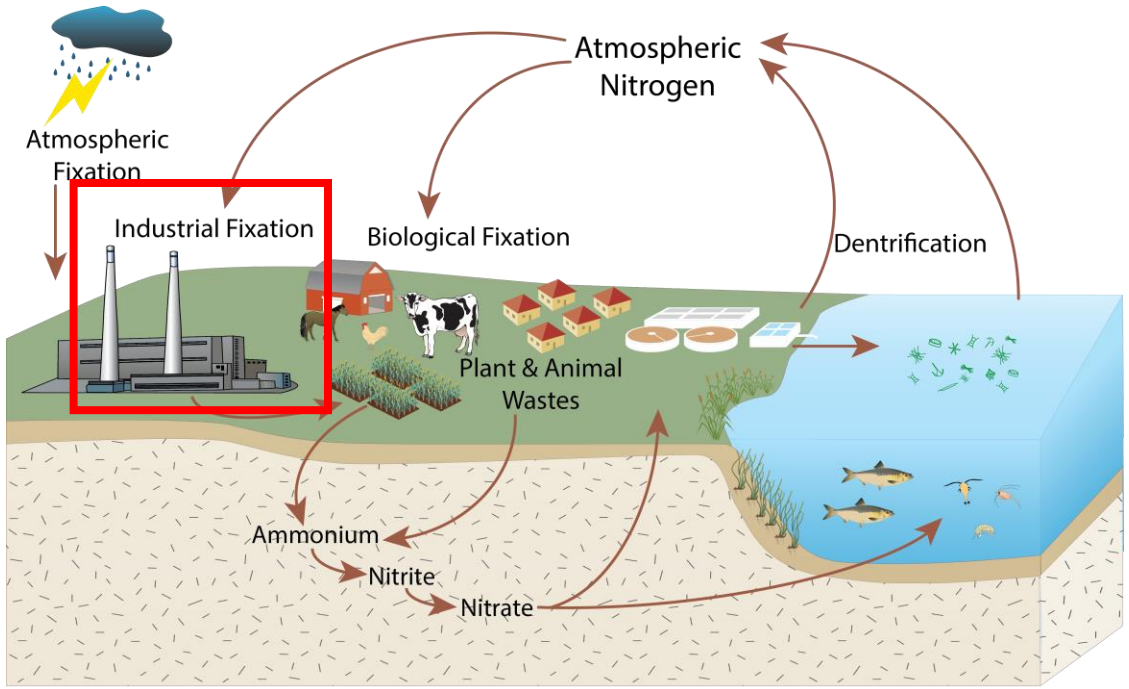
Protein



Nitrogen in urin

Nitrogen in feces

Nitrogen cycle – Industrial fixation
(1 % of global energy usage)



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Addition of nitrogen (organic or inorganic) is essential to gain Agricultural productivity!

Example industrial ammonia production:

H_2O + electricity

$N_2 + H_2 \rightarrow NH_3$

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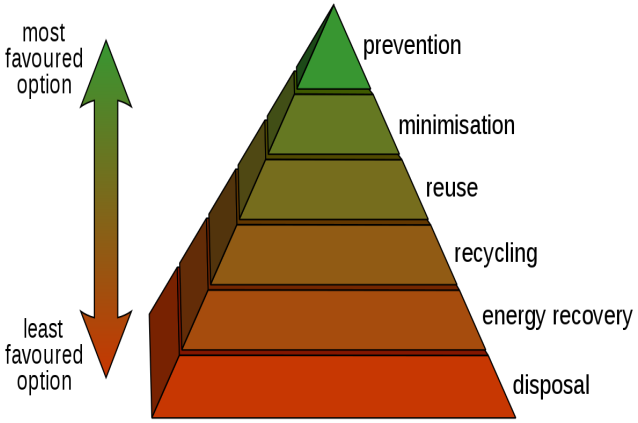
Key questions:
What is the C & N source and how efficient is the value chain



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Dry product

- Mix with water, veg. Oil and spices
- High protein content, gives upto 30 g protein/100 g food dish

Grain and legumes

Simplyfied value chain

- No handling of regrigerated goods
- Less transports
- Long shelf life results in less food waste

Resulting in:

Less climate footprint
Decreased production cost

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Thanks for listening!
Together we can make a change