Meat, Diet and Phosphorus Sustainability

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NATURAL ENVIRONMENT RESEARCH COUNCIL

NERC SCIENCE OF THE ENVIRONMENT

Talk Outline

- Phosphorus content of the human diet
- Phosphorus footprinting of the human diet
- Importance of reducing societal requirements of P

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NERC SCIENCE OF THE ENVIRONMENT

1% of the human body is composed of P

85% is in bones and teeth

15% in soft tissues

P is transported in blood and extracellular fluid

- 400 mg P l^{-1} in whole blood
- ~8% is inorganic

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- 400 mg P l^{-1} in whole blood
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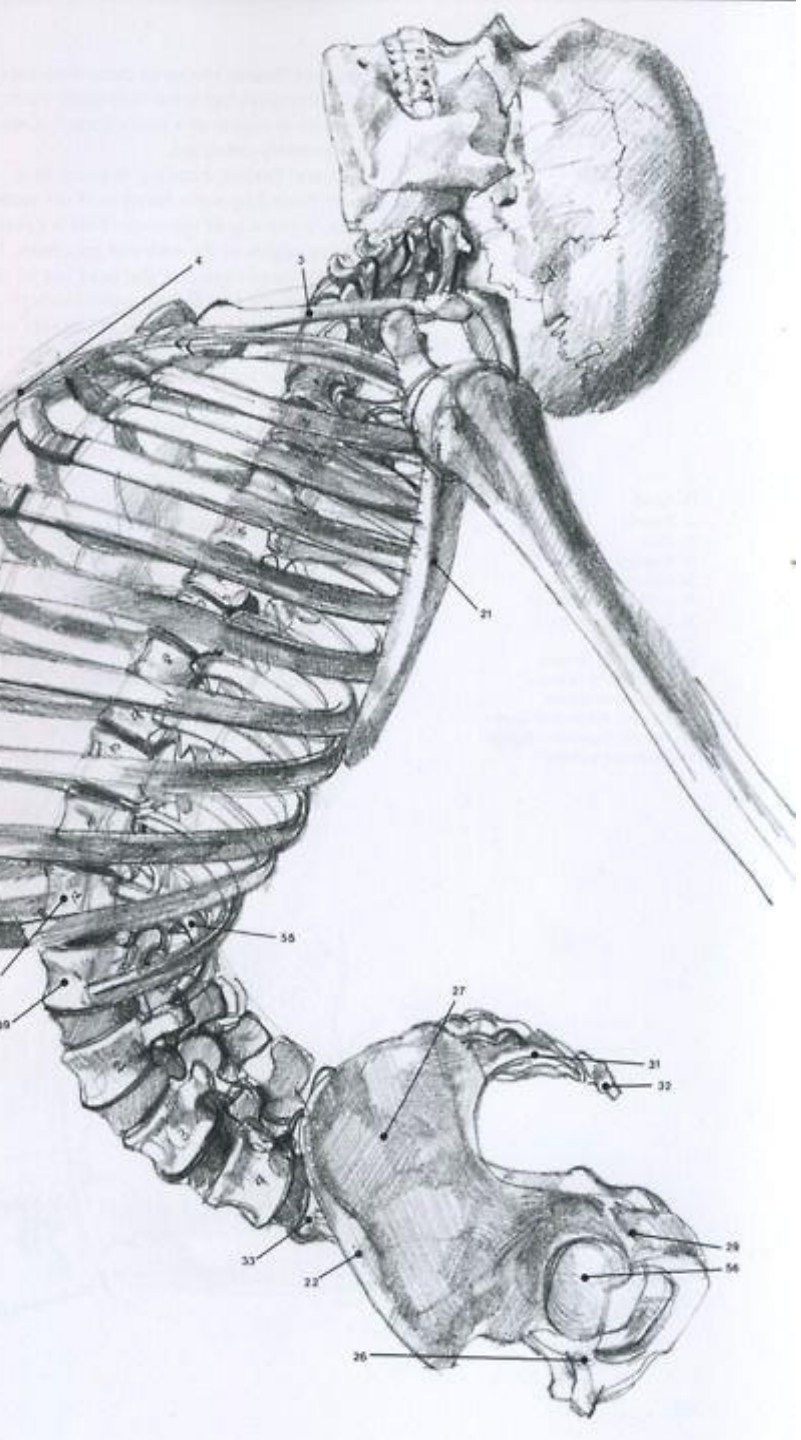


Apart from building our skeleton it other functions include:

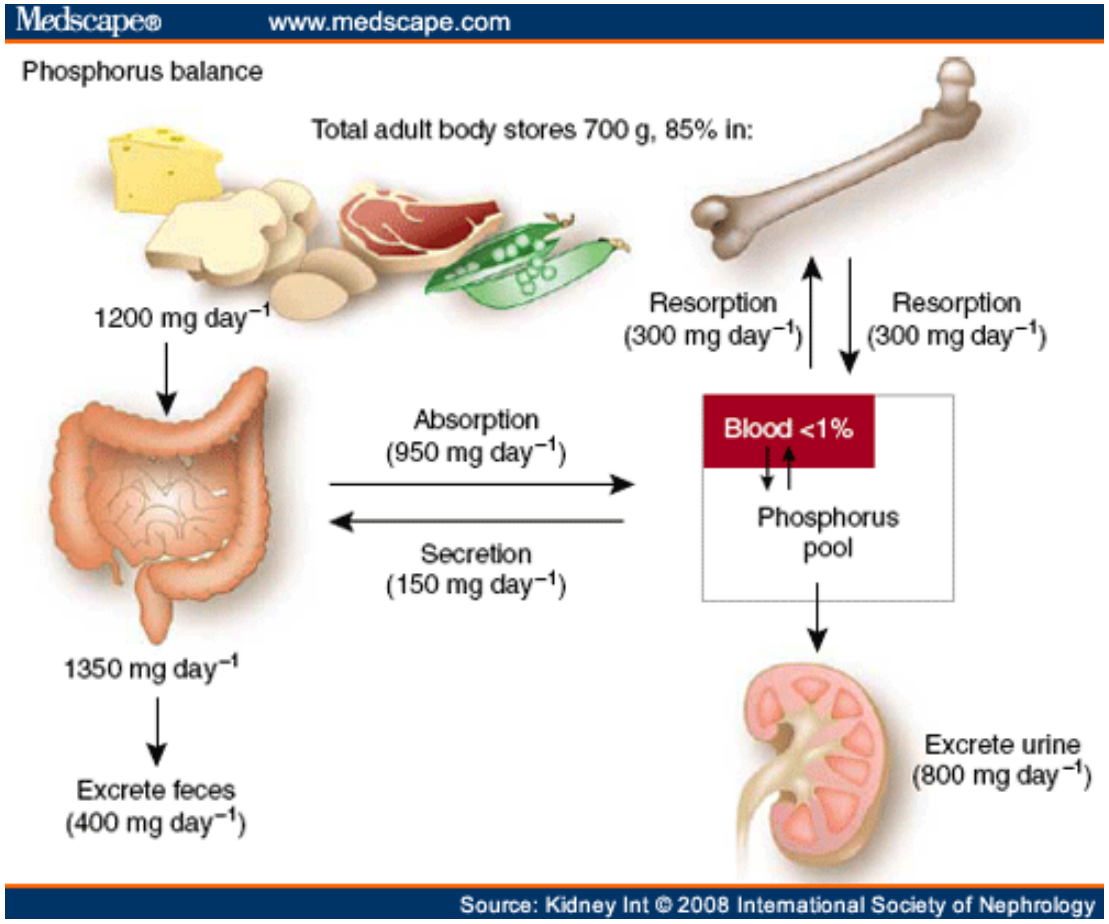
1. DNA, RNA etc.
2. Energy transfer ATP, ADP phosphorylation, activation of enzymes
3. maintaining normal pH;

The gut absorbs P, the bones store P, the kidney excrete P

P can be recycled indefinitely in the body

The P you eat = the P you excrete.

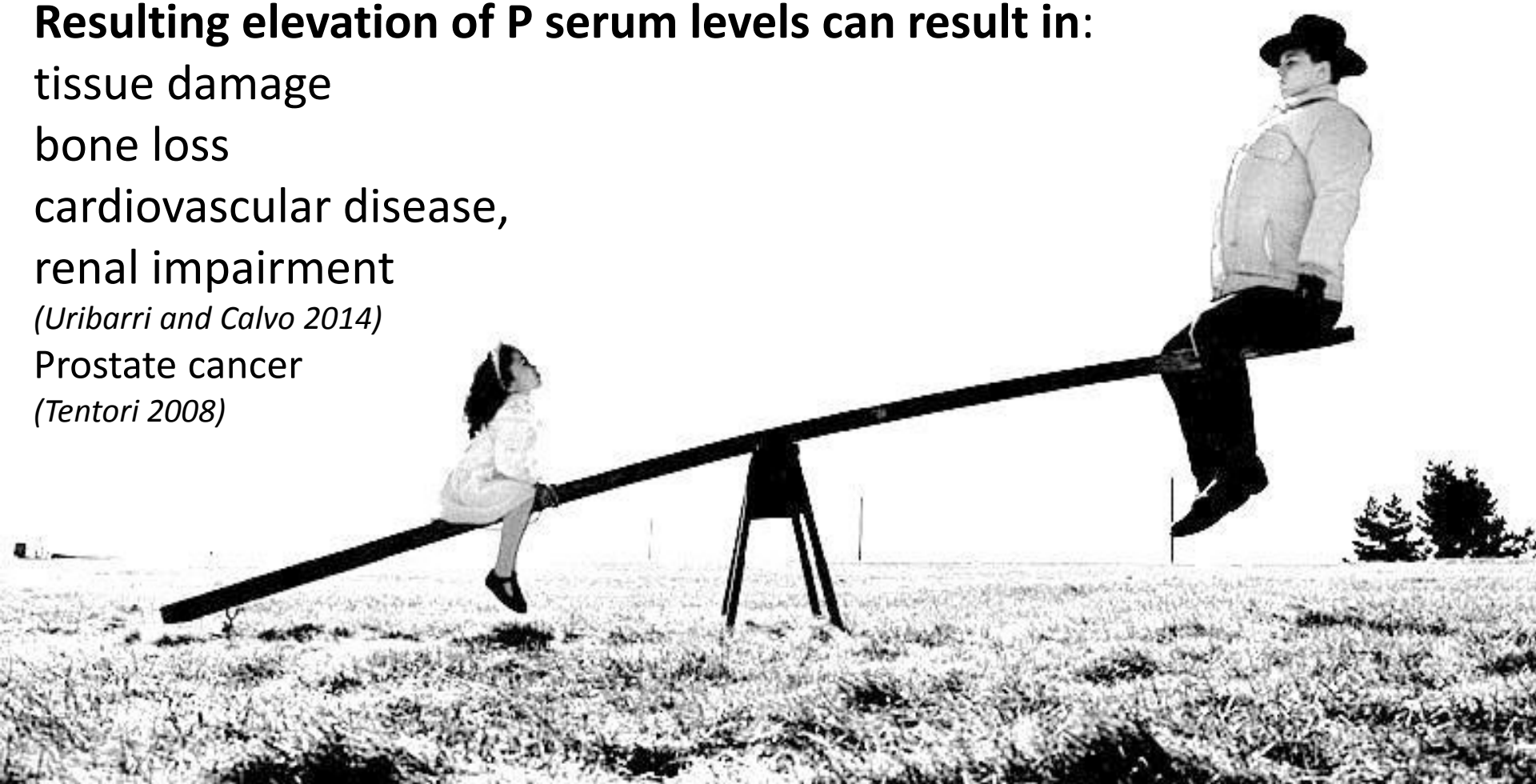
Dietary phosphorus is to **support growth and replaces excretory and dermal losses**.



Disruption of phosphorus homeostasis can occur when intake of phosphorus far exceeds nutrient needs and calcium intake is limited.
Calvo et al 2013

This is more common in those with kidney problems

Resulting elevation of P serum levels can result in:
tissue damage
bone loss
cardiovascular disease,
renal impairment
(Uribarri and Calvo 2014)
Prostate cancer
(Tentori 2008)



How much P should you eat?

- No international human nutrient requirements set for P
- Suggestion that P requirements should be linked and equal to Ca requirements

You need about 580 mg P day^{-1}

Aim for about 1000 mg P day^{-1}

Don’t go above 4000 mg P day^{-1}

Which food contain lots of P?

P content (339 mg)

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P content (339 mg)

Food additives – an unknown threat?

Also equivalent to over a months worth of apples (40 apples)

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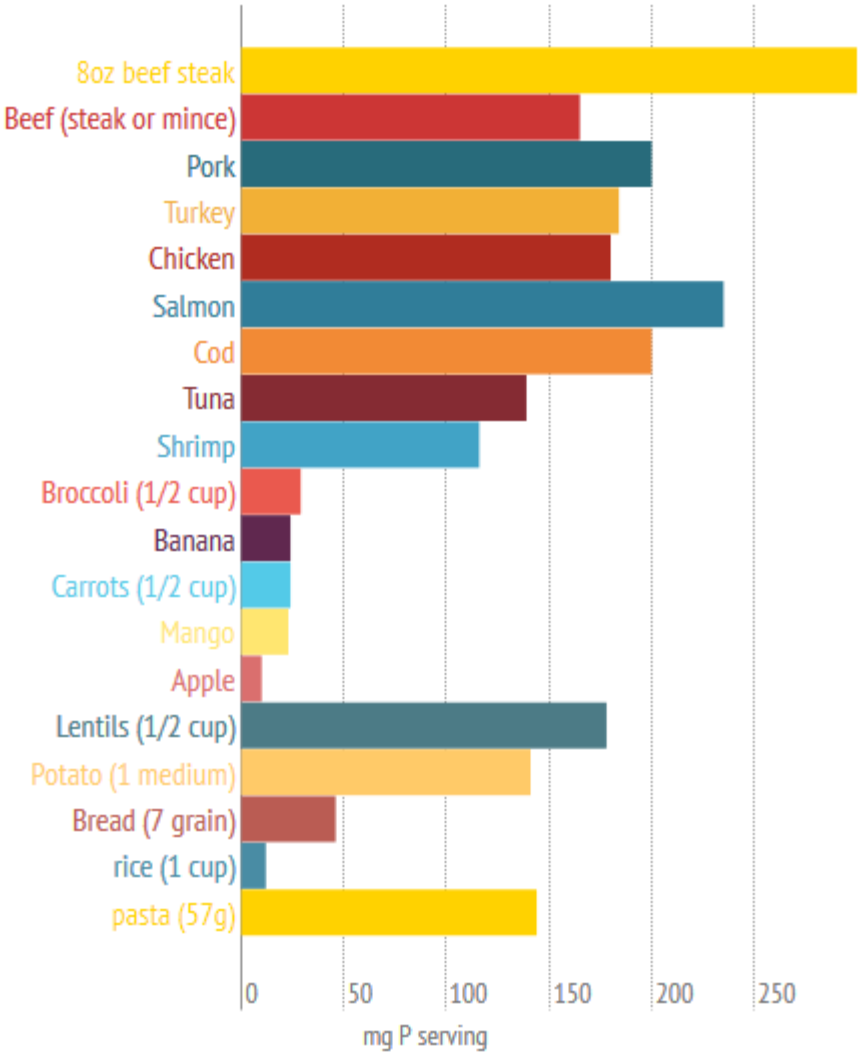
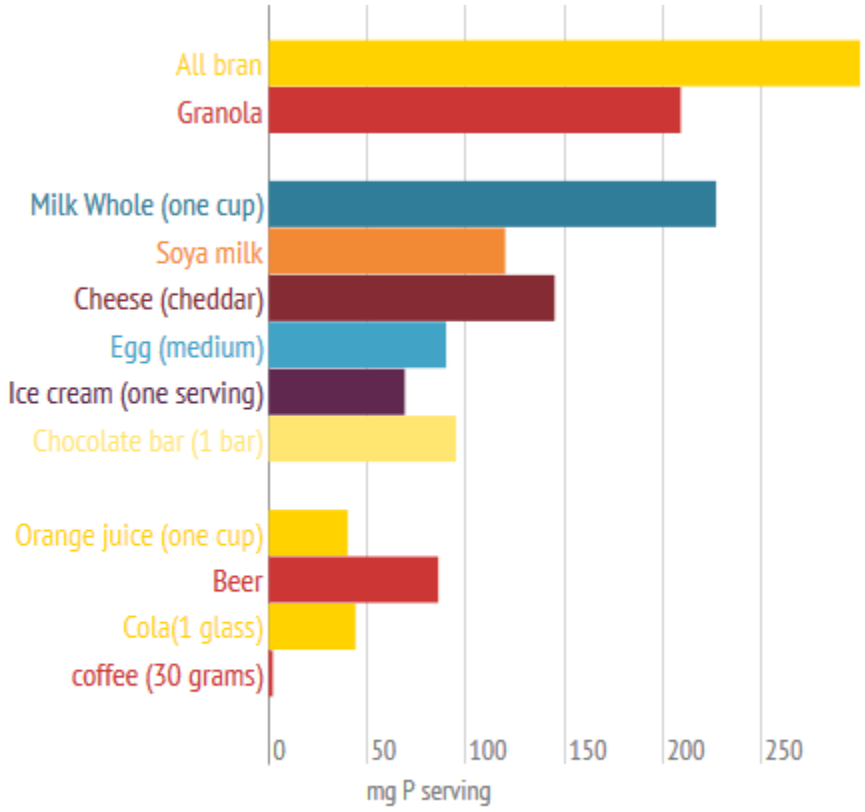
P content (339 mg)

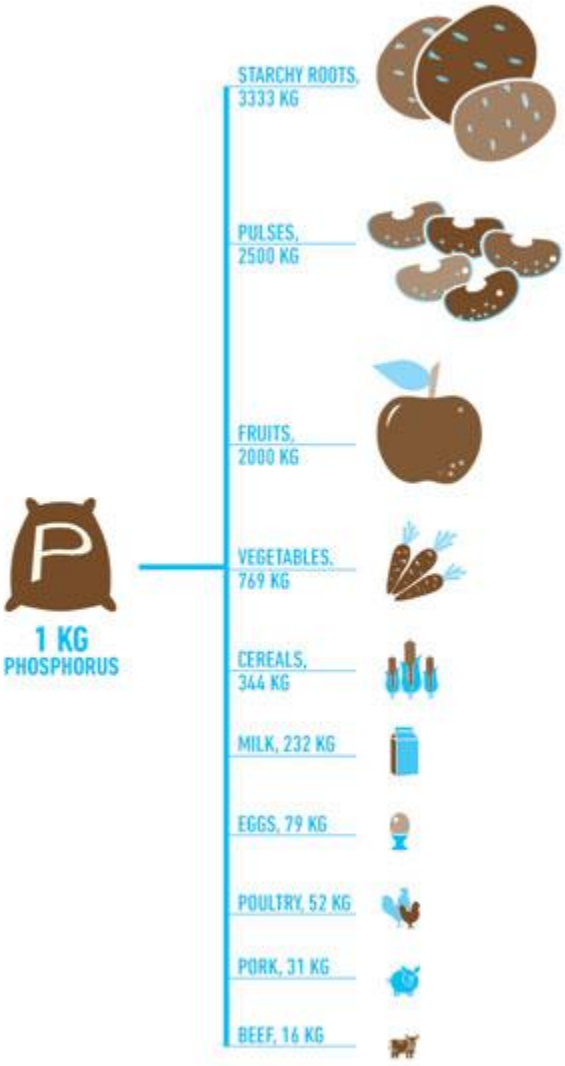

8oz beef steak
Beef (steak or mince)
Pork
Turkey
Chicken
Salmon
Cod
Tuna
Shrimp
Broccoli (1/2 cup)
Banana
Carrots (1/2 cup)
Mango
Apple
Lentils (1/2 cup)
Potato (1 medium)
Bread (7 grain)
rice (1 cup)
pasta (57g)
0
50
100
150
200
250
mg P serving


All bran
Granola
Milk Whole (one cup)
Soya milk
Cheese (cheddar)
Egg (medium)
Ice cream (one serving)
Chocolate bar (1 bar)
Orange juice (one cup)
Beer
Cola(1 glass)
coffee (30 grams)
0
50
100
150
200
250
mg P serving

Additives in a typical US diet **add between 606 to 1329 mg of P** to the dietary intake per day (Carrigan *et al* 2014)

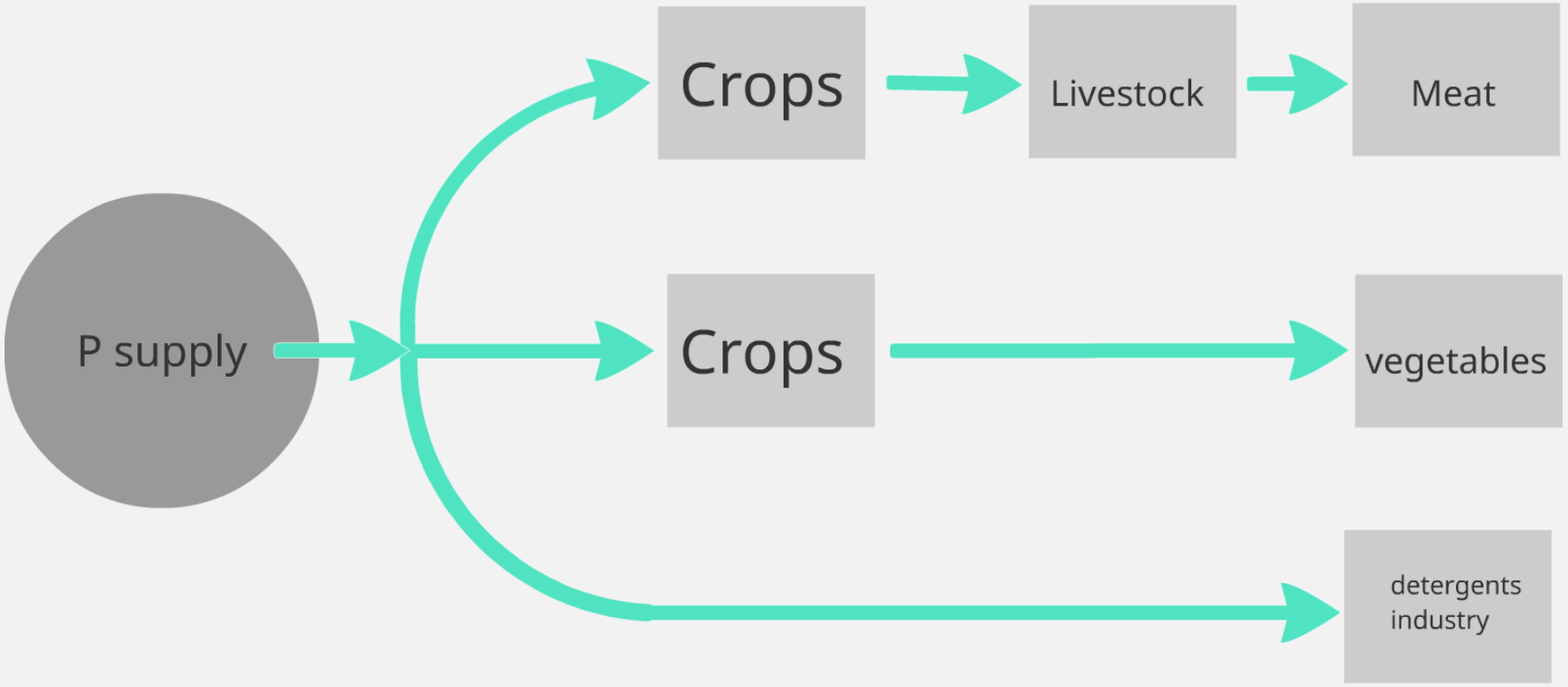
The P footprint and the P content

Healthy for you or healthy for the planet?

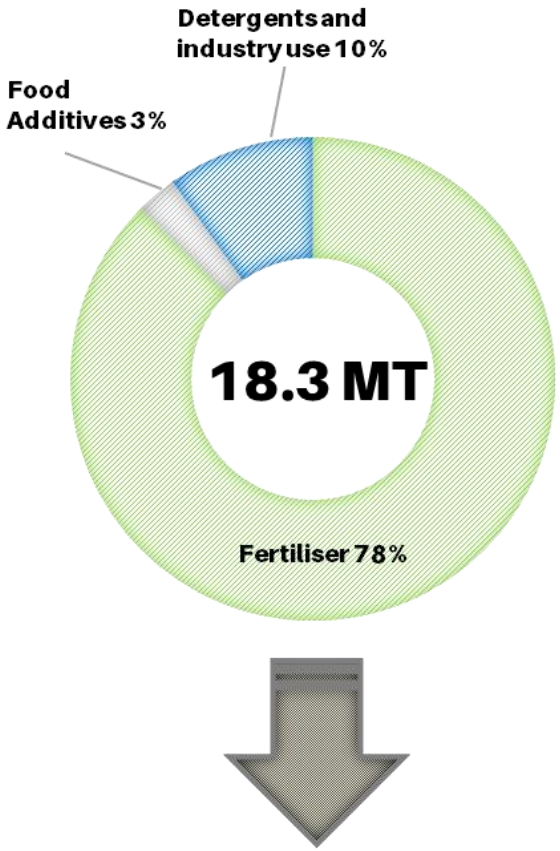


The phosphorus used to make one 8oz steak, is the same amount used to grow 755 potatoes

Metson 2012

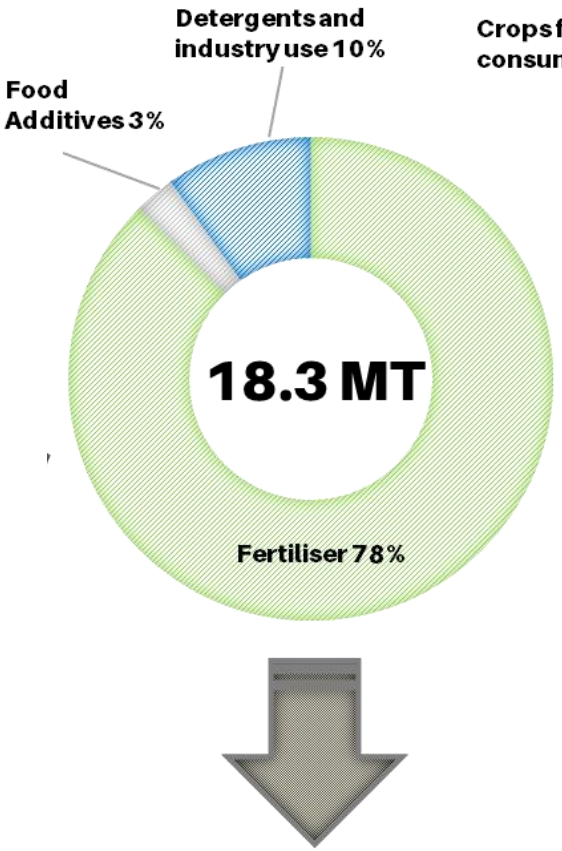

P supply
Crops
Livestock
Meat
Crops
vegetables
detergents
industry

Use of mined P



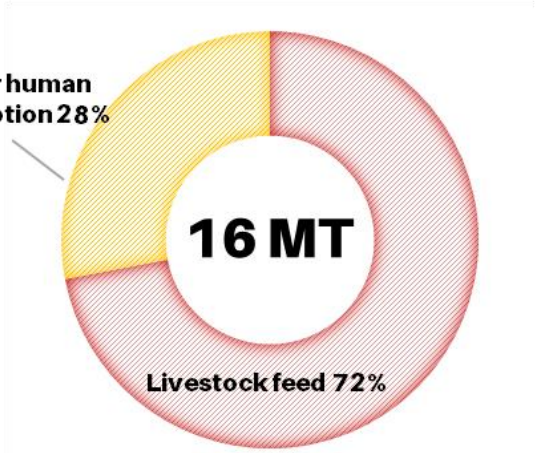
net losses = **6.7 MT**

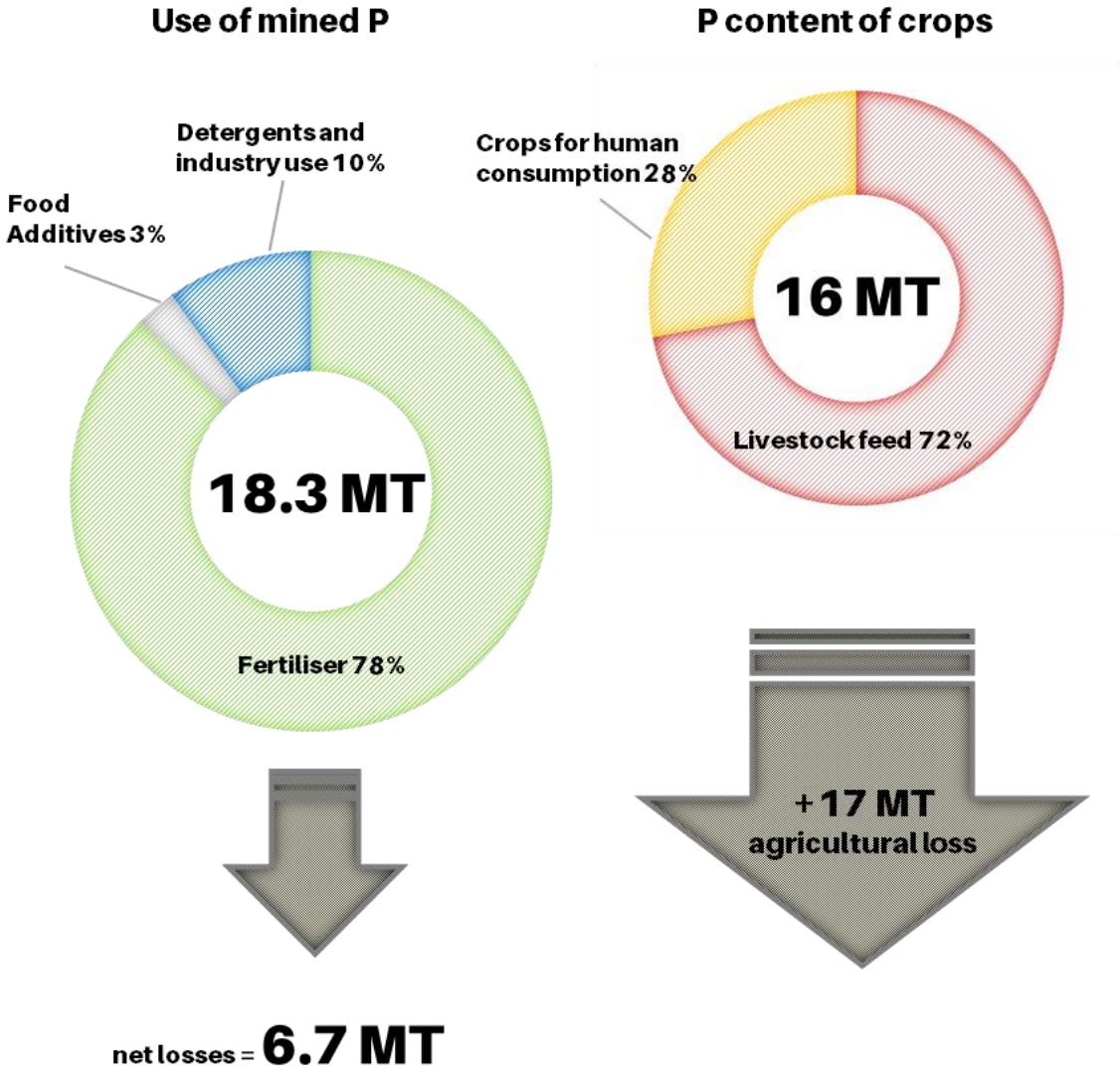
Use of mined P



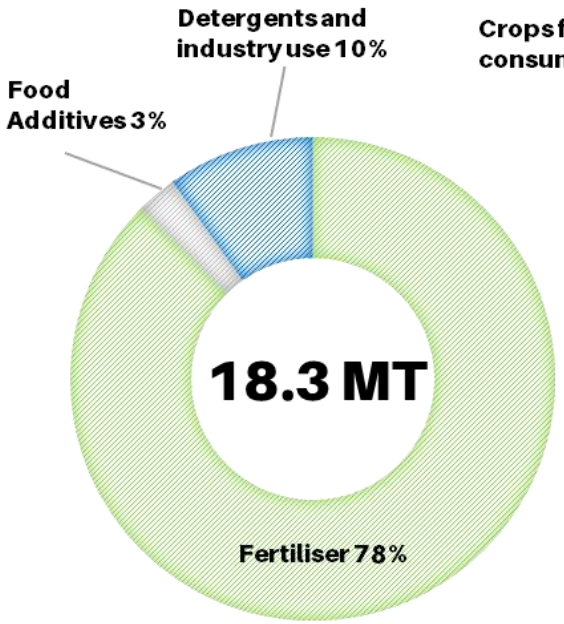
net losses = **6.7 MT**

P content of crops



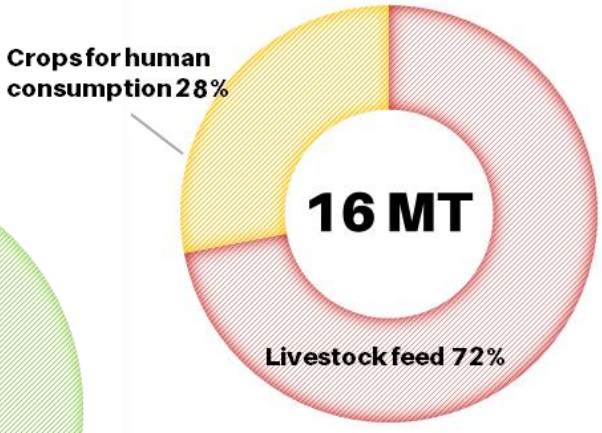

Use of mined P
Detergents and industry use 10%
Food Additives 3%
18.3 MT
Fertiliser 78%
net losses = 6.7 MT
P content of crops
Crops for human consumption 28%
16 MT
Livestock feed 72%
+17 MT agricultural loss

Use of mined P

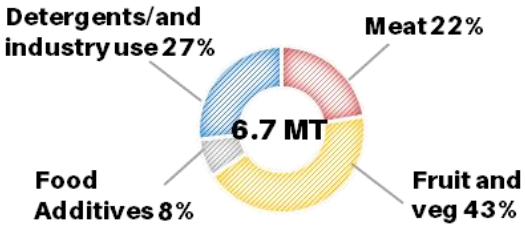


net losses = **6.7 MT**

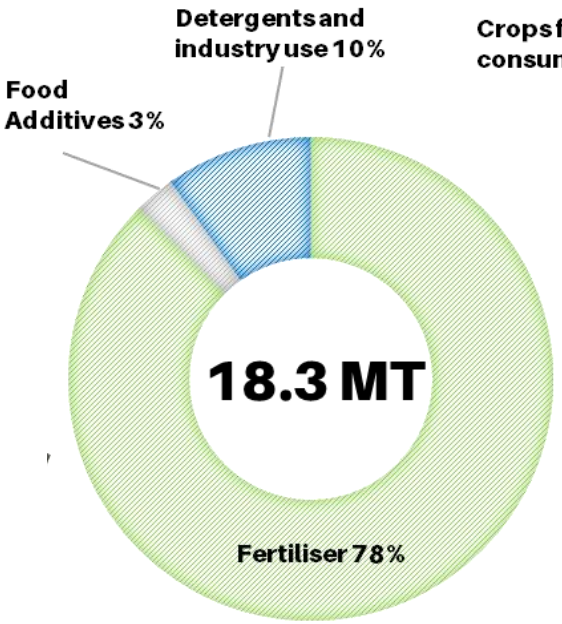
P content of crops



P for human consumption

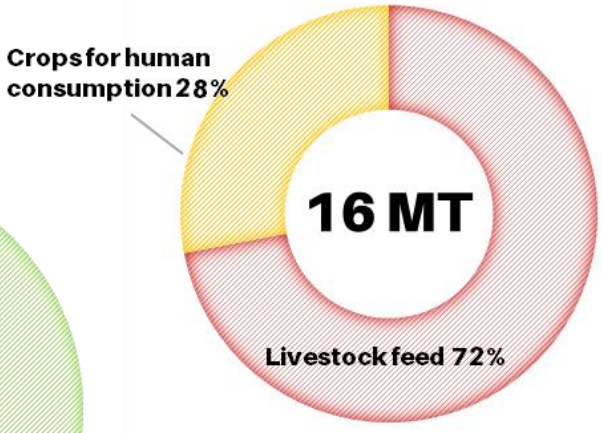


Use of mined P



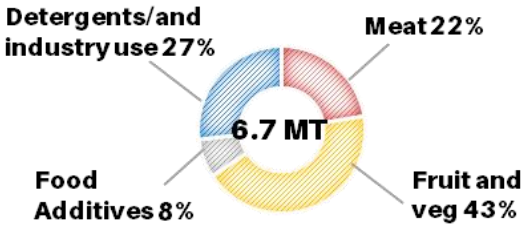
net losses = **6.7 MT**

P content of crops

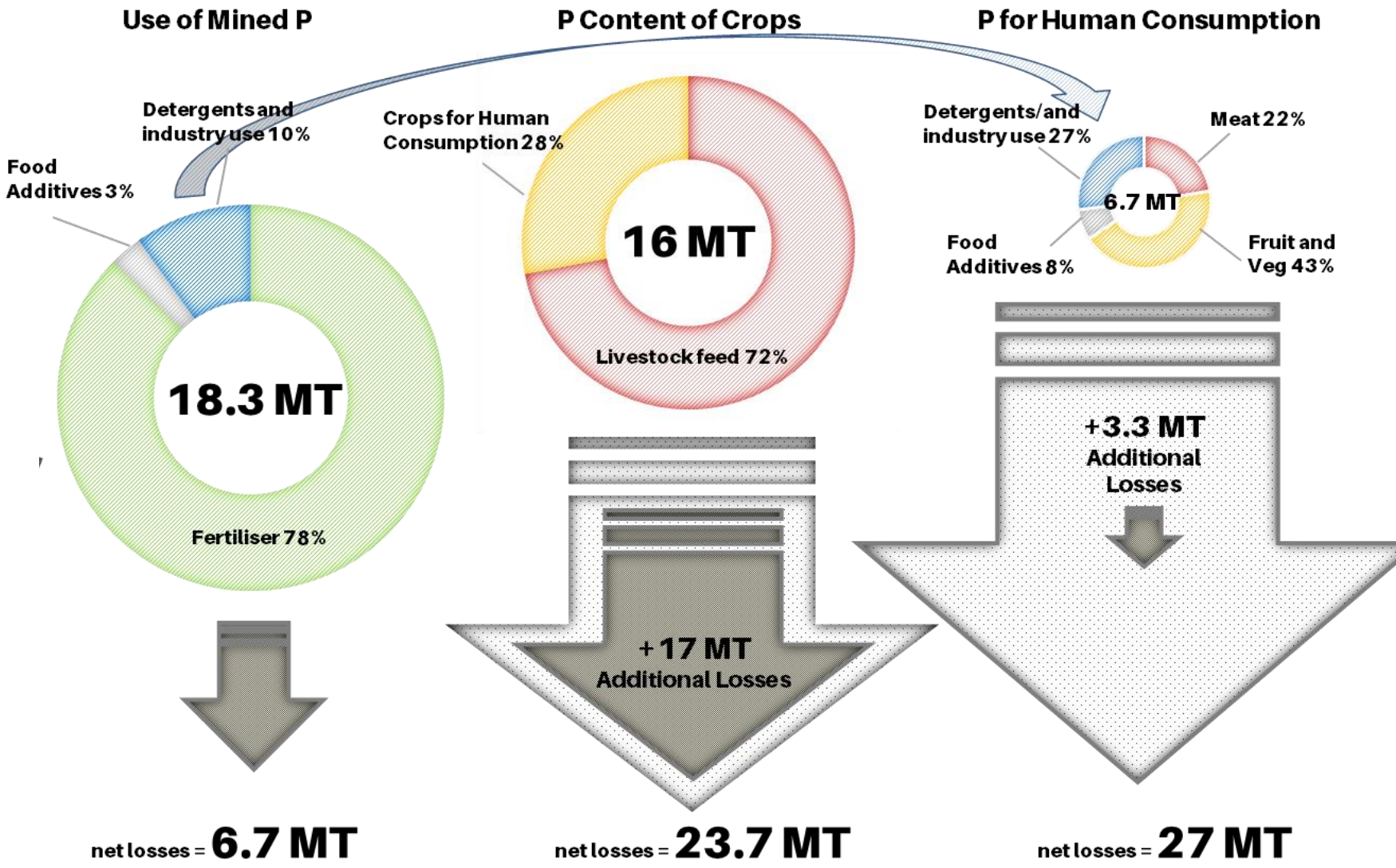


+17 MT
agricultural loss

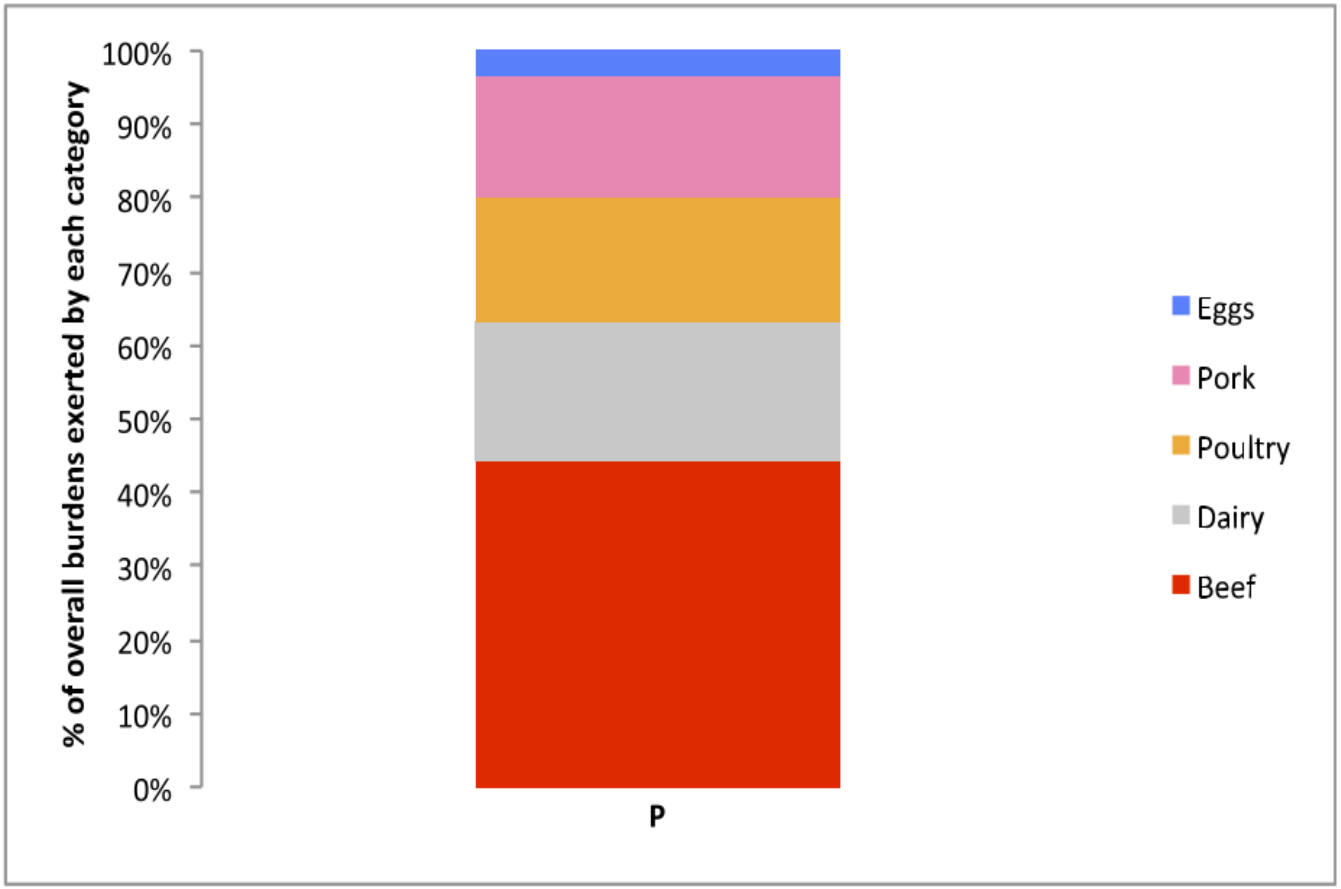
P for human consumption



+3.3 MT
human losses


Use of Mined P
P Content of Crops
P for Human Consumption
Detergents and industry use 10%
Food Additives 3%
18.3 MT
Fertiliser 78%
Crops for Human Consumption 28%
16 MT
Livestock feed 72%
Detergents/and industry use 27%
Meat 22%
6.7 MT
Food Additives 8%
Fruit and Veg 43%
+17 MT Additional Losses
+3.3 MT Additional Losses
net losses = 6.7 MT
net losses = 23.7 MT
net losses = 27 MT

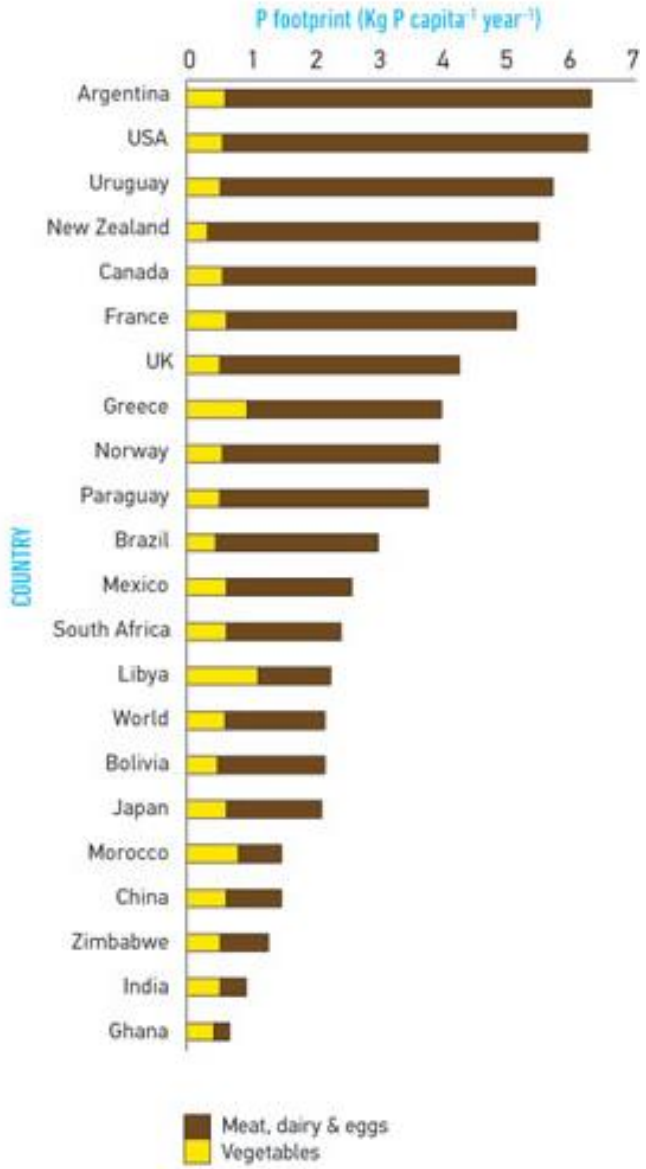
Meat consumption accounted for 72% of the global average footprint *(Metson et al 2012)*



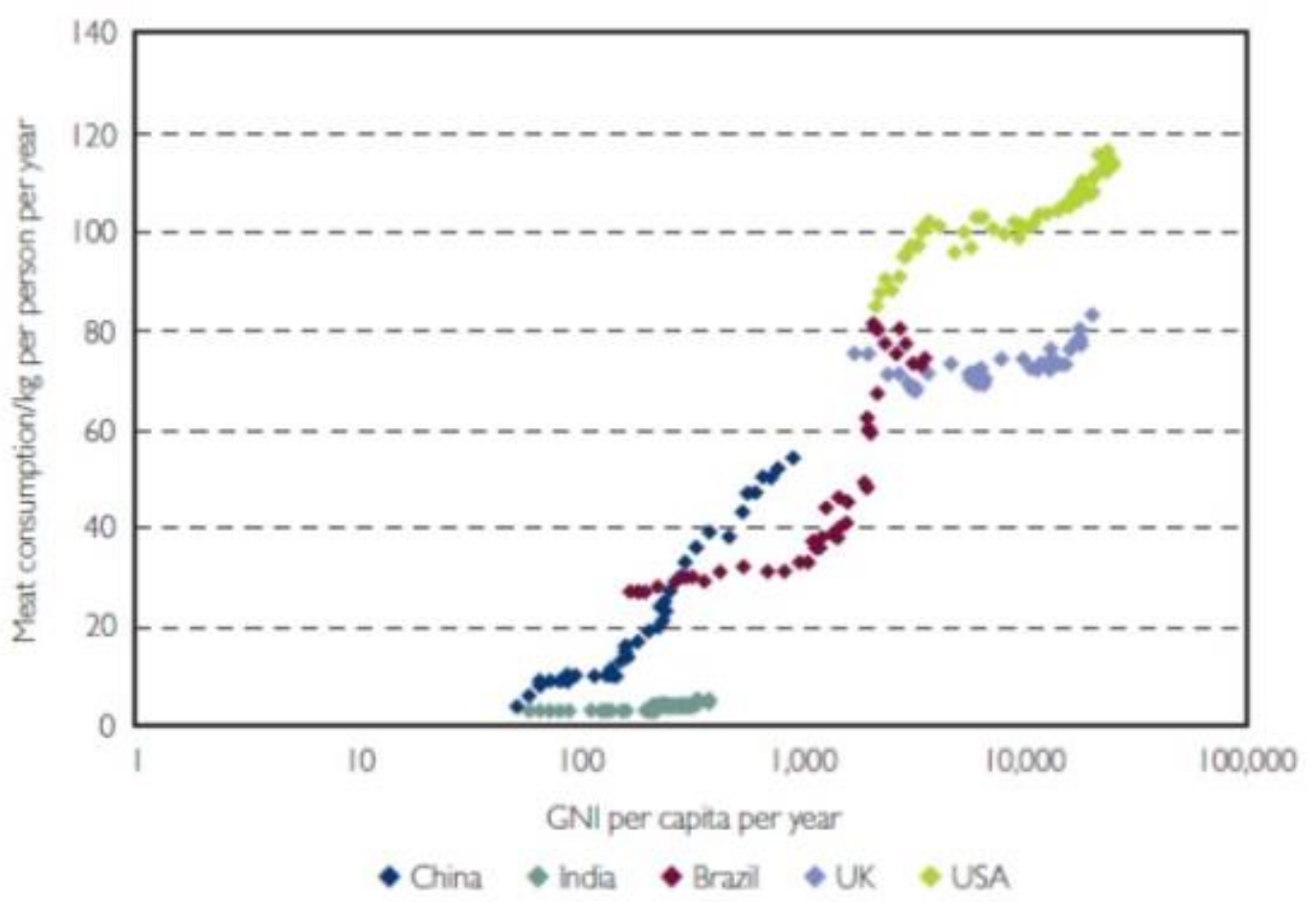
Relative contribution of each animal product in the United States per capita P footprint [as an addition to figure 3 in Eshel et al. (1)].

The per capita P footprint increased by 38% between 1961-2007

Although considerable variation exists between countries (i.e. China increased by 400% whilst Canada decreased). *(Metson et al 2012)*



Historically, with increased wealth comes a shift towards more meat



*Gross National Income

WORLD RESOURCES INSTITUTE

Source: FAOSTAT and World Bank in Foresight. 2011. "The Future of Food and Farming." Government Office for Science, London.

Its not just what we eat, but how much we eat

The world hosts 868 million undernourished people AND
1.5 billion obese or overweight individuals.

Every year 36 million people die because of an insufficient quantity of food, while 29 million die because they eat too much.
(WHO 2014)

The planet currently manages to supply enough food to feed everybody.

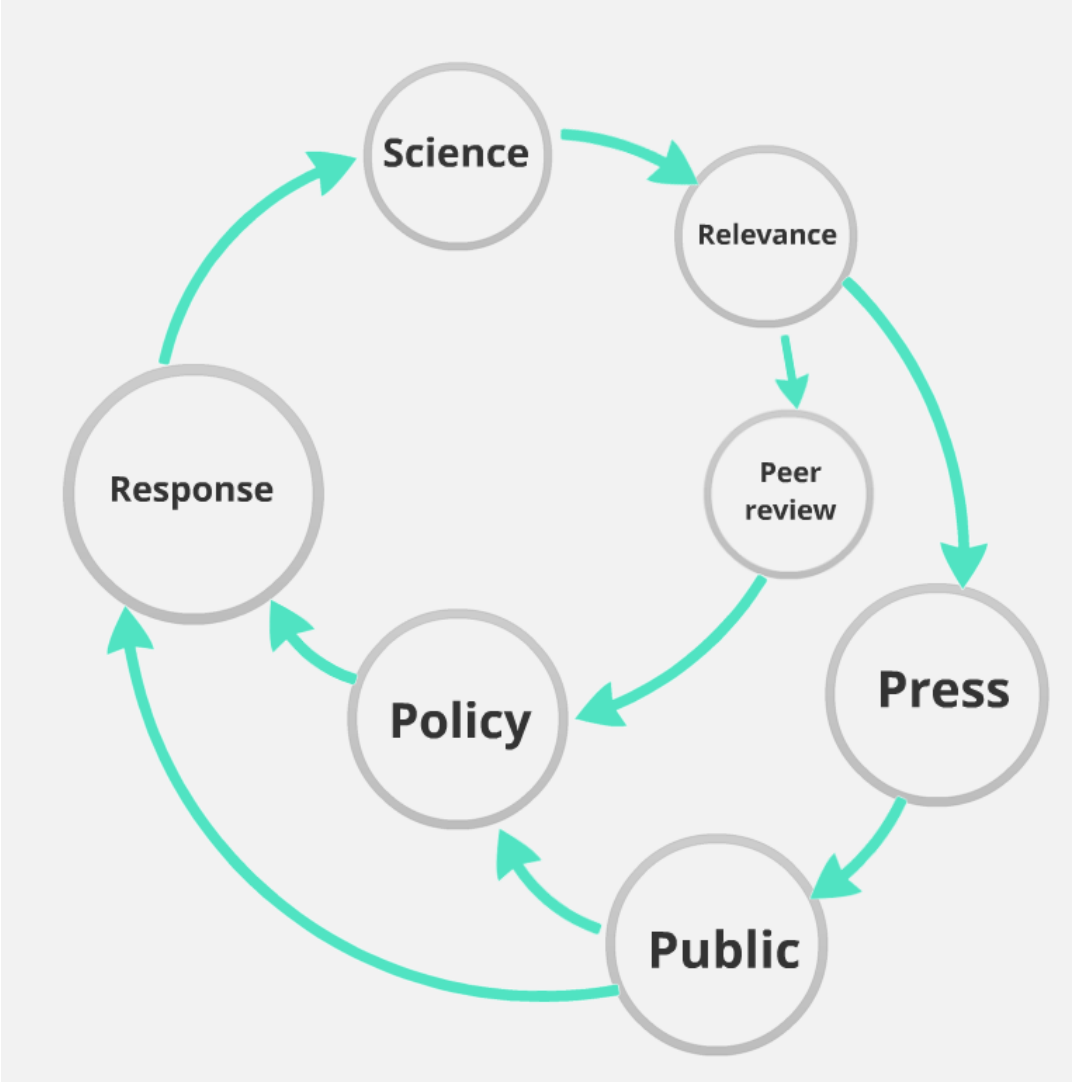

n Arthus-Bertrand

People Power

But a**spirational goals must be achievable.** *Meat free Mondays, the demitarian approach, flexitarianism, reducetarian* are all examples of this maxim**. It is not about not eating meat, it is about eating less meat.**

The many benefits of eating less meat are well documented (↓C, ↓GHG's, ↓N, water footprints, ↑human health).

We need to talk both policy makers and the public



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Scotland Edition
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- **Halving EU meat & dairy intake would reduce N pollution by 40%**
- **NUE of the food system increases from 22% to 44%**

Nitrogen on the Table Westhoek et al., 2014

Raise taxes on meat to turn us into demitarians, says UN

Ben Webster Environment Editor

Extra taxes could be imposed on meat to deter families from buying it, according to a United Nations task force which recommends halving consumption of meat and dairy products to reduce pollution.

Britain's livestock farmers would suffer a "severe" loss of income from such a change in diet but there would be environmental benefits, including less pollution of the air, water and soil, and lower greenhouse gas emissions.

A team of scientists advising the United Nations Economic Commission for Europe (Unece) studied ways of reducing nitrogen pollution from chemical fertiliser and manure.

The task force on reactive nitrogen concluded that if everyone in the EU became "demitarian" — halving the amount of meat and other animal products consumed — it could reduce greenhouse gases from agriculture by 25 per cent to 40 per cent and nitrogen emissions by 40 per cent.

It would also cut the risk of heart disease and cancer by bringing consumption of saturated fats down to within levels recommended by the World Health Organisation.

The task force's report, published today, will inform negotiations between governments over tightening the EU emissions directive and the Unece's convention on cross-border air pollution. The scientists found that beef was the worst meat for environmental impact, causing 25 times more nitrogen pollution per unit of food protein than cereals. For pig and poultry meat, eggs and dairy, the pollution was 3.5 to 8 times that of cereals.

The team questioned whether people would be likely to cut consumption of meat simply by being better informed. They suggested that tougher measures, such as new taxes, might be more successful in changing behaviour.

They conclude: "A more direct policy intervention could be that of making meat and dairy products more expensive, either by direct taxation or by taxing the environmental effects."

The report admits that "the effects on the livestock sector will most likely be severe". Some farmers would be able to switch from rearing animals to planting cereals, but others with land less suitable for crops, particularly in Scotland and Wales, would suffer loss of income.

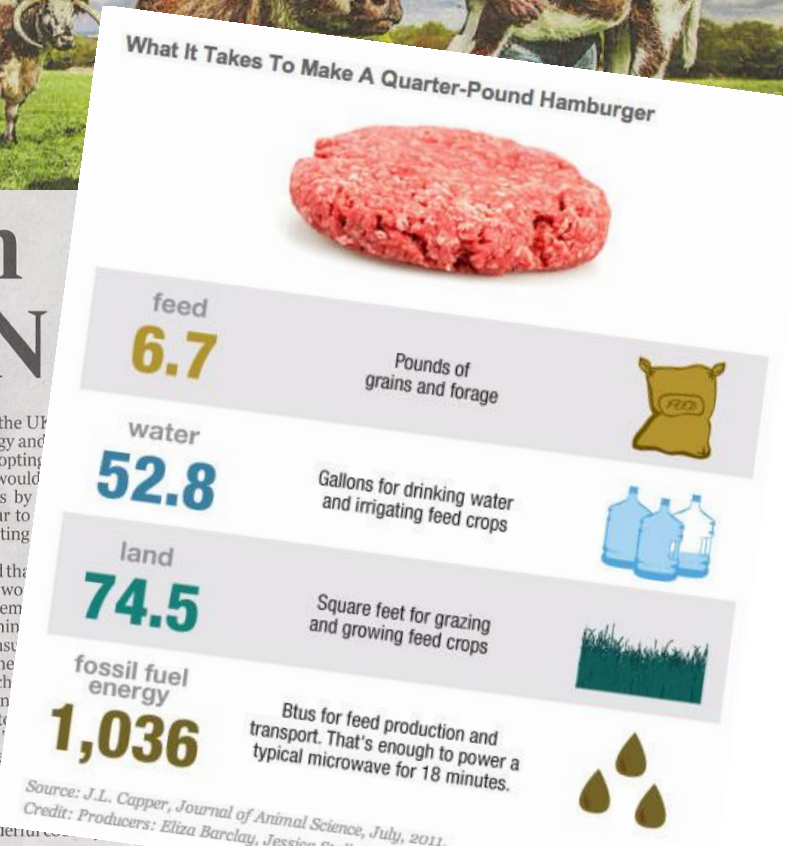
Reducing meat consumption would free "large areas of agricultural land in the EU" because much less land would be needed for grazing and for growing crops to feed to livestock. The report says the land could be used for growing biofuels to replace fossil fuels. Professor Mark Sutton, from the UK Ecology & Hydrology and the report, said: "Adopting diet across Europe would gen pollution levels by cent which is similar to achieved by adopting farming practices."

He acknowledged tha sumption in Britain wo impact on global em countries such as Chin increasing their consu

Dr Diane Mitche Farmers' Union ch adviser, said: "Eatin simplistic solution t complex situation. dairy sectors are alre tackle their footprir

"Some of this lar for pasture and protecting our wonder

1GM 1GM



Suggestions for reducing societal requirements for P

1. Reduce consumption of high P footprint foods
1. Ensure portion size is appropriate
2. Reduce food waste
3. Encourage other sources of protein, aquaculture?
4. Increase animal to product efficiency
5. Join in complimentary campaigns whilst maintaining P identity
6. Ensure presence of dietary change is included in policy/advocacy documents