



**ZWAI**  
ZERO WASTE ALLIANCE IRELAND



Herr Ltd

Domestic Water Systems  
for a sustainable future

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# The Urgent Need to Recycle Phosphorus from Human Urine

Presentation by Ollan Herr

The National Sustainability Summit

23<sup>rd</sup> February 2023

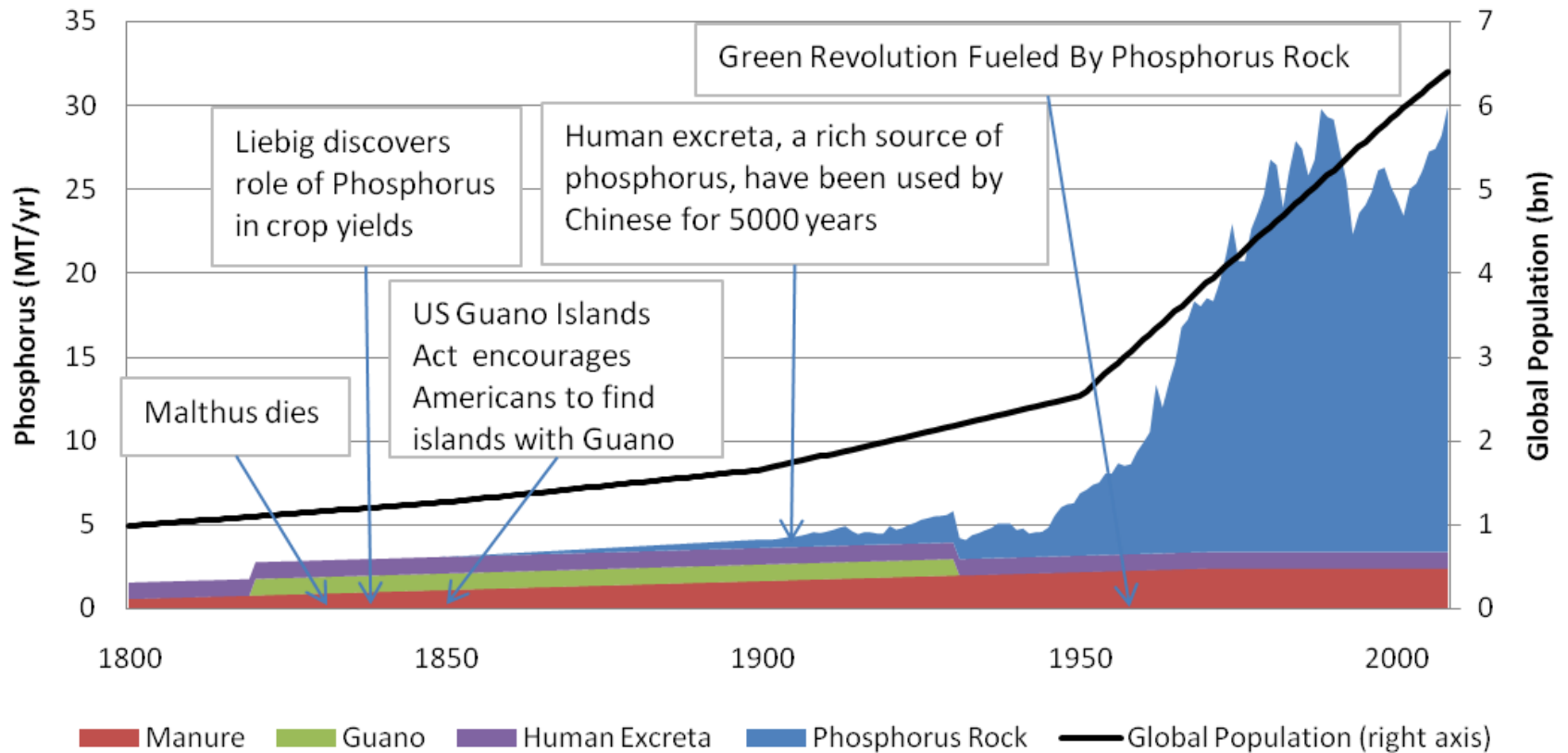
# Phosphorus and Nitrogen in Synthetic Fertilizer

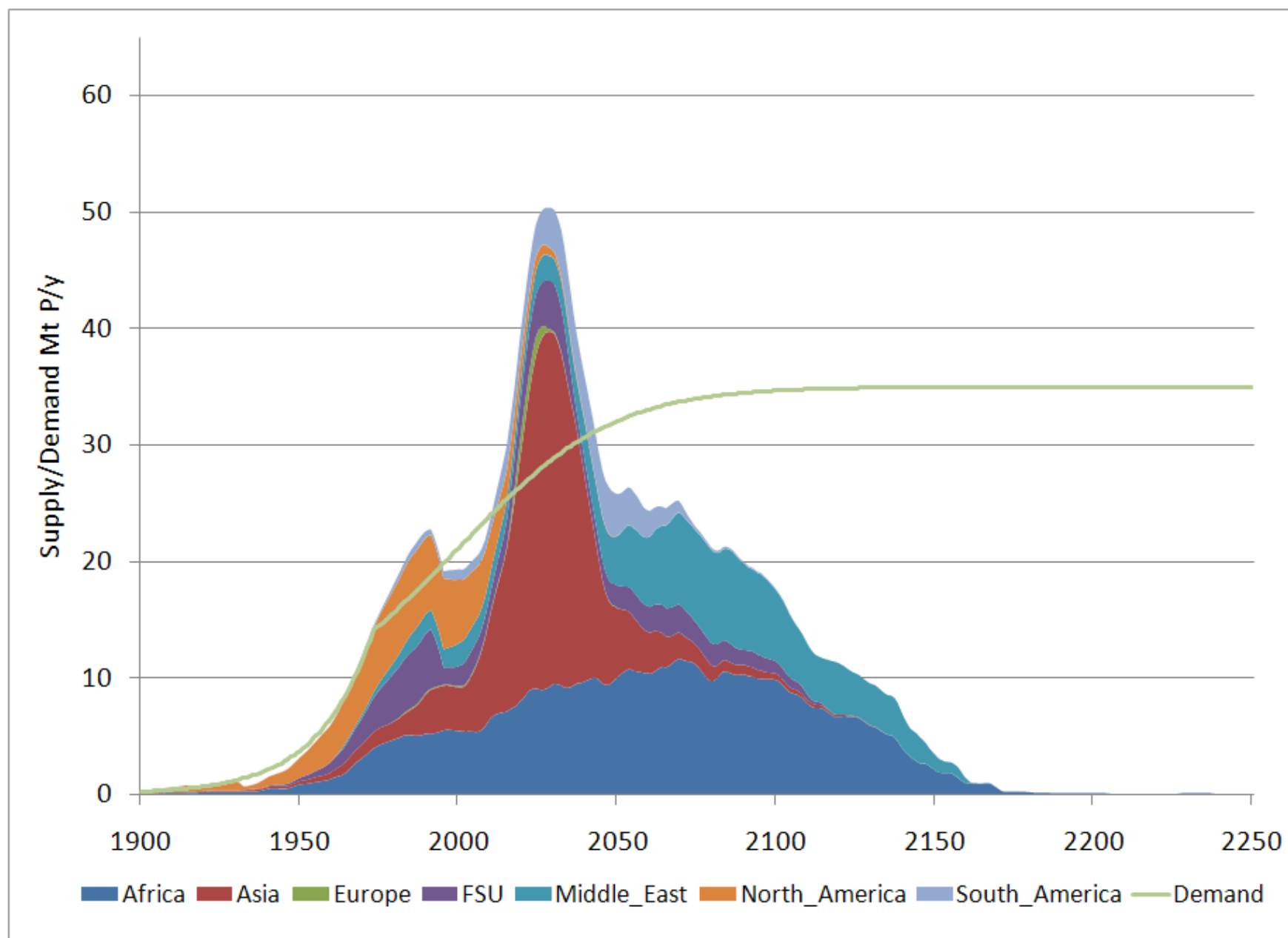




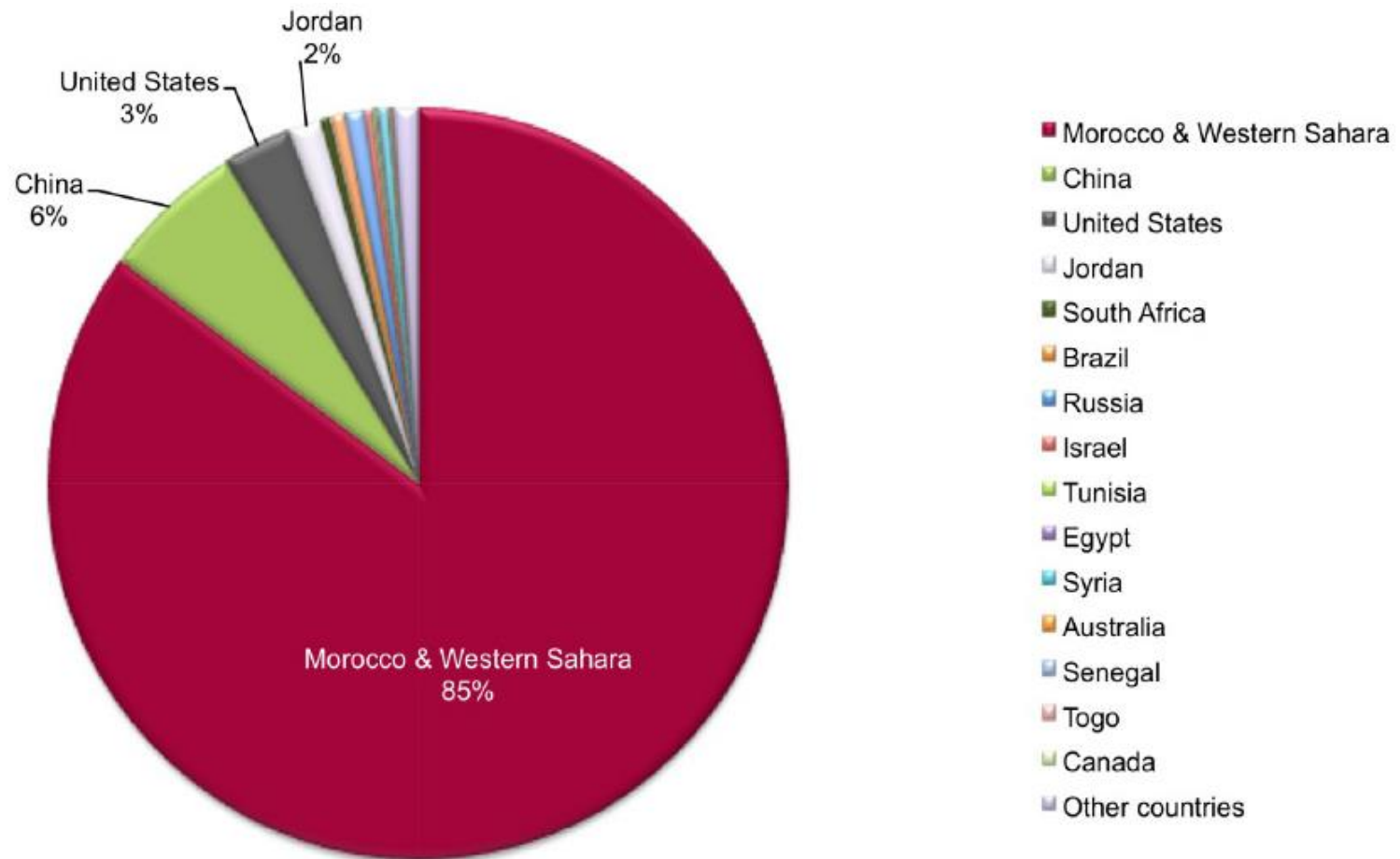


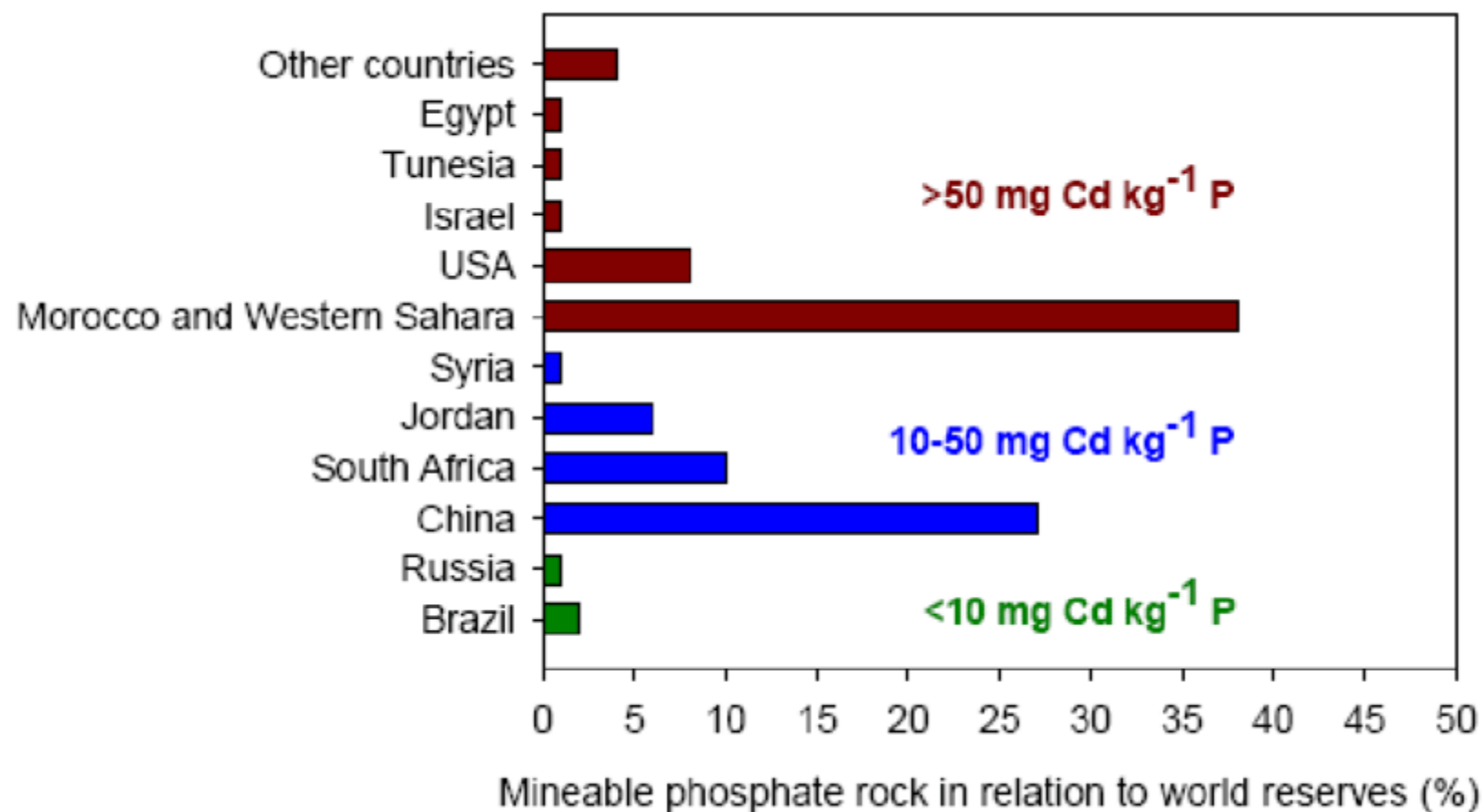
# Historical Sources of Phosphorus Fertilizer





# The Remaining Countries with Phosphorus Rock

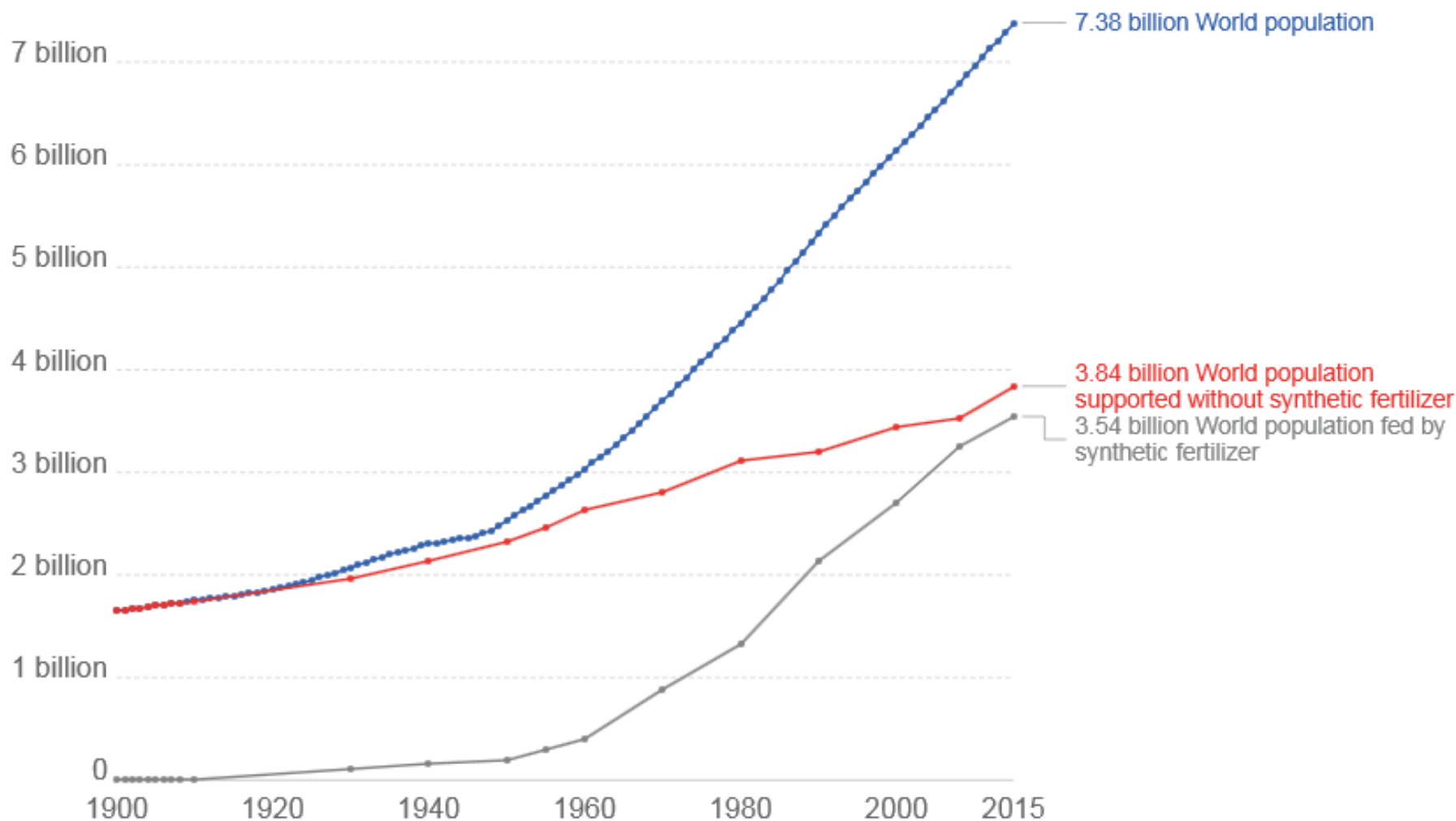






# World population with and without synthetic nitrogen fertilizers

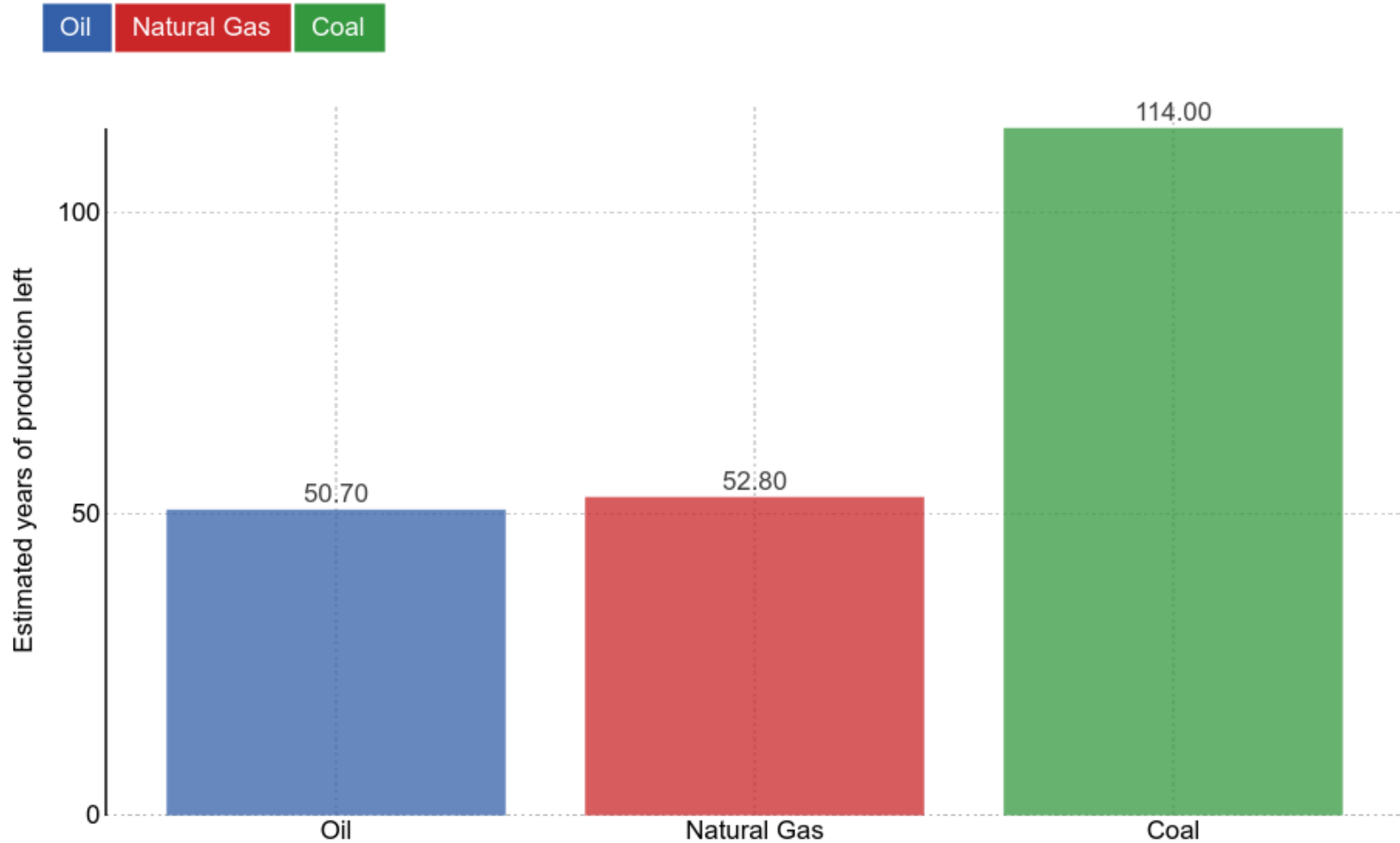
Estimates of the global population reliant on synthetic nitrogenous fertilizers, produced via the Haber-Bosch process for food production. Best estimates project that just over half of the global population could be sustained without reactive nitrogen fertilizer derived from the Haber-Bosch process.



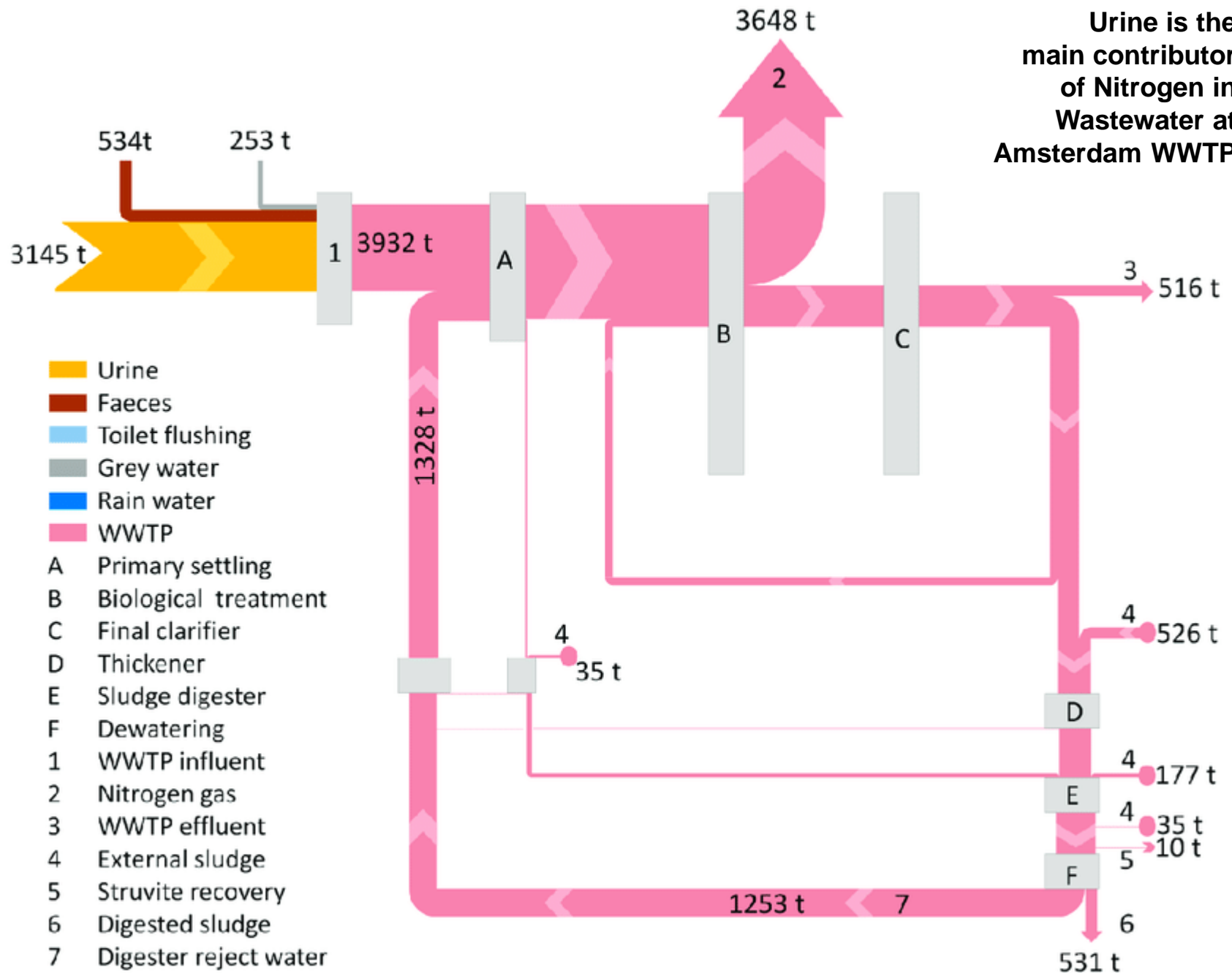


# Years of fossil fuel reserves left

Years of global coal, oil and natural gas left, reported as the reserves-to-product (R/P) ratio which measures the number of years of production left based on known reserves and annual production levels in 2015. Note that these values can change with time based on the discovery of new reserves, and changes in annual production



**Urine is the  
main contributor  
of Nitrogen in  
Wastewater at  
Amsterdam WWTP**



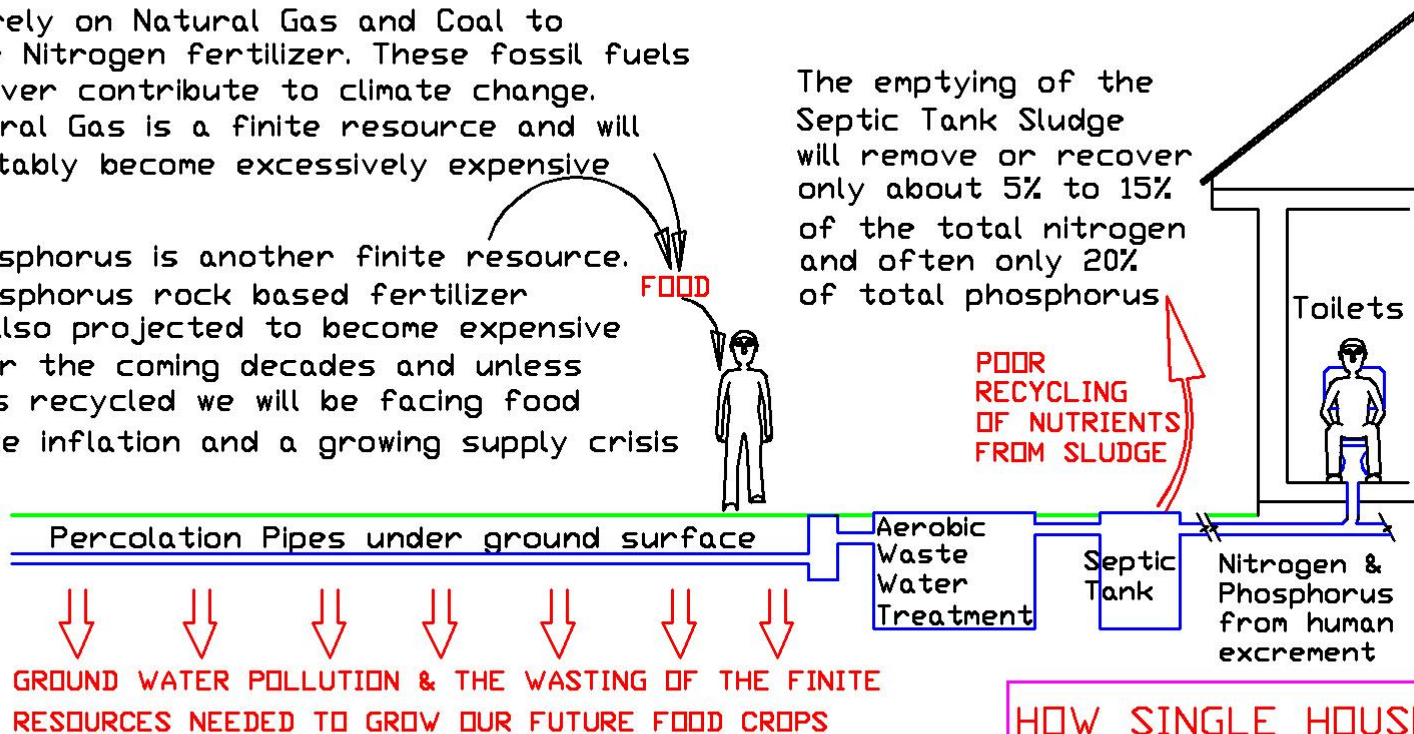
400,000 septic tank system in Ireland are adding nitrogen into the ground water. The prevention of ground water pollution with nitrates is now a requirement of EU Directive 2006/118/EC. Under this Directive every effort should now be made to protect the ground water pollution from nitrates. We should also be preventing the wasting phosphates

We rely on Natural Gas and Coal to make Nitrogen fertilizer. These fossil fuels however contribute to climate change. Natural Gas is a finite resource and will inevitably become excessively expensive

Phosphorus is another finite resource. Phosphorus rock based fertilizer is also projected to become expensive over the coming decades and unless it is recycled we will be facing food price inflation and a growing supply crisis

The emptying of the Septic Tank Sludge will remove or recover only about 5% to 15% of the total nitrogen and often only 20% of total phosphorus

POOR  
RECYCLING  
OF NUTRIENTS  
FROM SLUDGE



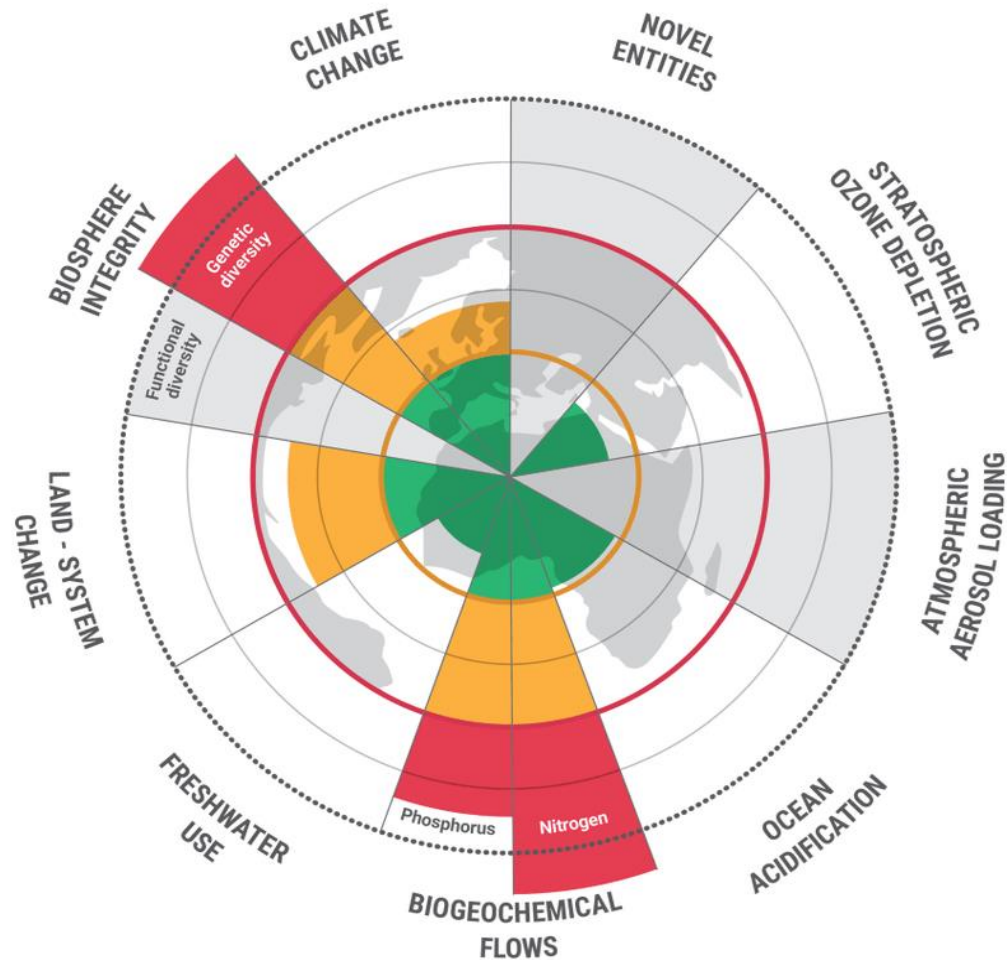
Between 85 % to 95% of remaining nitrogen is lost and wasted in the ground. Unless it is adequately diluted in ground water, it will also become a pollutant.

Between 65 % and 95% of phosphorus is wasted or lost in good percolating soil. It can also become a pollutant in nearby surface waters where there is poor percolating soils

HOW SINGLE HOUSE  
SEWAGE TREATMENT  
SYSTEMS ARE  
WASTEFUL OF OUR  
"FINITE RESOURCES"

# PLANETARY BOUNDARIES

A safe operating space for humanity

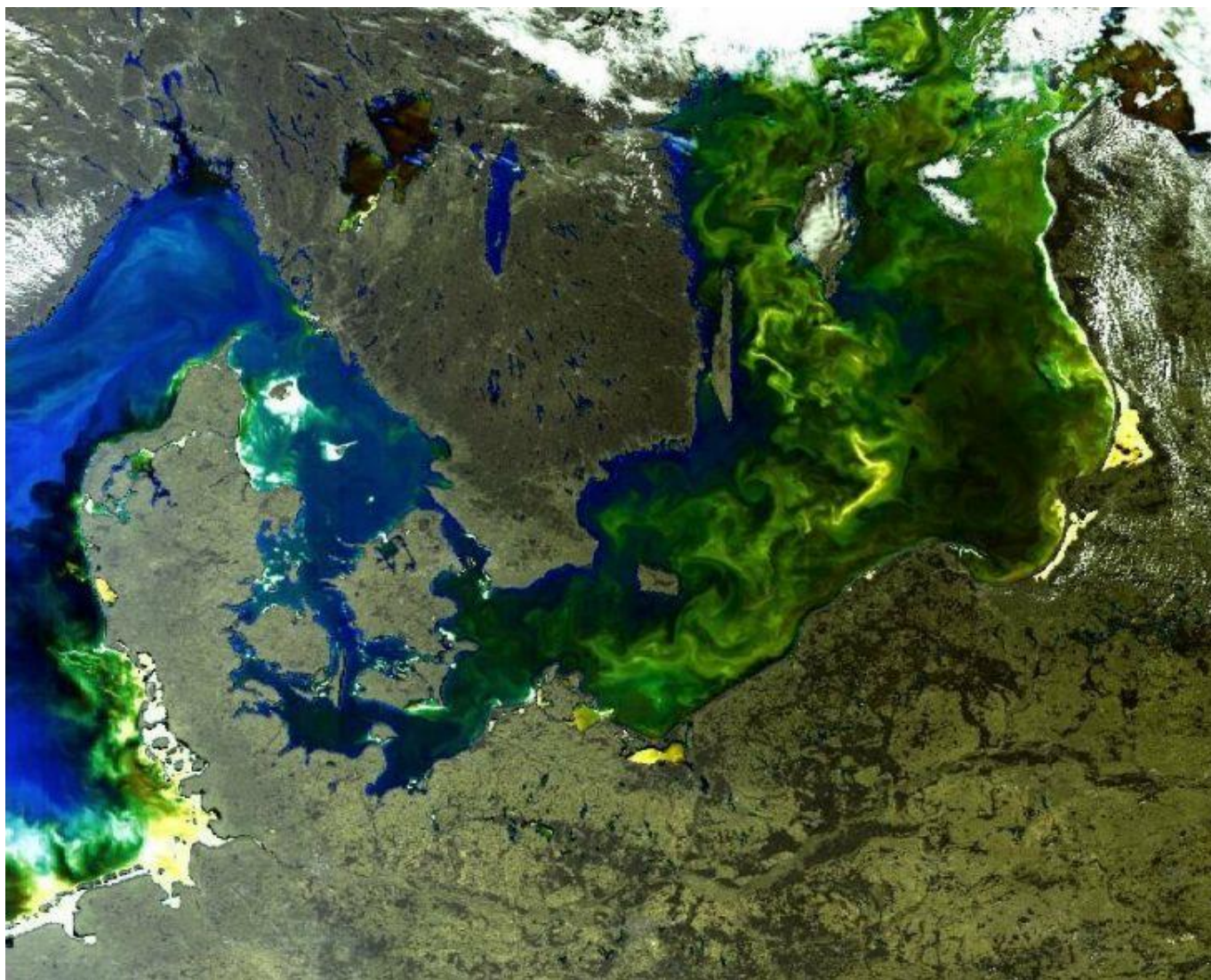


- Beyond zone of uncertainty (high risk)
- In zone of uncertainty (increasing risk)
- Below boundary (safe)
- Boundary not yet quantified

Source: Steffen et al. Planetary Boundaries: Guiding human development on a changing planet, Science, 16 January 2015.  
Design: Globalia













Comhairle Contae An Chláir  
Clare County Council

NOTICE

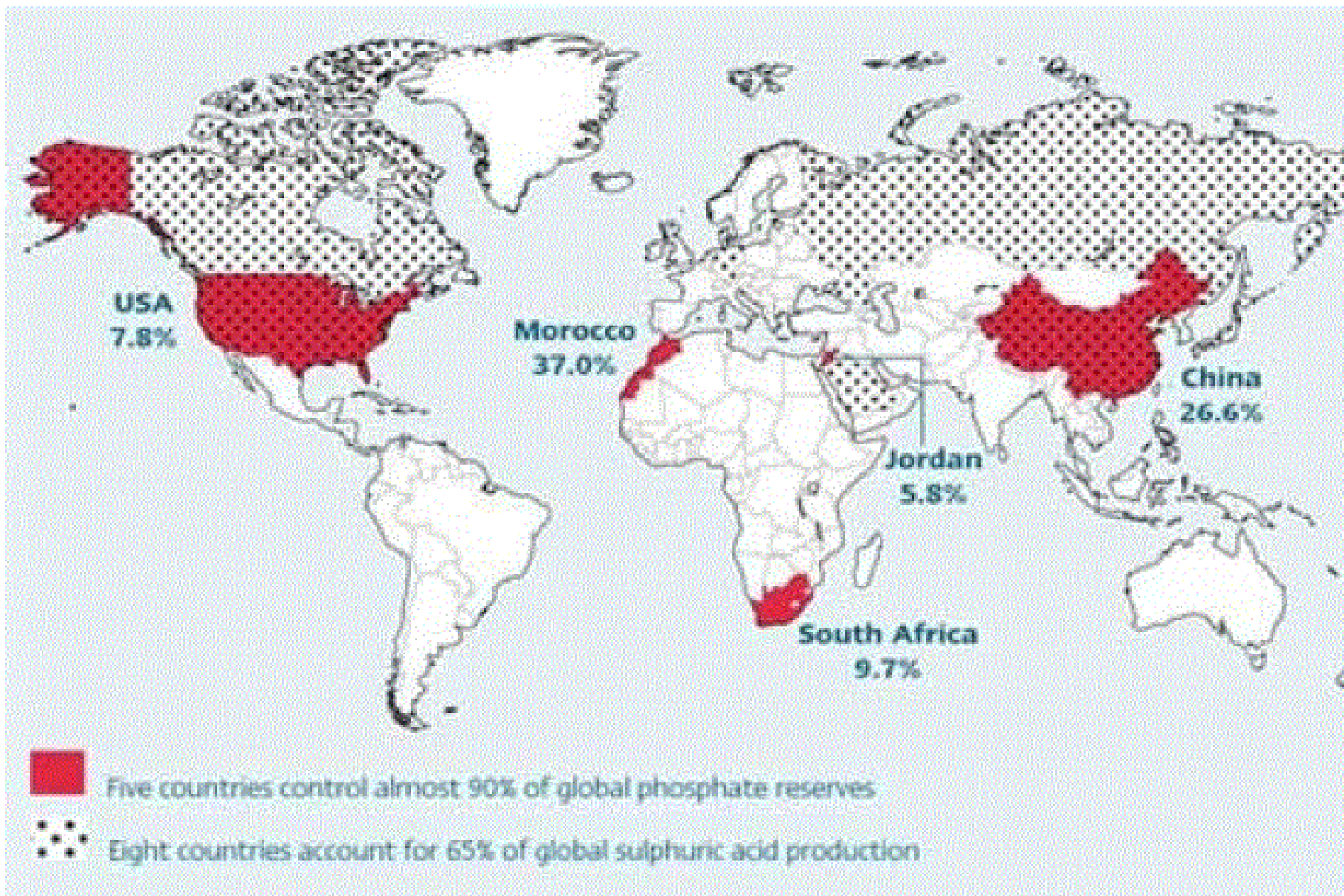
## **LOUGH DERG WATERS**

**DURING THIS PERIOD MAY TO SEPTEMBER  
AN ALGAL BLOOM OR DARKISH SCUM MAY  
APPEAR ON OR CLOSE TO THE SHORELINE**

## **PLEASE EXERCISE CAUTION**

**YOU ARE ADVISED TO AVOID CONTACT WITH  
THIS BLOOM / SCUM AS IT MAY CAUSE SKIN IRRITATION  
KEEP CHILDREN AWAY FROM THE SHORELINE  
KEEP ALL DOGS AWAY FROM THE WATER AND  
ANY SHORELINE SCUM**

THANK YOU





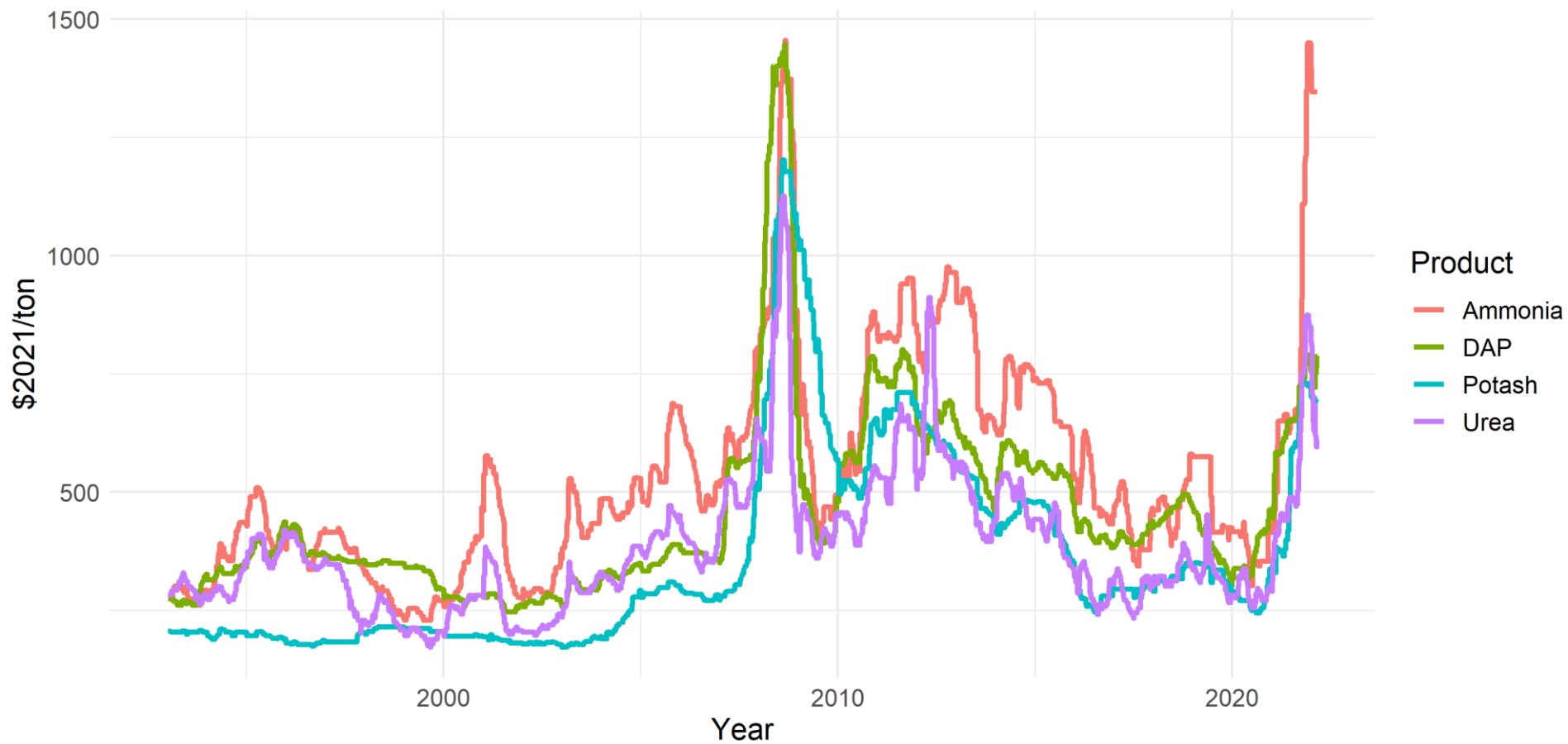








## US Cornbelt Fertilizer Prices



Source: Bloomberg

# Food riots in 2008

- Egypt Thousands of demonstrators in Mahalla el-Kobra loot shops and throw bricks at police during protests at rising food prices and low salaries, as part of nationwide strike
- Haiti At least four people killed in the southern city of Les Cayes after food prices rise 50 per cent in the past year
- Côte d'Ivoire Police injure more than ten protesters as several hundred demonstrators demand government action to curb food prices
- Cameroon Riots last four days and result in at least 40 deaths. Unrest is due to high fuel and food prices. Worst riots in country for 15 years
- Mozambique At least four people killed and 100 injured following fuel price rises
- Senegal Violent demonstrations in Dakar as prices of rice, milk and oil soar. Senegal imports almost all its food
- Yemen Five days of rioting and a hundred arrests after the price of wheat doubled over two months. Protesters set up roadblocks in Sana'a and Aden
- ...and in Mauritania, Bolivia, Indonesia, Mexico, India, Burkina Faso, and Uzbekistan

**- New Statesman, April 17, 2008**

<b>Approx analysis of the various pollutants and nutrients in waste water. Depends on national diets and washing preferences</b>	<b>Grey</b>	<b>Kitchen</b>			
	<b>Water</b>	<b>Sink Solids</b>	<b>Faeces</b>	<b>Urine</b>	<b>Faeces</b>
					<b>&amp; Urine</b>
Based on Swedish Research					<b>together</b>
<b>Nitrogen N</b>	<b>7%</b>	<b>8%</b>	<b>15%</b>	<b>70%</b>	<b>85%</b>
<b>Phosphorous P</b>	<b>14%</b>	<b>14%</b>	<b>26%</b>	<b>47%</b>	<b>73%</b>
<b>Potassium K</b>	<b>10%</b>	<b>37%</b>	<b>18%</b>	<b>35%</b>	<b>53%</b>
<b>Faecal bacteria &amp; faecal viruses</b>			<b>100%</b>		<b>100%</b>
Avoiding using phosphorus detergents will reduce the % phosphorus in the Grey Water					
Avoiding food grinders in the kitchen sink will also minimize N and P nutrients in Grey Water					





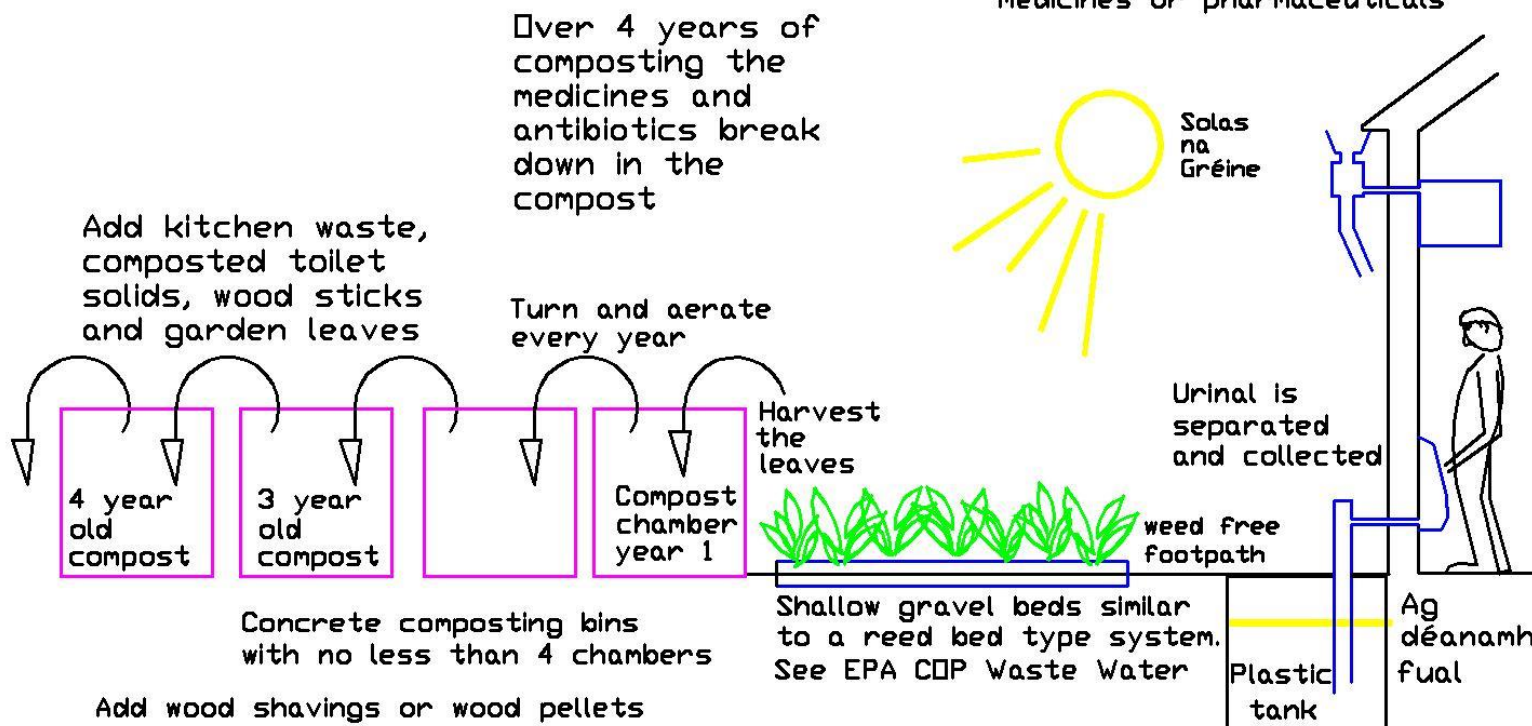
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Preparing New Houses using  
the "HANAPAK" System to prepare  
for Peak Phosphorus and a  
future food cost crisis

The leaves take up and absorb  
the nitrogen and phosphorus  
from urine and also any ingested  
medicines or pharmaceuticals



Do daoine atá  
ag súil le  
ganntanas  
fosfar agus  
ardú costas  
bia sa todhchaí



# Ag usáid uisce spéire & fual mar leasachán ar bláthanna agus plandaí neamh-inite .

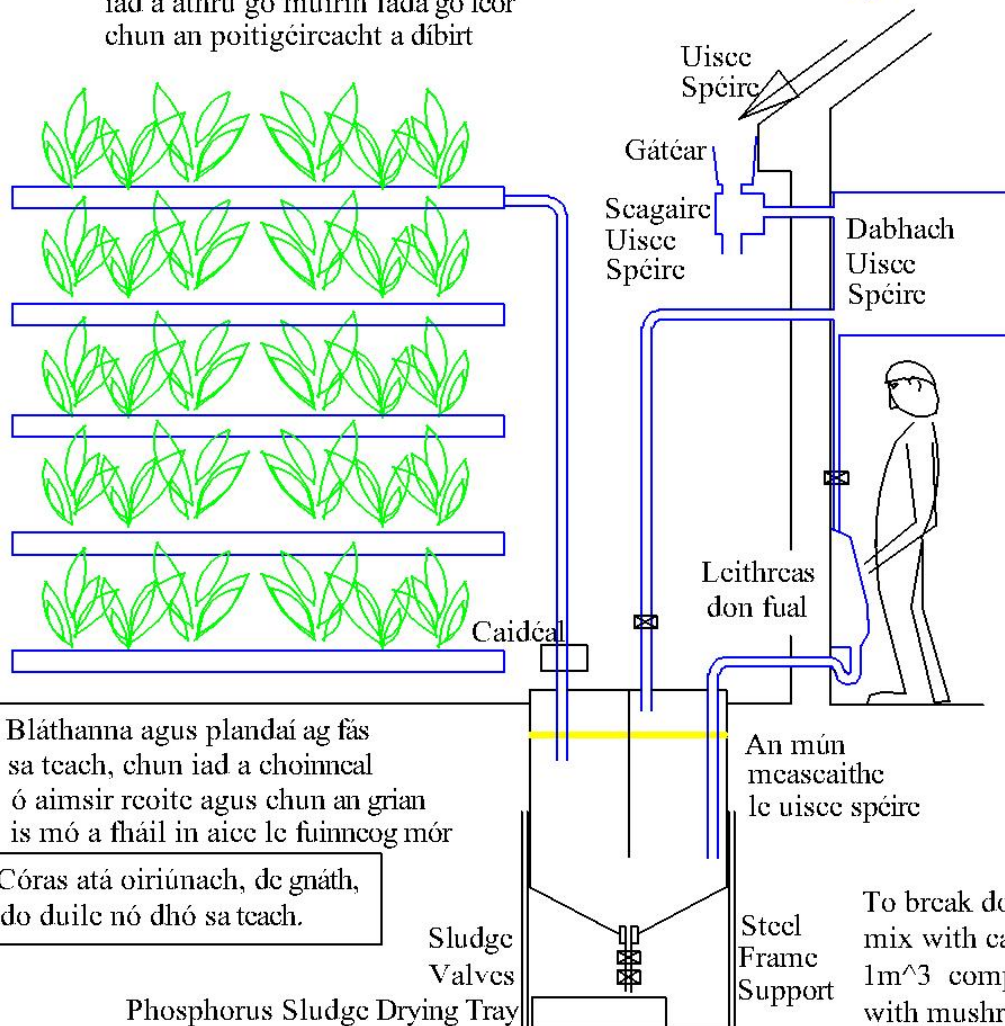
Plandaí ag fás sa griain chun an  
trualilú a baint as fual.  
Na duileoigí a gearadh ansin chun  
iad a athrú go múirín fada go leor  
chun an poitigéireacht a díbirt



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Bláthanna agus plandaí ag fás  
sa teach, chun iad a choinneal  
ó aimsir reoite agus chun an grian  
is mó a fháil in aice le fuinncoig mór

Córas atá oiriúnach, de gnáth,  
do duile nó dhó sa teach.

This system removes almost 80% of  
nitrogen and 50% of the phosphorus  
that is present in the urine fraction  
in domestic wastewater. This can also  
recycle phosphorus and other nutrients  
without pharmaceuticals, if composted  
with mycellium over long enough periods

The plastic containment prevents the nutrients  
that would otherwise pass down into the  
soil to be lost and wasted. So often the nitrogen  
fraction from septic tanks passes through soil,  
to pollute ground water and the local streams.

Locate the flower/plant growing system, to get  
plenty of sunlight, inside a warm house,  
behind large glass double glazed windows

Harvest the leaves and flowers of the plants  
to remove the Nitrogen and Phosphorus

To break down any pharmaceuticals in the harvested leaves,  
mix with carbon rich waste, over 3 to 4 years in 4 large  
1m<sup>3</sup> composting bins, with a year in each bin, ideally  
with mushrooms growing in the composting material

















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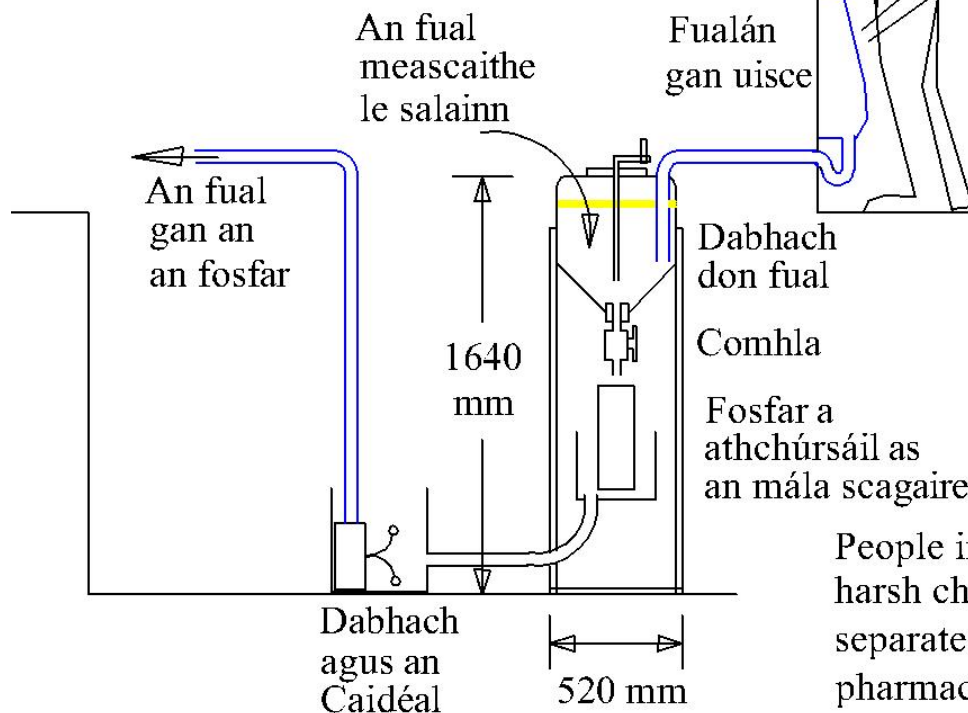
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System elements for phosphorus  
recycling as struvite.  
1 to 3 hrs to operate the process.

Herr system to recover & recycle  
phosphorus from urine without toxic  
metals, antibiotics or pharmaceuticals  
to safely grow vegetables in the garden


With the salt, tiny crystals of Phosphorus are  
caught in the fine filter bag.  
The white crystals of phosphorus need to be  
dried over the following weeks to remove  
any remaining pharmaceuticals and antibiotics.



Córas chun fosfar a baint  
agus a athchúrsáil ón fhual  
ó gach pobail & teach

People in their own houses can now easily, and using no  
harsh chemicals, recover and recycle phosphorus from  
separated urine without toxic metals, antibiotics or  
pharmaceutical, as a slow release fertiliser for vegetables.





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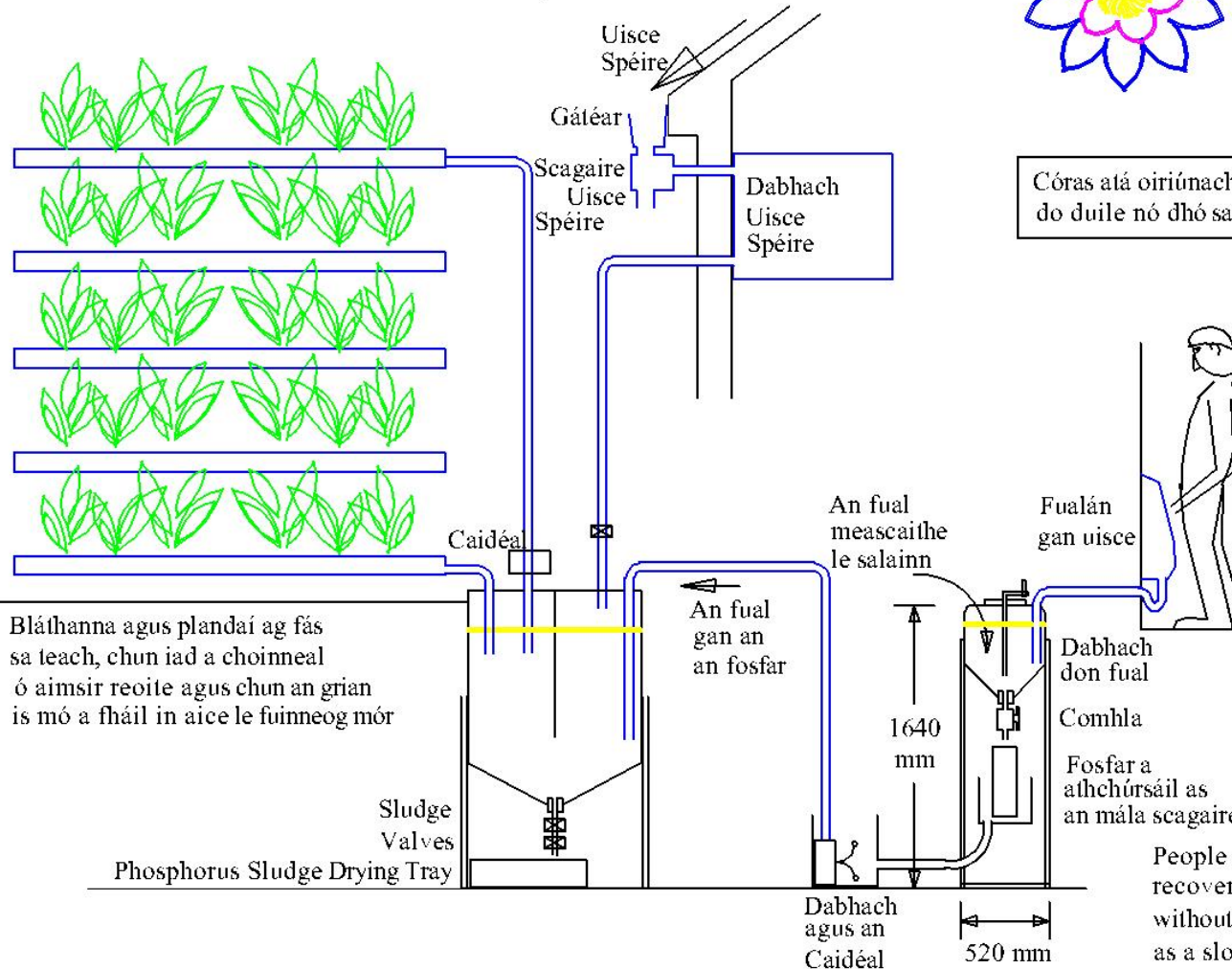
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Herr system to recover & recycle phosphorus from urine without toxic metals, antibiotics or pharmaceuticals to safely grow vegetables in the garden

With the salt, tiny crystals of Phosphorus are caught in the fine filter bag.  
The white crystals of phosphorus need to be dried over the following weeks to remove any remaining pharmaceuticals and antibiotics.

Córas chun fosfar a baint  
agus a athchúrsáil ón fhual  
ó gach teach

People in their own houses can now quite simply recover and recycle phosphorus from separated urine without toxic metals, antibiotics or pharmaceuticals, as a slow release fertiliser for vegetable gardens.

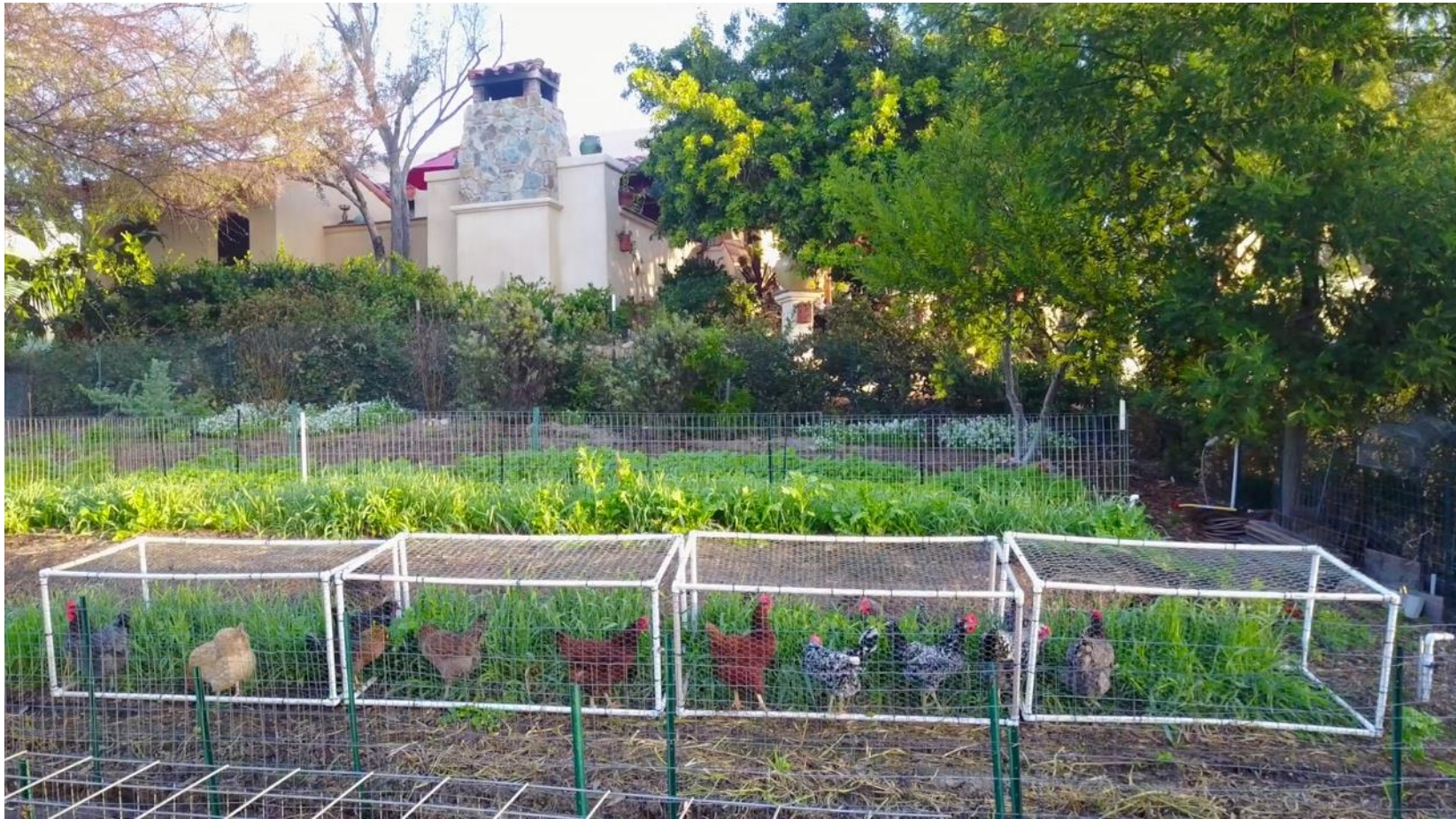






# Fertiliser and Food price inflation and shortages are now looking very probable

- How badly will future sulphuric acid shortages impact on fertiliser prices?
- How will people manage if the weekly spend for supermarket food becomes unaffordable?
- Will all the possible options for phosphorus recycling be happening at state, community and house level, to avoid a food price/ supply crisis?
- Should we see urine in a new light, as the most economically available phosphorus resource?







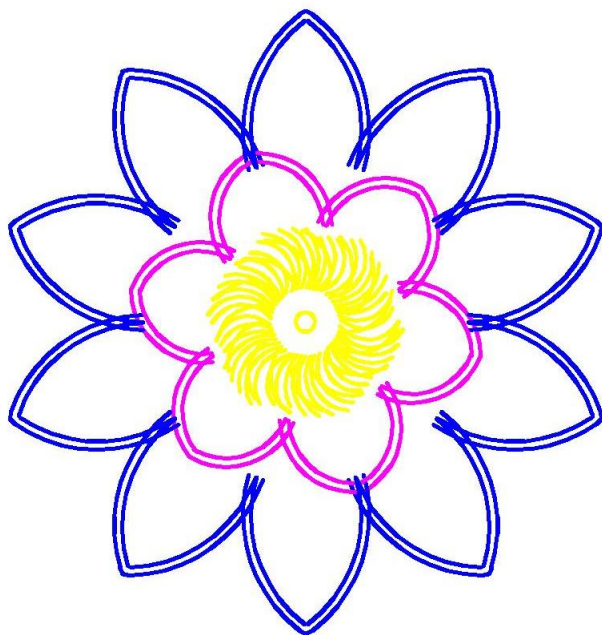








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