Circular economy interaction with climate policies, ecosystem services, biodiversity, and human health: Insights from GEO-6 and GRO 2019

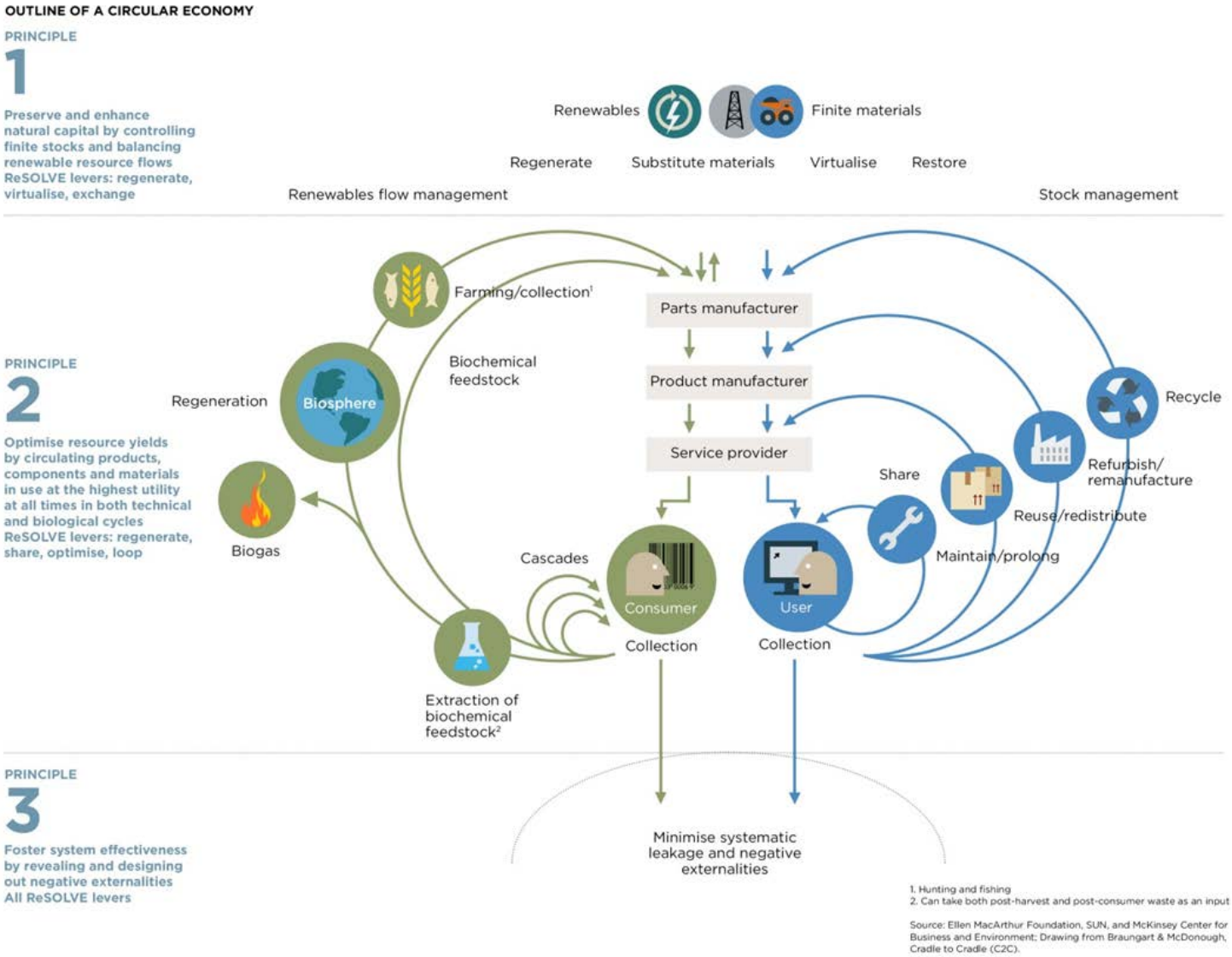
Presentation to the LCS-RNet 11TH Annual Meeting

Paul Ekins
Professor of Resources and Environmental Policy
University College London

ENEA, Rome October 17th 2019

Circular economy: historical background

- Kenneth Boulding 1966 'The Economics of the Coming Spaceship Earth'
- Athelstan Spilhaus 1966 'Resourceful Waste Management', 1970 'The Next Industrial Revolution; industrial ecology
- Walter Stahel 1977/1981 *Jobs for Tomorrow*, 1982 'The Product-Life Factor'
- David Pearce and Kerry Turner 1990 *Economics of Natural Resources and the Environment*
- Circular economy as new development strategy in China in 2002
- Ellen MacArthur Foundation 2013



Source: EMF 2013, p.24, https://www.ellenmacarthurfoundation.org/circular-economy/infographic

Definitions

- "A circular economy is an **industrial** system that is **restorative** or **regenerative** by intention and design. … It replaces the 'end-of-life' concept with restoration, shifts towards the use of **renewable energy**, eliminates the use of **toxic chemicals**, which impair reuse, and aims for the **elimination of waste** through the **superior design** of materials, products, systems, and, within this, **business models**." (EMF 2013, p.7)
- "Circular economy describes an **economic** system that is based on **business models** which replace the 'end-of-life' concept with **reducing, alternatively reusing, recycling and recovering** materials in production/distribution and consumption processes, thus operating at the **micro** level (products, companies, consumers), **meso** level (eco-industrial parks) and **macro** level (city, region, nation and beyond), with the aim to accomplish **sustainable development**, which implies creating **environmental quality**, **economic prosperity** and **social equity**, to the benefit of current and future generations." (Kirchherr et al. 2017, pp.224-225)
- OECD paper: The circular economy is one that has **low environmental impacts** and that makes good use of **natural resources**, through **high resource efficiency** and **waste prevention**, especially in the manufacturing sector, and minimal end-of-life **disposal** of materials.

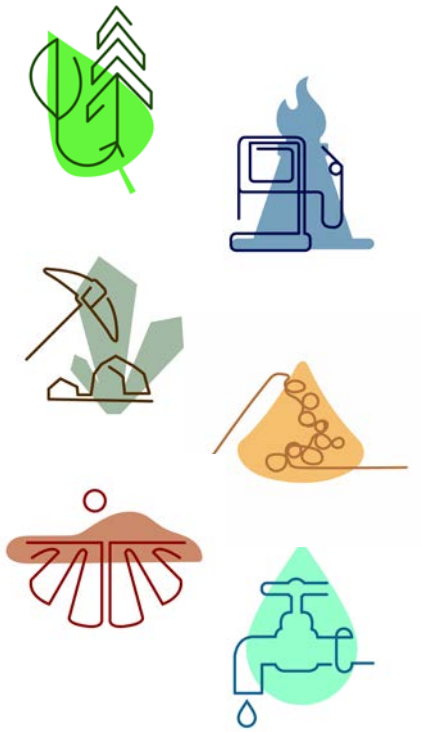
Current circularity levels

- MFA based estimations indicate that circularity, measured as the share of recyclable materials in raw material demand, is between 6-9% globally.
- EU, despite high recycling of around 40% of end-of-life products, only achieves 12-13% circularity levels
- Most studies agree to conclude that '*downscaling the overall size of social metabolism'* is also necessary, in particular, in industrial countries, in addition *'to advancing the degree of circularity*' (Haas et al., 2015)

Global Resources Outlook 2019

- ✓ **Global status and trends** on natural resources (metals, non-metallic minerals, fossil fuels, biomass, water, land).
- ✓ **Environmental, economic and social impacts** from current and future use of natural resources
- ✓ **Projections by 2060** of natural resource use and impacts under two scenarios: 'Historical Trends' and 'Towards Sustainability'
- ✓ **Policy recommendations** for economically attractive and technologically viable action to achieve sustainability goals.

Resources provide the **foundation** for the goods, services and infrastructure that make up **our current socio-economic systems**



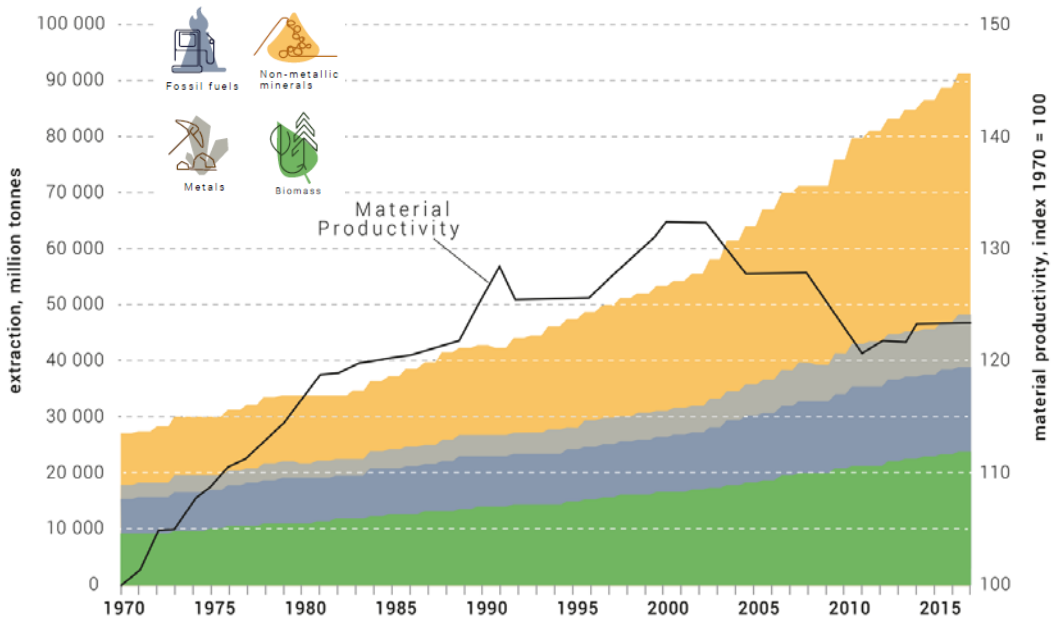
- **Biomass** (wood, crops, including food, fuel, feedstock and plant-based materials)
- **Fossil fuels** (coal, gas and oil)
- **Metals** (such as iron, aluminum and cooper…)
- **Non-metallic minerals** (including sand, gravel and limestone)
- **Land**
- **Water**

The use of natural resources has more than tripled from 1970, and continues to grow

92 billion tons of global extraction

12.2 tons materials demand per capita

Global material extraction and material productivity, 1970 - 2017



Myth: Technological advancement is making the global economy more resource efficient.

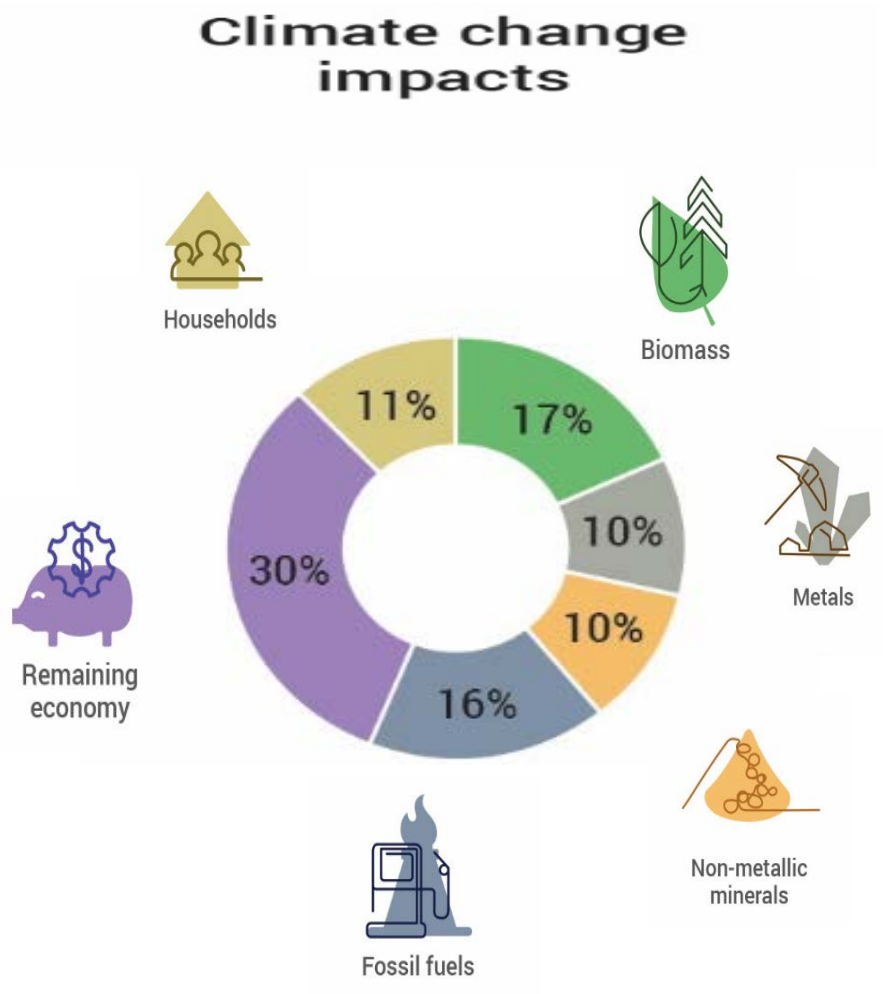
Fact: Some (high-income) countries are becoming much more efficient but **global productivity has not improved** in the last 20 years

Historical and current patterns of natural resource extraction, processing and use are resulting in increasingly negative impacts on the environment and human health

50% of global climate change impacts

90% of global biodiversity loss and water stress

11% of global species loss



Impacts of natural resource extraction and processing

Historical and current patterns of natural resource natural resource extraction, processing and use are resulting in **increasingly negative impacts** on the environment and human health

50% of global climate change impacts

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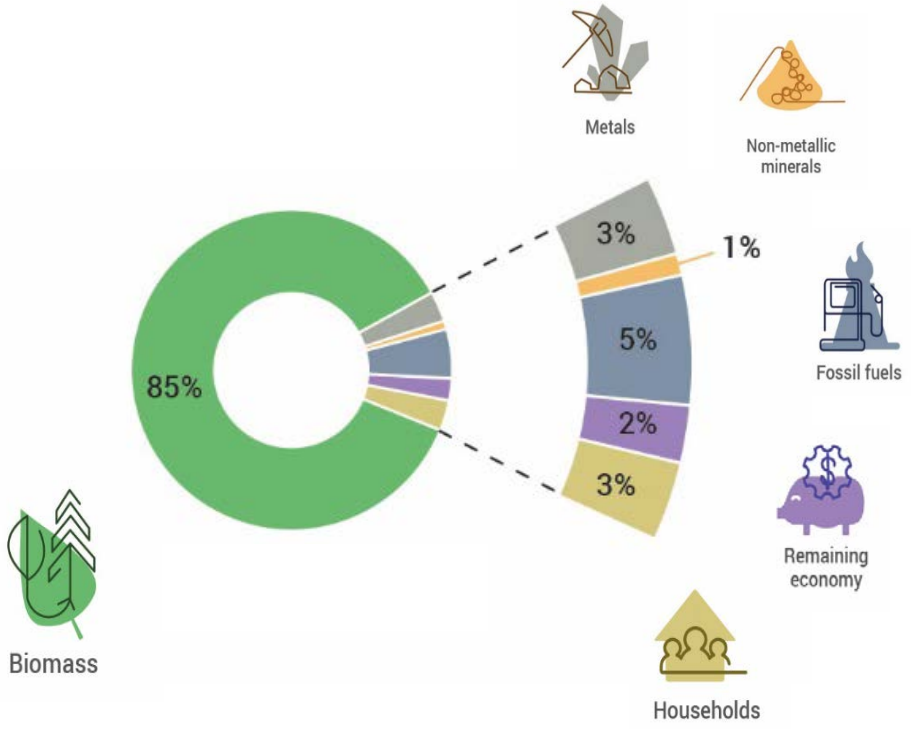
Water Stress Impacts



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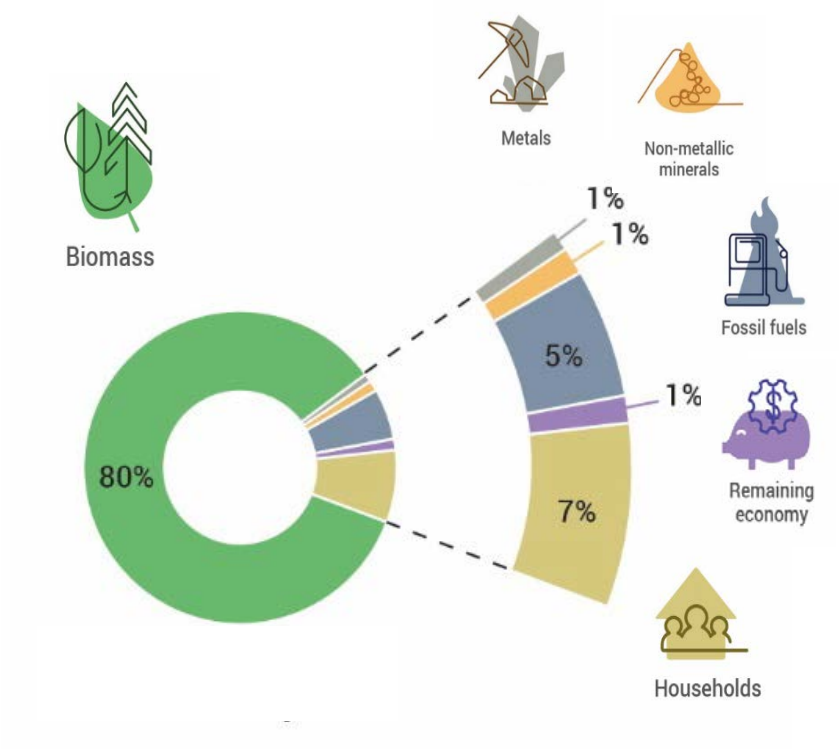
Land Use Related Biodiversity Loss



Impacts of natural resource extraction and processing

The use of natural resources and the related benefits and environmental impacts are unevenly distributed across countries and regions

The per capita material footprint from high-income countries is:

60% higher than the upper-middle-income group

13x the level of the low-income groups.

The per capita environmental impacts high-income countries is:

3-6x those of the low-income groups.

The use of natural resources and the related benefits and environmental impacts are unevenly distributed across countries and regions

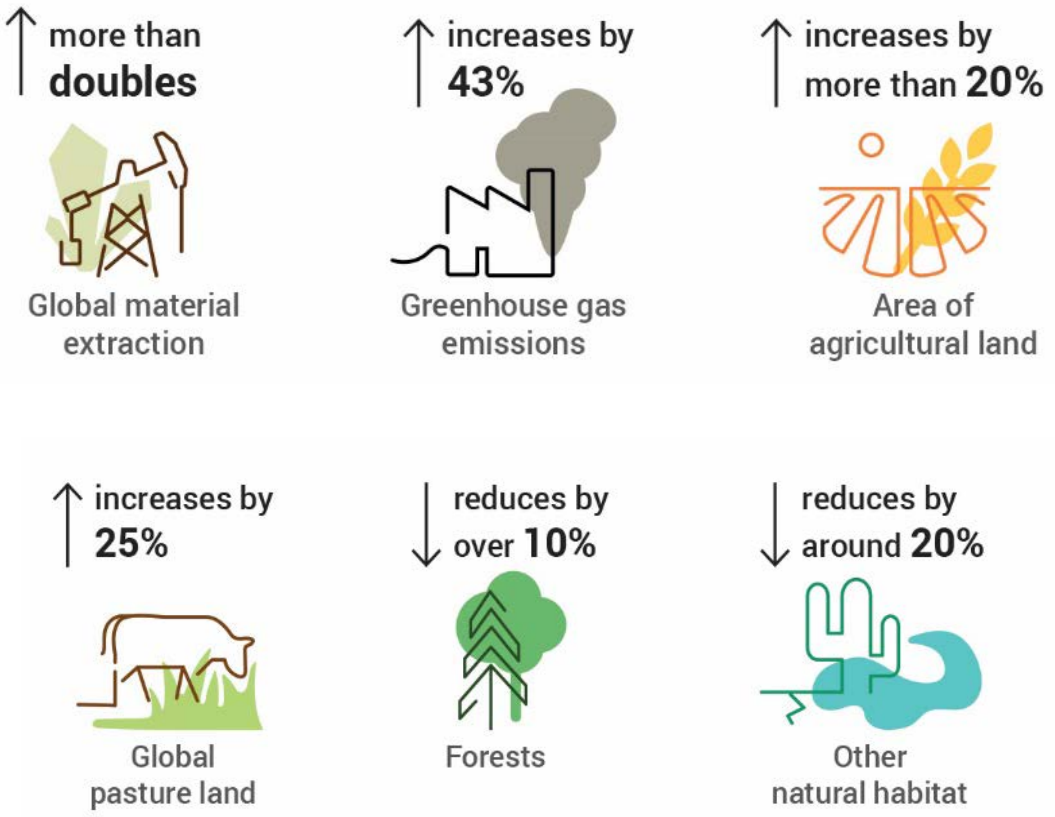
Rise of the upper-middle-income nations

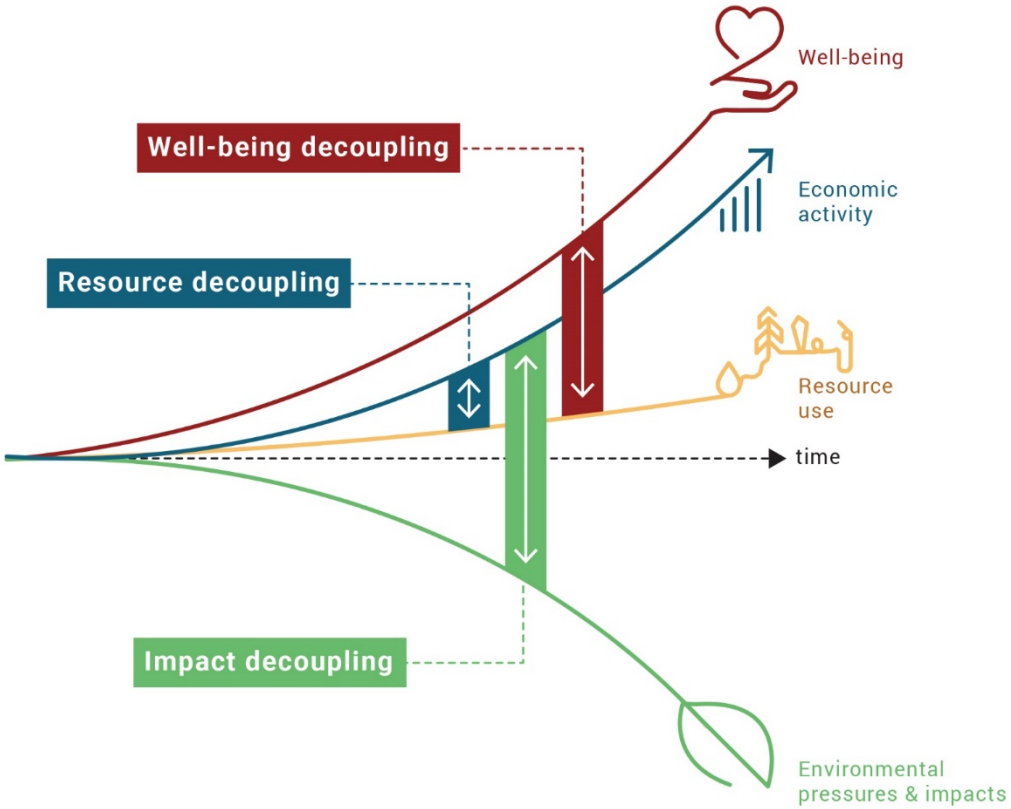
56% of the global share of domestic material consumption in 2017

Higher per capita material consumption than the high-income group as of 2012

Practically **no change** for low income countries despite needing it the most

Without urgent and concerted action, rapid growth and inefficient use of natural resources will continue to create unsustainable pressures on the environment.

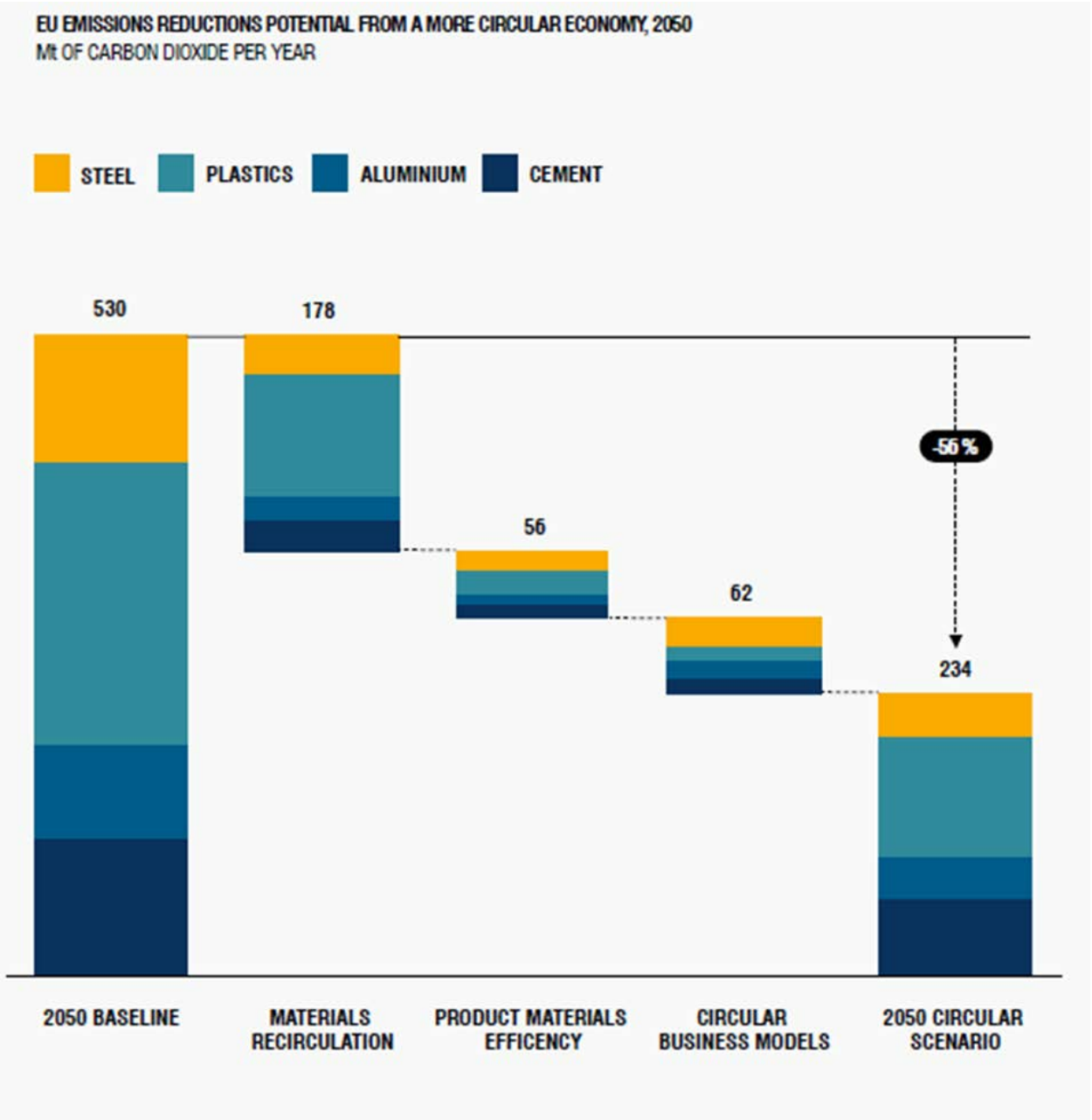




The **decoupling** of natural resource use and environmental impacts from economic activity and human well-being is an **essential** element in the transition to a **sustainable future.**

Environmental and resource implications of moves towards a circular economy (1)

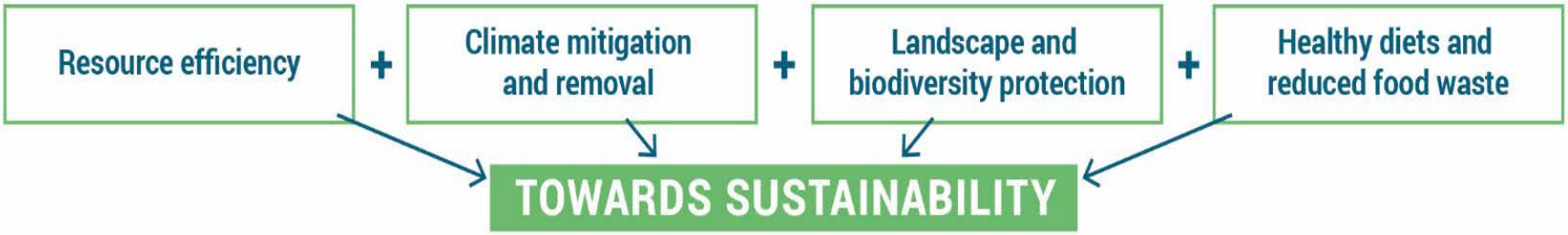
- Plausible that increasing the length of time that materials stay in the economy will reduce the extraction of virgin materials below what they would otherwise have been and associated environmental impacts – but empirical evidence scarce
- Recycling of energy-intensive materials and products can lead to substantial reductions in CO2 emissions
- Whether there are other net environmental benefits of 9Rs need to be determined through LCAs
- 'Zero waste' is most unlikely to be environmentally beneficial



Environmental and resource implications of moves towards a circular economy (2)

Source: Material Economics 2018, Exhibit 1.5, p.19

Achieving decoupling is possible and can deliver substantial social and environmental benefits, including repair of past environmental damage, while also supporting economic growth and human well-being



The *Towards Sustainability* scenario shows that changes in policies and behaviors can achieve decoupling of natural resource use and environmental impacts from economic growth and human wellbeing.

Towards Sustainability scenario assumptions

Resource Efficiency

Reduction in materials use in manufacturing and construction through innovation, increased demand and recycling

Assumed policies incl. regulations, technical standards, public procurement, shifts in taxation

Climate Mitigation and Removal

Bio-sequestration and carbon dioxide removal technologies

Assumed policies: Support of innovations through public investments, carbon levy for the financing of carbon sinks

Landscape and Biodiversity Protection

Bio-diversity in bio-sequestration solutions, reducing crop-based biofuels and limiting agricultural land

Assumed policies: biodiversity conditions on GHG sequestration sinks, and policies to conserve native vegetation and key biodiversity areas

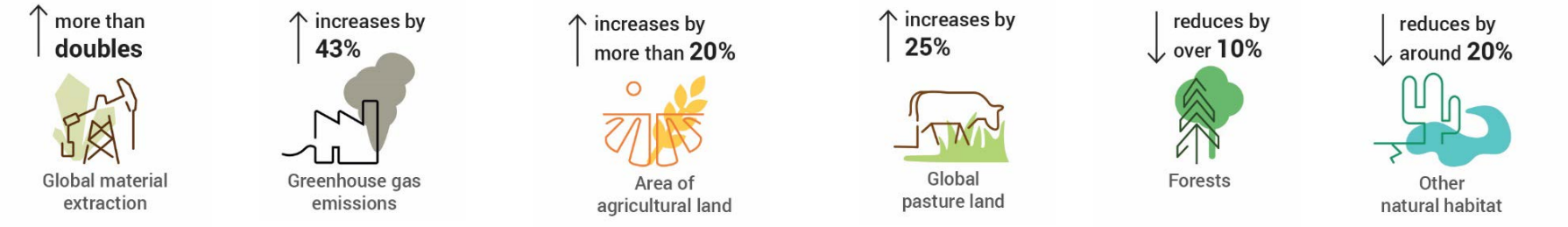
Shifts in Societal Behavior: Healthy Diets and Reduced Food Waste

Halving the current meat consumption (less in regions of low-meat diets) and halving food waste by 2050

Assumed policies: Including public education

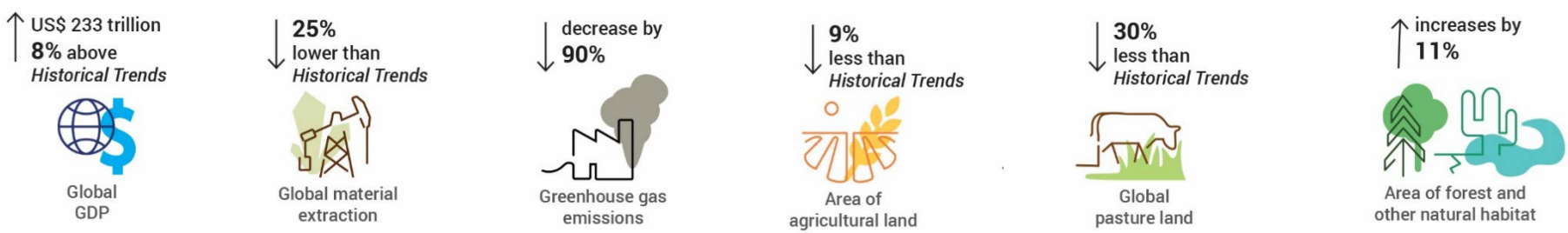
Historical Trends

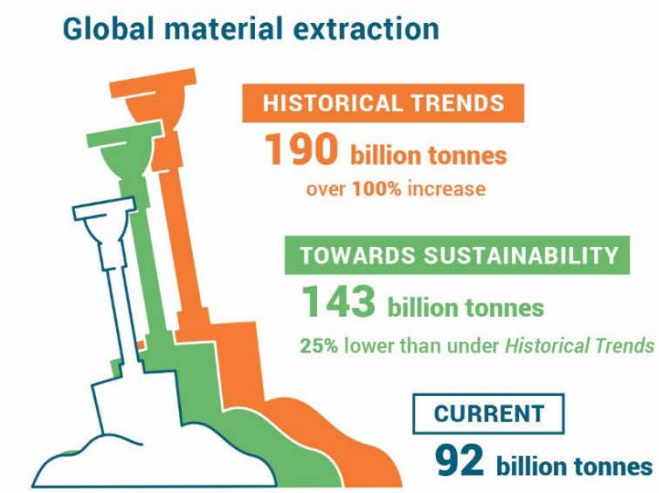
Projected 2060 compared to 2015 levels in absence of urgent and concerted action

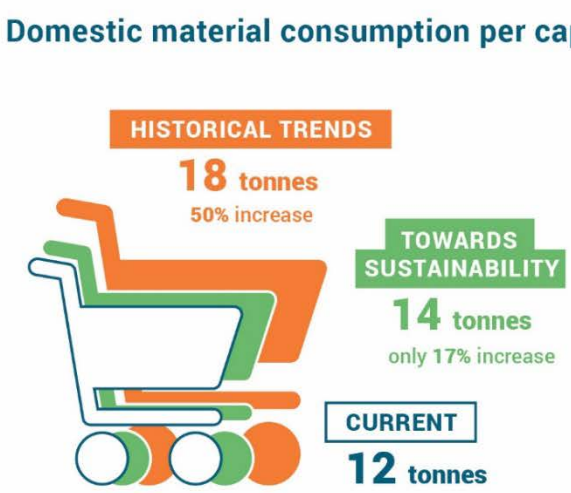


Towards Sustainability

Projected 2060 levels "Towards Sustainability" in comparison to "Historical Trends"





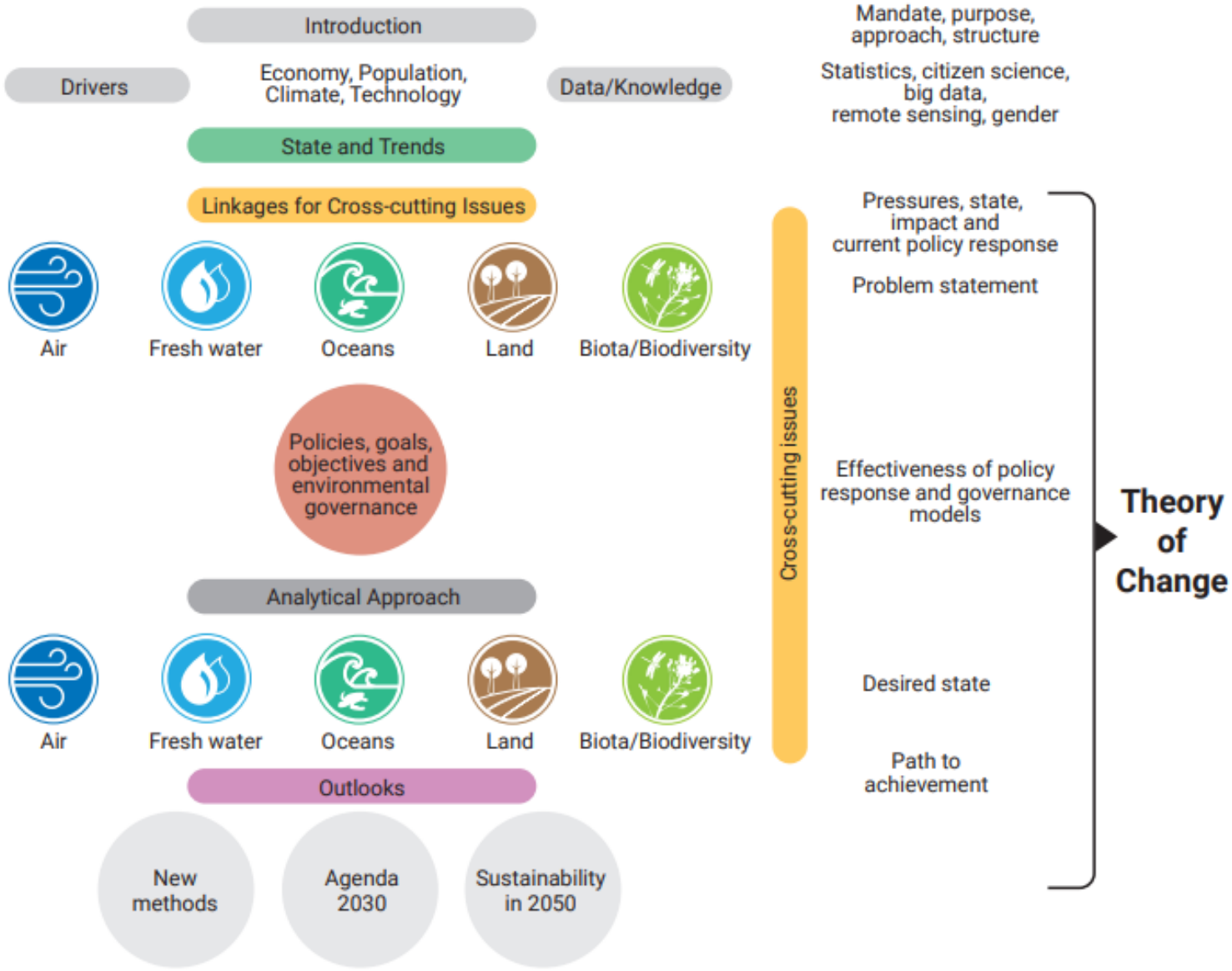


Growth rates in emerging and other developing economies must be **balanced** by absolute **reductions** in resource use in developed countries

GEO-6: The sixth Global Environment Outlook

Launched at the fourth UN Environment Assembly (UNEA-4)

March 2019, Nairobi


Introduction
Mandate, purpose, approach, structure
Drivers
Economy, Population, Climate, Technology
Data/Knowledge
Statistics, citizen science, big data, remote sensing, gender
State and Trends
Linkages for Cross-cutting Issues
Pressures, state, impact and current policy response
Problem statement
Air
Fresh water
Oceans
Land
Biota/Biodiversity
Policies, goals, objectives and environmental governance
Cross-cutting issues
Effectiveness of policy response and governance models
Theory of Change
Analytical Approach
Air
Fresh water
Oceans
Land
Biota/Biodiversity
Desired state
Path to achievement
Outlooks
New methods
Agenda 2030
Sustainability in 2050

A healthy planet supports healthy people

- Nature's contributions to humans:
  - Biodiversity, supporting, regulating, provisioning and cultural contributions;
  - 'Value': USD 125 Trillion (2011; using 2007 $);
  - Supports 70%of the world's poor to live, eat and work; and
  - Enables all economic activity and global GDP generation

An unhealthy planet damages human health

- Causes 25% of death and morbidity;
  - Air pollution (indoor/outdoor/heat) causes 7million deaths annually; could be underestimate;
  - Water pollution could become the number 1 cause of death in 2050;
  - Loss of biodiversity can lead to rise of zoonotic disease (60% of infectious disease)
  - Loss of ocean fisheries can affect protein security for 1 billion people, and jobs for millions
  - Land degradation affects 3.2 billion people's lives, livelihoods;
- Sudden-onset disasters in 2016 displaced 24.2 million people in 118 countries; three times more than conflict did.
- Between 1995 and 2015, 1.7 billion people affected by extreme weather events; killing 0.7 million people at a cost of USD 1.4 Trillion.

Drivers of an Unhealthy Planet

Driver	Policy
Population: More (10 billion in 2050) and greying	Education, gender equality, health care; Changing consumption patterns
Urbanization: 66% in 2050; increases consumption but can be more efficient; world's infrastructure will more than double in the next 20 years; informal settlements growing with people without access to services (e.g. water/sanitation)	Better design for urban settlements; more compact; spatial planning; circular economy USD 1 investment in water & sanitation could lead to USD 4.5 return
Growth: enhances welfare but is inequitable; rich pollute more; poor face more existential threats	Redefine development; de-linking growth from pollution; address inequality
Technology: enhances welfare but can be risky	Dematerialization, decarbonization, detoxification, precautionary principle
Climate change: may cross 1.5°C in 2030; cascading impacts on all sectors	Within 20 years, the energy related C budget is exhausted for a 2°C target Decarbonization; Mitigation; Adaptation

Figure 11.1: Conceptual outline of policy effectiveness analysis

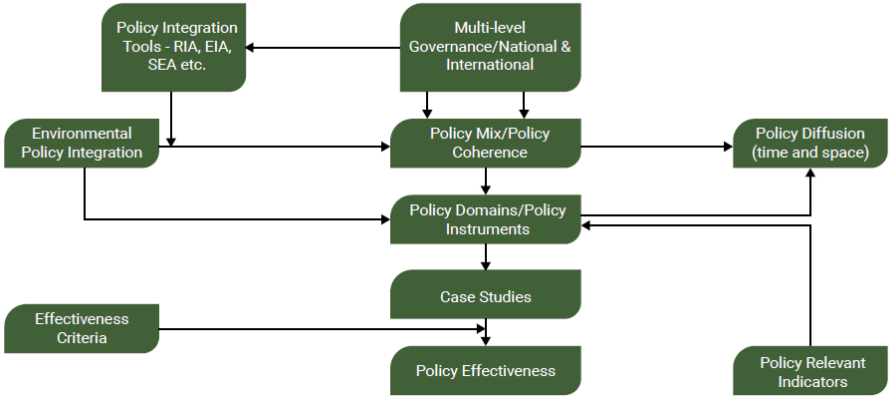
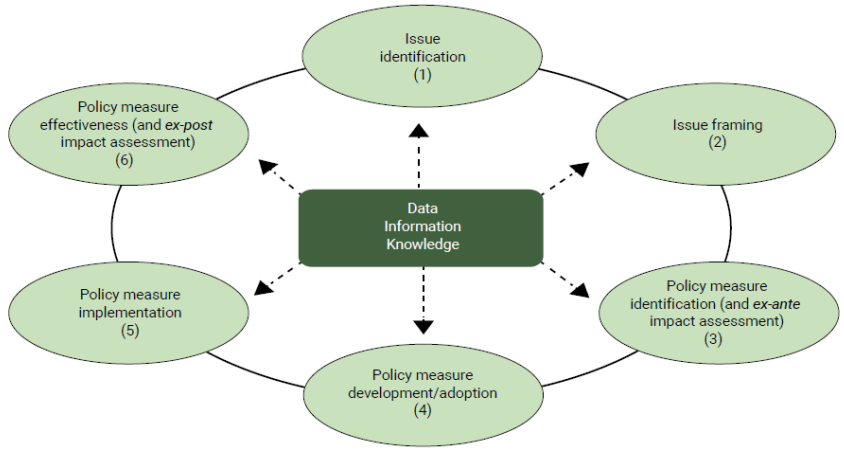


Figure 11.2: The policy cycle



Source: European Environment Agency [EEA] (2006)

Effectiveness of environmental policies

- **Policy design** – at least as important as policy choice when measuring effectiveness.
- **Effectiveness** – Not enough information is available to assess effectiveness, so policies may not reach their full potential.
- **Diffusion** –successful policies are used as role models for adoption in other countries.
- **Integration** – adding environmental concerns to other sectors of policymaking increases effectiveness.
- **Efforts are insufficient** – existing policies insufficient to address the backlog of environmental problems.
- **Systemic approaches** – transformative change by reconfiguring basic social and production systems and structures is needed.

Outlook for the future

- **Environmental dimension of SDGs and IAEGs** – not expected to be achieved under current policy scenarios.
- **All environmental areas are affected** – from climate change to biodiversity loss to water scarcity, land degradation and ocean acidification.
- **Urgent action needed** – failure to act now will lead to ongoing and irreversible impacts on the environment and human health.
- **Decarbonisation, detoxification, dematerialisation –** key priorities for development.
- **Costs** – It often costs more to clean up later than to prevent damage now, but 'grow now, clean up later' mindset still predominates.

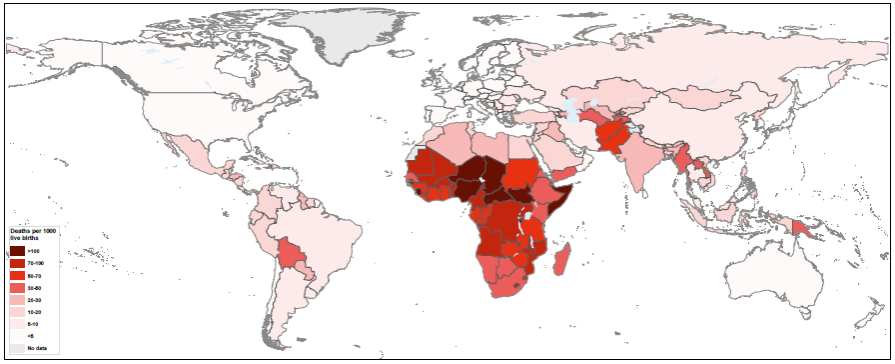
Figure SPM.8. Projected global trends in target achievement for selected Sustainable Development Goals and internationally agreed environmental goals

Human development indicators			Environmental indicators		
Related Sustainable Development Goals	Target	Projection	Related Sustainable Development Goals	Target	Projection
2	2.1 End hunger		6	6.3 Improve water quality 6.4 Reduce water scarcity	
3	3.2 End preventable deaths of children under 5		11	11.6 Improve air quality in cities	
6	6.1 Achieve universal access to safe drinking water 6.2 Universal access to adequate sanitation		13	13 Limit global warming	
7	7.1 Achieve universal access to modern energy services		14	14.1 Reduce marine nutrient pollution 14.3 Minimize ocean acidification 14.4 Sustainably manage ocean resources	
			15	15.2 Achieve land degradation neutrality 15.5 Halt biodiversity loss	

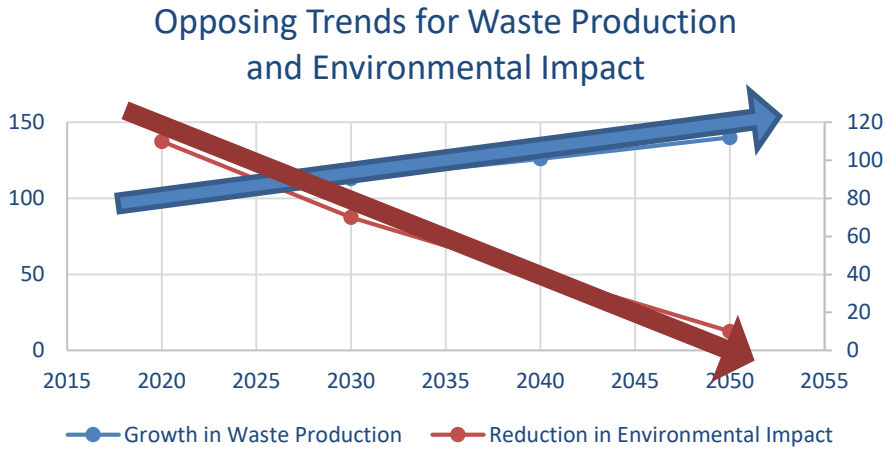
Legend

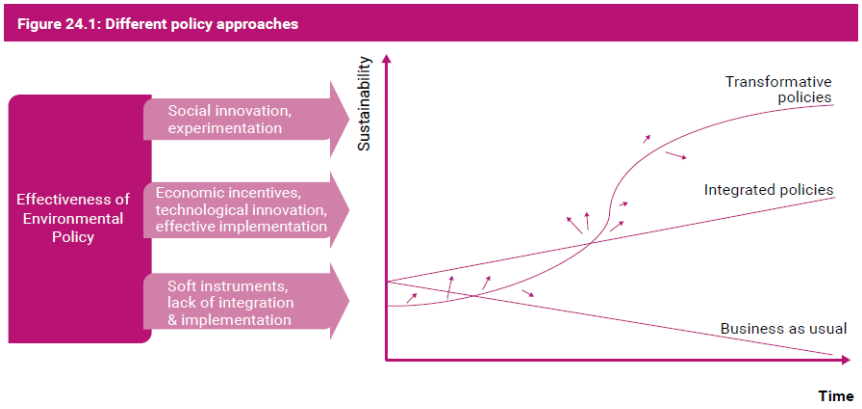
- On track to achieve target (under bbusiness-as-usual scenarios target is projected to be achieved)
- Progress towards target, but at an insufficient rate (unless effort is increased, target is projected not to be achieved)
- Moving away from target (the trend is projected to be worse, rather than better)

Figure 21.11: Projected under-five mortality rate in 2030



Source: Moyer and Hedden (2018).





The way forward

- **Healthy planet is a foundation for supporting all life forms** – we have transformed earth's natural systems and disrupted self-regulatory mechanisms and life-support systems.
- **Human health is now affected at a significant scale** – through exposure to harmful pollutants and reduced access to ecosystem services.
- **Policy innovation** – can help guide the transformative change that is needed.
- **Systemic innovation** – the key to socioeconomic development towards a sustainable world.
- **Transformative change** – is a disruptive process that goes beyond incremental improvement, but can be achieved.

Policies for a Circular Economy (1)

- Public policies may be characterised using a variety of classification frameworks. In this paper we identify five categories, adapted from those presented by the EMF's 2015 '*Delivering the Circular Economy: A Toolkit for Policymakers*' publication

Regulatory Frameworks & Instruments

- **Landfill bans for certain waste streams are common** (particularly in the EU, with recycling targets, often alongside landfill taxes for other waste streams). However, **diverted waste is often incinerated** rather than recycled, with little evidence of waste reduction
- **Extended Producer Responsibility (EPR)** instruments have been applied in most OECD countries; most commonly take-back requirements for electronic equipment. EPR **has contributed to a reduction in landfilling and an increase in recycling, but little to 'eco-design' of products**
- **'Eco-design' requirements** have generally focused on (use-phase) **energy consumption, CO_2 or local air pollutant emissions**, and have had little influence on material use
- **Bans on single-use plastic bags** have become increasingly common, with varied designs **producing highly varied results** (e.g. 90% reduction in Santa Barbara, to a negligible effect in Bangladesh)

Policies for a Circular Economy (2)

Fiscal Frameworks

- Landfill taxes widely applied (along with bans for certain waste streams), as discussed above. **Incineration taxes** increasingly applied, but **at lower effective rates**, maintaining incineration (and export) of waste as more economic, with **little impact on material re-use or recycling**
- **Deposit-refund schemes** are concentrated in beverage container and battery markets. These have often led to **high return rates** (and reduction in littering), **but little evidence on improving original design of products**
- **Taxes on virgin materials** (exc. energy products) **are rare**, and where they have been used, have **had limited effect** due to low rates, relative price inelasticity, and exemptions

Education, Information & Awareness

- **Environmental labelling and information schemes (ELIS) have proliferated** in recent years, with most being voluntary, and focusing on the methods of production of goods and services. However, **overlapping schemes and opaque methodologies produces confusion and concerns of 'greenwashing'**

Policies for a Circular Economy (3)

Public Procurement & Infrastructure

- **84% of OECD countries have GPP policies** at central government level, but **few include resource-efficient or circular economy** considerations

Innovation Support Schemes & Collaboration Platforms

- The **level of total public RD&D** support for new technologies, practices and business models for a circular economy is **difficult to track**
- A common approach to circular innovation support is the creation of **eco-industrial parks**. Over 250 currently exist, with **two-thirds in non-OECD countries** (particularly China).

Policies for a Circular Economy (4)

Summary

- There is no 'one size fits all' policy mix, however to be effective instruments must be ***coherent***, ***consistent***, and ***credible***. However, Geng *et al* (2019) propose **five priority actions** to 'globalise' the CE:

  (1) establish a global database to capture links between resource uses

  (2) establish a global platform to share knowledge

  (3) establish international alliances to promote large-scale experimentation

  (4) develop international standards for performance measurement, reporting and accounting

  (5) develop approaches to enforcing regulations, settle disputes and implement sanctions

Economic and social implications of CE

- Many estimates of cost-savings to firms from resource efficiency, but very dependent on resource prices, transaction costs
- Macro-economic outcomes of such cost savings depend crucially on model specification, and assumptions about the macro-economy, policy implementation, and innovation
- On plausible assumptions and efficient policy implementation macro-economic gains may be expected
- Macro-economic gains may be associated with a net increase in employment, but this is very dependent on specific labour market conditions: flexibility, existing unemployment, skills availability, policy implementation (e.g. reduction in labour taxes)

The circular economy and sustainability

- Discussion of ‘sustainability’ needs to be clear on: sustainability of what?
- Core focus of circular economy thinking is resource use and environmental impact
- Circular flows of materials are consistent with a range of economic and social conditions
- Whether policies for a circular economy will increase ‘social equity’ depends on the details of their design and implementation
- Equating the circular economy with sustainability or sustainable development is generally confusing and unhelpful

Lessons from China

- In China the circular economy was established as formal government policy in 2002
- The Chinese model of regional governance goes beyond the large-scale demonstrations funded by Europe's Horizon 2020 programme
- It is more coordinated than the experimentation that occurs among EU or OECD member states.
- It is more geared toward upscaling successes.
- Focus on creating arenas for transition experiments, focused on leading firms and institutions, as in transition management and attempts at green innovation-led development in transition regions.
- Coordinated administration, with encouragement and facilitation of local experimentation provide a governance model of potential relevance to Europe.

Conclusions

- No common understanding of the CE concept, means many different things to different people, cf. sustainable development
- Early focus on resources and the environment broadened to include economic and social objectives
- If resource efficiency leads to reduced resource use and environmentally justified 9Rs are implemented, environmental and resource benefits could be achieved through CE
- Delivery of social and economic objectives of CE depends crucially on the detail of resource prices, policy implementation, technology innovation and labour market conditions
- **If the world of the future will experience resource shortages and associated price volatility due to population and economic growth, at the very least a CE is likely to be a cost-effective insurance policy**

Thank you

p.ekins@ucl.ac.uk

www.bartlett.ucl.ac.uk/sustainable