

The Second State of Natural Resources Report (SoNaRR2020)

Assessment of the Achievement of SMNR Aim 4: Contributing to a Regenerative Economy, Achieving Sustainable Levels of Production and Consumption.

Natural Resources Wales

Final Report

About Natural Resources Wales

Natural Resources Wales's purpose is to pursue sustainable management of natural resources. This means looking after air, land, water, wildlife, plants and soil to improve Wales's well-being, and provide a better future for everyone.

Evidence at Natural Resources Wales

Natural Resources Wales is an evidence-informed organisation. We seek to ensure that our strategy, decisions, operations and advice to Welsh Government and others are underpinned by sound and quality-assured evidence. We recognise that it is critically important to have a good understanding of our changing environment.

We will realise this vision by:

- Maintaining and developing the technical specialist skills of our staff;
- Securing our data and information;
- Having a well resourced proactive programme of evidence work;
- Continuing to review and add to our evidence to ensure it is fit for the challenges facing us; and
- Communicating our evidence in an open and transparent way.

Title: **SoNaRR2020 Aim 4: Contributing to a Regenerative Economy, Achieving Sustainable Levels of Production and Consumption**

Lead Author: **R Elliott**

Contributors: **J Gossage**

Peer Reviews: Internal and external peer review

Restrictions: None

The Second State of Natural Resources Report (SoNaRR2020) contents

This document is one of a group of products that make up the second State of Natural Resources Report (SoNaRR2020). The full suite of products are:

Executive Summary. Foreword, Introduction, Summary and Conclusions. Published as a series of webpages in December 2020

The Natural Resource Registers. Drivers, Pressures, Impacts and Opportunities for Action for eight Broad Ecosystems. Published as a series of PDF documents and as an interactive infographic in December 2020

Assessments against the four Aims of SMNR. Published as a series of PDF documents in December 2020:

SoNaRR2020 Aim 1. Stocks of Natural Resources are Safeguarded and Enhanced

SoNaRR2020 Aim 2. Ecosystems are Resilient to Expected and Unforeseen Change

SoNaRR2020 Aim 3. Wales has Healthy Places for People, Protected from Environmental Risks

SoNaRR2020 Aim 4. Contributing to a Regenerative Economy, Achieving Sustainable Levels of Production and Consumption

The SoNaRR2020 Assessment of Biodiversity. Published in March 2021

Assessments by Broad Ecosystem. Published as a series of PDF documents in March 2021:

Assessment of the Achievement of SMNR: Coastal Margins

Assessment of the Achievement of SMNR: Enclosed Farmland

Assessment of the Achievement of SMNR: Freshwater

Assessment of the Achievement of SMNR: Marine

Assessment of the Achievement of SMNR: Mountains, Moorlands and Heaths

Assessment of the Achievement of SMNR: Woodlands

Assessment of the Achievement of SMNR: Urban

Assessment of the Achievement of SMNR: Semi-Natural Grassland

Assessments by Cross-cutting theme. Published as a series of PDF documents in March 2021:

Assessment of the Achievement of SMNR: Air Quality

Assessment of the Achievement of SMNR: Climate Change

Assessment of the Achievement of SMNR: Energy Efficiency

Assessment of the Achievement of SMNR: Invasive Non-native Species

Assessment of the Achievement of SMNR: Land use and Soils

Assessment of the Achievement of SMNR: Waste

Assessment of the Achievement of SMNR: Water Efficiency

Updated SoNaRR evidence needs. Published in March 2021

Acronyms and Glossary of terms. Published in December 2020 and updated in March 2021

Recommended citation for this section of the report:

Natural Resources Wales. 2020. State of Natural Resources Report (SoNaRR): Assessment of the Achievement of SMNR Aim 4: Contributing to a Regenerative Economy, Achieving Sustainable Levels of Production and Consumption. Natural Resources Wales.

Copyrights

Unless otherwise stated the content of this report can be used under the [Open Government licence](#)

Unless otherwise stated, all graphs, maps, tables and other images are © Natural Resources Wales and database right. All rights reserved.

All maps containing the Wales boundary:

© Natural Resources Wales and database right. All rights reserved. © Crown Copyright and database right 2020. Ordnance Survey licence number 100019741.

All maps containing marine aspects:

© Natural Resources Wales and database right. All rights reserved © British Crown and OceanWise Ltd, 2020. All rights reserved. License No. EK001-20120402. Not to be used for Navigation.

Introduction to the four aims of SMNR

SoNaRR2020 assesses Wales’s progress towards SMNR individually against four aims of SMNR, but it is important to note that they are inextricably linked and should not be seen in isolation (Figure 1). Wales cannot work towards healthy places for people without resilient ecosystems and cannot make our ecosystems resilient without safeguarding stocks of natural resources. The regenerative economy safeguards and restores those stocks and is the route to the transformational change needed to achieve SMNR.

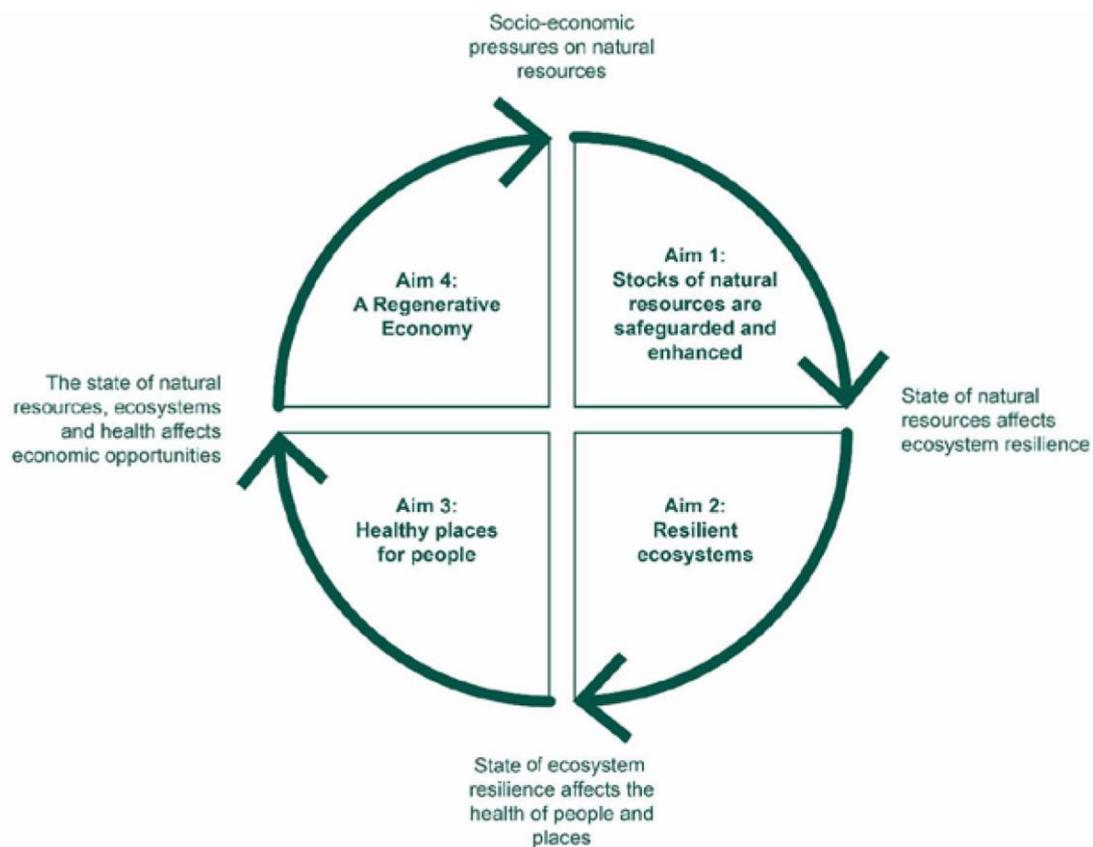


Figure 1 The linkages and cyclical nature of the four aims of SMNR.

SMNR Aim 4: Contributing to a Regenerative Economy, Achieving Sustainable Levels of Production and Consumption

Success would see a reduction in the environmental impact of production and consumption and the environmental footprint within Wales and internationally, while optimising benefits of ecosystem services.

Here, the economy includes (but is not limited to):

- use of natural resources for production
- material value of stocks of natural resources
- agriculture and other land use industries
- management of waste
- import and export of natural resources

Contents

About Natural Resources Wales	2
Evidence at Natural Resources Wales	2
The Second State of Natural Resources Report (SoNaRR2020) contents	3
Introduction to the four aims of SMNR	5
Table of Contents	7
Tables and Figures.....	8
Summary: A regenerative economy in Wales	9
Introduction: The degenerative economy	9
Defining a regenerative economy.....	11
Sustainable Production and Consumption.....	14
Overseas footprint	15
Some examples of current Welsh exports and imports	16
Opportunities to Transform the economy	19
References	21

Tables and Figures

- Table 1 The difference in Rate of Return between Natural Capital and Produced Capital 13
- Table 2 A comparison of the current model of the economy with the regenerative model..... 14

- Figure 1 The linkages and cyclical nature of the four aims of SMNR. 5
- Figure 2 Map of the world showing where indicators suggest a “good life” for citizens is being attained 10
- Figure 3 Map of the world showing where consumption per capita goes beyond the provision of each country 10
- Figure 4 Annual Global CO₂ Emissions between 1751 and 2018..... 11
- Figure 5 Beyond Sustainability towards a regenerative economy 12
- Figure 6 Equation showing the unsustainable use of the biosphere characterised by the degenerative economic system 13
- Figure 7 UK total material footprint 15
- Figure 8 Flows of primary aggregate sales between regions in Wales and England in 2014..... 17
- Figure 9 The 90 natural elements that make up everything. Those used in the production of smart phones are identified with a phone symbol 18
- Figure 10 The DISRUPT Framework..... 19

Summary: A regenerative economy in Wales

Wales helped to lead the first industrial revolution and bears the scars of the model of development that kickstarted, from old mine workings and polluted watercourses, to intensification of agriculture and loss of key habitats. This model of economic development is leading to the degeneration of natural systems, in Wales and internationally. By building a model of economic development which regenerates ecosystems, Wales could help lead the fourth industrial revolution and turn our degenerative economy into a regenerative one.

A regenerative economy would keep its material footprint within the regenerative capacity of the biosphere, it would fit the planet's stock of sustainable resources. A regenerative economy for Wales would mean everyone living within their fair share of the Earth's natural resources, meeting the goal of being globally responsible.

We do not currently have the detailed information which would allow us to calculate the extent to which Wales has a sustainable economy. We do know that if everyone on Earth used natural resources at the same rate as Wales, 2.5 planets would be needed. [Wales's 2019 well-being report](#) (Welsh Government, 2019) states that our ecological footprint, at 10.05 million global hectares, is roughly five times the size of Wales. We can therefore conclude that Wales is somewhat away from achieving a regenerative economy. This overconsumption is putting a strain on ecosystems worldwide.

The opportunities for action identified are:

- Decouple economic growth from environmental impact
- Use spatial planning to enable sustainability transition
- A whole systems approach to product lifecycle design
- Move from purchasing goods to purchasing services
- Move to a Circular economy using waste as a resource

Introduction: The degenerative economy

Overexploitation is driven by unsustainable social and economic systems. Demands placed by society on the environment started to become unsustainable in the 1960s and 70s, as recognised in writings by EF Schumacher (1973) and Kenneth Boulding (1966). Reconciling the conflicting demands of society and the natural systems upon which it depends has been the central project of sustainable development.

No country has yet entered that safe space where social needs are met within planetary limits, although some countries are closer than others. A snapshot from the website "[A Good life for all within planetary boundaries](#)" (O'Neill et al., 2018) shows those countries across the world where indicators suggest a "Good life" for citizens

(Figure 2). It also considers where consumption per capita goes beyond the provision from each country (Figure 3).

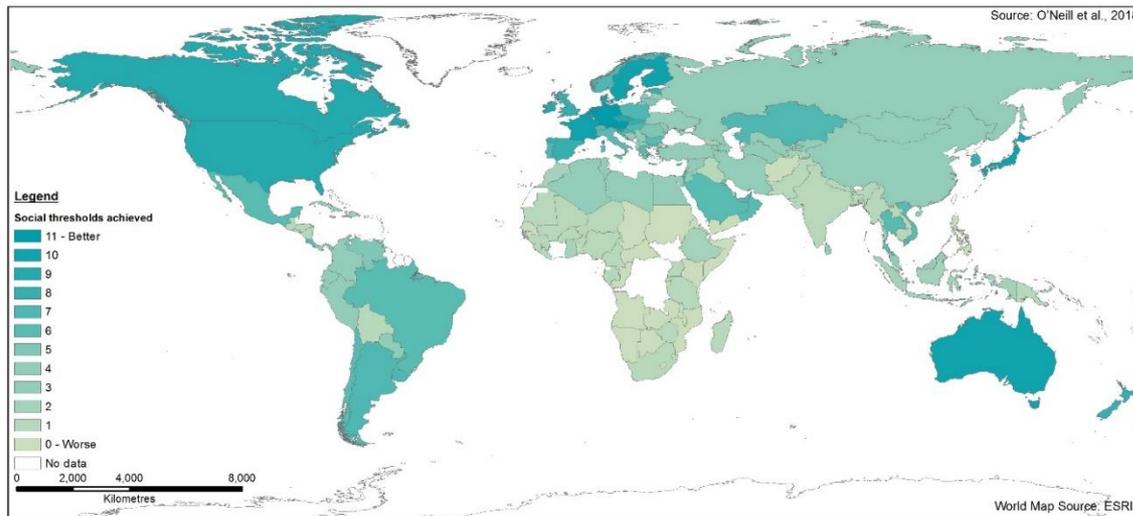


Figure 2 Map of the world showing where indicators suggest a “good life” for citizens is being attained (darker blue suggests better attainment). Using data from: O’Neill, 2018

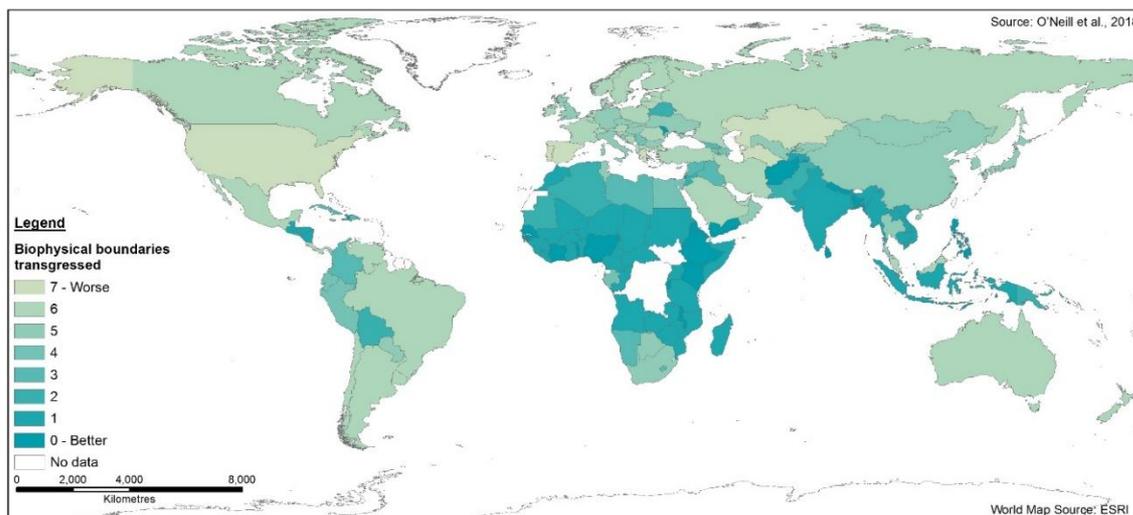


Figure 3 Map of the world showing where consumption per capita goes beyond the provision of each country (paler green and yellow suggests higher consumption per capita). Using data from: O’Neill, 2018

Extraction of natural resources lies behind 50% of greenhouse gas generation and 90% of biodiversity loss on a global scale. It is no surprise then, that ecosystems on which the economy depends are under pressure from current patterns of production and consumption (European Environment Agency 2019a). The World Economic Forum’s Nature Risk Rising report (2020) has identified more than half of global GDP as moderately or highly dependent on nature.

This pressure is not slowing but increasing in speed. An example can be seen in the fact that more than half of all global CO₂ emissions since 1751 were in the last 30 years (Figure 4).

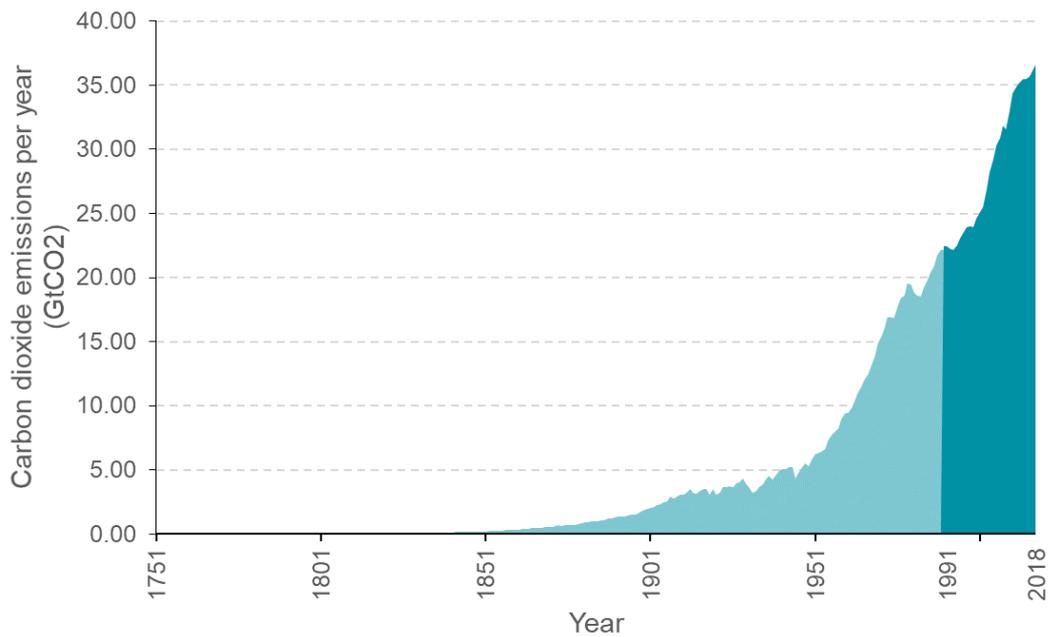


Figure 4 Annual Global CO₂ Emissions between 1751 and 2018

Source: Based on figures from Carbon Budget Project presented by Our World in Data, 2020

According to the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) global assessment, since 1980, greenhouse gas emissions have doubled, and average global temperatures have risen at least 0.7°C (IPBES 2019a). At the same time, global average per capita consumption rose 15%.

Current analysis of the drivers of change across Europe suggests that reconciling well-being and environmental goals will not be achievable without a fundamental reconfiguration of consumption patterns, to achieve a reduction in overall resource use (European Environment Agency, 2019b). In other words, to achieve sustainable development, people need to change the way they live. This message is echoed in the UN's IPBES (2019) report, which concludes that a transformation of socio-economic systems is needed if humanity wishes to address environmental problems.

Defining a regenerative economy

A regenerative economy would keep its material footprint within the regenerative capacity of the biosphere, it would fit the planet's stock of sustainable resources. A regenerative economy for Wales would mean everyone living within their fair share of the Earth's natural resources, meeting the goal of being globally responsible.

A regenerative economy would take Wales from an economy which degenerates its natural resources and ecosystems, through a sustainable, circular economy, which did no harm, to a regenerative one which works with natural systems (Figure 5).

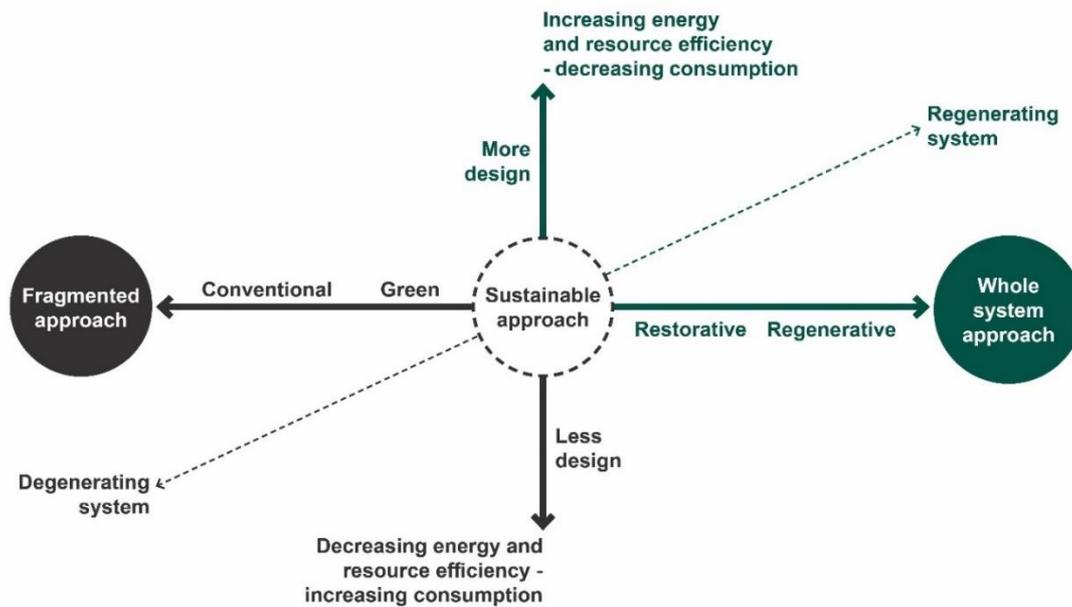


Figure 5 Beyond Sustainability towards a regenerative economy

Adapted from Reed 2007

Turning resources into waste faster than waste can be turned back into resources is driving global ecological "overshoot," depleting the resources on which human life and biodiversity depend. The current model of development in Wales is an unsustainable one. To deliver the sustainable management of natural resources (SMNR) and help secure the Well-being goals, Wales needs to change how it uses and manages natural resources and how it produces and consumes the products derived from them.

A regenerative economy would work with nature by rebalancing the portfolio of capital stocks, be it natural, human, social, built, or physical forms of wealth. Nature provides people with natural resources and ecosystem services, and absorbs the waste produced, regenerating it to produce the goods and services on which people's well-being depends.

Traditionally, economic analysis has been conducted in terms of weak sustainability, where the degradation or depletion of natural capital (i.e. stocks of natural resources) can be offset by the accumulation of other capital stocks, such as produced capital, for example, road networks and buildings. However, the return on natural capital is higher than on produced capital stocks as many natural stocks can replenish themselves (Table 1) (Dasgupta, 2020).

Accumulating produced capital at the expense of natural capital makes little sense: humanity has, in effect, been mismanaging global assets including ecosystems by investing too much in manufactured capital and not enough in natural capital. Some natural capital stocks are considered to be critical to human well-being, so they should not be depleted in order to accumulate other stocks such as human capital.

Table 1 The difference in Rate of Return between Natural Capital and Produced Capital (Dasgupta, 2020).

Forms of Capital	Share of total global capital stock 1990	Share of total global capital stock 2014	Change	Rate of return
Natural Capital	34.6%	22.6%	-12.0%	19%
Produced Capital	14.8%	21.0%	+5.2%	5%

*Rate of Return refers to the “own rate of return” (the increase in an asset’s size that would be expected tomorrow if a unit more of the asset were added today) corrected for their relative capital gains or losses. Therefore, it is the yield of an asset plus the gains it enjoys over a unit of time.

The world currently has a degenerative economic system eating into the very life on which it depends. Moving to a regenerative economy would embed the economy in the functioning of the biosphere to provide an abundance of natural resources. At the moment Wales is taking more resources out of the biosphere than it is able to regenerate. The Interim Report of the Dasgupta Review (2020) to the UK Treasury captures this in the equation shown in Figure 6.

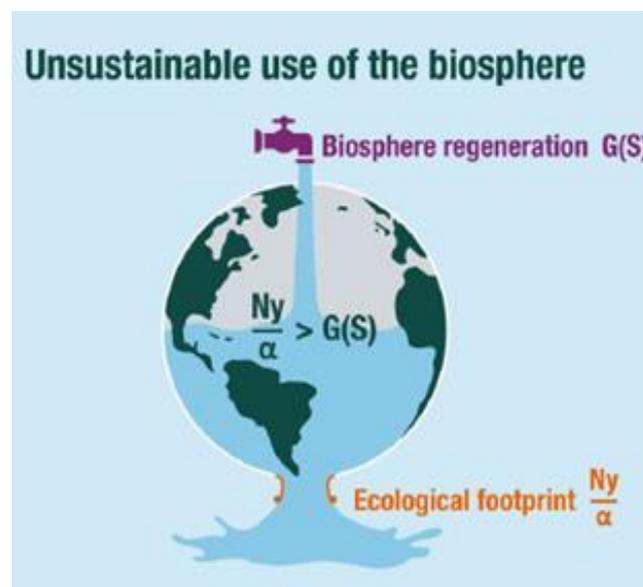


Figure 6 Equation showing the unsustainable use of the biosphere characterised by the degenerative economic system (Dasgupta, 2020)

Where: G = the rate at which the biosphere regenerates; S = the stock (“Capital”) of the biosphere; Y = the flow of economic activity per head (“Income per capita”); N = human population; α = the efficiency with which the biosphere’s goods and services are converted into economic activity and the extent to which the biosphere is transformed by waste products

The current model of the economy could be contrasted with a regenerative economy in the following ways (Table 2)

Table 2 A comparison of the current model of the economy with the regenerative model

Current economy	Regenerative economy
Gross Domestic Product (GDP) growth: more economic activity is the goal	"Beyond GDP": flourishing of all life is the aim
Short-termism: quarterly profits	Long-termism: durable prosperity
Maximisation of return	Safeguarding of long-term opportunity
Shareholder value	Stakeholder value: benefit to society
Extraction of natural resources	Management of ecosystem integrity
Linear production systems	Circular production systems
Short-life products for sale	Long-life services
Efficiency measured in monetary terms (Cost-benefit analysis (CBA))	Multidimensional resilience (e.g., multi criterion analysis (MCA))

Source: Alfredsson and Wijkman, 2014

Sustainable Production and Consumption

To change the economic model from one which degenerates nature to one which regenerates it, Wales needs to do more than use natural resources more efficiently. More efficient use of resources will not in itself lead to lower resource use. It will make resources cheaper, encouraging a growth in their consumption. So, more sustainable patterns of consumption are needed alongside more sustainable production. Adopting more sustainable patterns of consumption will require a change in social preferences to embrace sharing, reusing and repairing goods or adopting healthier diets with lower greenhouse gas emissions.

Securing such radical economic change needs to recognise the knock-on impact on society and groups who could have their well-being affected. Sustainable development means meeting human well-being goals at the same time as staying within global environmental limits. The environmental and social goals need to be pursued at the same time and sustainability transitions must be just and fair, in line with the Well-being Goals to achieve the social and economic transformation needed to address the nature and climate emergencies.

Overseas footprint

Focusing solely on the environmental impacts within Wales without considering the additional environmental impacts abroad can result in an overly positive perception of Wales’s sustainability.

The people of Wales currently represent approximately 0.04% of the world population (assuming Welsh and world populations of 3 million and 7 billion respectively). Therefore, Wales should aim to live off 0.04% of the resources that the world can sustainably provide. Currently it consumes more than this, around 0.14% (estimate based on the ratio of the ecological footprint of the UK to global biocapacity as estimated by the Global Footprint Network) (Stockholm Environment Institute and GHD, 2015).

The UK’s material footprint (Figure 7), or raw material consumption, captures the amount of domestic and foreign extraction of materials needed to produce the products used by households, governments and charities in the UK in one year. The University of Leeds has estimated that in 2017 the UK consumed 254,224 thousand tonnes of raw material (biomass, metal ores, non-metallic minerals and fossil fuels) originating from the UK, and 967,004 thousand tonnes of raw material originating from the rest of the world (Office for National Statistics, 2020).

This means Wales’s national material footprint is considerably larger than its domestic footprint. These imported materials are described as coming from “ghost acres”, as the effect of their extraction or production are not seen in the place where they are consumed. The decline in the UK’s domestic material footprint has been offset by the increase in its material footprint located in China, India and Brazil, which showed the most rapid growth between 1990 and 2017.

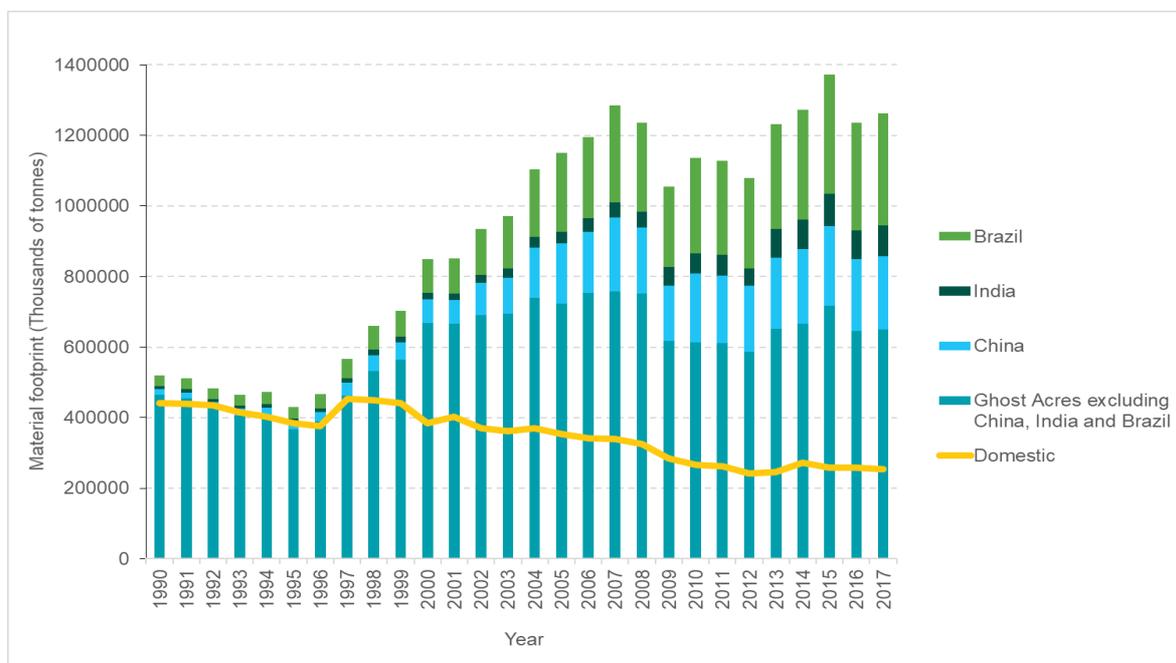


Figure 7 UK total material footprint (Office for National Statistics, 2020)

Reducing Wales's domestic material footprint at the expense of increasing the overseas footprint is incompatible with the goal of taking no more than a fair share of global resources. In future, Wales must avoid exporting more of its domestic material footprint, increase the resource efficiency of its domestic production, and take steps to avoid increased resource efficiency being offset by greater resource use.

We have not been able to assess overseas impacts from the use of all natural resources within and outside of Wales.

Some examples of current Welsh exports and imports

These are a few available examples which give a snapshot of how production and consumption is embedded within the global economy.

Waste

Recycling and waste treatment processes are reliant on external infrastructure and markets. The current recycling infrastructure within Wales is limited. For example, approximately 61% of collected plastic waste is recycled outside of Wales (WRAP Cymru, 2018). Checks are made in line with relevant legislation, before export, to ensure that the receiving overseas site is of broadly equivalent standards to that within the UK. However, there is still the possibility that Welsh waste may be managed at inappropriate locations around the world and treated or disposed of irresponsibly.

Waste is a global commodity with a demand for recyclable materials to be exported for recycling to countries with a high industrial/manufacturing economy, for example in Asia. This has changed significantly since 2018 with countries following China's lead and banning or restricting the waste materials they will accept. This is likely to increase in the near future, requiring increases in domestic reprocessing and production of recycled materials.

Aggregates

Primary aggregates are a non-renewable natural resource, normally categorised as either crushed rock or sand and gravel. Demand for these comes from construction, including infrastructure such as roads and railways. The latest figures for Wales collated by the British Geological Survey relate to the five-year period between 2009 and 2014 (Mankelov et al., 2016). The data we have illustrates the pressures being placed on the marine environment and National Parks.

In 2014 sales of Welsh primary aggregates within and without Wales reached 14.1 million tonnes (Mt) versus 12.8 Mt in 2009, a compound annual growth rate (CAGR) of 2.0%. Going by these figures, the total reserves of aggregates allowed to be taken (689 Mt in 2014) represents 34 years' supply. Within this overall figure, the share of sand and gravel rose from 11% of primary aggregates in 2009 to 15% in 2014, representing a CAGR of 8.4% versus only 1.0% for crushed rock. Nearly half of the sand and gravel (49%) came from marine sources. 7% of crushed rock sales and

11% of terrestrially sourced sand and gravel sales came from within the boundaries of National Parks.

Wales was not alone in experiencing a rise in primary aggregate sales between 2009 and 2014. The following maps (Figure 8) show flows between regions in Wales and England in 2014, and illustrate that Wales is a net exporter.

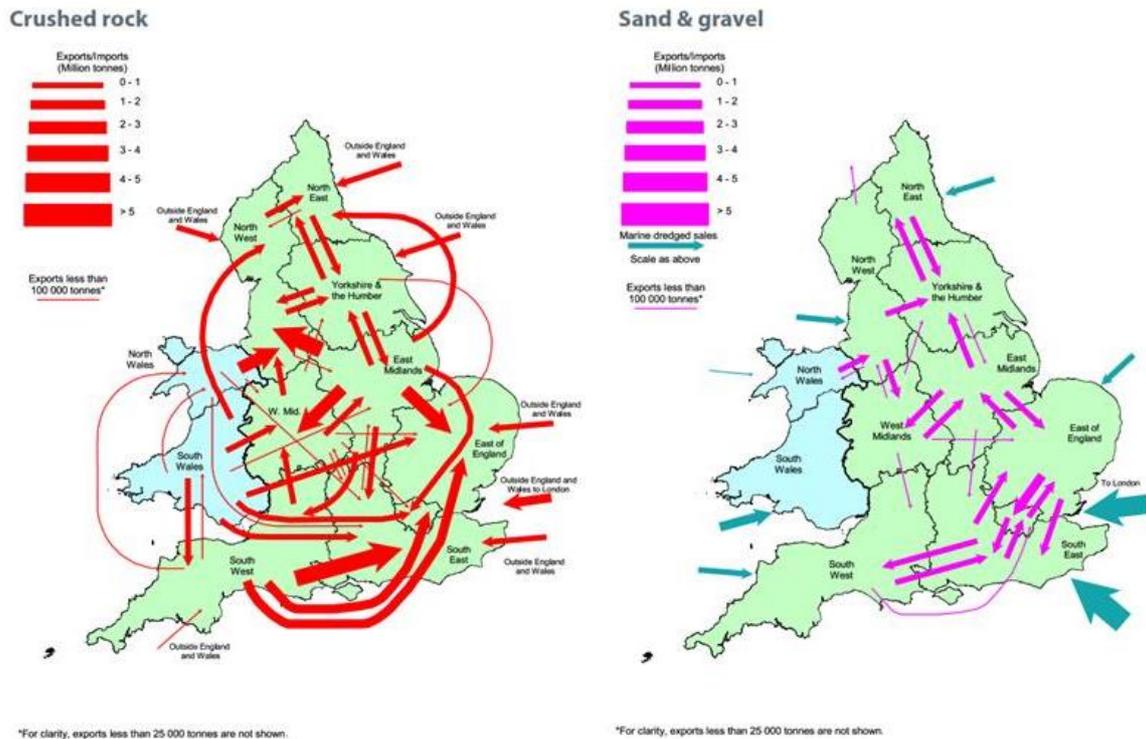


Figure 8 Flows of primary aggregate sales between regions in Wales and England in 2014 (Mankelov et al., 2016) ©Crown copyright.

Smart phones

Wales is contributing to the rapid global depletion of some rare elements through the importation of smart phones (Figure 9). The European Environment Agency report “Paving the Way for a Circular Economy” (European Environment Agency, 2019c) highlights the elements used to make smart phones. The majority of these are mined outside of Wales. Some of these are at serious threat of depletion in the next 100 years if we, and others across the world, do not consume less and improve recycling.

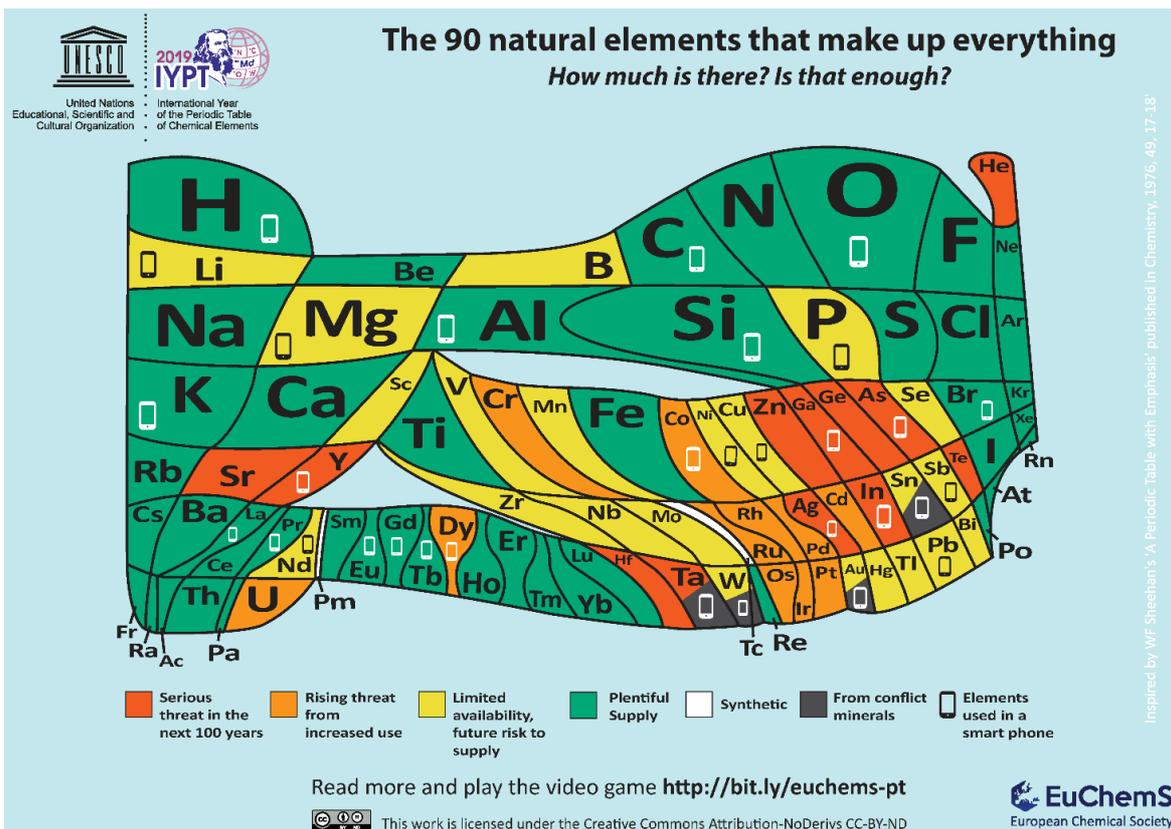


Figure 9 The 90 natural elements that make up everything. Those used in the production of smart phones are identified with a phone symbol (European Chemical Society, 2019).

Opportunities to Transform the economy

Key points using the DISRUPT framework (De Wit et al., 2020)

D	Design for the future
I	Incorporate digital technology
S	Sustain and preserve what is already there
R	Rethink the business model
U	Use waste as a resource
P	Prioritise regenerative resources
T	Team up to create joint value

Figure 10 The DISRUPT Framework

The DISRUPT framework (Figure 10) describes opportunities to transform the economy.

Where, “D” stands for Design for the Future and encourages a whole systems approach to product lifecycle design. This ensure that products can be repaired and remanufactured to extend the duration of use for the embedded resources. Designing for the future is a holistic approach to changing the food, energy and mobility systems, for example spatial planning to design out the car.

“I” represents the incorporation of digital technology, using the Internet of Things to support decarbonisation, for example the management of electricity transmission and distribution. Here tangible goods are substituted for intangible services.

“S” stands for sustaining and preserving what is already there by implementing nature-based solutions. Here, expanding and effectively managing the current network of protected areas, including terrestrial, freshwater and marine areas, is important for safeguarding biodiversity.

“R” represents rethinking the business model as models that encourage sharing, re-use and resale, including servitisation (delivery of a service as added value when providing products) and involve the third sector, for example community fridges, repair cafés. Here producer responsibility regimes for packaging, electrical goods and batteries are extended to other products by ensuring producers fund the full net

costs of end of life management, encouraging eco-design and providing a mechanism to tackle problematic water streams. In this way, Wales's regenerative economy transition would be a social agenda – integrating ambitions for green jobs, carbon and material equality, and helping to deliver against the Well-being goals.

“U” is for using waste as a resource by augmenting anaerobic digestion with technologies and develop markets to make use of residues from food and fibre production; ensuring Wales has the required land bank for the resulting digestate from food waste facilities; using biogas to generate electricity and substitute for natural gas in the gas transmission and distribution systems and using regulation to support the growth of markets for recycle.

“P” stands for prioritising regenerative resources through substituting biological and bio-augmented resources for abiotic non-renewable resources (for example timber for steel, and concrete or bioplastics for petroleum-based plastics).

“T” represents teaming up to create joint value. Sustainability transformations call for cross-sectoral thinking and approaches. Here, transformative change is facilitated by innovative governance approaches that incorporate existing approaches, such as integrative, inclusive, informed and adaptive governance; industrial symbiosis is promoted and encouraged, and Wales's industrial and innovation policies reflects the overall ambition to reduce material consumption and waste production.

References

- Alfredsson E, Wijkman A. 2014. The Inclusive Green Economy. MISTRAL 2014. Available from: https://www.bortombnptillvaxt.se/download/18.4a88670a1596305e782d4b/1487065428153/The+Inclusive+Green+Economy_April2014.pdf [Accessed December 2020]
- Boulding K. 1966. The economics of the coming spaceship earth. In H. Jarrett (ed.) 1966. Environmental Quality in a Growing Economy, pp. 3-14. Baltimore, MD: Resources for the Future/Johns Hopkins University Press.
- Dasgupta P. 2020. The Dasgupta Review – Independent review on the economics of biodiversity, Interim Report, April 2020.
- De Wit M, Hoogzaad J, Von Daniels C. 2020. The circularity gap report 2020. Amsterdam: Ruparo. Available from: <https://pacecircular.org/resources> [Accessed September 2020]
- European Chemical Society. 2019. Element Scarcity – EuChemS Periodic Table. The 90 natural elements that make up everything. Available from: <https://www.euchems.eu/euchems-periodic-table/> [Accessed October 2020]
- European Environment Agency. 2019a. The European environment – state and outlook 2020: Knowledge for a transition to a sustainable Europe. ISBN: 978-92-9480-090-9. Available from: <https://www.eea.europa.eu/soer> [Accessed November 2020]
- European Environment Agency. 2019b. Knowledge for a sustainable Europe: A Snapshot from the European Environment Agency. Available from: <https://www.eea.europa.eu/publications/eea-snapshot> [Accessed September 2020]
- European Environment Agency. 2019c. Paving the way for a circular economy: Insights on status and potentials. EEA Report number 11/2019. Available from: <https://www.eea.europa.eu/publications/circular-economy-in-europe-insights> [Accessed October 2020]
- IPBES. 2019. Global assessment report on biodiversity and ecosystem services of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services. E. S. Brondizio, J. Settele, S. Díaz, and H. T. Ngo (editors). Bonn: IPBES secretariat. Available from: <https://ipbes.net/global-assessment> [Accessed September 2020]
- Mankelov JM, Bide TP, Sen MA, Raycraft E, Cameron DG. 2016. Collation of the results of the 2014 Aggregate Minerals Survey for England and Wales. British Geological Survey Commissioned Report, OR/16/005. 160pp.
- O'Neill DW, Fanning AL, Lamb WF, Steinberger JK. 2018. A good life for all within planetary boundaries. Nature Sustainability 1, 88-95.
- Office for National Statistics. 2020. Material footprint in the UK. Data from University of Leeds. 1990-2017. Available from:

<https://www.ons.gov.uk/economy/environmentalaccounts/datasets/materialfootprintintheuk> [Accessed October 2020]

Our World in Data. 2020. Cumulative CO2 Emissions by world region. [online]. Available from: <https://ourworldindata.org/grapher/cumulative-co2-emissions-region?stackMode=absolute> [Accessed December 2020]

Reed B. 2007. Shifting from 'sustainability' to regeneration. Building Research and Information 35 (6), 674-680.

Schumacher EF. 1973. Small is beautiful: Economics as if people mattered. London: Blond & Briggs.

Stockholm Environment Institute and GHD. 2015. Ecological and Carbon Footprints of Wales, update to 2011. Available from: <https://gov.wales/ecological-and-carbon-footprint-report> [Accessed December 2020]

Welsh Government. 2019. Well-being of Wales Report 2018-19. Report by Statistics for Wales. Available from: <https://gov.wales/well-being-wales-2019> [Accessed October 2020]

WRAP Cymru. 2018. Towards a route map for plastic recycling: Creating circularity for plastics in Wales. Available from: <http://www.wrapcymru.org.uk/plastic-route-map> [Accessed December 2020]

World Economic Forum. 2020. Nature Risk Rising: Why the Crisis Engulfing Nature Matters for Business and the Economy. New Nature Series. Available from: <https://www.weforum.org/reports/nature-risk-rising-why-the-crisis-engulfing-nature-matters-for-business-and-the-economy> [Accessed September 2020]