PHOSPHORUS
GLOBAL RESOURCES PERSPECTIVE

ESPP

BRUSSELS, December, 1st 2016

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Partner SYSTEMIQ

WORLD

IN WHICH WE LIVE

International Resource Panel

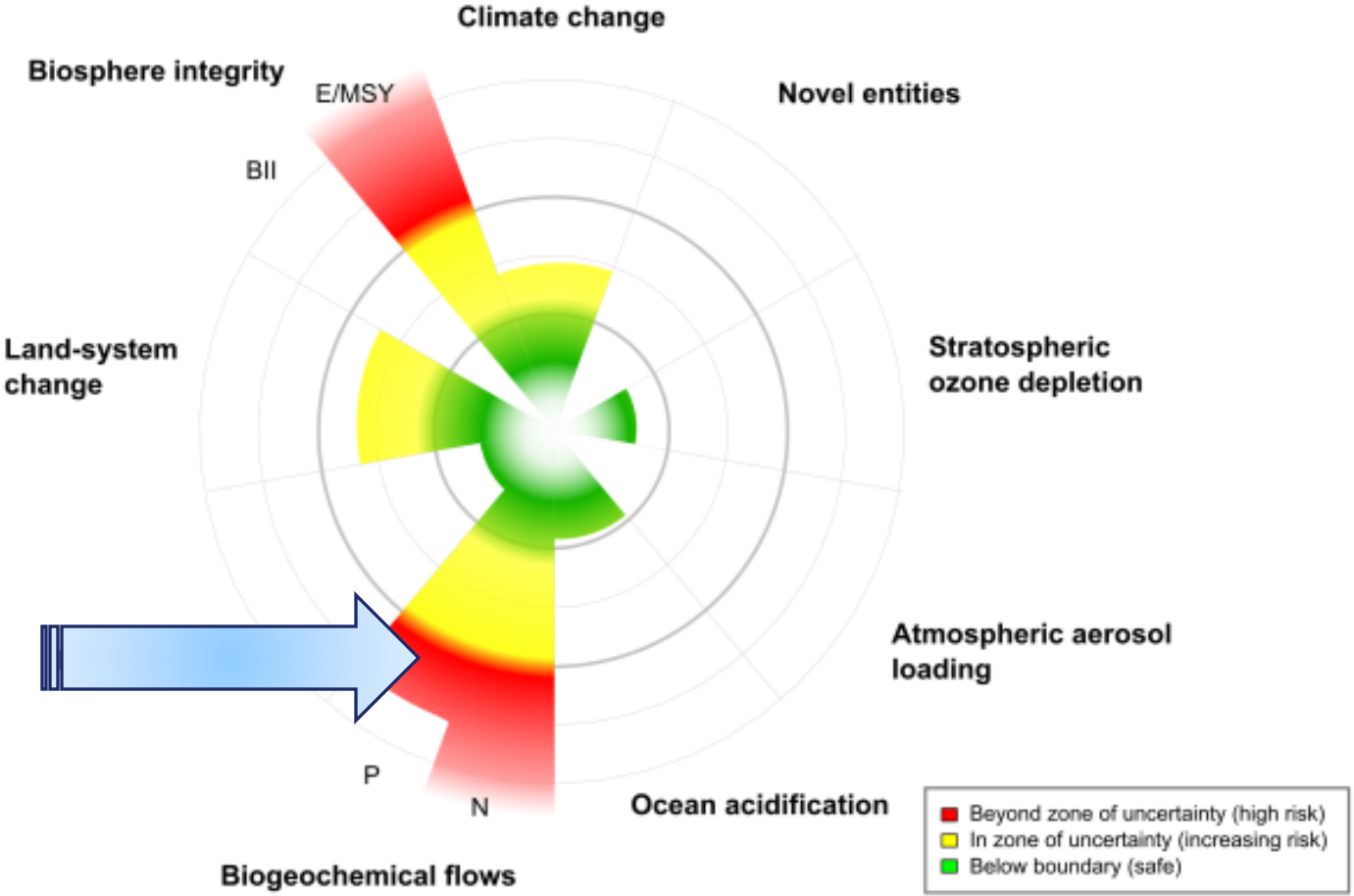
20th CENTURY

THE GREAT ACCELERATION

UNEP

- Growth of population by a factor 3.7
- Annual extraction of construction materials grew by a factor of 34, ores and minerals by a factor of 27, fossil fuels by a factor of 12, biomass by a factor of 3.6
- Total material extraction grew by a factor of 8
- GHG emissions grew by a factor of 13
- Globalisation

“PLANETARY BOUNDARIES”

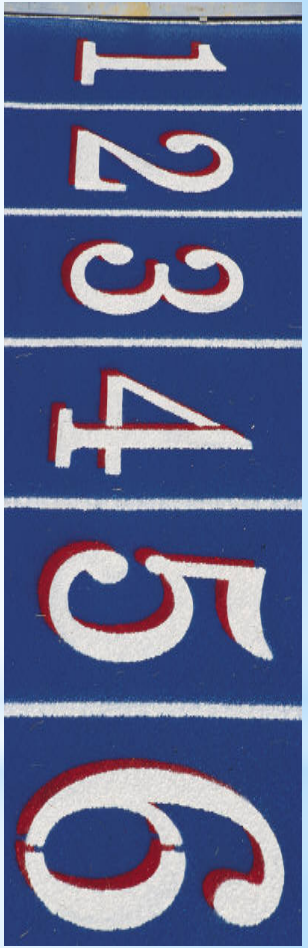


Source: Steffen et al. 2015

21th CENTURY

FACTS WE CAN NOT IGNORE

- *Population growth (2050 – 9.7 billion)*
- *Per capita consumption growth (McKinsey estimates 3 billion consumers moving from low to middle class consumption till 2030)*



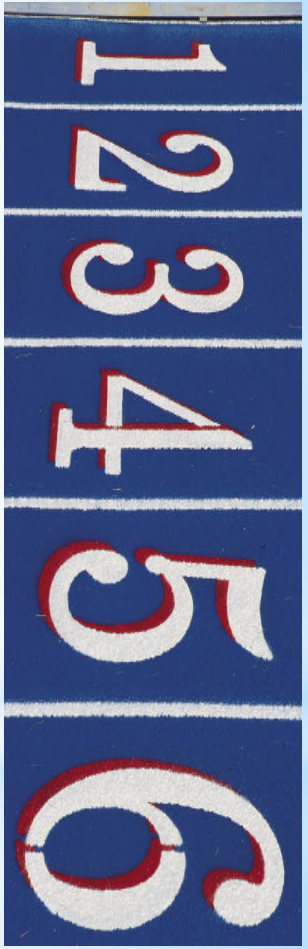
21th CENTURY

FACTS WE CAN NOT IGNORE - RAPID URBANISATION

- *52% of urban fabric expected to exist by 2050 still needs to be constructed*
- *Between 2000 and 2030 it is estimated that developing countries would have added 400,000 km2 of built-up urban area, equal to the world's built-up area in 2000*
- *In the three year period (2011-2013), China has used more cement than the USA during the entire 20th century*

21th CENTURY
FACTS WE CAN NOT IGNORE

- *Poverty and social inequality (Oxfam Report: 62 people own the same as half of the world and the richest 1% is more wealthy than the rest of the world)*
- *60% of ecosystems already degraded or used unsustainably*
- *Increasing evidence of the climate change threat*



INTERNATIONAL

DEVELOPMENTS

THE GLOBAL GOALS

For Sustainable Development

SDGs *offer unique opportunity to move to an integrated, universally relevant and potentially transformative Global Development Agenda.*

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12 SDGs ARE DIRECTLY DEPENDENT ON NATURAL RESOURCES

UNEP

International Resource Panel

UNEP

Sustainable Consumption and Production is the most efficient strategy to avoid trade-offs and create synergies to resolve the development and environmental challenges articulated in the SDGs.

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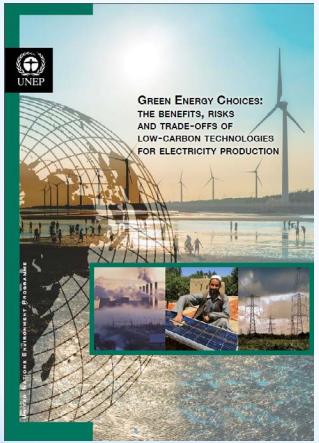
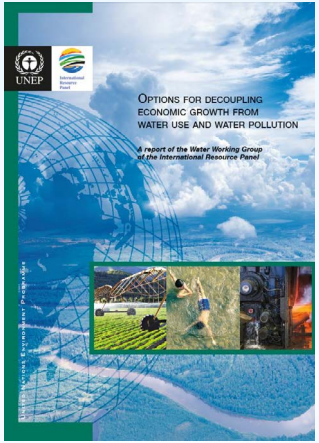
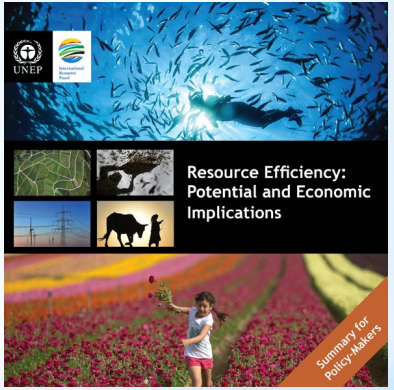
SDGs DIRECTLY DEPENDENT ON NATURAL RESOURCES

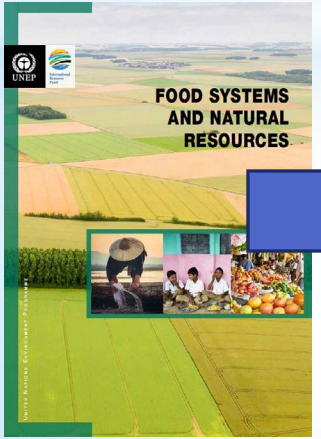
UNEP

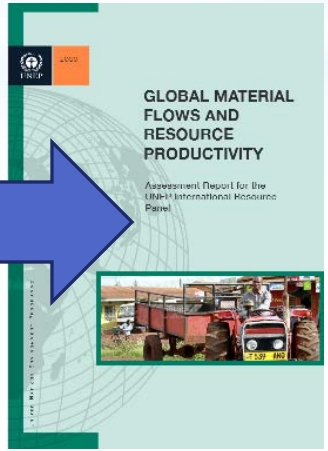
IN THE RECENT FEW MONTH ...

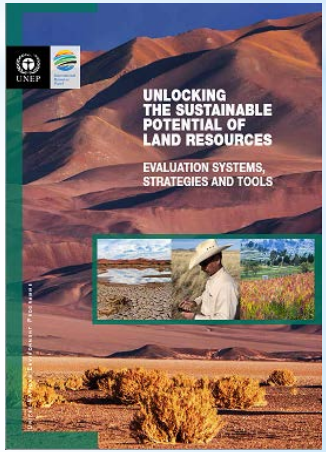












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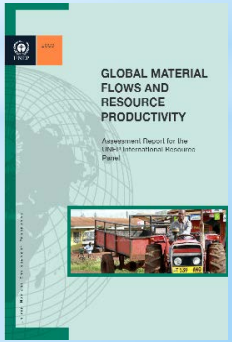
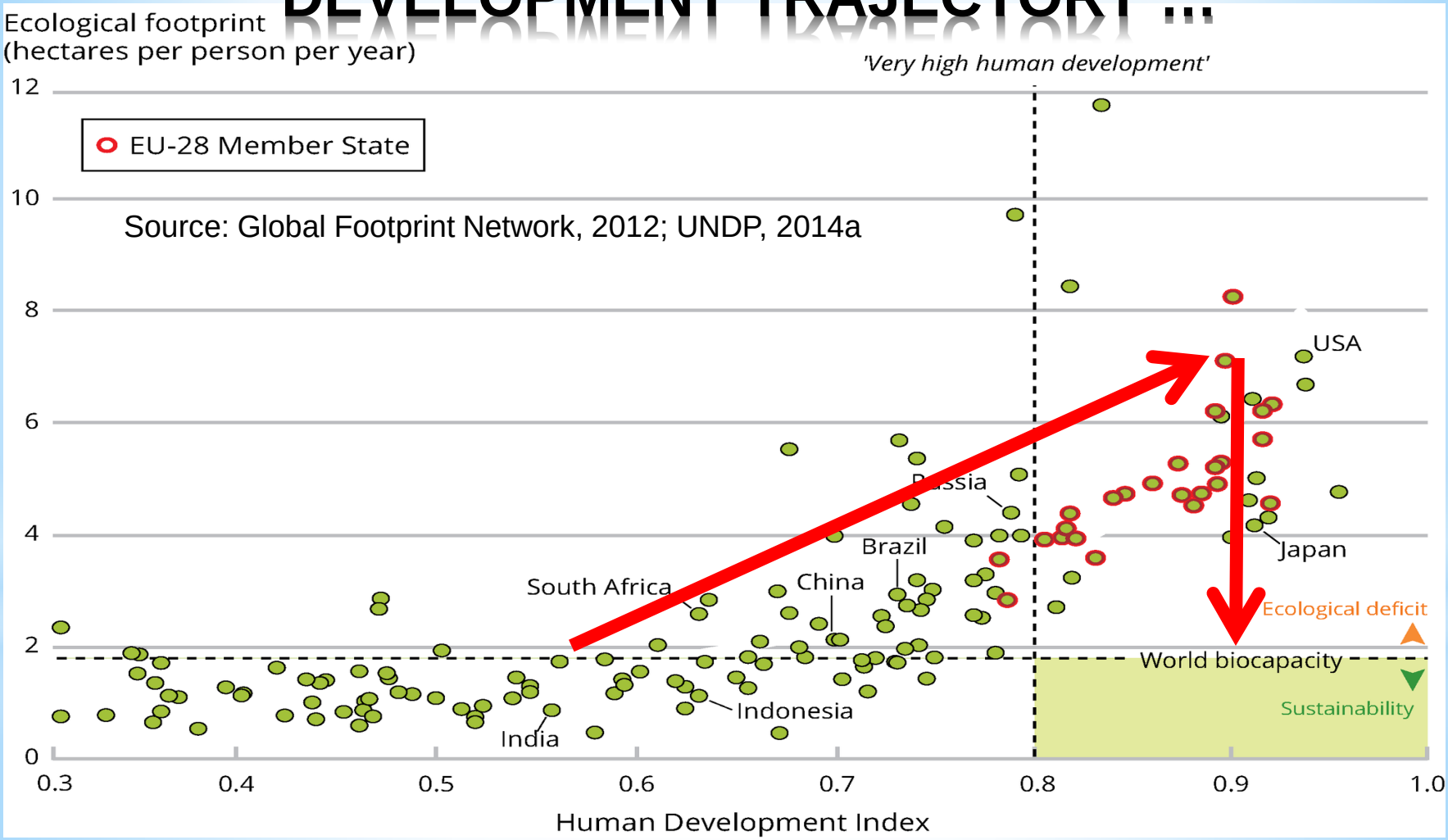
GLOBAL MATERIAL FLOWS AND RESOURCE PRODUCTIVITY

UNEP

- *Consumption has been stronger driver of growth in material use that population growth*
- *Since 2000 material efficiency has declined - global economy needs more materials per unit of GDP. Production has shifted from material efficient countries to countries that have lower material efficiency*
- *The richest countries consume on average 10 times more materials as the poorest*
- *The level of well-being achieved in wealthy industrial countries cannot be generalised globally based on the same system of production and consumption*



DEVELOPMENT TRAJECTORY …



AND …

SOLUTIONS

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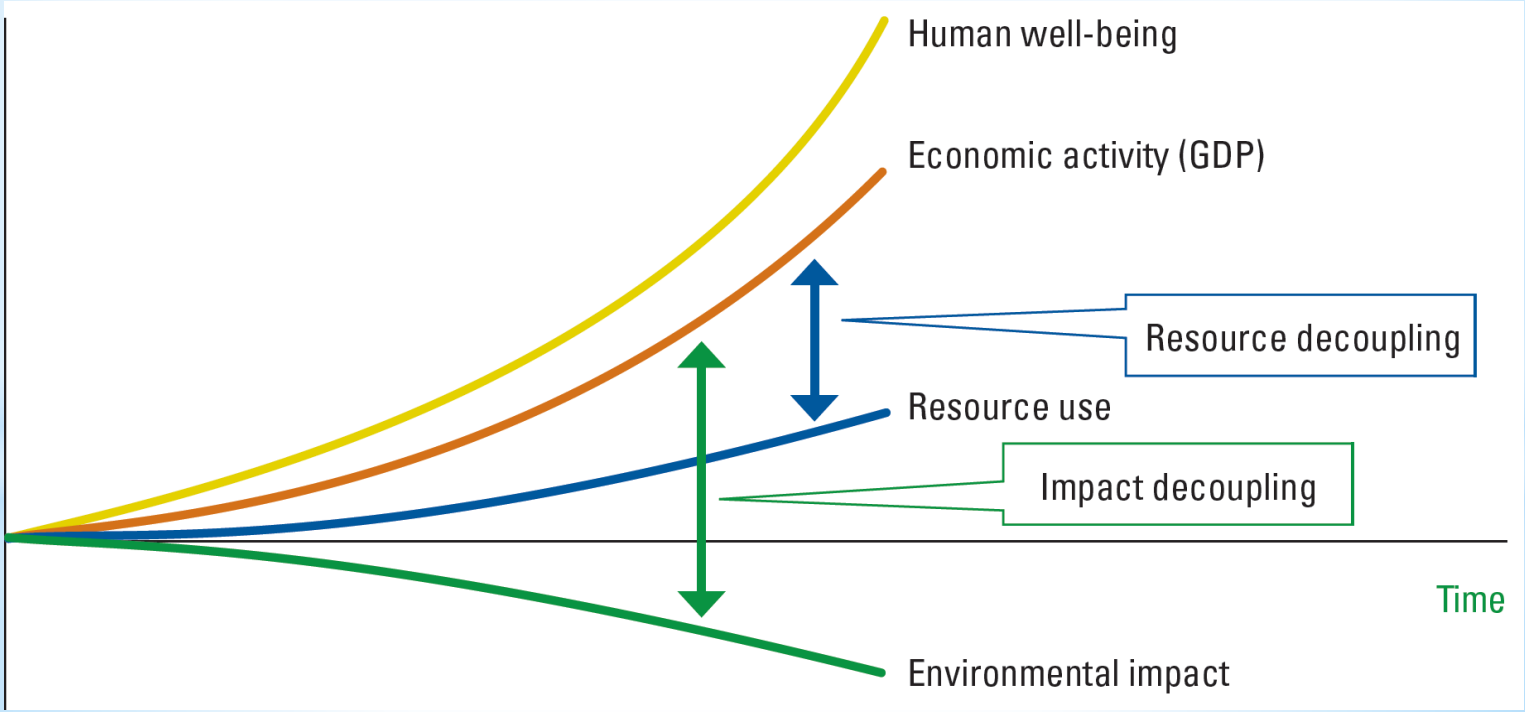
DECOUPLING IS THE IMPERATIVE OF MODERN ENVIRONMENTAL AND ECONOMIC POLICY

UNEP



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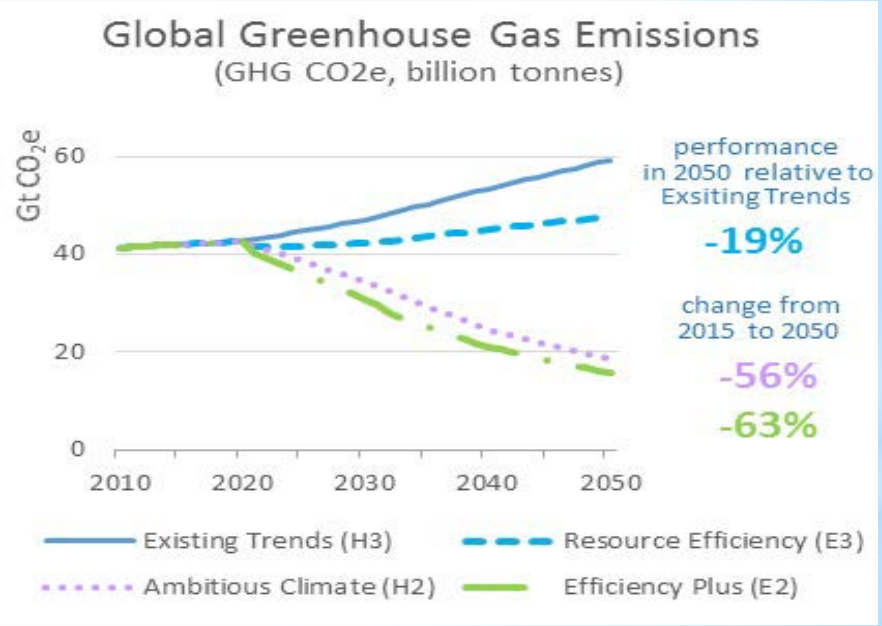
DECOUPLING AND RESOURCE EFFICIENCY POTENTIAL

UNEP

"Improving resource efficiency is indispensable for meeting climate change targets cost effectively"




CLIMATE
CARBON MANAGEMENT
LAND
WATER
GHG
MATERIALS
DECOUPLING
RESOURCES
RESILIENT SUSTAINABLE ECONOMY

PRINCIPLE

1

Preserve and enhance natural capital by controlling finite stocks and balancing renewable resource flows

PRINCIPLE

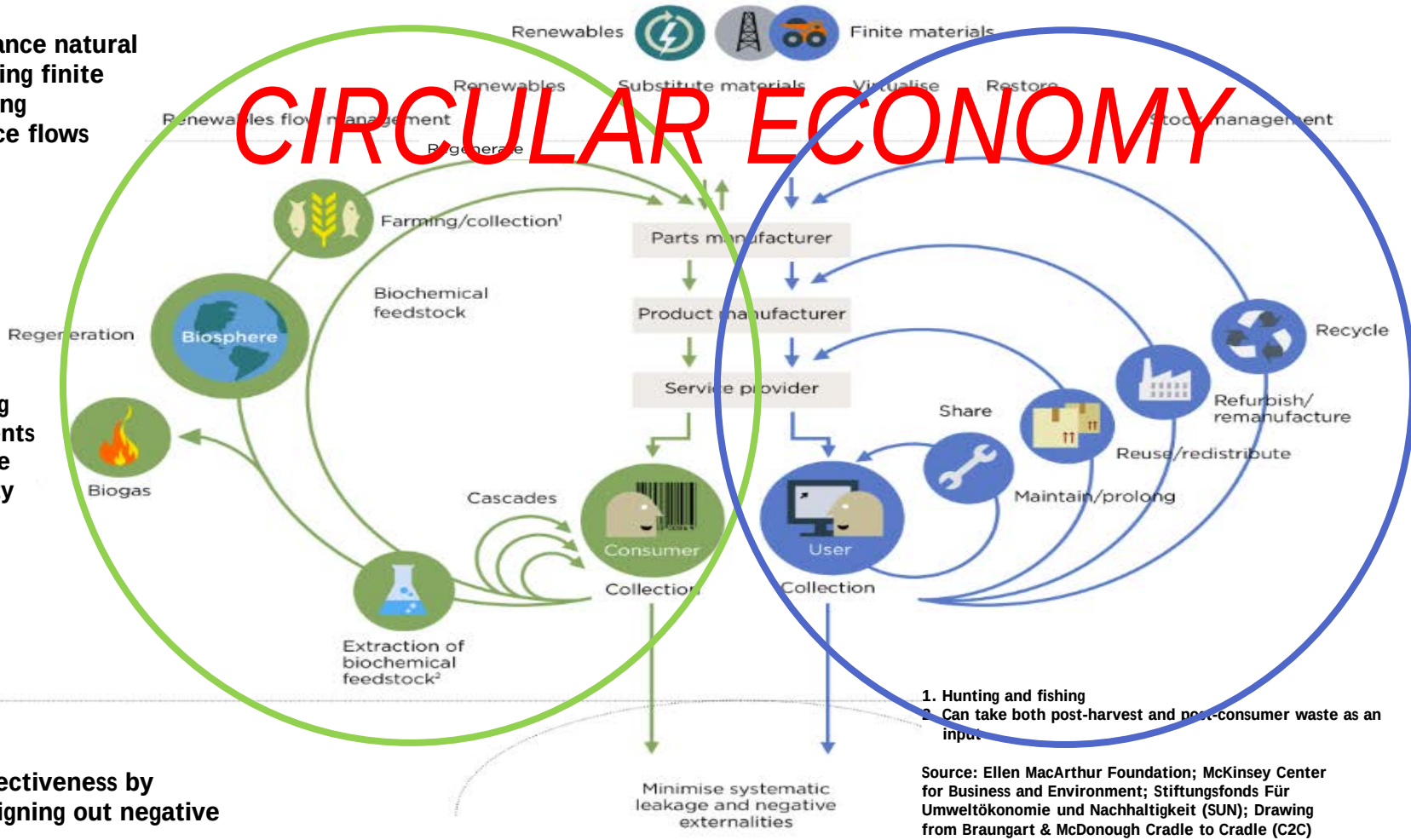
2

Optimise resource yields by circulating products, components and materials in use at the highest utility at all times in both technical and biological cycles

PRINCIPLE

3

Foster system effectiveness by revealing and designing out negative externalities



1. Hunting and fishing
2. Can take both post-harvest and post-consumer waste as an input

Source: Ellen MacArthur Foundation; McKinsey Center for Business and Environment; Stiftungsfonds Für Umweltökonomie und Nachhaltigkeit (SUN); Drawing from Braungart & McDonough Cradle to Cradle (C2C)

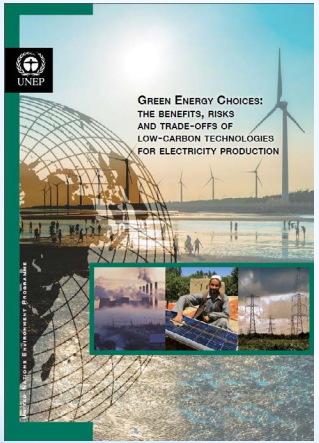
PHOSPHOROUS AND FOOD SYSTEM

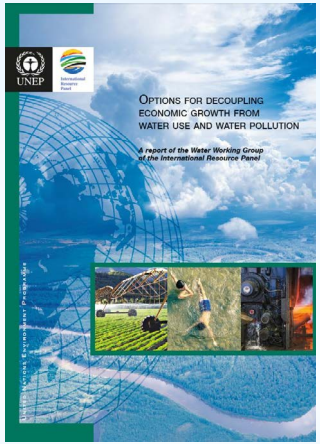
90-95 % of world phosphate rock goes to agriculture, around 85 % to fertilisers and 5-10 % to animal feed

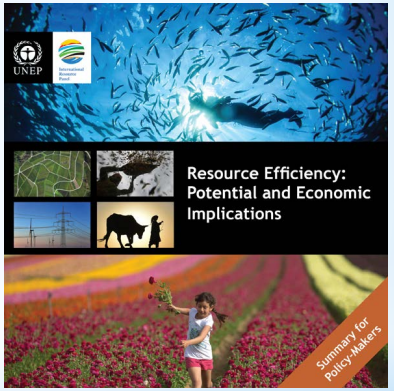
Food system is therefor critical for P and P is critical for the food system

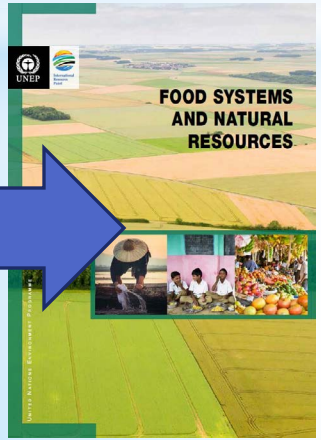
Even if our focus today is on P in industry this fact can not be ignored since it is influencing on the all P users and overall P availability

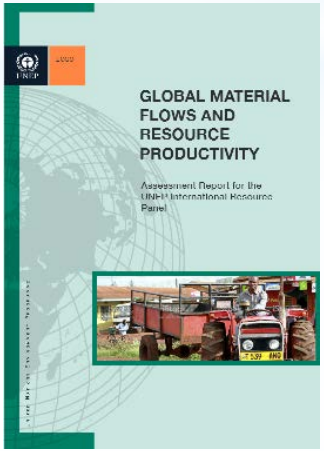
IN THE RECENT FEW MONTH ...

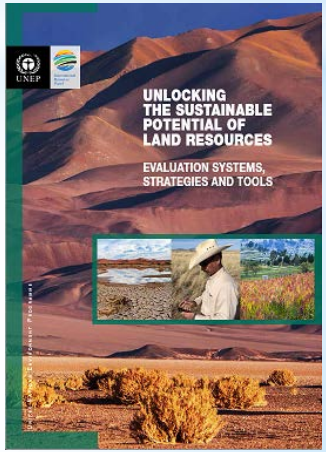












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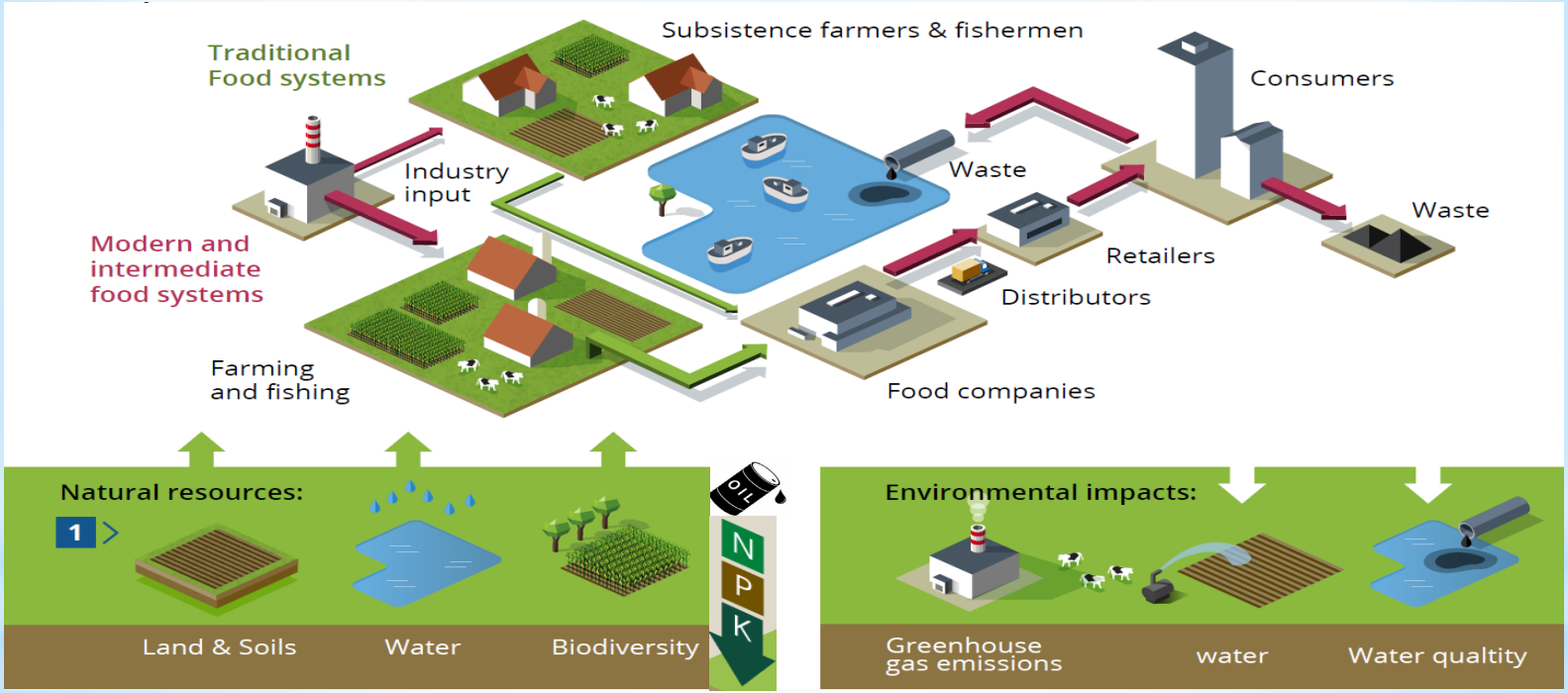
Food systems are at the heart of the 2030 agenda for sustainable development

The food we grow, harvest, process, trade, transport, store sell and consume is the essential connecting thread between people, prosperity, and planet

FOOD SYSTEMS DIFFER WIDELY GLOBALLY

often interconnected – and depending on the same resources



Critical shifts No 8: Reconnect mineral flows between urban areas and rural areas, as well as between crop and livestock production

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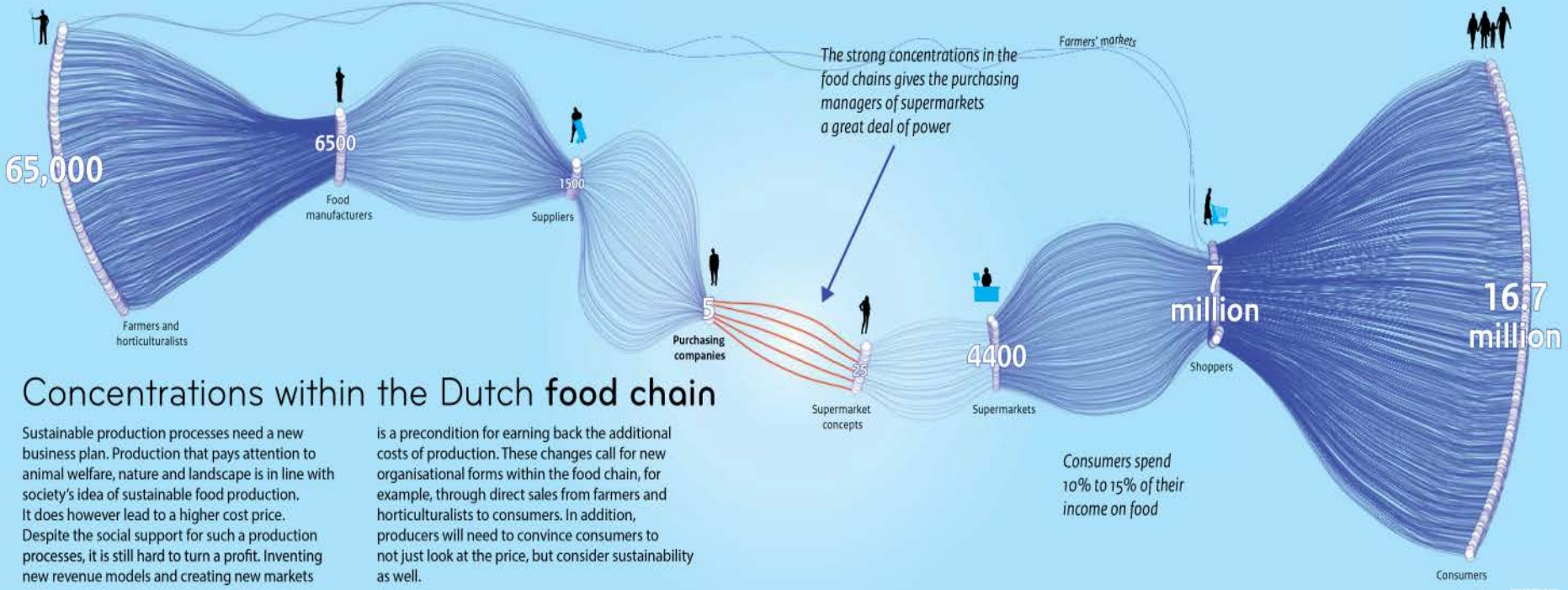
CONCENTRATION OF POWER IN THE WESTERN-TYPE FOOD CHAIN

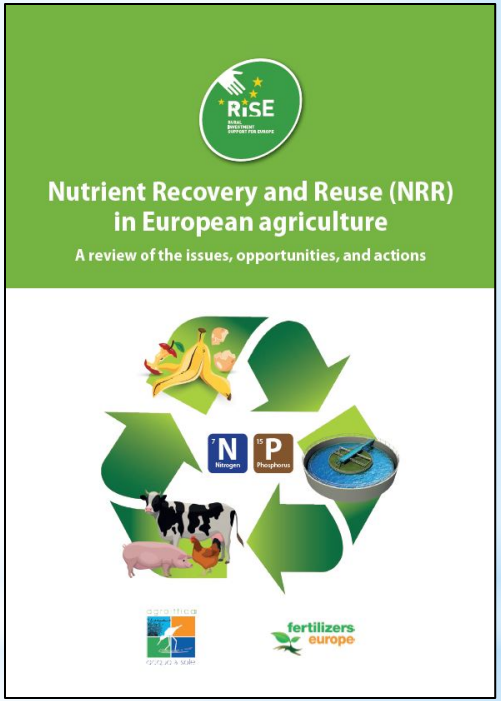
UNEP



Concentrations within the Dutch **food chain**

Sustainable production processes need a new business plan. Production that pays attention to animal welfare, nature and landscape is in line with society's idea of sustainable food production. It does however lead to a higher cost price. Despite the social support for such a production processes, it is still hard to turn a profit. Inventing new revenue models and creating new markets is a precondition for earning back the additional costs of production. These changes call for new organisational forms within the food chain, for example, through direct sales from farmers and horticulturalists to consumers. In addition, producers will need to convince consumers to not just look at the price, but consider sustainability as well.

NUTRIENT RECOVERY AND REUSE IN EUROPEAN AGRICULTURE



NUTRIENTS FACTS

***20 century**: feeding the larger, better-fed, longer-living human population*

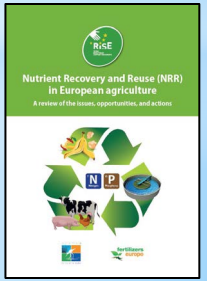
***Exponential growth** in nutrient use is **overwhelming the absorptive capacity** of natural nutrient cycles*

*Nutrient use has relatively **low efficiency and high leakage in 4 sectors**:*

- *Fertilizing crops with manure and mineral fertilizers*
- *Feeding livestock and managing their waste*
- *Processing food and feeding humans*
- *Managing human waste*

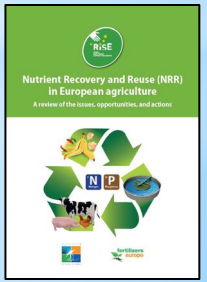
***Four signs** of this over-extended system:*

- *Eutrophication of waters (N and P)*
- *Pollution of air – nitrogen oxides, particulates, ammonia*
- *Greenhouse gases – nitrous oxide and methane*
- *Damage to terrestrial and aquatic/marine biodiversity*



CHARACTERISTICS OF MATERIAL FLOWS OF NUTRIENTS

- *Large volumes, of highly dilute, heterogeneous, material*
- *Continuous daily flows, multiple sources, spatially dispersed, but use of fertilizers is highly seasonal*
- *Multiple decentralized, relatively small production units for recovery*
- *Compared to fertilizers: relatively heterogeneous inputs and products*
- *Safety concerns: presence of: heavy metals, pathogens, pharmaceuticals, smell, in products destined to be added to soil*
- *Number of stakeholders involved*
- *No presumption that the products of NRR are perfect substitutes for mineral fertilizers: price, consistency, nutrient content and availability*
- *Workable business models not yet widely known*



FIVE GOALS AND CONCERNS FOR NUTRIENTS

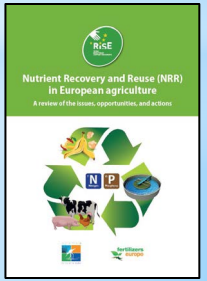
FOOD PRODUCTION

FARM VIABILITY

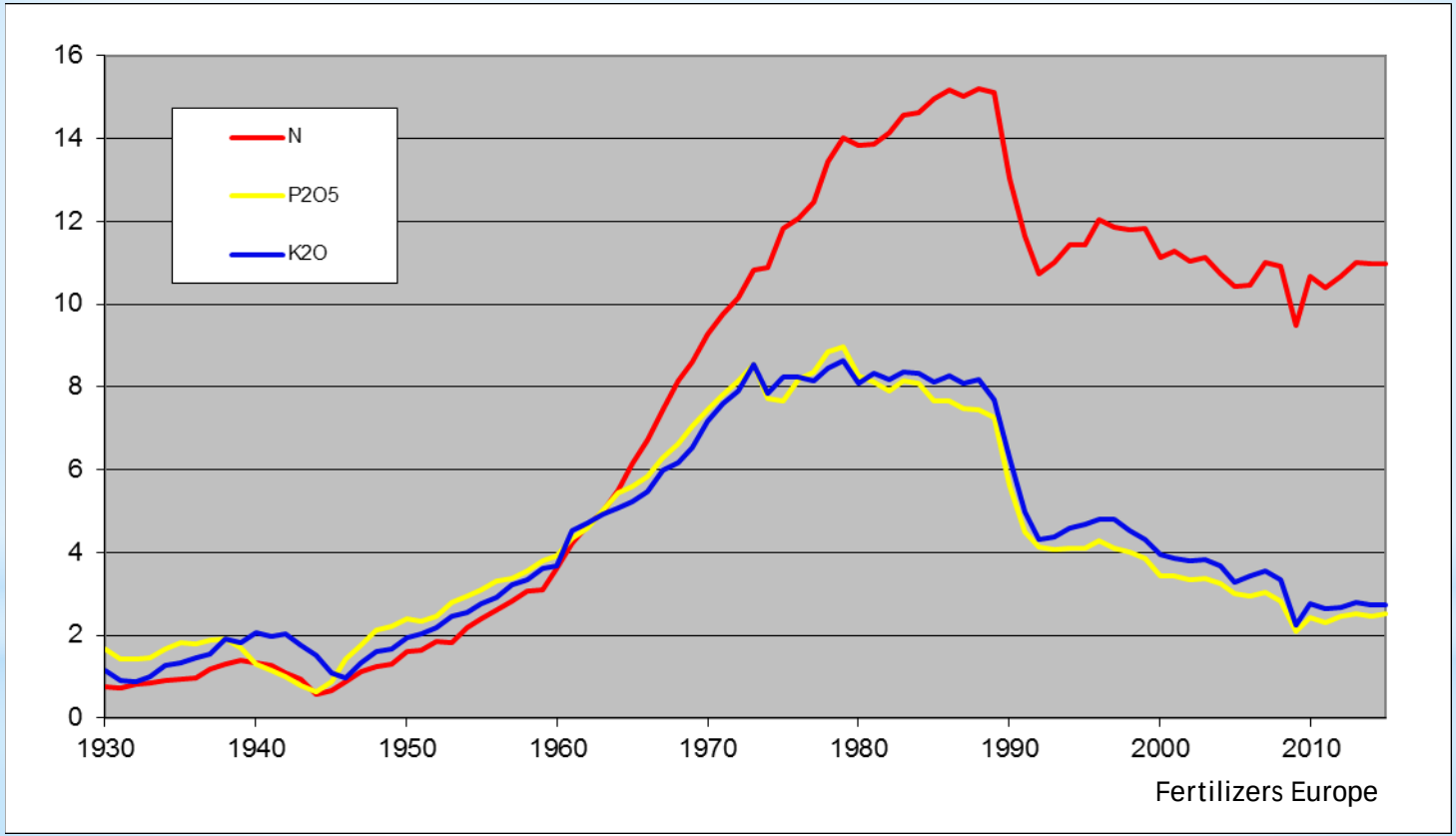
REDUCTION AND RECYCLING OF FOOD CHAIN WASTE

POLLUTION OF WATER, AIR, SOIL AND IMPACT ON THE CLIMATE

DEPENDENCE ON FINITE, INSECURE, NON-RENEWABLE RESOURCES

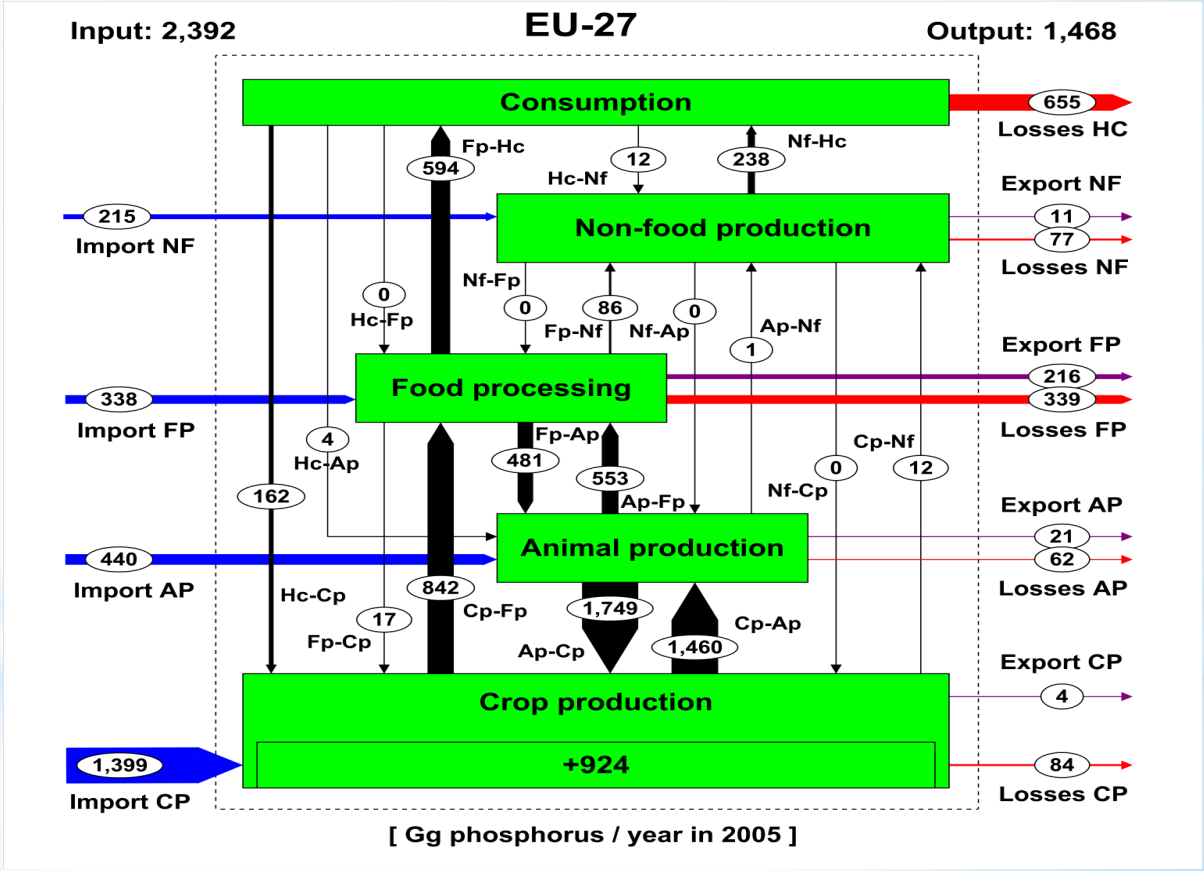


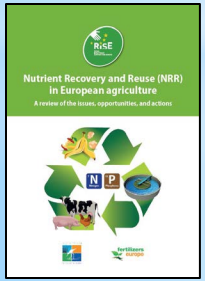
NUTRIENT USE – MINERAL FERTILISERS, 1930 -2015



PHOSPHORUS FLOWS IN THE EU27

ONLY 30% OF INPUT P REACHES HUMAN CONSUMPTION

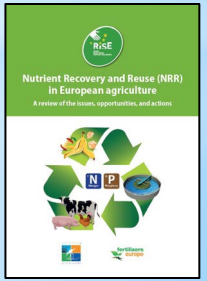




van Dijk et al. 2016

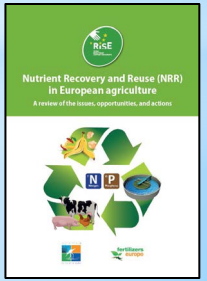
THREE LARGEST SUBSTRATE FLOWS FOR NRR IDENTIFIED

- ***Animal manure***
  - *Improve handling, storage and application of manure*
  - *Process manure to more concentrated product*
- ***Waste water and sewage sludge***
  - *Increase recovered amounts and recovery rates*
  - *Increase knowledge and specification of nutrient content*
  - *Address concerns about soil, plant and human health*
- ***Food chain waste (e.g. Slaughterhouse waste)***
  - *Increase recovered amounts and recovery rates*
  - *Increase knowledge and specification of nutrient content*
  - *Address concerns about soil, plant and human health*



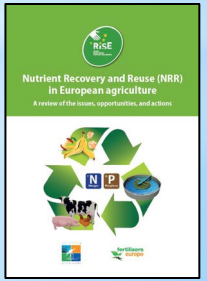
RECOMMENDATIONS (16)

1. ***Better data (2)***
2. ***Regulatory coherence (1)***
3. ***Appropriate policies to find optimal NRR contribution (5)***
4. ***Back the circular economy action plan (3)***
5. ***Consumer acceptance and land manager mobilization (4)***
6. ***Optimal level of livestock production and consumption (1)***



CRITICAL QUALITATIVE CONCLUSIONS

1. *Waste and the growing leakage of nutrients into the environment are more important challenges of nutrients management and a more urgent threat to food sustainability/security than resource finiteness*
2. *Security/reliability of EU supply of P and natural gas may be a serious challenge*



PHOSPHOROUS AND INDUSTRY

Phosphate rock is however essential for a whole range of industries

- *Electronics – production of microchips*
- *Fire safety – replacing halogenated flame retardants*
- *Pharmaceuticals, Medical applications, Agrochemicals*
- *Food additives, for example non toxic food preservatives*
- *Catalyst and Chemicals*
- *Other new innovative applications with high potential for society, such as new compounds for batteries, safer than lithium ion*
- *…*

ESPP ROLE

ESPP is active in addressing phosphorous sustainability and phosphorous recycling in both:

- *The agri-food system, in particular at present with the revision of the EU Fertiliser Regulation, phosphorous recycling from sewage, manure, and food industry by-product streams, and addressing improved phosphorous use in agriculture and livestock production*
- *Industrial applications of phosphorous*
- *It also makes the link between the two worlds of phosphorus (agricultural fertilisers, manure, sewage – and industrial):*
  - *technologies developing to recover P as high-quality industrial form;*
  - *links between agronomy, bio-chemistry, medicine, industrial chemistry*

TO CONCLUDE …

SUSTAINABLE, LOW-CARBON, CIRCULAR, GREEN, RESOURCE EFFICIENT, ENERGY EFFICIENT, DECOUPLING, 3Rs, ECOLOGICAL CIVILISATION, C2C, BIOECONOMY, ECO-ECONOMY, BLUE …

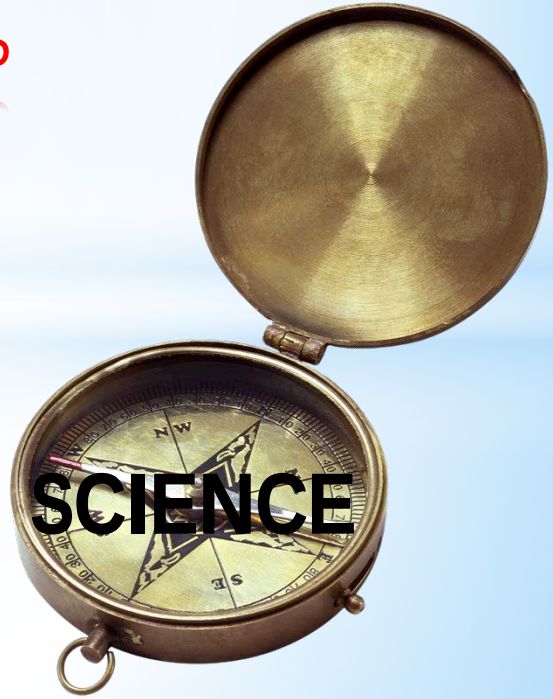
- *What we actually talk about*

WE HAVE TO FIX A BROKEN COMPASS

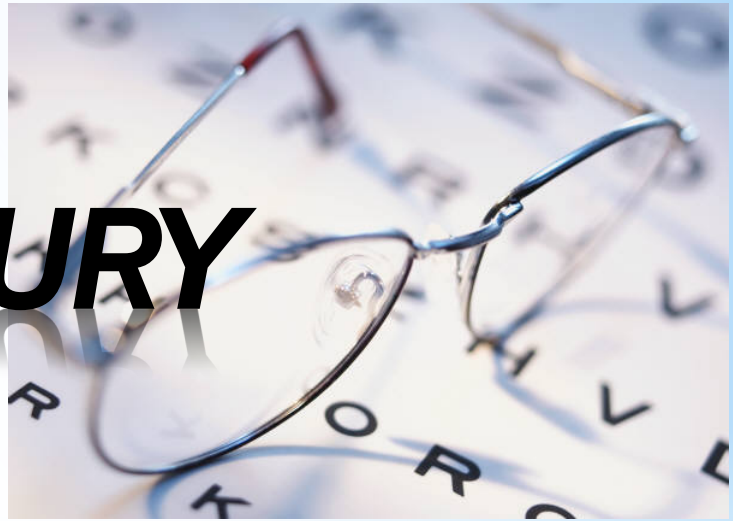
(PAVAN SUKHDEV)

NEW ECONOMIC MODEL BASED ON SCP INTEGRATING ALL THREE PILLARS OF SUSTAINABILITY IS

NECESSARY AND UNAVOIDABLE



21st CENTURY



FROM FRAGILITY TO SUSTAINABILITY

INCREASED RESPONSIBILTY

MARKETS
CANNOT ENSURE EFFICIENCY IN THE ALLOCATION AND USE OF RESOURCES …

- *If prices do not reflect the true value and costs of resources,*
- *If rewards to capital are disproportionate to other inputs (finacial capital is overvalued, human capital is undervalued and natural capital in many cases not valued at all)*
- *If managers on annual contracts are induced to make short term investment decisions overly influenced by bonuses based on short term share price,*
- *If …*

Better regulation

is not about less regulation, it is about creating the conditions for confidence to invest in technologies for the markets of the future, coupled with appropriate incentives to make the markets viable.

- *KNOWLEDGE (Creation)*
- *INNOVATION (Incentives)*
- *PRODUCTS (Design)*
- *CONSUMERS (Behaviour)*
- *BUSINESS MODELS (Sharing Products to services)*

Any global transition is a major new opportunity for the innovation, new development opportunities, new jobs

And alternative …
I would rather not think and talk about it!

ENVIRONMENT
ECONOMY

International Resource Panel

UNEP

THANK YOU

www.unep.org/resourcepanel