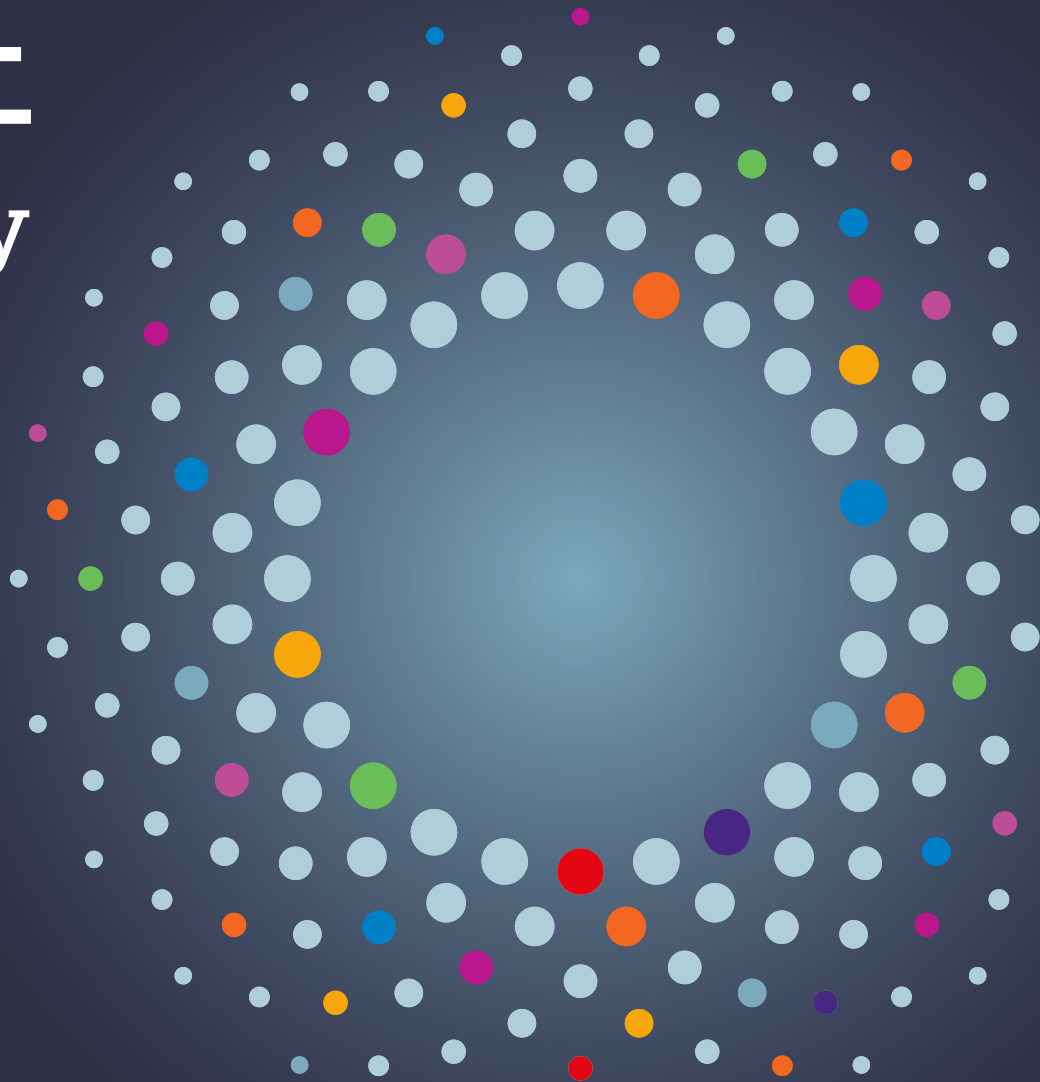
ELLEN MACARTHUR FOUNDATION

THE NATURE IMPERATIVE

How the circular economy tackles biodiversity loss



ABOUT THIS PAPER

This paper highlights the fundamental contribution the circular economy can make to halting and reversing biodiversity loss. It aims to detail the specific role of each circular economy principle, and their applicability across sectors. By showcasing four sectors - food, built environment, fashion, and plastics - the paper illustrates how the circular economy offers a framework for transformative change, and sets out actions business and policymakers can take to achieve this shift.

This paper draws on insights on the environmental benefits of a circular economy as laid out in previous research reports published by the Ellen MacArthur Foundation, including: *Completing the Picture: How circular economy can tackle climate change* (2019); publications from the Foundation's Food Initiative, Make Fashion Circular, New Plastics Economy, and Institutions, Governments & Cities department; and studies on the circular economy opportunity in Europe, China, and India.

While this paper sets out the theoretical underpinnings of how the circular economy is crucial to tackling biodiversity loss, rigorous quantitative analyses will be needed to gain a fuller understanding of the size of its potential.

An early step in this effort is the Foundation's study published in parallel with this paper: *The Big Food Redesign: Regenerating nature with the circular economy*. In recognition of the central importance of the food system to tackling biodiversity loss, the research - conducted in collaboration with Material Economics - quantifies the substantial opportunities fast moving consumer goods companies and food retailers have to employ circular design to move towards a nature-positive food system.

Another contribution to the quantification agenda is a research effort being undertaken by The Finnish Innovation Fund Sitra, in collaboration with Vivid Economics. The effort which will be published later in 2022 quantifies the role a circular economy can play in halting and reversing global biodiversity loss and the resulting economic benefits in sectors including agriculture, forestry, pulp and paper, construction, and textiles. This paper and Sitra's project are evidence of a high degree of complementarity between the insights produced by each organisation, a convergence borne of a longstanding series of collaborations spanning research reports, including *Cities and circular economy for food* (2019), World Circular Economy Forum, and other projects.

This paper has been produced with the support of our Strategic Partners.

To quote this paper, please use the following reference:
Ellen MacArthur Foundation, *The Nature Imperative: How the circular economy tackles biodiversity loss* (2021)

ABOUT THE ELLEN MACARTHUR FOUNDATION

The Ellen MacArthur Foundation is an international charity, committed to developing and promoting the idea of the circular economy in order to tackle some of the biggest challenges of our time, such as climate change, biodiversity loss, waste, and pollution. We work with, and inspire, business, academia, policymakers, and institutions to mobilise system solutions at scale, globally. In the circular economy, business models, products, and materials are designed to increase use and reuse, creating an economy in which nothing becomes waste and everything has value. Increasingly based on renewable energy and materials, the circular economy is a resilient, distributed, diverse, and inclusive economic model.

Further information:
www.ellenmacarthurfoundation.org
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ELLEN MACARTHUR FOUNDATION PROJECT TEAM

Steering Committee
Andrew Morlet - Chief Executive
Rob Opsomer - Executive Lead, Systemic Initiatives
Jocelyn Blériot - Executive Lead, International Institutions & Governments
Jarkko Havas - Lead, Insight & Analysis

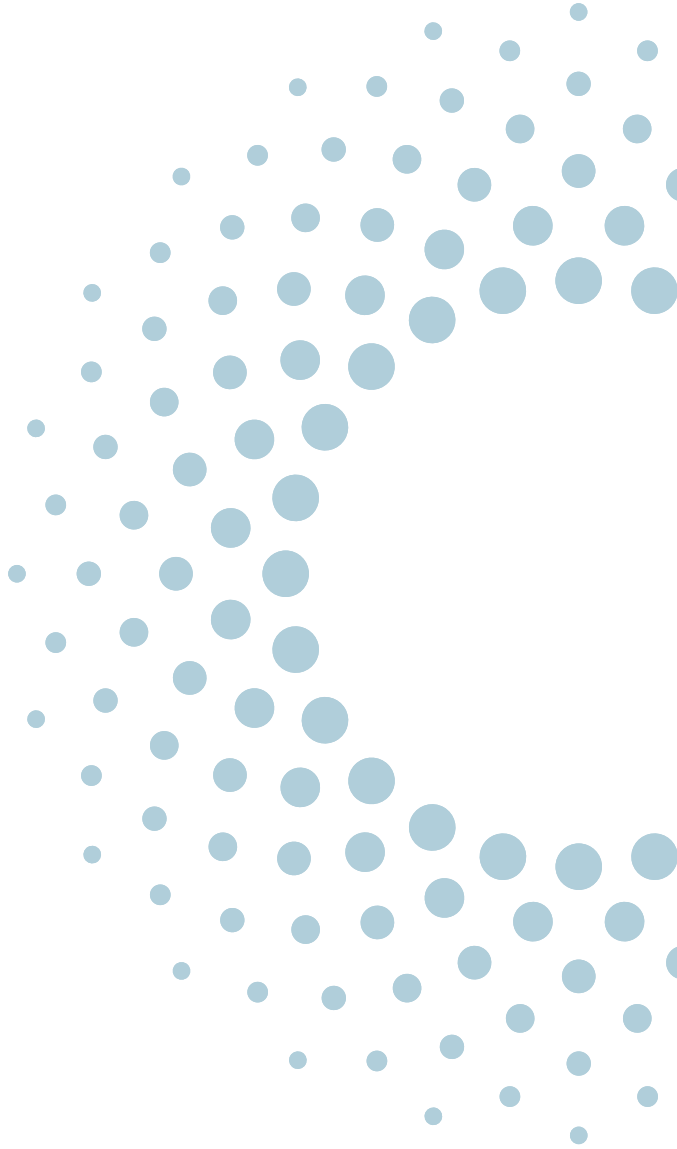
Core project team
Soukeyna Gueye - Project Manager, Insight & Analysis
Cindy Venho - Research Analyst, Insight & Analysis
Andrés Oliva Lozano - Research Analyst, Insight & Analysis
Lenaic Gravis - Senior Expert, Editorial

Contributors
Carsten Wachholz - Senior Policy Manager, Institutions, Governments, & Cities
Maria Chiara Femiano - Senior Policy Officer, Institutions, Governments, & Cities

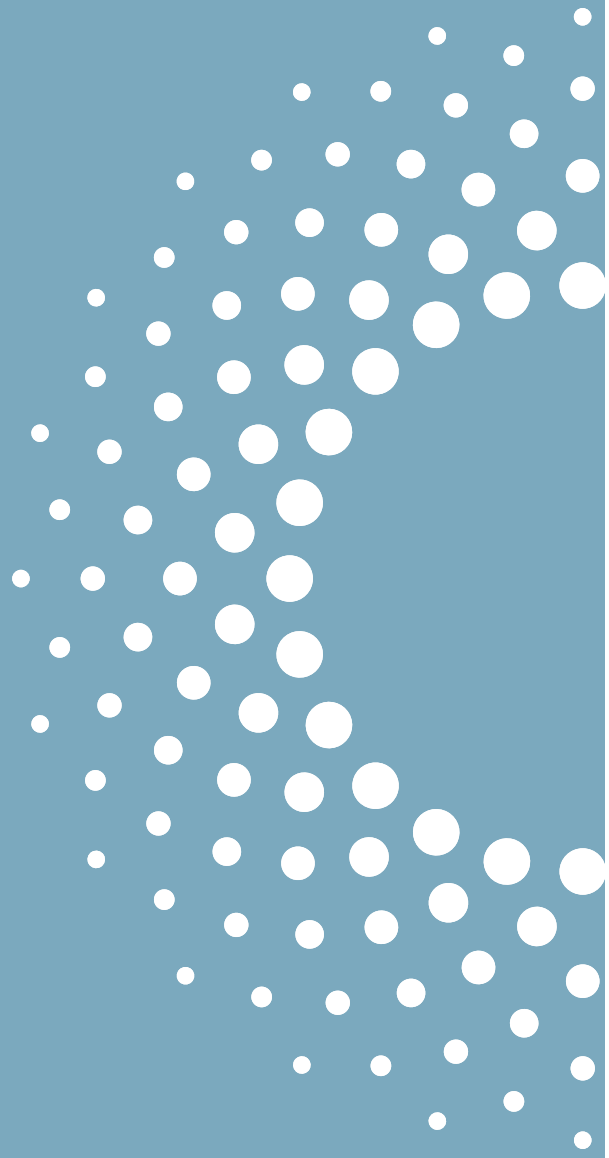
Editorial
Ian Banks - Editorial Lead
James Woolven - Editor

Production
James Wrightson - Creative Lead
Alex Hedley - Senior Graphic Designer
Fanny Breteau - Graphic Designer

External Contributors
Joanna de Vries, Conker House - Proofreader



Executive summary



Biodiversity loss is widely recognised as a systemic risk that threatens not only our prosperity but our very future as a species. To halt and reverse this loss, a transformative change to its main underlying cause - our extractive, wasteful and polluting economy - is urgently needed. The circular economy is being rapidly recognised as a powerful framework to achieve this seismic shift as it creates value in ways that rebuild biodiversity and provide other society-wide benefits.

Our extractive, wasteful, and polluting economy is increasingly acknowledged as the main underlying cause of the biodiversity crisis. Biodiversity has risen to the top of the global agenda as the planet faces its sixth mass extinction, with projections of the loss of more than a million species in the coming decade. It is becoming ever clearer that the main underlying cause of this crisis is our highly wasteful and polluting 'take-make-waste' economy. Indeed, more than 90% of biodiversity loss is due to the extraction and processing of natural resources. In the food sector for example, clearing land for agriculture causes habitat loss, whilst many conventional farming practices lead to air and water pollution and the overexploitation of natural resources. In industry, producing and processing raw materials emits large quantities of greenhouse gases and other pollutants.

To halt and reverse biodiversity loss by 2030, we need to transform our production and consumption systems. As argued by the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES), global biodiversity loss can only be tackled through transformative economic, social, political, and technological changes. This means going beyond conservation and restoration efforts - crucial though they are - to fundamentally transform the way we make, use, and reuse products and food. It means redesigning our economy to help achieve a nature-positive future.

The circular economy offers an actionable framework for such transformative change. By decoupling economic prosperity from resource consumption and environmental degradation, the circular economy offers opportunities for new and better growth that not only help safeguard and rebuild biodiversity, but also provide other society-wide benefits, such as helping tackle climate change, improving air and water quality, and reducing the cost of accessing goods and services. This paper focuses on four key sectors - food, the built environment, fashion, and plastic - but the framework applies across most if not all sectors of the economy.

Together, the 3 principles can tackle the root causes of biodiversity loss by:

- **Eliminating waste and pollution - to reduce threats to biodiversity.** Designing out problems from the start is crucial to reducing biodiversity loss. For example, eliminating unnecessary plastics and re-designing plastic products to have value post-use (for reuse, recycling or composting) means they can circulate in the economy rather than being wasted and polluting the environment.

- **Circulating products and materials - to leave room for biodiversity.** Reducing demand for natural resources reduces biodiversity loss. In fashion, for example, business models that keep cotton clothing in use for longer will, all things being equal, reduce the amount of land needed to grow cotton. This leaves more space for other uses including the preservation of wilderness areas, which are crucial to the health of wildlife populations. In electronics, using recycled metals in devices means fewer mines need to be dug, leaving room for biodiversity, and avoiding emissions of greenhouse gases and other pollutants.

- **Regenerating nature - to enable biodiversity to thrive.** Economic activity can, and needs to, actively rebuild biodiversity. For example, regenerative agricultural approaches such as agroecology,

agroforestry, and managed grazing sequester carbon in the soil and improve its health, increase biodiversity in surrounding ecosystems, and enable agricultural lands to remain productive instead of degrading over time, thereby reducing pressure to expand them.

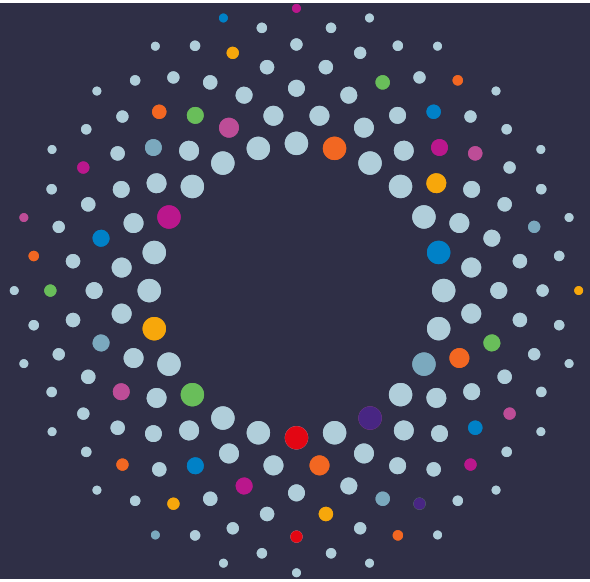
Momentum behind the transition to a circular economy is building in business, finance, and policymaking. More and more companies across industries are adopting circular principles to create value, drive innovation, and increase competitiveness. In fashion, clothing resale is expected to be twice as big as fast fashion by 2030. In consumer packaged goods, value chains are being transformed by regulation, public pressure, and innovation. In finance, interest in the circular economy is fast-growing as it is seen as an essential part of the solution to deliver on environmental, social, and governance (ESG) targets while driving economic growth. Governments across the globe are accelerating the shift: the circular economy is a key pillar of the European Green Deal and circular economy roadmaps; legislation has been enacted in key markets including China and the EU; and policy frameworks are emerging in others such as Latin America, with Chile being a frontrunner.

Leading businesses are starting to join the dots between their biodiversity ambitions and circular economy plans. The contribution the circular economy can make to supporting biodiversity is not just theoretical. Leading companies are beginning to use the circular economy framework as a delivery mechanism to meet their ambitions on biodiversity. We encourage others to follow them by using a three step approach. The first step is to assess biodiversity impacts and dependencies and set science-based targets. The second step is to identify circular economy opportunities that help meet those targets - some of which a company may already be pursuing. The third step is to collaborate across value chains to develop innovative solutions that can deliver system-level change. While many benefits can be delivered through individual business actions, this last step is essential as cross value chain collaboration can deliver vastly greater value and positive impact.

A conducive policy context, internationally and nationally, is key to bringing about transformative change. Many parties to the Convention on Biological Diversity (CBD) recognise that urgent policy action is needed to transform patterns of consumption and production. Governments and businesses are already starting to work together to value nature in financial and economic accounting systems, as the cost of inaction is felt in both policy and corporate decision-making. To crystallise these changes, governments can build a comprehensive circular economy approach as laid out in the Ellen MacArthur Foundation's *Universal Circular Economy Policy Goals paper*. The combination of implementing a Post-2020 Global Biodiversity Framework and putting in place national post-Covid recovery plans offers an opportunity to harness economic stimulus and financial flows to enable new forms of better growth, rather than simply to accelerate the current linear model that is massively wasteful, polluting, and catastrophically destructive for natural ecosystems and biodiversity.

Businesses and governments can join the dots between their ambitions for economic growth and for tackling biodiversity loss by elevating their focus on business transformation based on circular economy principles. By embracing this approach, they will create new and better forms of economic growth, bring social prosperity, and enable nature to thrive.

In support of this paper



- **IUCN**: "The circular economy can play a fundamental role in shaping a nature-positive future. By providing a framework that can be applied to our production and consumption cycles, this study shows how we can achieve economic prosperity without environmental degradation. I am very pleased that this topic is being discussed at the IUCN World Conservation Congress. Ultimately, the circular economy can help deliver the transformative change we need to halt and reverse biodiversity loss." — Dr. Bruno Oberle, Director General, International Union for Conservation and Nature

- **WWF International**: "We welcome this paper, exploring how the pursuit of a circular economy can help deliver transformative change for a safer, more equitable, and biodiverse future. Our future prosperity and survival depend on a living planet and our ability to create a nature-positive economy – one that operates within planetary boundaries and that helps us reverse nature loss and overcome the climate crisis. We are part of nature, not separate from it. Investing in what is our most precious asset will make it our greatest ally." — Marco Lambertini, Director General, WWF International

- **UNEP**: "Making peace with nature requires a 180-degree shift in how we produce and consume. Such a shift means recognising that a circular economy is the only economic model possible if we are to protect people and the planet. In connecting the dots between the actions of business and government, this study makes an important contribution to our understanding of how we can regenerate nature and ensure long-term prosperity for all." — Inger Anderson Executive Director, United Nations Environment Programme

- **Finnish Innovation Fund Sitra**: "Circular economy and biodiversity have hitherto largely been approached both in isolation and from different starting points, even though the circular economy is built on learnings from nature. This study helps to bring these two agendas closer together, in particular by highlighting the root causes – the drivers of biodiversity loss – as well as the significant opportunities that can follow from taking a circular approach to addressing these drivers." — Jyrki Katainen, President, Finnish Innovation Fund Sitra

- **European Forest Institute**: "We need a new economy where life, not consumption, becomes its true engine and purpose – a circular bioeconomy that is ultimately powered by biodiversity. This study presents why and how a circular economy can catalyse the transition towards a climate neutral and nature-positive world."

— Marc Palahí, Director of the European Forest Institute and Coordinator of The Prince of Wales' Circular Bioeconomy Alliance

- **Scion**: "Biodiversity loss is one of the biggest threats of this century. In response to this and other interwoven global challenges – climate change and resource scarcity – Scion is supporting the shift to a future that is biodiverse and circular, and with Te Ao Māori at its heart. We endorse the vision highlighted in this study of creating a nature-positive future by transitioning to a circular economy – where we work with nature, and not against it. Accelerating this transition is the solution to our challenges." — Dr. Florian Graichen, General Manager, Scion

- **The Nature Conservancy**: "It's no longer enough to produce food in ways that merely minimise harm to the planet. We must start producing food in ways that actively restore ecosystems, improve biodiversity, and address climate change. We commend the Ellen MacArthur Foundation in its efforts to advance the guidance needed to shift to a circular economy as we support stakeholders in the swift transition to a nature-positive food system and a new food economy that works for both nature and people." — Michael Doane, Global Managing Director, Food and Freshwater Systems, The Nature Conservancy

- **University of Oxford**: "Biodiversity is essential for life on Earth and functioning human societies. This report outlines why and how a circular economy appears as a conditio sine qua non to manage our global biodiversity resource sustainably. This report not only provides an excellent framing, but also gives concrete and tangible examples, that are applicable here and now, of circular economy opportunities in key natural resource sectors. Undoubtedly, this will become essential reading for citizens, business leaders and governmental policy makers alike interested in transition-planning towards a nature-positive economy." — Michael Obersteiner, Director of the Environmental Change Institute, University of Oxford

- **Morgan Stanley**: "Investors and participants across global capital markets are increasingly seeking to support biodiversity, the creation of healthy ecosystems, and the circular economy, including the systems-level solutions required to transform business-as-usual. This work is a welcome amplification of leading practices that demonstrate the business value of circular principles, across sectors and industries, while preserving long-term biodiversity." — Audrey Choi, Chief Sustainability Officer, Morgan Stanley

- **Sistema B and TriCiclos**: "As we build momentum towards a nature-positive low-carbon global economy in 2050, businesses, policymakers, and all sectors of society can rely on the circular economy guidelines developed by the Ellen MacArthur Foundation to go beyond incremental improvements. The insights in The Nature Imperative and The Big Food Redesign studies can be used to transform the food, fashion, plastic packaging, and built environment sectors to reduce pressure on biodiversity loss and make us more resilient to the impacts of climate change. The illustrative cases included highlight that this ambition is not only required, it is possible and growing." — Gonzalo Muñoz, Co-founder, Sistema B, and Founder, TriCiclos

- **Arup Group**: "Species all over the world face extinction as their habitats are destroyed, but destroying nature threatens our lives too. We must act now to go beyond 'lean-clean-green' design to circular design that values natural capital. In the process, we have to integrate biodiversity within our cities, making sure that buildings and materials are kept in use in order to minimise demand for virgin materials. In this way, we will create pathways that don't just stop biodiversity loss, but start to reverse it." — Alan Belfield, Chairman of Arup Group

- **CACE**: "There is a global consensus that developing a circular economy could be a way to respond to global challenges such as climate change and biodiversity loss. From the perspective of the circular economy development model, this report has further explained the huge contribution that a circular economy can make to global sustainable development." — Zhao Kai, Vice President, China Association of Circular Economy

- **Danone**: "We were honored to contribute to this work, which reaffirms our conviction that food can be a solution to many of the challenges we face. These two studies – 'The Nature Imperative: How the circular economy tackles biodiversity loss' and 'The Big Food Redesign: Regenerating nature with the circular economy' – show how circular economy principles can

help us design and deliver products that fight climate change, protect biodiversity, and reconnect consumers with their food. The opportunity is one we must seize – for our business and for our planet." — Henri Bruxelles, Executive Vice President and Chief Operating Officer, Danone

- **REMADE Institute**: "This report speaks to an unintended but devastating effect of our 'take-make-waste' economy: biodiversity loss. It shows how the three principles of the circular economy — eliminating waste and pollution, keeping products and materials in use for as long as possible, and regenerating natural systems — can serve as an actionable framework for restoring biodiversity while opening up new economic opportunities. It will be a welcome resource for policymakers and businesses working to transition the food, fashion, plastic-packaging, and built-environment sectors to the circular economy." — Dr. Nabil Nasr, CEO, the REMADE Institute, and Associate Provost for Academic Affairs & Director, Golisano Institute for Sustainability, Rochester Institute of Technology

- **SYSTEMIQ**: "We need to close a finance gap of USD 711 billion a year to reverse biodiversity loss by 2030. We can only do that by addressing one of the biggest root causes: our linear " take-make-waste" economy. This study powerfully illustrates how circular economy principles and sectoral strategies are an essential part of the solution." — Jeremy Oppenheim, Founder and Senior Partner, SYSTEMIQ

- **UNU-FLORES**: "The take-make-dispose paradigm of the linear economy is a major threat to biodiversity, which has already been pushed to the edge. A circular economy is an opportunity to halt and reverse the trend. Because we need everyone on board, this study offers clear reasons for the business community to act." — Dr. Nora Adam, Partnerships and Liaison Officer, United Nations University - Institute for Integrated Management of Material Fluxes and of Resources (UNU-FLORES)

- **African Leadership University**: "Given the current necessity for countries, companies, and individuals to create innovative solutions to current crises, this paper is very timely as it provides clear guidance as to how to ensure that we create value and promote prosperity, while at the same time allowing nature to thrive. It clearly highlights that economic development and biodiversity conservation are not mutually exclusive and that the circular economy provides an actionable framework for transforming production and consumption systems to align with conservation objectives." — Dr. Sue Snyman, Director of Research, School of Wildlife Conservation, African Leadership University

- **The Fashion Pact**: "It is inspiring to see our industry continue to place biodiversity protection and restoration high on our agenda of action. If we are to move at the scale and speed needed to restore and protect nature, we must move forward as an industry together. At The Fashion Pact, we are committed to collectively taking action, and support The Ellen MacArthur Foundation's integration of biodiversity as an important element of the circular economy." — Eva von Alvensleben, Executive Director and Secretary General, The Fashion Pact

- **TextileExchange**: "One of the biggest contributions the textile industry can make to the world we want is to reduce the pressure on natural ecosystems and even regenerate and restore landscapes. A shift to a circular economy not only creates benefits for nature and people by decreasing the need for virgin raw materials to fuel our industry but acknowledges and respects the importance of circular cycles in nature. As always, there is more we can learn from nature and this study beautifully outlines the full systemic transition we need. It gives us inspiration as well as guidance." — Liesl Truscott, Director Corporate Benchmarking, Textile Exchange

- **Renault Group**: "As a global partner of the Ellen MacArthur Foundation, Renault Group welcomes this new study linking circular economy with tackling biodiversity loss. After more than 15 years of commitment to circular business activities, including the implementation of a recycled plastic policy and recently shifting a production plant to a factory dedicated to reuse and recycling, Renault Group is actively involved in developing a robust circular business model, contributing to preserving the planet." — Luca de Meo, CEO, Renault Group

- **Kering:** "Circularity is a new mindset that reinforces what defines us as a Group: creativity, exceptional

know-how, high quality. At Kering, we are fully aligned with the Ellen MacArthur Foundation's new study "The Nature Imperative" and we see circular economy as one of the key solutions to achieving our commitment towards a net positive impact on biodiversity by 2025, but also as an enabler to innovate and further advance our sustainability goals." — Sophie Bonnier, Head of Environmental Excellence & Circularity, Kering

- **Intesa Sanpaolo**: "The current approach of our economic system, based on the linear take-make-waste sequence, is causing ever greater damage to the planet we live on. It is of fundamental importance to urgently rethink the methods of production and consumption of goods: for this purpose the principles of the Circular Economy can enable the transition to a new economic paradigm which, by design, is able to preserve the natural environment and biodiversity, while also fostering new opportunities to reconnect business and society." — Maurizio Montagnese, Chairman, Intesa Sanpaolo Innovation Center

- **Schneider Electric**: "We are at a tipping point for biodiversity. To preserve and restore it, we must learn from our experience in tackling the climate crisis and make sure we effectively measure the impacts of our entire value chain and take concrete action in line with science. This study highlights the important role industries need to play in halting and reversing biodiversity loss by transforming systems to a circular economy. At Schneider Electric we are committed to reach no net biodiversity loss in our direct operations by 2030, to keep growing circular business models and products, and to accelerate the fight against climate change." — Olivier Blum, Chief Strategy & Sustainability Officer, Schneider Electric

- **The Coca-Cola Company**: "Two years ago, the Ellen MacArthur Foundation published the 'Completing the Picture' report on the role the circular economy can play in tackling climate change. It has been crucial to our understanding and has helped build momentum towards our World Without Waste work in packaging. This study can do the same for the connection between the circular economy and addressing biodiversity loss, not just for plastics, but for food, fashion, and the built environment. We look forward to using it to build awareness and action in our supply chain." — Dr. Ben R Jordan, Senior Director, Packaging & Climate, The Coca-Cola Company

- **Inditex Group**: "Embracing circular economy principles is crucial to decouple economic growth from the extraction of raw materials – not only reducing the pressure on the climate but also preserving biodiversity, as this study makes clear. We recognise that biodiversity is a universal value and that each of us has a role to play to ensure it is respected, protected, and restored. We have committed to ambitious steps through our circularity strategy that will lead to the conservation and protection of biodiversity throughout our value chain." — Carlos Crespo, CEO, Inditex Group

- **H&M Group**: "Biodiversity loss is one of the most alarming crises of our time and science calls for it to be halted and reversed before 2030. A thriving fashion industry is undeniably dependent on healthy ecosystems and climate change kept within safe planetary boundaries. This study shows that the circular economy offers opportunities to move towards a more restorative and respectful relationship with nature. Prolonging the life cycle of our products through our new business models and keeping resources in circulation for as long as possible before eventually recycling them, will reduce our dependence on natural resources and the pressure on our planet. Together with decreasing this pressure, we also need to restore our planet's soil and oceans by moving towards using more regenerative practices along the industry's production chains. Furthermore, we focus on restorative and regenerative actions on nature to reduce the industry's negative impact." — Leyla Ertur, Head of Sustainability, Quality Strategy and Compliance, H&M Group

- **Philips**: "At Philips, we believe that a circular approach to doing business is key to meet global climate targets, and protect and restore the environment and biodiversity. This paper connects all the dots. A regenerative and greener future can only be realised by addressing climate change and biodiversity loss, and a key part of that effort is using circular practices, while collaborating with partners across the value chain to adopt innovative solutions." — Robert Metzke, Head of Sustainability, Philips

- **Kontoor Brands:** "Healthy and diverse ecosystems help regulate our climate, clean our water and purify our air. And the raw materials and resources healthy

ecosystems provide, that sustain our economy. This study makes a compelling case for fighting biodiversity loss using circular economy principles. We're proud to have partnered on this study, which calls on businesses and policymakers alike to work together to help transform our economies." — Jeff Frye, VP, Innovation, Product Development, and Sustainability, Kontoor Brands

- **DS Smith:** "We welcome this report which provides valuable insight into how the circular economy has a key role to play in regenerating natural systems while creating long-term benefits for business and society. At DS Smith, we have embraced the circular economy and believe that it is critical to addressing a wide range of urgent challenges such as material scarcity, climate change and biodiversity loss." — Miles Roberts, Group Chief Executive, DS Smith

- **Solvay**: "Solvay is honoured to contribute to the 'The Nature Imperative: How the circular economy tackles biodiversity loss' study as we work to connect the dots between our biodiversity ambition and our circular economy plans. We have committed to reducing our pressure on biodiversity by 30% by 2030, including by acting locally through numerous local conservation and impact reduction projects." — Pascal Chalvon Demersay, Chief Sustainability and Government Affairs Officer, Solvay

- **PepsiCo**: "When we act together with urgency, businesses and policymakers can make great progress on the critical issues facing society. Nothing is more important than protecting the diversity of life on our planet and the natural resources on which we depend, and the Ellen MacArthur Foundation has made a vital contribution to our understanding of how we can achieve these goals by transitioning to a circular economy." — Ramon Laguarta, Chief Executive Officer, PepsiCo

- **Brambles**: "We face runaway climate change and biodiversity loss that threatens our ecosystem, human health and jobs. 2020 kicked off the 'decade of action' in the United Nations' Sustainable Development Goals and we are committed to playing an active role in transforming supply chains and how we get products to people. At Brambles, we are working to pioneer regenerative supply chains and helping to create a nature-positive economy with re-use, resilience and regeneration at its core, based on the principles of a circular economy. I believe that this study provides the relevant framework to effectively fight climate change and biodiversity loss through the implementation of circular economy principles." — Juan José Freijo, Vice President Global Head of Sustainability & EMEA Government Affairs, Brambles

- **DSM**: "We all know that biodiversity loss is accelerating, and that its key drivers are all connected with human activity. Our goal is to create brighter lives for all – and this ultimately starts with a healthy planet. Thus, we welcome this new study, which rightly emphasises the role business can play to halt and reverse biodiversity loss by applying circular economy practices and innovations that help to eliminate waste and pollution, keep products and materials in use, and regenerate natural systems." — Helen Mets, Executive Vice President, DSM

- **NatureWorks**: "We believe in creating an equilibrium between nature and human needs – finding the right balance between crop yields, soil health, water and air quality, and supporting biodiverse ecosystems. To achieve this, an integrated and transformative approach is needed in the way we produce and use goods and food that also regenerates nature. The circular economy offers a way forward towards such a nature-positive future, as this study illustrates." — Erwin Vink, Sr. Sustainability Manager, NatureWorks

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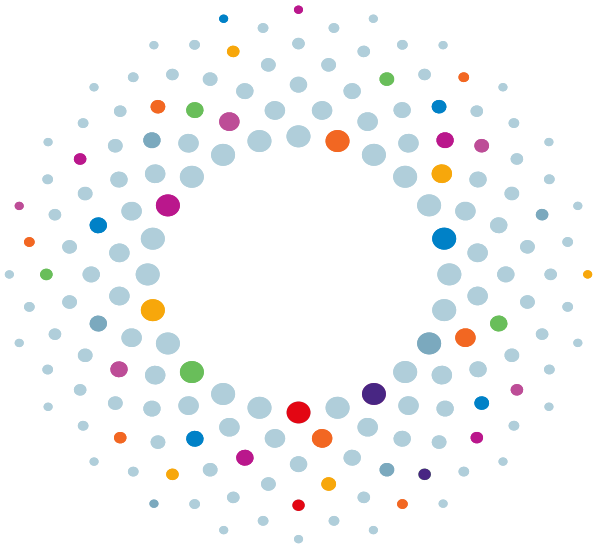


Regenerating nature means transforming the economy

The main underlying cause of the biodiversity crisis is our highly extractive, wasteful, and polluting economy. Over the past 70 years, the world has experienced a 13-fold increase in global economic activity,[16,I] While this growth has brought greater prosperity for many, it has been fuelled by the extraction of natural resources. The level of this extraction has long since exceeded that which the earth can renew: as of 2020 an estimated 1.6 earths are needed to regenerate the biological resources society demands.[17] Today's linear 'take-make-waste' economic system is therefore placing a huge burden on nature: the extraction and processing of natural resources accounts for more than 90% of biodiversity loss and water stress.[18,II] Such pressures have been attributed mainly to major value chains such as food, the built environment, energy, and fashion.[19]

A transformative change to our patterns of production and consumption is needed to halt and reverse biodiversity loss. Leading scientific organisations in the field have established that to successfully tackle biodiversity loss, nature conservation and restoration on their own will not be enough.[20] Tackling individual biodiversity loss drivers in isolation, will also not suffice. To effectively halt and reverse biodiversity loss, transformative change that goes to the heart of our production and consumption systems will be needed.[21] Such change is at the core of United Nations' Sustainable Development Goal 12 (Responsible Consumption and Production) and contributes to meeting several other of the SDGs, including those relating to life on land and at sea, and to climate change. It should be noted that the IPBES recognises that such transformation can only take place in the context of substantial shifts in world views, norms, values, and governance structures.[22]

Image: Red Zeppelin on Unsplash

The extraction and processing of natural resources accounts for more than

90%

of biodiversity loss and water stress

I On a per capita basis, the high-income group maintains levels of material footprint consumption that are 60% higher than the upper-middle income group, and 13 times the level of the low-income groups. International Resource Panel, Global resources outlook 2019: natural resources for the future we want (2019)

II Some industries and businesses account for a greater share of this, either directly through their reliance on natural resources, or indirectly through their operations further up the supply chain. PBL Netherlands Environmental Assessment Agency, Business for biodiversity: mobilising business towards net positive impact (2020)

BIODIVERSITY LOSS - IMPACTS AND DRIVERS

Healthy ecosystems and rich biodiversity are fundamental to life on our planet. Beyond nature's intrinsic value, biodiversity plays an essential role in providing a multitude of ecosystem services that make human life possible such as food, materials, clean water, climate regulation, cultural and spiritual enrichments, and many others.[23] Healthy ecosystems also offer an important source of jobs and innovation, and the total economic value of ecosystem services to society has been estimated to be more than one and a half times the size of global GDP.[24]

However, biodiversity is being lost at an unprecedented rate. Having lost an estimated 83% of all wild mammals and half of plants, the earth is experiencing its sixth mass species extinction.[25,III] The IPBES has found that this crisis is largely due to five key pressures driven by human activity: changes in land and sea use, overexploitation of species and natural resources, climate change, pollution, and invasion of alien species (see below).[26]

Biodiversity loss has now become one of the greatest risks to humanity of the twenty-first century. Ecosystems in about a fifth of countries are currently at risk of collapse due to the decline in biodiversity and its related services,[27] and over half of global GDP is potentially threatened by nature loss.[28] The loss of pollinators (on which 75% of food crops to some degree depend[29]) threatens global food production. Human health is also at risk, with more than half the global population relying primarily on natural medicines, and around 70% of drugs used to treat cancer derived from natural or nature-inspired products.[30]

DIRECT DRIVERS OF BIODIVERSITY LOSS

Land and sea use change
Human actions have significantly altered 77% of land and 87% of the area of the ocean. The loss of 83% of wild mammal biomass, and half that of plants, are linked to these vast changes.[31]

Overexploitation
In 2019, humanity was using nature and its resources at rates 1.75 times faster than the planet's ecosystems can regenerate[32], disturbing habitats at extraction sites and overexploiting specific organisms.[33]

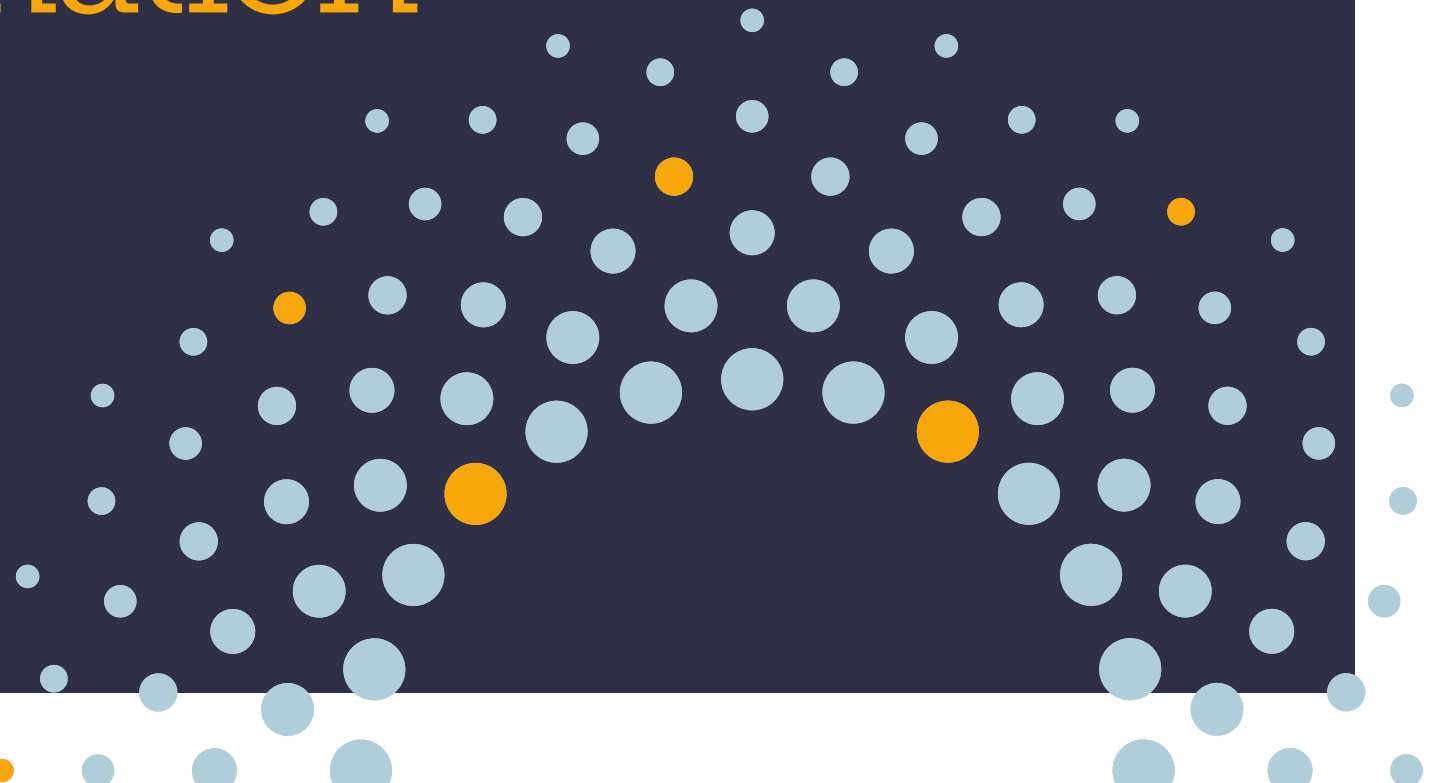
Climate change
Human actions have warmed the globe by more than 1°C compared to pre-industrial levels, and climate change has already negatively affected nearly half of threatened terrestrial mammals and a quarter of threatened birds.[34]

Pollution
Approximately 11 million tonnes of plastic are dumped into the world's oceans each year - an amount expected to nearly triple by 2040[35] - affecting at least 267 species.[36] Other pollutants, such as those from industrial, mining, and agricultural activities, have had strong negative impacts on soil, freshwater, and marine water quality, disrupting vital habitats.[37]

Invasive alien species
Since 1980, cumulative records of alien species have increased by 40%, with plant and animal invasions posing a risk to nearly a fifth of the Earth's surface, impacting native species, ecosystem functions, and nature's contributions to people.[38]

III Species extinction rates are now accelerating hundreds of thousands of times faster than the 'normal' rates measured over the last tens of millions of years. Earth.org, Sixth mass extinction of wildlife accelerating study (2020)

The circular economy is a framework for transformation



THE CIRCULAR ECONOMY CAN PLAY A SUBSTANTIAL ROLE IN HALTING AND REVERSING BIODIVERSITY LOSS

The circular economy tackles the five key direct drivers of biodiversity loss identified by the IPBES:

- It reduces the amount of land needed to provide resources to the economy **(addressing changes in land and sea use)**
- It manages renewable resources such as fish stocks for the long term **(addressing direct exploitation of organisms and natural resources)**
- It reduces greenhouse gas emissions across the economy **(addressing climate change)**
- It designs out pollution at every stage of a product's life cycle **(addressing pollution)**
- It designs out the waste on which invasive alien species can be transported to new ecosystems **(addressing invasive alien species)**

It does this by addressing the underlying cause of all five drivers: our extractive, wasteful, and polluting economy. Currently, more than 90% of biodiversity loss is caused by resource extraction and processing.[39] In a circular economy, the need for virgin resources is dramatically reduced since they are kept in use longer, more productively managed, and are not wasted.

The circular economy is therefore crucial for bending the curve on biodiversity loss. Efforts to conserve nature at every scale, and most importantly at the landscape level, by maintaining wilderness areas will be crucial to safeguarding biodiversity. These efforts will however be insufficient unless they are allied with a transformation of the economy (see Figure 1).

WHAT IS A CIRCULAR ECONOMY?

The circular economy is a framework for systems solutions and transformation that tackles global challenges like climate change, biodiversity loss, waste, and pollution. It has three principles, all driven by design:

Eliminate waste and pollution

Circulate products and materials

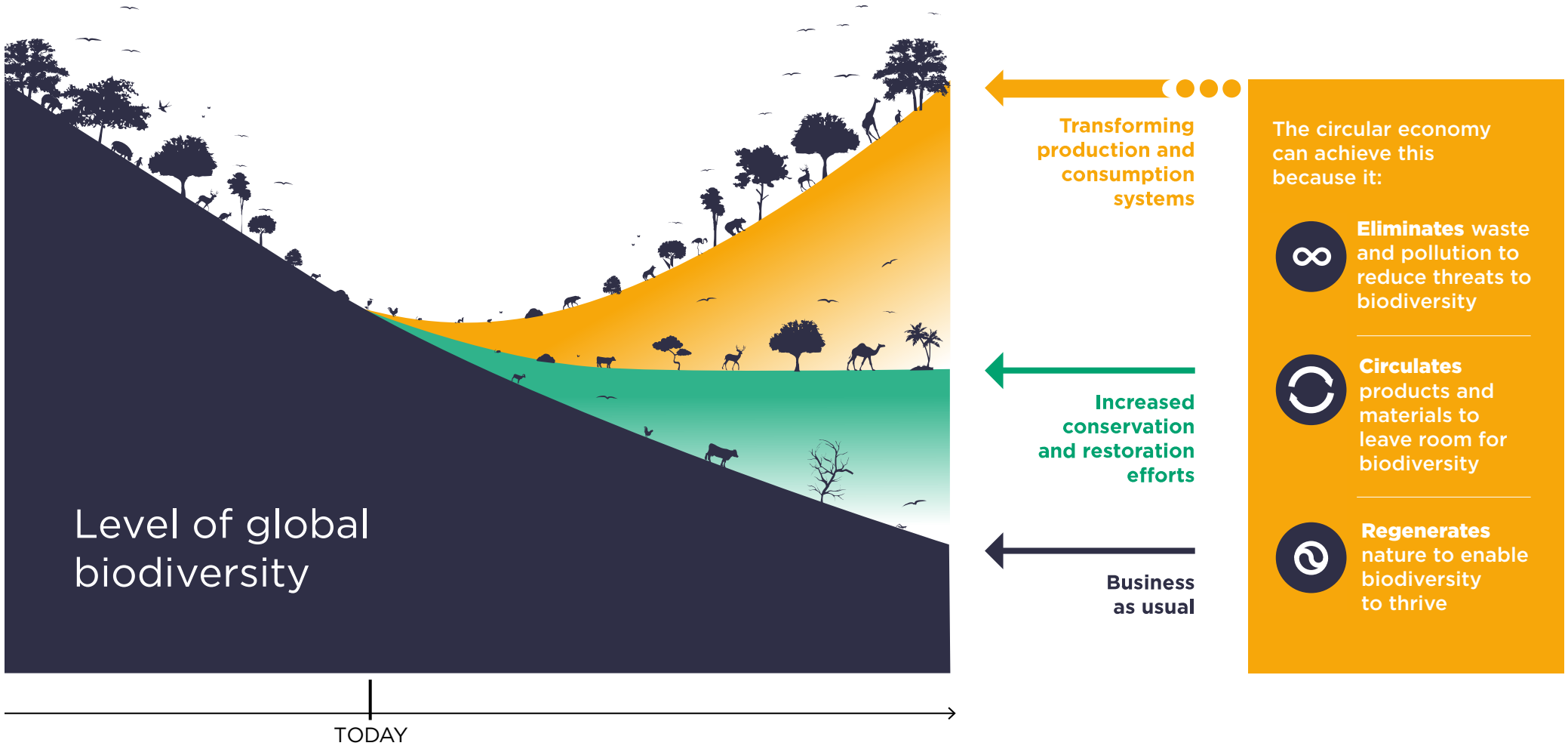
Regenerate nature

Based increasingly on renewable energy and materials, and accelerated by digital innovation, it is a more resilient economic model that is distributed, diverse, and inclusive. As in nature, the circular economy does not create waste because products, materials, and nutrients are kept in use and circulated in the economy or returned to the environment to support ecosystem health.

The circular economy is a systems change agenda that presents opportunities to create better growth. Going well beyond addressing the symptoms of today's wasteful and polluting economy, the circular economy represents an opportunity to create value in ways that benefit society, business, and the environment, thereby offering the potential to substantially contribute to the delivery of the Sustainable Development Goals.

These solutions, which can scale-up quickly and are applicable anywhere in the world, reduce the likelihood of future shocks and create greater resilience. The circular economy is underpinned by design, spurring innovation that harnesses digital technologies across a range of opportunities.

FIGURE 1 **THE CIRCULAR ECONOMY PLAYS A CRUCIAL ROLE IN BENDING THE CURVE ON BIODIVERSITY LOSS** [1]



1 This image is an adaptation of that presented by the Secretariat of the Convention on Biological Diversity's report Global Biodiversity Outlook 5 (2020) and the Nature article Bending the curve of terrestrial biodiversity needs an integrated approach (2020). It does not intend to accurately represent the impact of potential scenarios.

EACH CIRCULAR ECONOMY PRINCIPLE HAS A PART TO PLAY

ELIMINATE WASTE AND POLLUTION

TO REDUCE THREATS TO BIODIVERSITY

In a circular economy the release into nature of substances harmful to biodiversity in the form of waste or pollution (e.g. hazardous chemicals, greenhouse gases, and unnecessary single-use materials) is designed out. Achieving this means viewing waste and pollution as design flaws and embracing new business models, materials, and technologies to eliminate them. Each part of the value chain – from production, through use, to after-use – is included in this redesign of materials, products, and systems.

For example:

FOOD: adopting practices for regenerative outcomes can reduce or eliminate the need of synthetic fertilisers, pesticides, and other inputs that harm biodiversity on farms and beyond by polluting waterways and emitting greenhouse gases

FASHION: designing clothing that uses non-toxic dyes and more shed-resistant or safely biodegradable fabrics helps avoid the leakage of hazardous substances and microfibres into the environment

PLASTIC PACKAGING: eliminating non-essential packaging items such as 'tear-offs', using innovative materials that are edible, or redesigning products and business models so they no longer need packaging – all these design interventions help to avoid plastic waste from being generated in the first place

CIRCULATE PRODUCTS AND MATERIALS

TO LEAVE ROOM FOR BIODIVERSITY

By circulating products and materials, the circular economy can help meet society's demand for goods and services with far fewer virgin resources, substantially reducing the negative impacts on biodiversity imposed by their extraction and processing.[40] Higher value loops that require less reprocessing of products and materials – such as sharing, resale, and repair models – should be prioritised where possible. Lower value loops – such as upcycling and recycling – are also attractive when further recirculation is no longer possible. Realising these opportunities requires innovating in new business models, redesigning products for multiple use cycles, and developing infrastructure to enable circulation.

For example:

BUILT ENVIRONMENT: designing buildings to make use of reusable modular concrete components reduces demand for sand – the extraction of which harms local wildlife populations and is occurring at rates beyond those that can be naturally replenished[41]

DURABLE GOODS: using recycled metals in electronic devices means less metal needs to be processed from ore and fewer mines dug – leaving more room for biodiversity, and avoiding the greenhouse gas emissions and pollution associated with metal production

FASHION: keeping clothes made from natural fibres in use for longer will, — assuming the purchase of new clothes is also displaced — reduce the demand for virgin fibres and the land needed to grow them, leaving more room for other land uses including the preservation of wilderness

REGENERATE NATURE

TO ENABLE BIODIVERSITY TO THRIVE

It is possible and necessary to go beyond reducing the negative effects of economic activity on biodiversity, towards employing it actively to regenerate natural systems. Regenerative production can help achieve this by creating the conditions to allow below- and above-ground biodiversity to prosper within and beyond managed areas, securing the long-term provision of critical ecosystem services on which society relies (e.g. the provision of food and clean water, flood protection, and nutrient cycling) and preventing land degradation.

For example:

FOOD PRODUCTION ON LAND: designing food products with a diverse range of regeneratively produced ingredients promotes biodiversity by supporting farming systems that grow food in ways that, for example, build soil health, enhance carbon sequestration, improve air and water quality, and eliminate the need for harmful synthetic inputs

FOOD AND MATERIAL PRODUCTION AT SEA: shifting from extractive practices to models that proactively enhance biodiversity – such as growing shellfish and seaweed in vertical ocean farms – can create healthy agroecosystems that filter water, absorb excess nutrients, and capture carbon while producing food, animal feed, fertiliser, and biomaterials

FORESTRY: drawing on forest management approaches such as continuous cover forestry, and employing practices such as using mixed stands, sparing veteran trees, and leaving deadwood, can help create timber production systems that regenerate biodiversity by proactively limiting habitat disturbance and improving soil health and water quality

WHAT IS REGENERATIVE PRODUCTION?

Regenerative production is an approach to managing agroecosystems that provides food and materials – be it through agriculture, aquaculture, or forestry – in ways that create positive outcomes for nature. These outcomes include, but are not limited to, healthy and stable soils, improved local biodiversity, improved air and water quality, and higher levels of carbon sequestration. They can be achieved through a variety of context-dependent practices and can together help regenerate degraded ecosystems and build resilience on farms and in surrounding landscapes. Farmers may draw on several different schools of thought – such as regenerative agriculture, restorative aquaculture, agroecology, agroforestry, and conservation agriculture – to help them apply the most appropriate set of practices to drive regenerative outcomes in their agroecosystems.

Image: Thai Tong on Unsplash

THE BIODIVERSITY BENEFITS OF THE CIRCULAR ECONOMY CAN BE DEMONSTRATED ACROSS SECTORS

Business and policymakers can apply the circular economy principles across the economy to unlock system-wide benefits. This paper focuses on four sectors important to biodiversity loss:

- **Food**
- **The built environment**
- **Fashion**
- **Plastic packaging**

While this is the focus of the paper, the same thinking applies to all sectors. The circular economy creates value through product redesign for longevity and repairability, digital-enabled resale and sharing platforms, remanufacturing, material innovation, and regenerative production. Digital technologies and innovations, such as artificial intelligence and Internet-of-Things solutions, play important roles in optimising and enabling the adoption of these circular opportunities.[42] For companies, circular practices can boost competitiveness by generating new sources of revenue through new business models, reducing material costs, spurring innovation, and reducing risks associated with supply chain disruption and resource price volatility. For policymakers, a society-wide shift to the circular economy represents a framework for economic development that helps meet goals on biodiversity, climate change, improvements in human health and wellbeing, and job creation.

The following section outlines how applying circular economy principles to the four focus sectors helps tackle biodiversity loss while also offering many other benefits at the same time (see Figure 2 for an illustration). For more detail, see the section on sector deep-dives in this paper, and in the case of food see *The Big Food Redesign: Regenerating nature with the circular economy (2021)*. Further inspiration can be found in the biodiversity case study library on the Ellen MacArthur Foundation website.

Food

In a circular economy, food production regenerates rather than degrades the environment, by-products are recirculated, and all people have access to healthy and nutritious food.[43] Regenerative food production increases biodiversity on farms and in surrounding and nearby ecosystems by improving soil health, reducing the pollution caused by excessive use of synthetic inputs like fertilisers and pesticides, and sequestering carbon in the soil. Excess food is redistributed and by-products are transformed for other uses, thereby optimising what is grown and reducing the pressure to expand agricultural land. A circular economy for food could generate annual benefits worth USD 2.7 trillion by 2050 globally if cities alone take action across these areas at scale.[44] Circular design for food has a key role to play in unlocking these opportunities. For example, designing food products for nature by using diverse, lower-impact, upcycled, and regeneratively grown ingredients has been shown in a recent study by the Ellen MacArthur Foundation – *The Big Food Redesign: Regenerating nature with the circular economy* (2021) – to have great potential. Looking at three example ingredients (wheat, potatoes, dairy) it was revealed that such a circular economy approach can reduce farm-level greenhouse gas emissions by an average of 70% and the impact on farm-level biodiversity by an average of 50% versus business-as-usual by 2030. This can all be achieved while providing a 50% higher 'steady state' total food production versus baseline and a USD 3,100 per hectare per year net value creation for farmers, following a transition period.

REGENERATIVE OCEAN FARMING

Actively rebuilding biodiversity and allowing it to thrive

GreenWave (USA)

GreenWave has developed a polyculture model that grows a mix of seaweed and shellfish called regenerative ocean farming, which allows cultivation to take place whilst enabling biodiversity to prosper. The technique involves suspending a simple structure of ropes and buoys between the sea surface and seabed, on which scallops, clams, oysters, mussels, and seaweeds, are grown at different depths. A mature, twenty acre regenerative ocean farm can produce up to 68 tons (~61.7 tonnes) of nutritious seaweed and 250,000 shellfish.[45] These harvests can be used as ingredients in novel food products - such as the range of seaweed products made by Seamore[46] - processed to create fertiliser or animal feed for the agricultural sector, or transformed into materials for other industries.[47] Studies on seaweed aquaculture more broadly have shown that farming 0.03% of the ocean's surface area in this way could offer an economic opportunity of USD 500 billion and create 50 million jobs, helping to revitalise local communities that have long relied on the sea for their livelihoods.[48]

Source: Wikipedia

Biodiversity benefits:

GreenWave's regenerative ocean farms can turn barren patches of ocean into thriving reefs, attracting biodiversity and rebuilding degraded coastal ecosystems. The farms can provide storm surge protection for coastal communities and require zero inputs: no fresh water, fertilizer, land, or feed. Studies have also shown that in general, growing seaweed can enhance water quality and absorb nutrient run-off, with the production of 500 million tons (~ 453.6 million tonnes) of seaweed having been estimated to be able to assimilate 10 million tons (~ 9.1 million tonnes) of nitrogen from seawater, equaling some 30% of the nitrogen estimated to enter the ocean. At the same time, these actions offer substantial carbon sequestration potential: growing seaweed in less than 5% of U.S. waters could absorb 135 million tons of carbon (~450 million tonnes of CO2).

REGENERATIVE ORGANIC AGRICULTURE

Actively rebuilding biodiversity and allowing it to thrive

Rizoma Agro (Brazil)

Rizoma Agro is a Brazilian producer, researcher, and technology developer for regenerative organic agriculture.[49] In its 1,100 hectares, it draws on schools of thought like agroforestry and intensive silvopasture, and uses practices such as crop rotation and integrated crop-livestock management to produce a wide range of products including corn, soy, oats, beans, citrus, and cattle.[50] In 2019, it became the largest producer of regenerative organic grains and pulses in Brazil and now supplies major food companies, including Nestlé and Unilever. By 2030, its goal is to grow organic crops regeneratively on 350,000 hectares in Brazil.[51]

Biodiversity benefits

The regenerative production approaches of Rizoma Agro have enabled its farms to approximately double their water retention capacity and sequester up to 41 tonnes of carbon per hectare each year (in just the first year after shifting to regenerative production, levels of soil organic matter on two farms increased from 2.7% to 3.3% and from 1.3% to 2.5% respectively).[52] Taken together, these effects help reduce the pressures on biodiversity usually associated with food production.

Image: Rizoma Agro

The built environment

In a circular economy, urban areas are designed to be compact and integrate nature, to be made up of buildings and construction materials that are kept in use, and to use renewable materials that are regeneratively produced. By planning compact and biodiverse urban environments that optimise the use of space, the sector can leave room for nature within and beyond urban areas. In Europe, for example, up to 30,000 km^2 of fertile land could be saved by 2050 by planning cities with higher densities instead of encouraging urban sprawl.[53] Keeping existing buildings and materials in use can reduce the impacts on biodiversity associated with the extraction and processing of virgin raw materials, and those impacts brought about by the construction and demolition of buildings. This can be achieved by employing circular business models such as space sharing or rental, refurbishing and retrofitting existing buildings, and reusing and recycling construction materials. Where new materials are needed, switching to renewable materials like timber or hemp – and ensuring they are regeneratively produced – can help the sector actively rebuild biodiversity and safeguard the health of ecosystems. Such a circular economy approach helps create biodiverse, resilient, and healthy cities that have the potential to reduce emissions from four key building materials by 2Gt of CO_2 in 2050[54] and capture the approximately EUR 2.1 trillion (USD 2.5 trillion) of annual lost value from depreciated building materials.[55]

ADAPTIVE REUSE OF AN EXISTING BUILDING

Reducing demand for virgin natural resources to leave room for biodiversity

Quay Quarter Tower (Australia)

Quay Quarter Tower, originally built in 1976, has been the centrepiece of Sydney's harbour area revitalisation.[56] Since 2018, the building has been undergoing a redevelopment which will see a height increase, the construction of additional floorspace, and a modernisation of the building's entire design. Instead of demolishing the existing building and constructing a new one, which usually occurs with any major urban development and leads to waste generation and resource demand, Arup and Danish architects 3XN took an adaptive reuse approach to convert the existing building and change it to a new use.

Biodiversity benefits This adaptive reuse approach retained 68% of the building's structure, which allowed for a reduction in virgin material extraction and ensured that part of the tower's embodied energy and CO_2 could also be retained – equivalent to 10,000 aeroplane flights from Sydney to Melbourne.[57] By doing so, the renovation was able to minimise its contribution to the overexploitation of natural resources and climate change, thereby reducing the project's impact on biodiversity.

Image: 3xn

Fashion

A circular economy for fashion ensures that products are used more, made to be made again, and made from safe and recycled or renewable inputs that contribute to the regeneration of natural systems.[58] Using materials for longer, through reuse or recycling, displaces the need for new production and therefore offers one of the greatest opportunities to reduce the negative impacts on biodiversity associated with virgin fibre production, processing, and disposal. By shifting to safe chemistry and designing out microfibre release, the industry can also design out environmental pollution and promote safe material cycles. To illustrate the potential, implementing circular practices in a textile industry in China could reduce pressures on biodiversity by bringing about a 14% reduction in virgin material needs, a 28% reduction in greenhouse gas emissions, and a 39% reduction in water pollutant treatment costs (from increased water recycling).[59] Economically, these outcomes would generate USD 193 billion in cost savings by 2040, when compared with the current development path.[60] However, to go beyond reducing impacts and truly become nature-positive, fashion companies also need to embrace regenerative production. Such an approach can actively rebuild biodiversity by creating the conditions for it to thrive (e.g. healthy soils, clean water, habitat) within the agricultural and forest ecosystems which provide the renewable fibres that account for 36% of all fibres used in the textile industry.[61]

KEEPING CLOTHING IN USE

Reducing demand for virgin natural resources to leave room for biodiversity

thredUP (USA)

thredUP is a managed resale marketplace that makes it easier for people to sell unwanted clothes in order to keep garments in use for longer. By facilitating this increase in utilisation rates, the company is starting to decouple its business model from the extraction of natural resources, while preventing incineration and landfilling – ultimately avoiding the negative impacts on biodiversity associated with the manufacturing and disposal of garments. Customers send in their clothes for free, and the company sorts, selects, and lists them for sale on its e-commerce platform. The platform inventory includes more than 35,000 brands that are sold at a fraction of their original price.[62] In 2021, thredUP reached a valuation of above USD 1 billion.[63]

Biodiversity benefits

Until now, thredUP has processed 125 million unique secondhand items, avoiding the emission of about 500,000 tonnes of CO_2e, saving over 16 billion litres of water,[IV] and reducing other pressures on biodiversity associated with the manufacturing and disposal of garments.

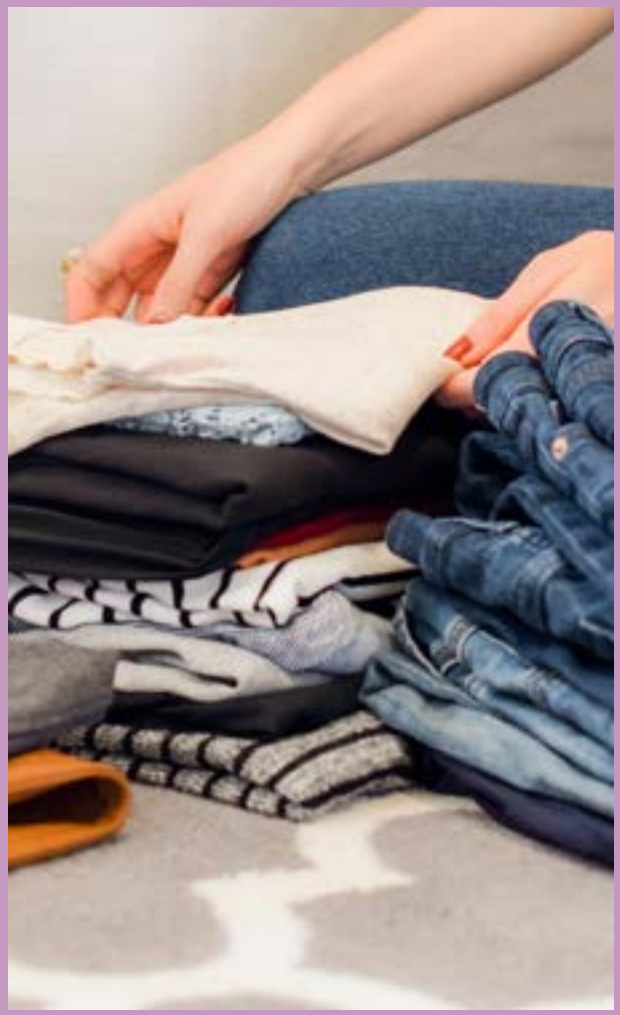


Image: Sarah Brown

IV Assuming that there is 1:1 switching from buying brand new apparel to buying second-hand apparel from thredUP, and that the second-hand clothing sold by thredUP has 70% of its useful life still left. For more information, see GreenStory, Comparative Life Cycle Assessment (LCA) of second-hand vs new clothing (2019)

Plastic packaging

A circular economy for plastic is one in which unnecessary plastics are eliminated; innovation ensures that all necessary plastics are reusable, recyclable, or compostable; and all used plastics are circulated, keeping them in the economy and out of the environment.[64] In doing so, the sector can minimise its demand for finite virgin materials, eliminate waste and pollution, and reduce greenhouse emissions – alleviating its main pressures on biodiversity. Compared to a business-as-usual scenario, such an approach has the potential, by 2040, to reduce the global annual volume of plastics polluting our oceans by 80% and the sector's greenhouse gas emissions by 25%, while generating savings of USD 200 billion per year and creating 700,000 net additional jobs.[65]

REFILLABLE PACKAGING ON-THE-GO

Keeping packaging out of the environment to reduce threats to biodiversity

Algramo (Chile)

Algramo, a Santiago-based start-up founded in 2013, offers affordable quantities of everyday products without single-use, non-recyclable packaging. Targeting economies where recycling infrastructure is limited and packaging items often end up in the environment, Algramo has a reusable packaging system with dispensers for the products and affordable reusable containers. Sales at Algramo's 'refill-on-the-go' system in Santiago increased by 356% between April and June 2020 while the city was in full lockdown.[66] After its success in Chile, Algramo is working with Walmart, Unilever, Nestlé's Purina, and other players to expand its services and scale up, with pilot programmes in the USA and Indonesia already underway, and plans to enter markets in Mexico and the UK being made.

Image: Algramo

Biodiversity benefits

In a pilot with Unilever, over the course of a year some Algramo customers refilled their detergent bottle 15 times – each refill eliminated the need for a new bottle and its associated impacts on biodiversity, and kept the refillable bottle in use and out of the environment.[67]

FIGURE 2 **THE CIRCULAR ECONOMY PROVIDES BENEFITS TO BIODIVERSITY AND THE ECONOMY**

Previous reports by the Ellen MacArthur Foundation[68] have found that applying a comprehensive circular economy approach across sectors at a regional or global level generates system benefits that safeguard and rebuild biodiversity.

CLIMATE

9.3 billion tonne reduction in CO_2e

can be achieved in five key global industries (cement, steel, aluminium, plastics, and food) in 2050 - the equivalent of eliminating current emissions from all transport globally.[267]

MATERIALS

20-71% reduction in primary material consumption

can be achieved in key economic sectors - such as food, mobility, and the built environment - in Europe, India, and China.[268]

AGRICULTURE

~50% reduction in the negative impact on farm-level biodiversity

can be achieved in the EU and UK for three example ingredients (wheat, potatoes, dairy) by 2030 by designing food products for nature using diverse, upcycled, lower-impact, and regeneratively-grown ingredients.[269]

ECONOMY

Trillions of USD in annual benefits

can be achieved by 2050 - in the form of net material cost savings and reductions in externalities - in key economic sectors in Europe, India, and China.

OCEAN

80% reduction in plastic leakage

can be achieved in the global plastics sector in 2040.[270]

There are compelling ways for business and policymakers to accelerate the shift

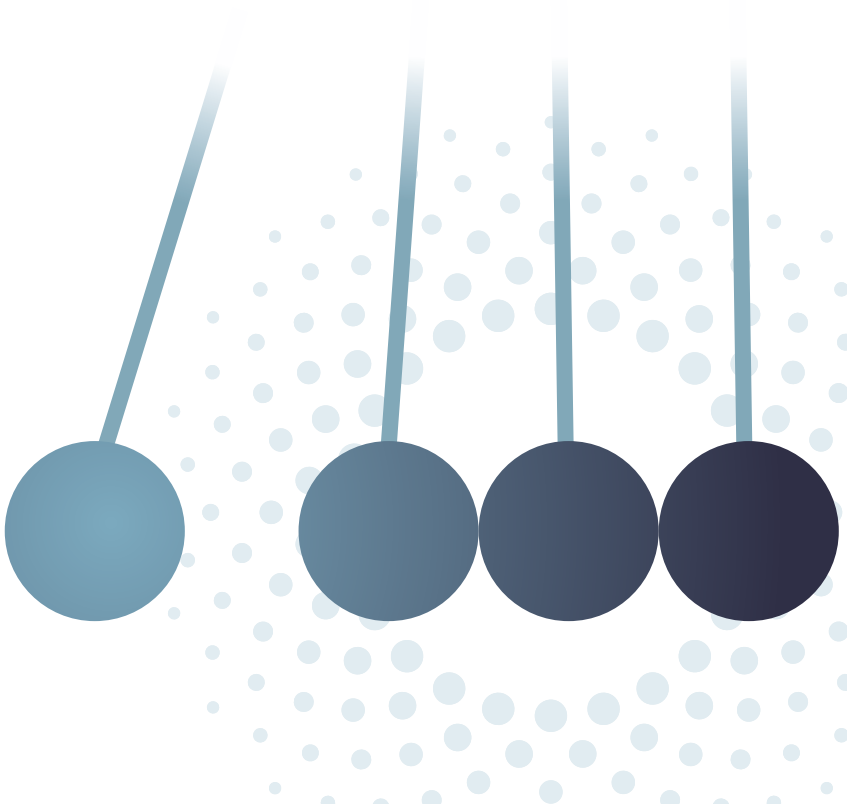
MOMENTUM BEHIND THE CIRCULAR ECONOMY IS BUILDING

More and more leading companies across industries are adopting and making commitments to circular economy principles in their core business. Recently established companies such as the The RealReal and Rent the Runway, each having been valued at nearly USD 1 billion,[69] offer customers second-hand or subscription clothing rental. In other sectors, health technology company Philips offers circular products and services that, in 2019, were responsible for generating 13% of its revenues (which they are aiming to increase to 25% by 2025).[70] As these efforts intensify, the circular economy has started to transform entire industries. In fashion, for example, clothing resale is expected to become twice as big (in economic terms) as fast fashion by 2030.[71] Small businesses with circular innovations are fast-emerging, looking for opportunities to bring their solutions to scale.

In the public sector, the circular economy is increasingly being integrated into growth strategies and efforts to tackle global issues such as the EU Green Deal, African Green Stimulus Programme, and countries' Nationally Determined Contributions under the UN Framework Convention on Climate Change. Numerous circular economy alliances and coalitions are being created across the world, with the EU launching in 2021 the Global Alliance on Circular Economy and Resource Efficiency (GACERE), and regional alliances being established in Latin America, the Caribbean, and Africa.

In finance, the circular economy is increasingly being viewed as an essential part of the solution to deliver on climate, biodiversity, and Environmental, Social and Governance (ESG) targets, and manage risks. The number of public equity funds dedicated to the circular economy increased 14-fold in 2020 alone,[72] reaching a total of 13 in 2021, including funds by leading providers such as BlackRock, BNP Paribas, Credit Suisse, and Goldman Sachs. Combined assets under management in these funds has grown to over USD 8 billion - 26-fold increase since December 2019 – demonstrating the potential for circular economy-related financial products to attract capital inflows.[73]

Several megatrends are accelerating this shift away from today's linear model to the circular economy. Consumer preferences are creating strong pull factors, particularly among the Millennial and Gen-Z age groups, who are increasingly driven in their consumption patterns by their growing awareness of environmental and social issues.[74] The growth of urbanisation is bringing people and resources closer together, thereby enabling more effective circulation of goods and materials.[75] Digitalisation, automation, artificial intelligence, and other innovations open up new circular economy opportunities, such as digital-enabled sharing and resale platforms, and decentralised production using 3D printing.[76] As these trends grow, the attractiveness and relevance of a circular economy transition only increases.



LEADING BUSINESSES ARE STARTING TO USE THE CIRCULAR ECONOMY TO HELP ACHIEVE THEIR BIODIVERSITY AMBITIONS: THERE IS ENORMOUS OPPORTUNITY TO SCALE THIS APPROACH

Some leading businesses are already starting to use circular economy solutions to help meet their biodiversity ambitions. For example, in food, Danone[77] and General Mills[78] have invested millions in scaling regenerative agriculture to help address biodiversity loss. In fashion, Kering[79] and H&M Group[80] are positioning the circular economy as a key framework to help achieve their biodiversity objectives. These examples show encouraging first signs of businesses understanding the value of the circular economy in addressing biodiversity loss. Individual companies can broaden and deepen their application of the circular economy principles and, crucially, engage in cross value chain collaboration to deliver vastly greater value and enhanced positive impact.

To build on the momentum and shape nature-positive solutions with the circular economy, businesses can take three key steps now to help kick-start their journey:

1 Assess biodiversity impacts and dependencies, and set targets

The first step in exploring how a business can best use the circular economy framework to help meet its biodiversity ambitions is to fully understand how the business impacts and depends upon biodiversity across its value chain. Many tools are now available to help companies on this journey. For example, the Science-Based Targets Network (SBTN) has recently developed initial guidance for companies looking to set biodiversity targets that are aligned with globally agreed goals.[81] It encourages a broader uptake of measurement approaches such as the IUCN Species Threat Abatement and Restoration (STAR) metric, the Natural Capital Protocol, and the Global Biodiversity Score – all of which offer companies useful methods and resources to help assess, act, and report on their progress towards meeting biodiversity targets.[82]

2 Identify circular economy opportunities that help meet biodiversity ambitions

As a business sets its biodiversity commitments, targets, and plans for action, the circular economy framework offers a compelling and economically attractive delivery mechanism.[V] With over 80% of a product's environmental footprint determined during its design phase, circular design provides an approach and mindset to start redesigning products, services, and systems for a nature-positive future.[83] The sector deep-dives in this paper offer examples of innovative and inspiring solutions, showing how companies have joined the dots on biodiversity and the circular economy. They also present some of the key resources to help other companies follow their lead.

3 Collaborate to find solutions that can deliver transformative change

Circular economy innovations need to emerge at scale to drive the transformative change in production and consumption patterns necessary to halt and reverse biodiversity loss. Collaborating along and across value chains and with other entities, such as conservation organisations and universities; finding synergies with biodiversity platforms, and mobilising stakeholders behind a vision for a regenerative future are all necessary to develop innovative solutions that can be widely adopted to achieve systems change. Examples of recent actions in this direction include the Global Commitment on Plastics, the Jeans Redesign, and the public call by industry for the introduction of Extended Producer Responsibility (EPR) schemes for plastic packaging.[84]

V The circular economy is in direct alignment with the Action Framework developed by the SBTN, which builds on the mitigation and conservation hierarchy to help businesses take action towards a nature-positive future. The SBTN's Action Framework covers actions to avoid future impacts, reduce current impacts, regenerate and restore ecosystems, and transform the systems in which companies are embedded. Concurrently, the circular economy is an action-orientated framework that eliminates waste and pollution; keeps products and materials in use; regenerates natural systems, and that is transformative by design.

POLICYMAKERS PLAY A CRUCIAL ROLE IN ENABLING AND PROPELLING THE TRANSFORMATION NATIONALLY AND INTERNATIONALLY

Policymakers can seize the opportunity offered by linking the international discussions on implementing a Post-2020 Global Biodiversity Framework with national post-Covid economic recovery plans to transform our linear consumption and production models. To do so, they can take action on three fronts:

1 Recognise the circular economy as a delivery mechanism to address the underlying causes of biodiversity loss under the CBD's Post-2020 Global Biodiversity Framework

A conducive policy context at the international level is instrumental to enable transformative change. To leverage the industrial transformation potential of the circular economy, a new policy approach is required. It is vital that governments go beyond considering the intrinsic value of nature, and overcome the widespread perception of nature protection being a trade-off with economic development. If environmental and economic policy-making is better integrated, it will become a powerful enabler to meeting several SDGs. In the context of the Convention on Biological Diversity (CBD), it is important that governments and businesses agree on how to better value nature in financial and economic accounting systems,[85] recognising the cost of inaction in policy and corporate decision-making. The first draft of the Post-2020 Global Biodiversity Framework from July 2021[86] acknowledges the need to transform our linear consumption and production models. The circular economy offers such a delivery mechanism, as described in chapters 2 and 3.

The circular economy provides a solution framework which can help meet the new global biodiversity targets to be defined under the UN Convention on Biological Diversity. The linear economic model creates value by depleting and consuming natural resources. The circular economy, as in nature, does not create waste since products, materials, and nutrients are kept in use and circulated in the economy or returned to the environment to support ecosystem health, creating value while building biodiversity. To gain an understanding of the full potential, scientifically sound analyses on the extent to which the circular economy can address the main drivers of biodiversity are needed and their findings used to inform a framework that drives systemic change. Governments have a role to play in reviewing cost and incentive structures to ensure that positive biodiversity outcomes are consistently integrated in sector policies and development strategies. Such an approach would facilitate a whole-of-government commitment when implementing biodiversity-related strategies and policies at national level.

2 Create enabling conditions for the circular economy at the national level

The post-Covid recovery offers a rare opportunity to mobilise economic stimulus and align financial flows with the needs of both people and nature. Circular economy opportunities exist in all sectors – including food, the built environment, fashion, and plastic packaging – to build a resilient, net-zero, and nature-positive economic recovery.[87] By embedding biodiversity targets in the recovery programmes of national governments and international financial institutions, the business case for the transition to a circular economy can be further strengthened. For example, the EU agreed to introduce a new biodiversity mainstreaming approach for the 2021–27 Multiannual Financial Framework, with the ambition of providing 7.5% of annual spending to biodiversity objectives in the year 2024, and 10% in 2026 and 2027.[88]

Effectively addressing biodiversity loss at the global scale means cultivating new forms of collaboration to change the predominantly linear economic system. A recent analysis by the European Central Bank (ECB), World Bank, and OECD shows that countries with higher environmental protection measures are expected to experience higher GDP and sectoral growth than countries that do not prioritise these measures.[89] By making the circular economy a key element of national biodiversity strategies, ministries across government can own it as a shared policy agenda – enabling innovation and helping businesses to scale solutions. The complex task of halting and reversing biodiversity loss will require collaboration across government as well as with investors, industry, academia, and civil society.

3 Leverage the Universal Circular Economy Policy Goals to build policy alignment

Offering a system-wide approach, the five universal circular economy policy goals, developed by the Ellen MacArthur Foundation, can help establish the right conditions for transformative change.[90] By tackling the root causes of our current linear system throughout the whole economy, these goals open up opportunities for national governments and policymakers, cities, and businesses to align ambitions and create a common direction of travel, as well as to coordinate relevant policy efforts. Although the starting point for each country and each sector will be different, and trade-offs will need to be considered, policymakers and stakeholders can use the five goals to link biodiversity targets with the development and implementation of circular economy measures tailored to the local context. The five goals are:

- **Make the economics work:** Governments can, for example, eliminate or repurpose financial incentives that are harmful to biodiversity, including subsidies,[91] recognised as a priority under the CBD. This could be complemented with developing positive market incentives, such as payments for ecosystem services (PES), through public procurement, or with tax breaks for circular economy solutions that have clear biodiversity benefits.[92] Finally, there is growing consensus around establishing new standards and methods of economic accounting that integrate natural, social, and human capital.[93]

- **Stimulate design for the circular economy:** A policy focus on circular design aims to eliminate waste and pollution across production and use phases, and to ensure that goods and by-products can safely remain in the system. To achieve this, it is key that the right choices on material and nutrient inputs, design, and business models have been made from the outset. Circular design practices can also inform whether goods and by-products can return to natural systems, based on their ability to support the regeneration of natural systems. Policies relating to products, buildings, chemicals, agriculture, land-use, and food all have a role to play in ensuring that what is placed on the market is designed with the circular economy in mind.

- **Manage resources to preserve value:** Policymakers can support the development of resource management systems that stimulate regenerative production approaches in agriculture and forestry; diversify ingredients and feedstocks; valorise waste products; incentivise material circulation; eliminate inefficient use; and minimise waste generation. In the food sector this includes policies on redistributing food surplus, upcycling edible by-products, and closing nutrient loops. More broadly, the promotion of a circular economy would also include the reuse, sharing, repair, and remanufacture of products, as well as the development of markets for by-products and secondary raw materials.

- **Invest in innovation, infrastructure, and skills:** Governments can also invest in, and mobilise private investments into, a wide range of areas that can enable the circular economy to scale, in turn supporting biodiversity. As part of this, policymakers can develop sustainable finance taxonomies, as the EU has,[94] allow public and private financial institutions and businesses to identify and support economic activities, including nature-based solutions,[95] that substantially contribute to the protection and restoration of biodiversity and ecosystems. Better understanding of what it takes to integrate biodiversity into financial decision-making and strategies is also

key,[96] as is the adopting disclosure requirements for businesses and financial institutions on biodiversity impacts, risks, and opportunities.[97]

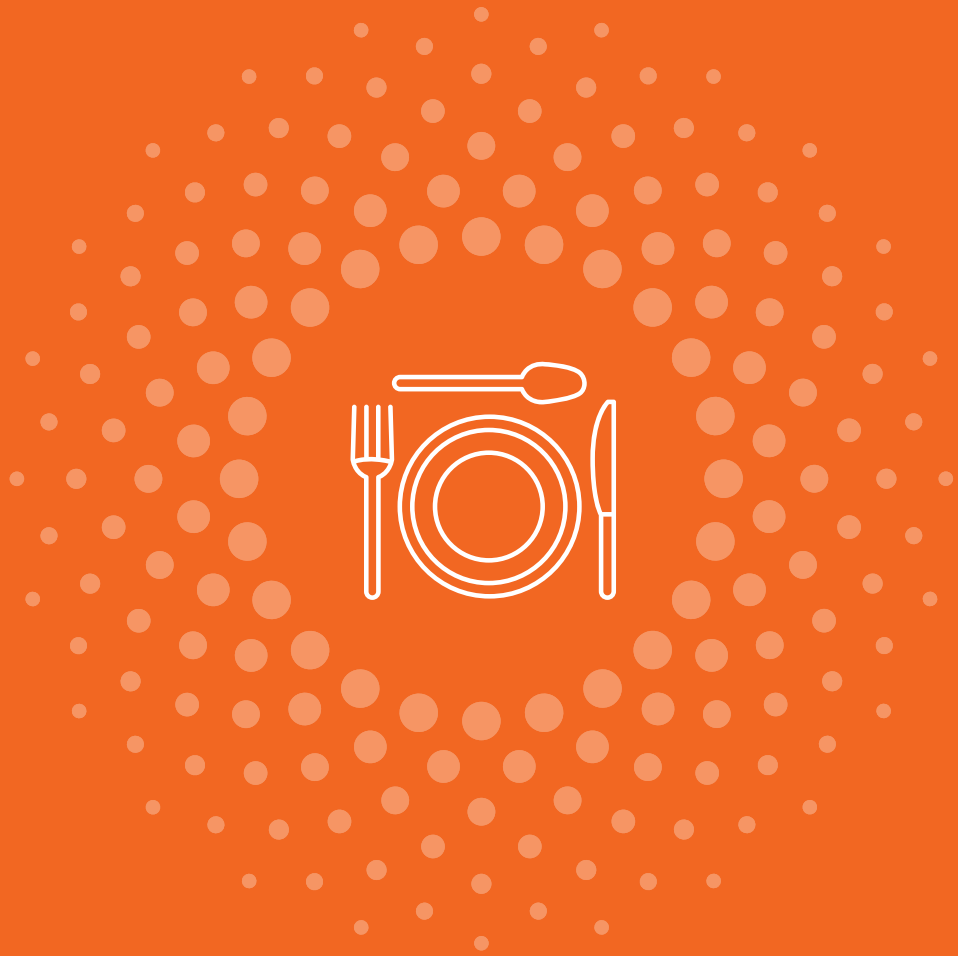
- **Collaborate for systems change:** It is important to recognise that the relevant policies to ensure nature-positive outcomes are interconnected. A circular economy approach needs to foster responsive public-private collaboration across value chains to remove barriers, develop new policies, and align existing ones. This will help avoid the creation of a patchwork of fragmented solutions and allow the impacts of embedding circular economy policies into effective biodiversity strategies at national and international levels to be measured.

Sector deep-dives

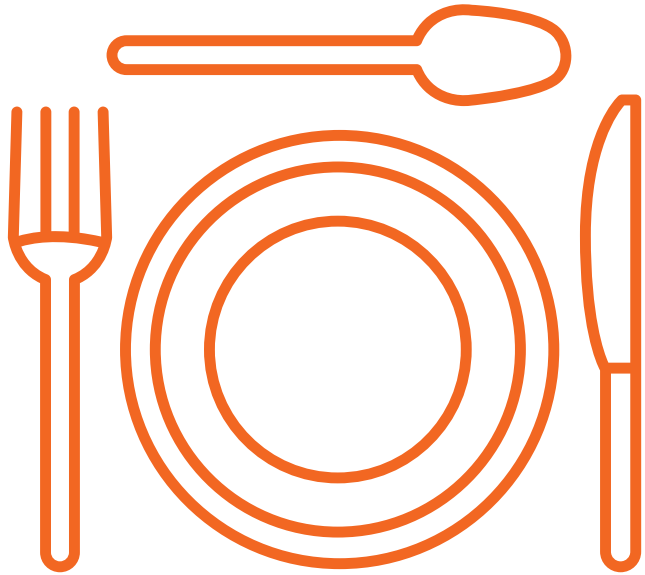
SECTOR DEEP-DIVE

Food

REGENERATING NATURE BY REDESIGNING FOOD SYSTEMS



The current food sector is the principal driver of global biodiversity loss and a major contributor to climate change. A circular economy for food offers the opportunity to ensure that, through food redesign, the sector can help nature and people thrive. By designing food product portfolios that are regeneratively produced, make use of diverse, low-impact ingredients and crops, eliminate waste, and harness all the nutritional value of what is grown, the sector can create a nature-positive food system that enhances the livelihoods of present and future farmers.



Today's food system is the sector with the greatest impact on biodiversity, with over 50% of all human-induced pressures on biodiversity traceable back to food value chains.[98] The very same industrial food production methods that have enabled considerable population growth by increasing agricultural productivity in the past century are now putting a massive strain on nature. These unsustainable methods of feeding the population are fuelling all five key drivers of biodiversity loss (see table below) and amounting to substantial societal costs.[99] Today, for every dollar spent on food, two dollars' worth of health, environmental, and economic costs are generated.[100] Half of these costs – totalling USD 5.7 trillion annually worldwide – are directly attributable to the way food is produced and how waste and by-products are managed. This linear 'take-make-waste' model degrades soil and wider ecosystems; pollutes soils, water, and air; and today accounts for the release of over a third of all anthropogenic greenhouse gas emissions.[101]

The circular economy offers a systems-level approach to producing food in ways that build biodiversity while providing economic opportunities and enhancing resilience. In a circular economy, food production improves rather than degrades the environment and all people have access to healthy and nutritious food.[116] The regenerative production of food in a circular system increases the biodiversity on farms and in the surrounding ecosystem, while decreasing the pollution and climate impacts of the current linear food system to reduce threats to biodiversity. This model encourages food designers to create products and menus with ingredients that have better outcomes for biodiversity, and any excess is redistributed or transformed for other uses to capture its value and reduce pressure to expand agricultural land. Besides directly benefiting biodiversity, if it was adopted and scaled across cities globally, a circular economy for food could reduce global food sector emissions by 49% in 2050,[117] decrease the health costs related to the current system, and generate annual benefits worth USD 2.7 trillion by 2050.[118] With business and policy action around climate and biodiversity increasing, and customers becoming more discerning about the health and environmental impacts of their food, the time is ripe for a circular economy transformation of the food system.[119]

In recognition of the central importance of the food system to both biodiversity loss and the potential to regenerate nature, the Ellen MacArthur Foundation is going beyond a deep dive chapter in this paper and launching a new study.

To learn more, please see *The Big Food Redesign: Regenerating nature with the circular economy* (2021)

THE IMPACT OF THE FOOD INDUSTRY ON THE FIVE DIRECT DRIVERS OF GLOBAL BIODIVERSITY LOSS[102]

Land-use change

- Half of the world's habitable land has now been converted to agriculture.[103] Factors such as population growth, land degradation, and changing consumption patterns are putting more pressure on converting land for agriculture.[104] If the food sector continues to operate in the same way, it is estimated that, using 2010 as a baseline, an additional 593 million hectares – an area nearly twice the size of India – will need to be converted to agriculture to feed the global population in 2050[105]

Overexploitation

- Marine fish stocks are increasingly overexploited, with a third already classed as overfished in 2015[106]
- About 60% of the world's plant-derived calories come from just four crops[107]
- Current agricultural practices are also putting a huge strain on the soil[108] and freshwater[109] resources, at a time when 33% of land around the world is already degraded,[110] and current practices and rising demand are expected to create a 40% shortage of water supply by 2030[111]

Pollution

- Approximately 78% of global eutrophication is caused by the way food is produced today[112]
- In addition, conventional farming practices such as tillage, the mismanagement of manure, and excessive utilisation of pesticides and synthetic fertilisers, have led to increasing air pollution from agriculture to such an extent that today it costs societies USD 0.2 trillion[113]

Climate change

- Over a third of all anthropogenic greenhouse gas emissions can be attributed to the food system, ~70% of which come from agriculture and land-use change and ~30% of which come from the rest of the food value chain[114]

Invasive alien species

- The combination of food distribution and climate change encourages the unintentional invasion of non-native species to new areas, which can have serious negative consequences for local ecosystems[115]

THE IMPORTANCE OF BIODIVERSITY TO THE FOOD INDUSTRY

The food sector depends on biodiversity for its survival. Biodiversity is critical for the creation of healthy and productive agroecosystems from which we derive our food. For example, 75% of food crops around the world are at least somewhat dependent on animal pollination.[271] Higher levels of diversity in the soil, in crops and animals, and in wider ecosystems, improve the food system's resilience to external shocks such as extreme weather events, thereby enhancing long-term food security.[272] Enhanced food system biodiversity can also contribute to farmer livelihoods by providing them with diverse sources of income, and reducing their reliance on costly external inputs such as pesticides and herbicides.[273]

Image: Unsplash

THE BIG FOOD REDESIGN: REGENERATING NATURE WITH THE CIRCULAR ECONOMY

This project looks at the role fast-moving consumer goods companies (FMCGs) and food retailers can play in employing circular design to move towards a food system that benefits business, people, and the environment.

The study underscores the enormous influence of the leading FMCGs and retailers – with the top 10 players in the EU and UK, for example, buying food from farms that account for about 40% of all EU and UK agricultural land – and highlights the significant opportunity they have to contribute to a net-zero and nature-positive future. To realise this, companies need to move beyond incremental sourcing improvements and go to the heart of their business to redesign their product portfolios for nature.

Designing for nature

Circular design for food - the combining of food design with the principles of the circular economy - offers an actionable framework to redesign product portfolios for nature-positive outcomes, through combining four opportunities: using diverse, lower-impact, upcycled, and regeneratively-produced ingredients. This approach can generate environmental, economic, and yield benefits. Analysis of example ingredients - wheat, dairy, and potatoes - in the EU and UK shows it can reduce farm-level[VI] greenhouse gas emissions[VII] by an average of 70% and the impact on farm-level biodiversity[VIII] by an average of 50% versus business-as-usual by 2030. It also creates significant food production and economic benefits for farmers, with analysis indicating there is the potential to achieve 50% higher 'steady state'[IX] total food production versus baseline and USD 3,100 per hectare per year net value creation.[X]

Businesses can take five actions to make nature-positive food mainstream:

1. Create ambitious and well-resourced action plans to make nature-positive product portfolios a reality
2. Create a new collaborative dynamic with farmers
3. Develop iconic products to showcase the potential of circular design for food
4. Contribute to and use common on-farm metrics and definitions
5. Advocate for policies that support a nature-positive food system

VI Farm level refers to impacts on the farm before the farm gate.

VII Greenhouse gas emissions including all emissions generated during the production phase (including those from agricultural inputs) plus net carbon sequestration through land use. These were measured using the GWP100 metric.

VIII On-farm, above-ground biodiversity footprint, is measured in 'biodiversity weighted hectares'. This is a product of land use area, proportion of biodiversity lost due to agricultural intensity and relative global importance of biodiversity of that geographic location. This is calculated using the Biodiversity Impact Metric (BIM) developed by Cambridge Institute for Sustainability Leadership.

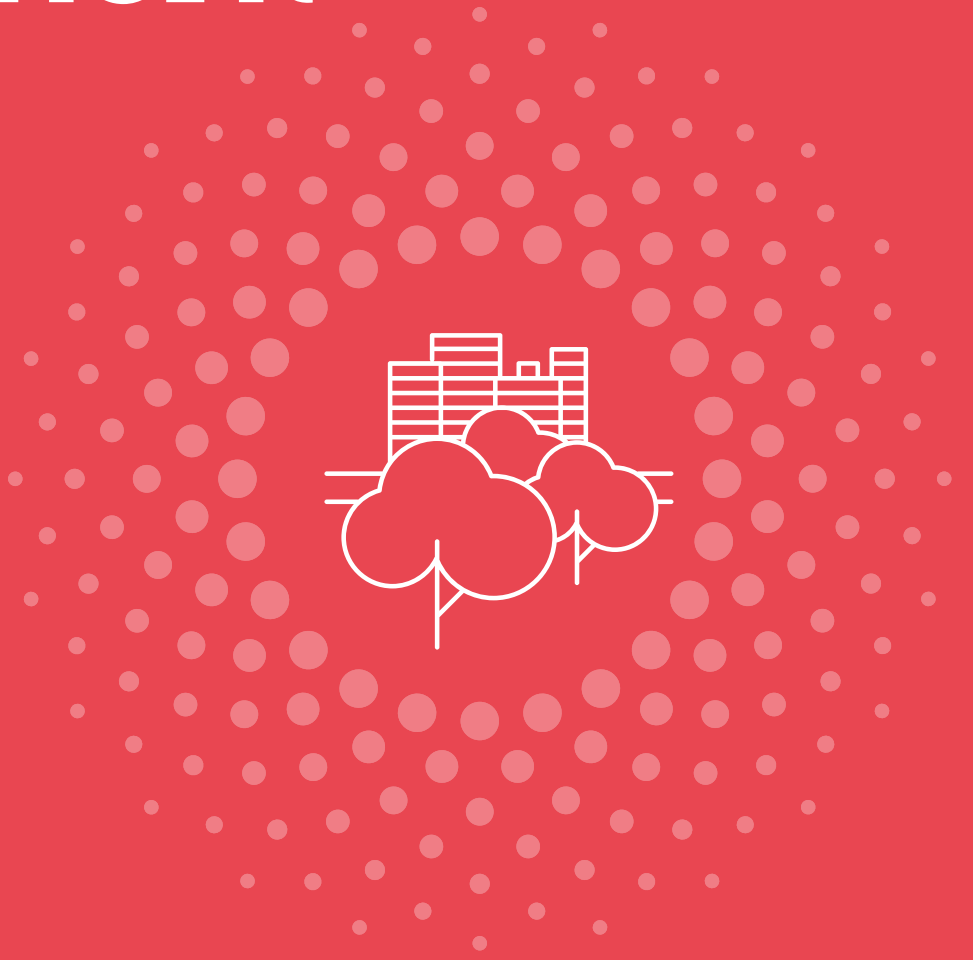
IX 'steady state' is defined as the year in which the farm system reaches maturity; when yields and annual economic return stabilise.

X For example ingredients (wheat, dairy, potatoes) analysed on an average farm in the EU/UK following an initial transition period

SECTOR DEEP-DIVE

Built environment

LEAVING ROOM FOR BIODIVERSITY BY REDUCING PRESSURES ON NATURAL RESOURCES



The built environment currently operates under a wasteful linear model that puts significant pressure on biodiversity. A circular economy for the built environment offers a comprehensive system-level approach to transform the way we source materials, build infrastructure, and use assets in order to create opportunities for better growth while halting and reversing global biodiversity loss. By planning for compact and biodiverse urban environments that optimise space, the sector can leave room for nature to thrive within and beyond urban areas. Keeping buildings and materials in use reduces the need for new construction and material extraction, thereby limiting the associated negative impacts on biodiversity. Where new materials are needed, switching to renewable materials produced regeneratively can help the sector actively rebuild biodiversity and safeguard the health of ecosystems.

The built environment we live in today is designed around a linear 'take-make-waste' model that contributes to biodiversity loss. In fact, this approach has turned the sector into the world's largest consumer of raw materials and a major producer of waste and greenhouse gas emissions.[120] Overall, the built environment is estimated to impact 29% of the International Union for Conservation of Nature's (IUCN) list of threatened and near-threatened species.[121] As the global urban population is expected to reach 7 billion by 2050, the size of the built environment is set to double.[122] This expected expansion under a linear model would only magnify the sector's impact on global biodiversity loss.

The circular economy offers an approach to fundamentally transform the way we design, produce, and use materials and infrastructure to shift towards a built environment that protects and rebuilds biodiversity. A circular economy for the built environment reduces demand for virgin building materials by keeping assets and materials in use and, where possible, appropriately integrates nature in urban areas by design. In doing so, the sector can reduce the pressures on biodiversity related to urban expansion, the processing of materials, and the construction of buildings. Additionally, by leaving room for nature within and beyond urban areas, and by regeneratively producing renewable materials, the sector can have a direct beneficial effect on biodiversity. Such a circular economy approach helps create biodiverse, resilient, and healthy cities. This approach also has the potential to reduce emissions related to the production of four key building materials - cement, steel, aluminium, and plastic - by 2Gt CO_2 in 2050[123] and capture the approximately EUR 2.1 trillion (~USD 2.49 trillion) of annual lost value from depreciated building materials.[124]

In the built environment there are three principal circular economy opportunities to tackle the main direct drivers of biodiversity loss:

A **Planning for compact and biodiverse urban environments**

B **Keeping buildings and materials in use**

C **Switching to renewable materials produced in regenerative ways**

THE IMPORTANCE OF BIODIVERSITY TO THE BUILT ENVIRONMENT

Image: Fanny Breteau

The construction industry is one of the three economic sectors, with agriculture and fisheries, food and beverages, most dependent on natural resources for its raw materials.[125] When it comes to the built environment itself, higher levels of biodiversity in and around urban areas provide myriad environmental and socioeconomic benefits, including improved levels of mental health, better water quality, and increased resilience to climate shocks.[126] As an example of the latter, mangrove forests alone are estimated to protect 18 million people from annual flood risks and prevent damage to infrastructure worth approximately USD 80 billion.[127]

THE IMPACT OF THE BUILT ENVIRONMENT SECTOR ON THE FIVE DIRECT DRIVERS OF GLOBAL BIODIVERSITY LOSS[274]

Land-use change

- On current trends, by 2030 the global expansion of urban areas could threaten 290,000 km^2 of natural habitats – an area larger than Ecuador[128]

Overexploitation:

- The construction industry is the largest global consumer of natural resources for raw materials.[129] Sand and gravel are the most extracted materials in the world and make up about 79% of the natural resources used in the built environment.[130] Their extraction, sometimes undertaken illegally inside biodiversity-rich areas, exceeds natural replenishment rates and leads to the disruption of river and coastal habitats[131]

Pollution

- Poor design of the built environment hinders proper waste management, leading to the pollution of terrestrial and aquatic ecosystems, and increasing health risks[132]
- High rates of vehicle use, exacerbated by low-density urban planning, contribute to air pollution: in the US vehicles are responsible for almost 40% of national carbon monoxide and nitrogen oxide emissions[133]
- Higher temperatures and light- and noise-pollution arising from activities in the built environment disrupt the natural cycles and species dynamics of surrounding ecosystems[134]

Climate change

- Buildings and the construction sector account for 39% of global energy- and process-related CO_2 emissions, 11% of which result from manufacturing building materials such as steel, cement, and glass[135]

Invasive alien species

- Long-range transport of construction raw materials and products facilitates the spread of invasive alien species, which can have serious negative consequences for their new environment[136]
- Conventional urbanisation can create disturbed environments where invasive alien species can thrive, outcompeting native species[137]

A PLANNING FOR COMPACT AND BIODIVERSE URBAN ENVIRONMENTS

Planning for compact urban environments increases the density of urban settlements, reducing urban sprawl and helping to safeguard natural habitats around cities. Compact planning can apply as much to new urban developments as to regeneration or infill projects where disused, abandoned, or vacant lots are reintegrated into the city.[138] It can be achieved by, for example, repurposing or rehabilitating existing buildings, or promoting mixed-used development. In Europe, reducing urban sprawl by planning cities for increased density could save up to 30,000km^2 of land by 2050, compared to the current development scenario.[139] Such land savings are critical for biodiversity as many of the world's Key Biodiversity Areas are located in close proximity to cities and are therefore subject to land conversion from urban sprawl.[140,XI] Additionally, it has been estimated that, by 2030, urban expansion under a business-as-usual scenario would destroy natural habitats that store over 4 billion metric tonnes of above- and below-ground CO_2 – equivalent to the annual emissions of 931 million cars.[141] Preventing the clearance or burning of ecosystems for urban expansion through compact planning could help avoid the release of the carbon stored in these ecosystems and safeguard their sequestration potential.

Strategically designed compact built environments also offer favourable conditions to reduce the greenhouse gas emissions and air pollution associated with urban transportation systems. For example, while Stockholm and Pittsburgh, have roughly the same number of inhabitants, the latter occupies five times as much land, which means longer journeys and transport emissions almost six times higher than in Stockholm.[142] Supported by technological and digital innovations, compact cities can also better integrate different modes of transport such as active mobility (e.g. walking, cycling) or shared mobility options (e.g. buses, trams, rideshares) running on renewable energy,[143] thereby further reducing greenhouse gas emissions and air pollution.[144] The adoption of such compact and connected urban environments is well underway with concepts like the 15- or 20-minute neighbourhoods, which aim to reduce emissions by enabling people to live close to jobs, essential services, and recreation and are being adopted by, among others, Paris and Melbourne.[145]

When planning for compact and biodiverse urban environments, it is crucial to appropriately integrate biodiversity within and around the city in order to shape more liveable, resilient, and healthy cities. Designing urban areas with more trees, parks, green roofs, and other green infrastructure – choosing species appropriate to the local context – not only increases biodiversity within the city but also helps mitigate the urban heat island effect, improves water quality, sequesters carbon, and increases environmental resilience, amongst other benefits.[146] Cape Town, for example, prevented major water shortages by protecting its watershed using nature-based solutions that restored vegetation and degraded land.[147] Globally, developing compact and biodiverse built environments that promote the reforestation of watersheds in peri-urban areas would improve water security and stormwater management and, at the same time, could reduce the risk of extinction for 5,408 species around the world.[148] Overall, according to the World Economic Forum, building compact and biodiverse built environments could create over USD 3 trillion in business opportunities and 117 million jobs by 2030.[149]

XI Key Biodiversity Areas (KBAs) are sites contributing significantly to the global persistence of biodiversity, for more information on KBAs see http://www.keybiodiversityareas.org/

THE CITY IN NATURE
(Singapore)

Singapore is an example of a city that has adopted a compact and biodiversity-friendly approach to urban planning. Despite its population density increasing from 3,538 residents per km^2 in 1970 to 7,810 residents per km^2 in 2020,[150] the city managed to expand green areas from 36% to 47% of its total land area.[151] In fact, since the early 1960s, Singapore has had a strong ambition to green itself in order to become a highly liveable and competitive city. For example, high-rise greenery has increasingly become an essential component of the city's development plan, in part due to the limited amount of land available. The government now requires property developers to replace any greenery lost during construction and covers 50% of the costs of installing green roofs and walls on existing buildings.[152] As a result, the city's 72 hectares of rooftop gardens and green walls are set to triple by 2030.[153] These, combined with 4,172 hectares of green space (parks and park connectors), reduce the city's heat-island effect, help absorb stormwater, provide space for recreation, and increase urban biodiversity.[154]

Biodiversity Benefits

By promoting a compact urban environment where biodiversity is integrated, Singapore's development has been able to leave room for nature within and beyond its built-up area. Singapore is home to an estimated 23,000–28,000 species of terrestrial organisms and 12,000–17,000 marine organisms.[155]

Image: Daniel Welsh on Unsplash

B KEEPING BUILDINGS AND MATERIALS IN USE

Using buildings more and for longer can displace the need for new construction, thereby reducing the overexploitation of natural resources and greenhouse gas emissions. Extending the active life of buildings can be achieved through circular business models like sharing and rental, together with repairing, refurbishing, and retrofitting existing buildings. Such strategies offer more cost-effective, less resource-intensive, and less greenhouse gas-emitting solutions than demolition and new construction. This approach is particularly interesting for OECD countries, where 65% of the projected building stock required by 2060 already exists.[156] For example, as a consequence of the Covid-19 pandemic in London, more than 1 million square feet of office space (approximately 92,900m^2)[XII] was given up by companies between March and September 2020, with many properties earmarked for conversion to residential use.[157] Such office-to-residential conversion can meet new housing needs while limiting the conversion of natural areas in the city's periphery and reducing natural resource demand and greenhouse gas emissions. Globally, extending the lifetime of existing buildings could reduce greenhouse gas emissions by 1 billion tonnes of CO_2 per year beyond 2050.[158]

Once buildings can no longer be used, circulating the materials they contain – instead of landfilling or incinerating them – can avoid the impacts on biodiversity associated with the unnecessary extraction, processing, and disposal of natural resources.[159] Reusing and recycling four key materials in the built environment sector – namely steel, plastics, aluminium, and cement – can reduce global greenhouse gas emissions by at least 0.6 billion tonnes of CO_2 per year in 2050.[160] Examples of recycling and reusing materials can already be found in the sector. For example, the construction company Mace collected 200 tonnes of timber in 2016, 79% of which was reused – saving 117 tonnes of carbon emissions and displacing the need for new logging.[161] Furthemore, increased policy attention is being given to material circulation strategies with, for instance, in Australia, the Victoria State government's 'Recycled First' programme for infrastructure requiring the prioritisation of recycled and reused materials for new construction projects.[162] Additionally, a built environment that circulates materials at the local level would, in theory, require less movement of materials – reducing the potential spread of invasive alien species through transport.

Design will play a crucial role in ensuring that buildings and materials are kept in use, thereby alleviating the sector's pressures on biodiversity. By selecting longer-lasting materials, applying modular designs, and increasing the intensity of use, for example through building sharing models, the sector can bring greater flexibility to new constructions and make better use of resources – minimising the waste and emissions associated with construction and building use. Companies like DIRTT are embracing this approach by working with interior building components that are modular and standardised, allowing for maximum efficiency in changing the use of a building and supporting sharing and mixed functionality.[163] These designs must be aligned with the intended end-of-use materials circulation strategy. For example, design for disassembly can facilitate the recovery of components for their reuse in new projects, once the original building can no longer be used.

The sector can leverage technological developments to facilitate the circulation of materials. Applying digital technologies, such as building information modelling (BIM) and material passports, to the built environment can help turn buildings into material banks.[164] This approach ensures that information on which materials and components were used, where they were sourced from, and guidance on their potential future use is easily available. Combined with a design-for-disassembly approach, this technology makes reuse and recycling significantly easier at the building's end-of-life, which is key to reducing future natural resource overexploitation and greenhouse gas emissions.[165]

XII This area equates to over 1,250 three-bedroom apartments for four people, calculated based on the dwelling space standards guidance of the Greater London Authority, where a three-bedroom apartment with four bed spaces requires a minimum gross internal floor area of 74m^2; see Greater London Authority, Housing design quality and standards (2020), p.49.

ADAPTIVE REUSE OF AN EXISTING BUILDING

Reducing demand for virgin natural resources to leave room for biodiversity

Quay Quarter Tower (Australia)

Image: 3XN

Quay Quarter Tower, originally built in 1976, has been the centrepiece of Sydney's harbour area revitalisation.[166] Since 2018, the building has been undergoing a redevelopment which will see a height increase, the construction of additional floorspace, and a modernisation of the building's entire design. Instead of demolishing and constructing a new building, which usually occurs with any major urban development and leads to waste generation and resource demand, Arup and Danish architects 3XN took an adaptive reuse approach to convert the existing building and change it to a new use.

Biodiversity benefits

This adaptive reuse approach retained 68% of the building's structure, which reduced the need for virgin material extraction and retained a part of the tower's embodied CO_2 equivalent to 10,000 aeroplane flights from Sydney to Melbourne.[167] In doing so, the renovation was able to reduce its contribution to the overexploitation of natural resources and to climate change, thereby minimising the project's impact on biodiversity.

C SWITCHING TO RENEWABLE MATERIALS PRODUCED IN REGENERATIVE WAYS

Switching to renewable raw materials, where appropriate, can help decouple the built environment from finite, carbon-intensive materials. When making use of existing materials is no longer possible, the sector can alleviate its impact on biodiversity by favouring renewable materials over sand, gravel, and other finite resources – the extraction and production of which are associated with ecosystem disruption and high greenhouse gas emissions.[168] Timber, in particular, is increasingly viewed as a compelling alternative to concrete. Switching to timber for 75% of new residential and 50% of new commercial buildings in a selection of 96 cities around the world could cut their total greenhouse gas emissions by 6% between 2017 and 2050.[XIII] Additionally, unlike conventional concrete structures that are more likely to be downcycled, wood beams can more easily be reused or repurposed if designed for disassembly.[169] Relevant stakeholders are already promoting the adoption of timber as a construction material because of its potential to reduce pressures on biodiversity and the climate. The French government recently mandated that all new public buildings must contain 50% wood or other organic materials from 2022 onwards.[170]

An example of this directive in action is the timber-based swimming pool pavilion designed for the Paris 2024 Olympics Games, following the organisers' pledge to be the first climate-positive Games.[171]

Regenerative production can ensure that the switch to renewable materials has a positive impact on biodiversity. For example, if sourced from well-managed forests that employ continuous cover techniques, promote mixed stands, spare veteran trees, and leave deadwood behind, timber production can limit habitat disturbance, reduce erosion, and improve soil health.[172] By contrast, damaging practices such as planting trees in ecosystems that have not historically been forests or monocultures – particularly with exotic tree species – must be avoided.[173] Ultimately, the specific set of practices used to grow renewable materials need to be adapted to the particular context, geography, and climate in which the production takes place in order to successfully rebuild biodiversity.

XIII This research drew on data for 96 cities, from within the C40 cities network membership at the start of the research project in June 2018. C40, Arup, and University of Leeds, Building and infrastructure consumption emissions (2019).

A TIMBER-BASED OFFICE LEVERAGING THE CIRCULAR ECONOMY

Using innovative solutions that allow biodiversity to thrive

Triodos Bank Office (The Netherlands)

The timber-based structure of Triodos Bank's new headquarters in the Netherlands demonstrates the potential of switching to renewable materials.[174] The building reduces the pressures on biodiversity associated with the overexploitation of finite, greenhouse gas-intensive raw materials. The five-storey office building, with a surface of 12,994m^2, contains 1,615m^3 of laminated wood, over 1,000m^3 of cross-laminated wood (CLT) and five tree trunks.[175] Only the basement uses concrete due to the high-water table. The timber for the structure came from a German manufacturer using spruce from PEFC-certified managed European forests*.[176]

The application of circular economy principles in the building's design goes further as its structure was designed for disassembly by joining the timber components using screws instead of glue. This means the building can be taken apart simply by unscrewing the components, which can then be reused in other projects. The office is also conceived as a materials bank, with all its materials monitored using a public online repository so they can more easily be reused in the future.[177] Built in 2019, the building achieved a BREEAM Outstanding Certificate for its environmental, social, and economic sustainability thanks to, among other factors, making use of sustainable materials and natural light, and carefully regulating its climate.

Biodiversity benefits Using timber instead of concrete allowed the construction process to reduce its dependence on the extraction of finite resources like sand and gravel, which are associated with detrimental effects to biodiversity,[178] and stored the equivalent of 1,633 tonnes of CO_2 in the building's structure.[179] Moreover, thanks to being designed for disassembly and to using digital technology to record its materials, the circulation of components at the building's end-of-use will be able to further reduce greenhouse gas emissions and resource extraction.

** To secure an overall positive impact on biodiversity, forest managers and certification schemes must ensure timber is grown in regenerative ways, meaning biodiversity is rebuilt by, for example, proactively limiting habitat disturbance and improving soil health and water quality.*

Images: Bert Rietberg

CIRCULAR ECONOMY ACTIONS BUSINESSES IN THE BUILT ENVIRONMENT SECTOR CAN TAKE TODAY TO ACHIEVE THEIR BIODIVERSITY AMBITIONS

The table below highlights three key steps that businesses can take to help kick-start their journey:[XIV]

1 Assess impacts and dependencies on nature

Measure impacts and dependencies on biodiversity to help identify priority areas to focus on and help deliver biodiversity-positive outcomes	• Measurement approaches such as the IUCN Species Threat Abatement and Restoration (STAR) metric, the Natural Capital Protocol, Biodiversity Impact Metric, and the Global Biodiversity Score offer companies useful methods and resources to help assess, act, and report on progress towards meeting biodiversity targets[180] • Draw inspiration from examples such as Acciona's biodiversity impact measuring tool, developed together with PwC
Set biodiversity targets that are aligned with the best available science	• Set targets for biodiversity: The Science-Based Targets (SBT) for Nature has for example recently developed an initial guidance for companies looking to set biodiversity targets that are aligned with globally agreed goals

XIV To make sure these steps are successfully implemented and achieve a positive outcome for biodiversity, businesses can benefit from bringing in technically competent biodiversity and circular economy expertise, fostering a culture of innovation within the organisation, and allocating sufficient funding to circular economy plans and innovations.

2 Identify circular economy opportunities that help meet biodiversity ambitions

Assess the circular economy potential by leveraging the framework and searching for best practices on how circular economy solutions can help businesses preserve biodiversity, at the same time as generating economic and social benefits[XV]

- Throughout this chapter, examples have been provided of how the circular economy framework can help tackle the key drivers of biodiversity loss most impacted by the built environment sector. For deeper insights on the circular economy in the built environment see Ellen MacArthur Foundation's Built Environment Factsheets as well as Arup's comprehensive reports highlighting the first steps towards a circular built environment, the business models, and how to best realise its value in real estate
- The Biodiversity Case Study library showcases circular economy business examples in the built environment industry that help safeguard and rebuild biodiversity.
- Circulytics is one of the most comprehensive circularity measurement tools available for companies. Going well beyond assessing products and material flows, it informs businesses on their circularity level across their entire operations

Shape a circular economy action plan to help tackle a company's most urgent impacts and dependencies on nature, with the circular economy acting as a key delivery mechanism

- Examples of circular economy and biodiversity commitments:
  - Balfour Beatty has committed to generating zero waste and going beyond net-zero carbon emissions by 2040, while enhancing biodiversity
  - In its Biodiversity Policy, Saint-Gobain commits to reducing its environmental impact, and the group is also working towards a circular economy and a carbon neutral business by 2050
  - Grosvenor Britain and Ireland has committed to a significant net biodiversity gain by 2030, while achieving a net-zero carbon state from its buildings, developments, and supply chain, and adopting circular economy strategies

XV The circular economy directly aligns with the SBTN's Action framework – Avoid; Reduce; Regenerate and Restore; Transform – in helping to deliver on biodiversity targets.

3 Stimulate collaboration to find solutions that can deliver transformative change

Design for the circular economy to ensure products are designed, accessed, and used in ways that eliminate waste, pollution, and environmental degradation

- The circular design learning pathway, toolkit, and guide highlight how and why design sits at the heart of the circular economy, and what steps businesses can take to help rethink their products or services
- Heta Architects developed A guide to designing for material re-use
- Arup shows the importance of facade design for the circular economy
- MI-ROG's procurement guidance shares how circular economy principles can be embedded into infrastructure operator procurement activities

Stimulate collaboration by identifying key stakeholders within and outside value chains to collaborate and innovate with, and find circular solutions that help tackle biodiversity loss

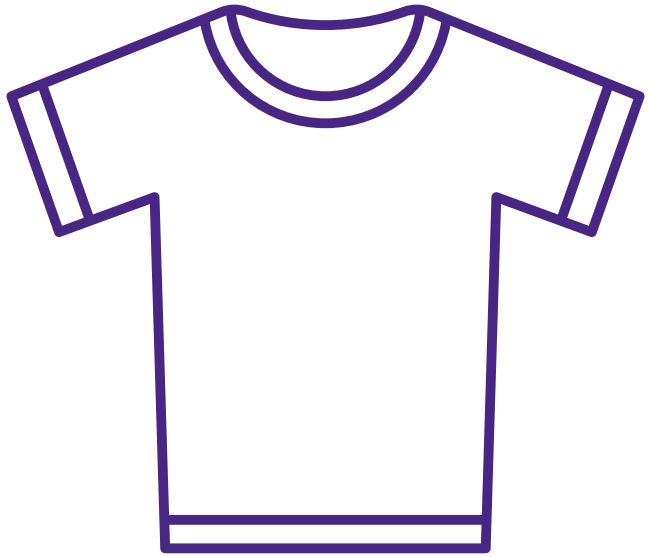
- Major-Infrastructure - Resources Optimisation Group (MI-ROG) is the first forum of its kind in the infrastructure sector. It has inspired and facilitated workflows on asset life cycle, carbon performance, circular economy planning, critical materials availability, materials exchange, and sustainable procurement and supply chains. The group benchmarks approaches, shares best practices, and collaborates across projects – seeking greater resilience and efficiency in the planning, development, and delivery of major programmes
- The UK Green Building Council (UKGBC) is an industry-led network uniting over 400 organisations across the construction value chain. Its mission is to radically improve the sustainability of the built environment by eliminating waste and maximising resource efficiency, and embracing and restoring nature and promoting biodiversity, among other goals
- The Spanish Business and Biodiversity Initiative provides a cooperation framework for infrastructure and construction companies as well as businesses from other sectors, NGOs, associations, and the government to integrate natural capital in business management, with an emphasis on circular economy measures
- Grosvenor's Materials Re-use Network connects built environment professionals and organisations like HETA, ARUP, Orms, and Elliott Wood to explore the barriers and enablers to accelerating material reuse in the building and construction sector

SECTOR DEEP-DIVE

Fashion

SAFEGUARDING BIODIVERSITY BY CIRCULATING CLOTHES, ELIMINATING POLLUTION, AND GROWING NATURAL FIBRES REGENERATIVELY

The linear way in which today's fashion industry operates puts significant pressure on the biodiversity on which it depends. A circular economy for fashion offers a comprehensive system-level approach to transform the way we produce and use clothing in order to create opportunities for better growth while helping to halt and reverse global biodiversity loss. Keeping clothes and the materials they are made from in use displaces the need for new production, and therefore reduces the negative impacts on biodiversity associated with virgin fibre production, processing, and disposal. By shifting to safe chemistry and designing out microfibre release, the industry can design out environmental pollution and promote safe material cycles. Finally, by producing materials regeneratively the sector can actively rebuild biodiversity and safeguard the health of ecosystems.



The textiles system operates in an almost completely linear way that puts a heavy burden on biodiversity. Currently, large amounts of non-renewable resources are extracted to produce clothes that are often used for only a short time, after which 99% of materials are sent to landfill, incinerated, downcycled, or leak into the environment as microfibres.[181] As a result of this extractive and wasteful model, the fashion industry contributes to global biodiversity loss through the degradation of natural habitats; pollution of air, water, and soil; and contribution to climate change.

The circular economy offers an approach to fundamentally rethink the fashion industry to evolve from a model that degrades natural systems to one that protects and rebuilds biodiversity. A circular economy for fashion ensures that products are used more, are made to be made again, and are made from safe and recycled or renewable inputs produced in regenerative ways.[182] In doing so, the sector can not only reduce the demand for virgin materials and eliminate waste and pollution, but also improve soil health, sequester carbon, and actively rebuild biodiversity. Alongside the benefits to biodiversity, a circular economy for fashion can address the USD 500 billions of value lost annually due to clothing underutilisation and the lack of recycling, while supporting the creation of safe, healthy conditions for textile workers and users.[183]

In the fashion sector, three especially effective circular economy opportunities to tackle the main direct drivers of biodiversity loss emerge:

A **Keeping clothes and fibres in use**

B **Shifting to safe chemistry and designing out microfibre release**

C **Producing materials regeneratively**

THE IMPORTANCE OF BIODIVERSITY TO THE FASHION INDUSTRY

Cotton, viscose, wool, and other renewable materials derived from nature account for over 36% of all fibres used in the textiles industry.[184] The agricultural and forestry systems where these materials are produced are directly dependent on biodiversity for soil fertility, organism health, and water availability.[185] Biodiversity also helps to enhance the ability of agroecosystems to adapt and increases their resilience to external shocks such as floods or droughts, thereby mitigating risks to business operations.[186]

Image: Unsplash

THE IMPACT OF THE FASHION SECTOR ON THE FIVE DIRECT DRIVERS OF GLOBAL BIODIVERSITY LOSS[187]

Land-use change

- At the current pace, by 2030 the fashion industry is projected to use 35% more land for cotton cultivation, forest for cellulosic fibres, and grassland for livestock[188]

Overexploitation

- Over 4% of global freshwater withdrawal is linked to the textiles industry, with consumption expected to double by 2030[189]
- Conventional cotton cultivation – the most water-intensive fibre production process – is often located in already water-stressed regions[190]

Pollution

- Despite accounting for approximately 3% of total arable land, the production of cotton is estimated to use as much as 16% of all insecticides, 6% of all pesticides, and 4% of all synthetic fertilisers globally, which can degrade soil health, pollute waterways, and endanger biodiversity[191]
- Out of 2,450 textile-related chemicals studied by the Swedish Chemical Agency, 5% were of high potential concern for the environment due to their capacity to spread globally and bioaccumulate, causing diseases and allergic reactions, and increasing cancer risk[192]
- An estimated 35% of microplastics in the ocean originate from synthetic microfibre release[193]

Climate change

- The fashion industry was estimated to account for 4% of global emissions in 2018 – approximately as much as France, Germany, and the UK combined[194]
- At the current pace, the sector's emissions would nearly double the maximum required to stay on the 1.5ºC pathway[195]

Invasive alien species

- Long-range transport of raw materials and fashion products facilitates the spread of invasive alien species, which can have serious negative consequences for their new environment[196]

A KEEPING CLOTHES AND FIBRES IN USE

Extending the life of garments through circular business models is one of the most effective ways to reduce the fashion industry's impact on biodiversity. By leveraging circular business models that keep products in use for longer, such as resale or rental, the negative impacts on biodiversity associated with the extraction of natural resources, production, processing, and disposal are avoided (assuming new garments are displaced). In fact, compared to buying new, a pre-owned purchase is estimated to save on average 1kg of waste, 3,040 litres of water, and 22kg of CO_2.[197] Studies have shown that 65% of second-hand clothing purchases in the US and UK, and 41% in China, successfully prevented the purchase of a new item.[198] By 2030, with proactive industry action, circular business models that keep clothing in use for longer could grow to represent 20% of the market (up from 3.5% today)[199] – representing a USD 700 billion opportunity globally and helping to gradually decouple the sector's growth from its impacts on biodiversity.[200] In addition, such a scale-up of circular business models will assist the fashion industry in staying on track for a 1.5ºC pathway by delivering a third of the emissions reduction needed.[201] The second-hand market in particular is expected to drive growth of the sector, with studies estimating that resale will become twice as big as fast fashion by 2030.[202]

Once clothes can no longer be used, recycling them into new garments avoids the negative impacts on biodiversity associated with virgin material extraction, landfilling, and incineration. Capturing the material value of clothes that can no longer be worn minimises the need for new materials to be grown or extracted, meaning that land can be left for other uses, including food production or conservation. Recycling materials with particularly high biodiversity impacts at the fibre growing stage, like cashmere, is especially beneficial. After stopping the use of virgin cashmere in 2016 and moving to recycled inputs, Stella McCartney estimated an instant 92% reduction in their cashmere-related environmental impact, which had accounted for 28% of the firm's total environmental impact despite making up only 0.1% of their material usage.[203] Innovators across the world are developing new technologies to divert textile waste from landfill and achieve environmental, social, and economic benefits. For example, the Green Machine, developed through a partnership between the Hong Kong Research Institute of Textiles and Apparel (HKRITA) and the H&M Foundation, uses a closed loop system of only water, heat, and green chemicals to fully separate and recycle cotton and polyester blends into new fibres.[204] Overall, textile-to-textile recycling can tap into an annual material value loss worth more than USD 100 billion.[205]

Design will play a key role in ensuring clothes and materials are kept in use. To ensure that a circular economy for fashion is successful, garments need to be designed for physical and emotional durability in alignment with their intended business model. Physical durability maximises product use by considering garment construction and component reinforcement to create products that can resist damage and wear. Emotional durability refers to the product's ability to stay relevant and desirable to the user, or multiple users, over time. For example, in resale models, it is important to consider the ability to clean and repair the products, while leveraging their history and 'uniqueness' to new users. Simultaneously, encouraging optimal recyclability through product design can be achieved by selecting components, materials, and specific designs that can be easily recycled when necessary. For example, for their Circular Series of jackets, Napapijri has greatly simplified the design so that the entire jacket – fabric, filling, and trimmings – is manufactured using one material: Nylon 6, leading to a high-performance, durable product that is also easily recyclable.[206]

KEEPING CLOTHING IN USE

Reducing demand for natural resources to leave room for biodiversity

thredUP (USA)

thredUP is a managed resale marketplace that makes it easier for people to sell unwanted clothes in order to keep garments in use for longer. By facilitating this increase in utilisation rates, the company is starting to decouple its business model from the extraction of natural resources, while preventing incineration and landfilling. Ultimately, this will allow it to avoid the negative impacts on biodiversity associated with the manufacturing and disposal of garments. Customers send in their clothes for free, and the company sorts, selects, and lists them for sale on its e-commerce platform. The platform inventory includes more than 35,000 brands that are sold at a fraction of their original price.[207] In 2021, thredUP reached a valuation of above USD 1 billion.[208]

Biodiversity benefits

Until now, thredUP has processed 125 million unique secondhand items, avoiding the emission of about 500,000 tonnes of CO2e, saving over 16 billion litres of water,[XVI] and reducing other pressures on biodiversity associated with the manufacturing and disposal of garments.

Image: Sarah Brown on Unsplash

XVI Assuming that there is 1:1 switching from buying brand new apparel to buying second-hand apparel from thredUP, and that the second-hand clothing sold by thredUP has 70% of its useful life still left. For more information, see GreenStory, Comparative Life Cycle Assessment (LCA) of second-hand vs new clothing (2019).

B SHIFTING TO SAFE CHEMISTRY AND DESIGNING OUT MICROFIBRE RELEASE

Shifting to safe chemistry in the fashion industry's value chain protects the health of ecosystems and people. Toxic and persistent chemicals, such as water repellents or dyes currently used in textile processing for performance or aesthetic purposes, can have severe impacts on biodiversity and human health.[209] Schemes like the Zero Discharge of Hazardous Chemicals' Manufacturing Restricted Substances List (ZDHC MRSL) have proven successful at preventing toxic substances from entering the value chain in the first place.[210] Simultaneously, innovators are developing alternatives to conventional chemicals and processes that do not have harmful environmental effects. For example, Archroma's Earthcolors dyeing agents are made out of agricultural by-products and offer an alternative to hazardous, conventional dyes.[211] When it is unavoidable to use toxic substances, it is essential to control their usage. To reduce toxicity risk, closed-loop systems like those implemented by TENCEL™ for Lyocell fibres, are able to recycle process water and reuse the solvent at a recovery rate of more than 99%, leaving no trace of the chemical in the final garment.[212] In addition to designing out potential impacts to biodiversity and human health, shifting to safe chemistry processes will allow for safe and healthy material cycles to be either reused or returned to the biosphere.

Fibre design and innovation will play an essential role in ensuring that microfibres are not released into natural environments. Once in the environment, microfibres can be taken up by organisms and enter the food chain.[213] Microfibres that carry toxic substances on their surface or within their materials can bioaccumulate and threaten the health of humans and wildlife.[214] To tackle this issue, focus needs to be placed on the design and production stages in order to avoid fibre fragmentation and, therefore, the potential for microfibre release in the first place. This could be achieved by increasing fabric resistance to shedding or finding alternative materials that can safely biodegrade if they leak into the environment.[215] The Houdini outdoor brand provides one example of this in the use of Polartec's Power Air fabric in their Houdi jackets[216] – this fabric has encapsulated fibres that reduce fragmentation and shedding, therefore minimising the potential for microfibre release into the environment.

A SAFE, BIO-BASED DYEING PROCESS

Eliminating hazardous chemicals to reduce threats to biodiversity

Colorifix (UK)

Colorifix, a UK-based biotech company, aims to eliminate the negative impacts on biodiversity and human health caused by conventional textile dyeing. The Colorifix dyeing process moves away from toxic petrochemicals and other harmful substances. Instead, they have developed an entirely biology-based process to produce, deposit, and fix pigments onto textiles.[217] Via online DNA sequencing, they can identify and replicate the colour information found in a living organism such as an animal, plant or microbe. They then insert that information into a non-pathogenic microbe. Using renewable feedstocks such as sugars, yeasts, and plant by-products, they grow these microorganisms that can not only produce the desired colour but also transfer it onto clothing with zero harmful substances and a fraction of the water and energy necessary in conventional dyeing.

Their solution has already received the support of big players in the sector, like Fashion for Good. The first collection using their technology was launched by H&M in early 2021.[218]

Biodiversity benefits

Compared to conventional dyeing, Colorifix says its process requires up to 90% less water and 70% less energy, as well as eliminating the use of hazardous chemicals, therefore reducing the potential harm to natural environments.

Image: Engin Akyurt on Unsplash

C PRODUCING MATERIALS REGENERATIVELY

Producing fibres and materials regeneratively establishes healthy agroecosystems, reverses land degradation, and minimises greenhouse gas emissions and pollution. Practices that lead to regenerative outcomes can improve on-farm biodiversity and ensure that soils remain healthy, reducing pressure to expand into natural habitats when conventional practices degrade land. Working with conservation charity Rare and Soil & More Impact consultancy, Jintian farm in China started implementing composting and cover cropping, and reducing tillage in their cotton fields in 2018. After just one year, they achieved similar yields to conventional farming while increasing organic matter by 15% and observing three times more beneficial insects than neighbouring conventional operations.[219] By improving soil health, regenerative approaches also increase the soil's water retention capacity, reducing demand for finite sources and improving resilience to natural shocks like droughts while also increasing yields.[220] Furthermore, practices aimed at improving soil health go hand in hand with increasing the ability of soils to sequester carbon. Research from Fibershed suggests that regenerative sheep husbandry for wool production can sequester up to 37kg of CO_2 per garment, in contrast to the high emissions produced using conventional practices.[221] Similarly, a study from Wrangler suggests that adopting a combination of regenerative approaches in 1 acre of a cotton field can sequester and store as much carbon as 0.75 acres of forest.[222] Furthermore, implementing regenerative approaches reduces reliance on synthetic inputs like fertilisers and pesticides, which are linked not only to pollution and eutrophication, but also account for around 70% of emissions in conventional cotton cultivation.[223] Improved farming practices and reduced synthetic inputs in cotton cultivation are estimated to cut around 50% of greenhouse gas emissions and increase net revenue for farmers.[224]

Regenerative production of raw materials for the fashion industry builds soil health and carbon content, increases water quality and biodiversity, and improves the resilience of ecosystems. In order to achieve such goals, cultivation practices are adapted to the local conditions and can include managed grazing, intercropping, agroforestry, minimal or no-tillage, cover crops, and compost applications.

EXAMPLES OF COMPANIES ADOPTING PRACTICES FOR REGENERATIVE OUTCOMES

- **Kering** has, through their Biodiversity Strategy, committed to converting 1 million hectares of farms and rangelands in its supply chain landscape into regenerative agriculture by 2025.[225] In order to achieve this, the fashion group has partnered with Conservation International to launch the Regenerative Fund for Nature, which will assist producers explore and transition to practices with regenerative outcomes[226]

- **Timberland** is working with other organisations like the Savory Institute's Minnesota Hub, Other Half Processing, and Thousand Hills Lifetime Grazed regenerative ranches, to build a more responsible leather supply chain. For their recently launched collection of hiking boots, they have used regenerative leather production practices, such as encouraging animal grazing in natural patterns and planting diverse species of cover crops[227]

- **Patagonia** is piloting Regenerative Organic Certified™ programmes with over 800 cotton farmers in India. Their aim is to rehabilitate soil, respect animal welfare, and improve the lives of farmers[228]

- **VF Corp-owned** brands Icebreaker and Smartwool, together with Allbirds have announced a partnership with the New Zealand Merino Company to create ZQRX. The ZQRX index will be applied to 167 sheep growers in New Zealand, representing 2.4 million acres of land, with the goal of sequestering carbon and improving the natural landscapes they operate in[229]

- **Eileen Fisher** has introduced Regenerative Wool – a fibre they claim helps restore grasslands in Patagonia and fight climate change. They work with local farmers to implement holistic management for sheep, whose grazing helps to aerate the soil and add nutrients back into it[230]

- Under its Natural Climate Solutions Portfolio, **Gucci** is promoting regenerative agriculture by identifying projects in its supply chain with the aim to source regenerative raw materials for its products, as well as supporting farmers' transition to regenerative agriculture through carbon farming. As an example, Gucci has partnered with Native to help scale its regenerative wool and leather project to 32,000 hectares of land managed with regenerative practices with the goal of sequestering over 200,000 tons of CO_2 (~181,000 tonnes) while promoting soil health, water quality, increased biodiversity, animal welfare and carbon sequestration. [231]

- **Stella McCartney**, who primarily use organic cotton, recognises that there can be a net-negative environmental impact even when fibres are grown organically. The brand is working with scientists and their cotton suppliers in Turkey to test a suite of regenerative farming practices that rebuild soil health, increase soil organic carbon, improve water-holding capacity, enhance biodiversity, and increase productivity and yields[232]

- **Organic Basics**, together with **WWF**, are supporting farmers in Turkey to transition 62,500 m^2 of conventional cotton field into regenerative cotton field. They promote the planting of cover crops, no deep tilling, and developing compost systems, among other practices[233]

- **In Brazil,** a partnership between **FarFarm** and **Renature** is regeneratively producing food and fibres, including materials like cotton and jute, for the footwear brand Veja. By implementing agroforestry in a potential area of up to 635 hectares, their model aims to reverse the deforestation of the Amazon, absorb 1,440 tons of CO_2 (~1,306 tonnes) per hectare per year, and improve the livelihoods of 1,600 community members[234]

CIRCULAR ECONOMY ACTIONS FASHION BUSINESSES CAN TAKE TODAY TO ACHIEVE THEIR BIODIVERSITY AMBITIONS

The table below highlights three key steps that businesses can take to help kick-start their journey:

1 Assess impacts and dependencies on biodiversity

Measure impacts and dependencies on biodiversity to help identify priority areas and help deliver biodiversity-positive outcomes	• Measurement approaches such as the IUCN Species Threat Abatement and Restoration (STAR) metric, the Natural Capital Protocol, Biodiversity Impact Metric, and the Global Biodiversity Score offer companies useful methods and resources to help assess, act, and report on progress towards meeting biodiversity targets[235] • The Biodiversity Benchmark from the Textile Exchange's Corporate Fiber & Materials Benchmark (CFMB) Program enables the textile industry to understand its impacts and dependencies on nature in regards to materials sourcing strategies. Using this information, they can chart a pathway to delivering positive biodiversity outcomes and benchmark progress
Set biodiversity targets that are aligned with the best available science	• Set targets for biodiversity: For example, the Science-Based Targets (SBT) for Nature has recently developed an initial guidance for companies looking to set biodiversity targets that are aligned with globally agreed goals

2 Identify circular economy opportunities that help meet biodiversity ambitions

Assess the circular economy potential by searching for best practices and identifying circular economy strengths and opportunities for innovation that can help businesses preserve biodiversity [XVII]

- Throughout this chapter, examples have been provided of how the circular economy framework can help tackle the key drivers of biodiversity loss most impacted by the fashion industry, for deeper insights on the circular economy vision for fashion see Make Fashion Circular
- The Biodiversity Case Study library showcases circular economy business examples in the fashion industry that help safeguard and rebuild biodiversity Identify circular economy strengths and opportunities for innovation that can have a positive impact on biodiversity:
- Circulytics is one of the most comprehensive circularity measurement tools available for companies. Going well beyond assessing products and material flows, it informs businesses on their circularity level across their entire operations

Shape a circular economy action plan to help tackle a company's most urgent impacts and dependencies on nature, with the circular economy acting as a key delivery mechanism

Examples of circular economy and biodiversity commitments:

- Timberland commits to a net-positive impact on nature by 2030, setting goals aiming for 100% of products to be designed for circularity, and 100% of natural materials used in its products to be sourced through regenerative agriculture by 2030
- Kering commits to a net-positive impact on biodiversity by 2025, publishes biodiversity strategy, and launches a regenerative agriculture fund for 1 million hectares of land
- H&M commits to becoming 100% circular and climate positive by 2040, while protecting and restoring biodiversity and natural ecosystems, in line with the best scientific guidance

XVII The circular economy directly aligns with the SBTN's Action framework – Avoid; Reduce; Regenerate and Restore; Transform – in helping to deliver on biodiversity targets.

Design for the circular economy
to ensure products are designed, accessed, and used in ways that eliminate waste, pollution, and environmental degradation

- The circular design learning pathway, toolkit, and guide highlight how and why design sits at the heart of the circular economy, and what steps businesses can take to help rethink their products or services
- The circular toolbox is a step-by-step guide for apparel brands to design and launch a rental or resale pilot in 10 months
- The Jeans Redesign Guidelines present the minimum requirements for the durability, material health, recyclability, and traceability of denim jeans (as collaborated on with over 80 denim experts). In doing so, they ensure positive impacts for the environment, society, and the health of those people working in the jeans industry
- The Circular Design for Fashion book (launched in November 2021)
- The Square your Circle guidebook, co-developed by the World Resources Institute (WRI) and the Waste & Resources Action Programme (WRAP), aims to help fashion companies successfully transition to reuse business models in a way that increases clothing utilisation, decreases clothing impact, and decouples their business success from resource use

3 Stimulate collaboration to find solutions that can deliver transformative change

Stimulate collaboration by identifying key stakeholders within and outside value chains to collaborate and innovate with, and find circular solutions that help tackle biodiversity loss

- Fashion Pact is an example of a global coalition of companies in the fashion and textile industry committed to stopping global warming, restoring biodiversity, and protecting the oceans. A biodiversity strategy is being shaped in the next year that aligns with the SBT for Nature
- The Ellen MacArthur Foundation's Make Fashion Circular brings together industry leaders from across the fashion industry to stimulate the level of collaboration and innovation necessary to create a new textiles economy. It aligns with the principles of the circular economy to help tackle the root causes of global challenges like biodiversity loss, climate change, and pollution
- PVH is collaborating by participating in two pilots focused on traceability in the fashion industry: the Organic Cotton Traceability Pilot, the first digitised project of its kind to track the organic cotton journey from farm to retail garment; and the Connect Fashion Initiative, which tests the use of EON's CircularID, which has been designed to promote circularity by creating a new standard for communicating information about fashion products

SECTOR DEEP-DIVE

Plastic packaging

TACKLING PLASTIC POLLUTION THROUGH ELIMINATION, INNOVATION, AND CIRCULATION

Currently, most plastic packaging flows through a wasteful linear system that threatens biodiversity by polluting natural habitats, endangering wildlife, and contributing to climate change. The circular economy offers a comprehensive system-level approach to transform the way we produce and use packaging to create opportunities for better growth, while helping to halt and reverse global biodiversity loss. By eliminating the packaging we don't need and keeping the packaging we do need in use and circulation, the impacts on biodiversity associated with the extraction, production, and disposal of plastic packaging can be reduced.

The 'take-make-waste' way in which plastic packaging is currently produced, used, and disposed of poses a serious threat to biodiversity. Only 14% of plastic packaging is collected for recycling, with the rest ending up burned, landfilled, or leaking into the environment.[236] Plastic pollution is overwhelming our soils, oceans, and wildlife. If no action is taken, by 2050, there could be more plastic than fish in the ocean.[237]

The circular economy offers an approach to fundamentally rethink the plastic packaging industry to evolve from a model that protects rather than degrades natural systems. Through the New Plastics Economy Global Commitment and the many Plastics Pacts around the world, more than 1,000 organisations have united behind the Ellen MacArthur Foundation's vision of a circular economy for plastic packaging, in which unnecessary plastics are eliminated; innovation ensures that all necessary plastics are reusable, recyclable, or compostable; and all used plastics are circulated, keeping them in the economy and out of the environment.[238] In doing so, the sector can minimise the demand for finite virgin materials, eliminate waste and pollution, and reduce greenhouse gas emissions, thereby alleviating pressures on biodiversity. Compared with business-as-usual, such a circular economy approach has the potential to reduce the annual volume of plastics entering our oceans by over 80%, while offering system-wide benefits that reduce greenhouse gas emissions by 25%, generate savings of USD 200 billion per year, and create 700,000 net additional jobs by 2040.[239]

In the plastic packaging sector, there are two principal circular economy opportunities to tackle the main direct drivers of biodiversity loss:

A **Eliminating the need for plastic packaging where possible**

B **Circulating packaging and materials in the economy**

THE IMPORTANCE OF BIODIVERSITY TO THE PLASTIC PACKAGING INDUSTRY

Today, the plastic packaging industry is not directly dependent on biodiversity, as over 90% of plastics produced globally are derived from virgin fossil feedstocks.[240] However, with the projected growth of bio-based plastics,[241] healthy ecosystems could become increasingly important for the industry's biomass production.

Image: Adobe Stock

THE IMPACT OF THE PLASTIC PACKAGING SECTOR ON THE DIRECT DRIVERS OF GLOBAL BIODIVERSITY LOSS[242]

Land-use change

- Plastic demand growth under a business-as-usual scenario is forecasted to be the main driver for future oil and gas extraction, which may cause disruptions in ecosystems with high or endangered biodiversity, such as the Amazon rainforest or the Arctic coastal plains[243]

Pollution

- Globally, 86% of plastic packaging is not collected for recycling: 40% is landfilled, 14% incinerated, and 32% leaks into the environment[244]
- If no action is taken, by 2050, there could be more plastic than fish in the ocean[245]
- Conservative estimates suggest that there could already be 14 million tonnes of microplastics on the ocean floor.[246] On land, up to 730,000 tonnes of microplastics are estimated to be dumped onto agricultural soils in the US and Europe every year, potentially affecting the interaction between soils and plants[247]

Climate change

- Under a business-as-usual trend, by 2040, the plastics sector is on track to use 19% of the total emissions budget allowable if we are to remain below a 1.5°C increase in global warming[248]

Invasive alien species

- Plastics can move seafaring organisms across vast distances, potentially leading to the spread of invasive alien species, which can have serious negative consequences for their new environment[249]

A ELIMINATING THE NEED FOR PLASTIC PACKAGING WHERE POSSIBLE

Eliminating the need for plastic packaging, where appropriate, prevents waste and pollution. One way to do this is through direct elimination of plastics that do not serve an essential function. For example, Nestlé removed the plastic tear-offs that covered their Pure Life plastic bottles in Egypt in January 2019. In the first 18 months of the initiative, this eliminated the need for 240 tonnes of materials in the form of small tear-offs, which have a relatively high likelihood of ending up in the environment.[250] Moreover, such an approach to elimination avoids the emissions that would have been produced throughout the packaging's life cycle, which could be up to 6.9 tons (6.26 tonnes) CO_2e per tonne of plastic if it were to be produced, transported, used, and open burnt in the open at its end-of-life.[251]

In other cases, where packaging does serve an essential purpose, there are innovative solutions for eliminating the need for plastic packaging. As an example, Ohoo and Monosol are designing films that are edible or dissolve in water, eliminating the need for items like sachets or bottles that could potentially end up polluting natural habitats and endangering organisms.[252] The elimination of plastic packaging reduces the volume of waste and brings down the cost of waste management. This would be especially helpful in areas where collection infrastructure is limited or non-existent at scale.[253]

Ultimately, a holistic approach should be taken to ensure that elimination does not lead to other negative impacts on biodiversity or society, such as reduced food shelf-life resulting in increased food waste and greenhouse gas emissions.

EDIBLE FOOD PACKAGING

Eliminating waste at the design stage to reduce threats to biodiversity

Ooho from Notpla (UK)

Ooho is an edible and home compostable "blob" for beverages and condiments made from seaweed. It offers an alternative to small flexible packaging used in take-away food and beverages, which has a low recycling value and can leak into the environment, harming biodiversity. Ooho's potential is being recognised by various market players. For instance, following a successful trial of Lucozade filled Oohos at the 2019 London Marathon, Ooho is being rolled out as the selected hydration solution for Lucozade at running events.[XVIII] They are also partnering with Just Eat, Hellmann's and Innovate UK to scale the uptake of Ooho as an alternative for plastic condiment sachets throughout the UK.[XIX] Notpla, the company behind Ooho, is now exploring other applications like seaweed-based takeaway boxes, heat-sealable films, and sachets for non-food products.

Biodiversity benefits

Ooho eliminates the need for plastic-based beverage bottles and cups as well as sachets that could potentially leak into the environment and harm biodiversity. For example, approximately 36,000 plastic-based items were eliminated at the 2019 London Marathon trial and 46,000 sauce sachets were eliminated during an eight week trial with ten London restaurants. [XX]The blob can be eaten or composted and, if in the very worst-case scenario it ends up in the environment, it will take less than six weeks to biodegrade. Additionally, in contrast with fossil fuel-based plastics, the material is based on seaweed, a renewable resource that has the potential to regenerate coastal environments and capture carbon.[XXI]

Image: Notpla

XVIII Lucozade Sport, Lucozade Sport Pods, (accessed 6th September 2021)
XIX Unilever, Hellmann's and Just Eat join forces to tackle single-use plastic pollution across takeaway sector (2019)
XX Ellen MacArthur Foundation, Upstream Innovation Guide (2020); Unilever, Hellmann's and Just Eat join forces to tackle single-use plastic pollution across takeaway sector (2019)
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B CIRCULATING PACKAGING AND MATERIALS IN THE ECONOMY

By leveraging reuse business models that keep packaging in use for longer where appropriate, the negative impacts on biodiversity associated with material extraction, processing, and disposal are reduced. For at least 20% of plastic packaging, reuse alternatives represent an attractive opportunity worth over USD 9 billion, while saving around 6 million tonnes of material.[254] These savings would, in turn, reduce the pressures on biodiversity linked to the extraction of virgin materials, the greenhouse gas emissions associated with new production, and the potential leakage into the environment. Just adopting reuse models for carrier bags, which make up 3% of the packaging market and are amongst the deadliest types of debris for marine wildlife, could reduce the use of plastic material by about 2 million tonnes.[255] Similarly, applying reuse models to personal care and household product bottles, which represent 5% of the packaging market, could further reduce material use by about 3 million tonnes.[256] As an example, Splosh and Replenish – who sell the active ingredients of cleaning products to customers instead of conventional bottles containing the liquid – have managed to reduce the need for plastic packaging by an estimated 80%.[257]

For plastic packaging that cannot be eliminated or reused, material circulation offers an attractive opportunity to keep materials in the economy and out of the environment, thereby reducing pressures on biodiversity across the value chain. Circulating materials through recycling prevents plastic from becoming pollution and displaces the need for virgin material extraction, hence reducing the potential disturbance to ecosystems. Furthermore, compared to landfill, mechanical recycling is estimated to save up to 50% in life cycle greenhouse gas emissions, and even greater reductions compared to incineration and open burning.[258] Integrating the latest technology, such as AI in camera detection and automation, can further contribute to achieving efficient, higher-quality recycling.

However, for the majority of packaging items no recycling options are currently available and in some countries there are huge infrastructure gaps that require large-scale investment. In order to attract this investment and meaningfully scale recycling, the process must be made profitable. At the moment, collection, sorting, and recycling comes at a net cost. The only proven and likely pathway to ensure dedicated, ongoing, and sufficient funding at scale is through mandatory, fee-based Extended Producer Responsibility (EPR): a scheme in which all industry players introducing packaging to the market provide funding dedicated to collecting and processing their packaging after its use.[259]

Design is also critical to enabling the circulation of packaging and materials. Designing packaging for a circular economy ensures that materials can safely move within the economy in a way that is technically and economically viable, and without posing risks to humans or biodiversity. For example, moving from multi-material to mono-material packaging, or removing pigments, could improve the economics of recycling by USD 120 per tonne.[260] Sprite has put this in action by shifting from green bottles to clear bottles to improve the material value throughout the recycling stages in many of their markets, including South Africa, Western Europe, and the Asia-Pacific region.[261] Improving the economics and efficiency of recycling through such initiatives can, in turn, help reduce pressures on biodiversity.

REFILLABLE PACKAGING ON-THE-GO
Keeping packaging out of the environment to reduce threats to biodiversity
Algramo (Chile)

Algramo, a Santiago-based start-up founded in 2013, offers affordable quantities of everyday products without single-use packaging. Targeting economies where recycling infrastructure is limited and packaging items often end up in the environment, Algramo introduces a reusable packaging system with dispensers and affordable containers. Their model keeps packaging in use in order to help address the problem of single-use plastic pollution and its impacts on biodiversity. Algramo's 'refill-on-the-go' tricycle system in Santiago has proven resilient to shocks: sales increased by 356% between April and June 2020 while the city was in full lockdown.[262] After their success in Chile, Algramo is working with Walmart, Unilever, Nestlé's Purina, and other players to expand their services and scale up. At the international level, they already have pilot programmes in New York and Jakarta, and are looking to enter new markets, including Mexico and the UK.

Biodiversity benefits

During their one-year pilot in partnership with Unilever, some of Algramo's customers refilled their detergent bottle 15 times – with each refill eliminating the need for a HDPE bottle and its associated impacts on biodiversity, and keeping the original refillable bottle in use and out of the environment.[263]

Image: Algramo

INVASIVE ALIEN SPECIES

Plastic debris in the ocean may act as a new pathway for the spread of invasive alien species. In the past, organisms have travelled on driftwood and other materials that would decompose at sea after some time. The durability of plastics makes longer journeys possible, as species can remain in the environment for hundreds of years. Hence, plastic can act as a raft and carry marine animals, plants, and microbes to distant locations. When these organisms arrive in a new environment, some may thrive and become invasive – out-competing local and indigenous species for natural resources, and disrupting the ecological functioning of their new habitats.[264]

After the 2011 Japan tsunami, this was proven to be the case when millions of objects of debris washed offshore. Due to ocean currents, some of these objects were transported across large distances. For the following six years, researchers collected over 600 items washed ashore on the west coast of North America and Hawaii, including vessels, buoys, and household items. They found more than 280 Japanese marine species living on the debris, 30 of which were known invasive species.[265] Their discoveries were unprecedented given the length of time that the organisms had survived rafting along the ocean (over five years in some cases) and the extraordinary distance travelled before landing on North American shores.

A circular economy for plastic that minimises leakage into the oceans through elimination, reuse, and material circulation, can reduce the potential for plastic debris to become a pathway for species invasion.

CIRCULAR ECONOMY ACTIONS PLASTIC PACKAGING BUSINESSES CAN TAKE TODAY TO ACHIEVE THEIR BIODIVERSITY AMBITIONS

The table below highlights three key steps that businesses can take to help kick-start their journey:

1 Assess impacts and dependencies on biodiversity

Measure impacts and dependencies on biodiversity to help identify priority areas to focus on and help deliver biodiversity-positive outcomes

- Measurement approaches such as the IUCN Species Threat Abatement and Restoration (STAR) metric, the Natural Capital Protocol, Biodiversity Impact Metric, and the Global Biodiversity Score offer companies useful methods and resources to help assess, act, and report on progress towards meeting biodiversity targets[266]

Set biodiversity targets that are aligned with the best available science

- For example, the Science-Based Targets (SBT) for Nature has recently developed an initial guidance for companies looking to set biodiversity targets that are aligned with globally agreed goals
- The Ellen MacArthur Foundation's Global Commitment and Plastic Pacts have already mobilised over 1,000 signatories that are determined to start building a circular economy for plastic. These include companies representing 20% of all plastic packaging produced globally

2 Identify circular economy opportunities that help meet biodiversity ambitions

Assess the circular economy potential by searching for best practices and identifying circular economy strengths and opportunities for innovation that can help businesses preserve biodiversity[XXII]	• Throughout this chapter, examples have been provided of how the circular economy vision for plastics, see New Plastics Economy • The Biodiversity Case Study library showcases circular economy business examples in the plastic packaging industry that help safeguard and rebuild biodiversity • Circulytics is one of the most comprehensive circularity measurement tools available for companies. Going well beyond assessing products and material flows, it informs businesses on their circularity level across their entire operations
Shape a circular economy action plan to help tackle a company's most urgent impacts and dependencies on nature, with the circular economy acting as a key delivery mechanism	• L'Oreal has made a commitment for 100% of their plastic packaging to be refillable, reusable, recyclable, or compostable by 2025, and 100% of the plastic used in their packaging to come from recycled or bio-based sources by 2030, in alignment with their commitment to fight plastic pollution • Sainsbury's commits to cut plastic packaging by 50% through a circular economy approach by 2025 and reach net-zero emissions by 2040, while ensuring that the impact of their operations is net positive for biodiversity
Design for the circular economy to ensure products are designed, accessed, and used in ways that eliminate waste, pollution, and environmental degradation	• The circular design learning pathway, toolkit, and guide highlight how and why design sits at the heart of the circular economy, and what steps businesses can take to help rethink their products or services • The Upstream Innovation is a guide for companies to tackle packaging waste and pollution at its root by rethinking their packaging, products, and business models, including a case study library and other resources to get started • The Circular Economy Playbook for Chemical Companies provides chemical industry companies, including plastic packaging businesses, with tools for evaluating their operations and developing new circular business models

XXII The circular economy directly aligns with the SBTN's Action framework – Avoid; Reduce; Regenerate and Restore; Transform – in helping to deliver on biodiversity targets.

3 Stimulate collaboration to find solutions that can deliver transformative change

Stimulate collaboration by identifying key stakeholders within and outside value chains to collaborate and innovate with, and find circular solutions that help tackle biodiversity loss

- The Ellen MacArthur Foundation's New Plastics Economy initiative brings together more than 1,000 organisations from across the plastics industry to stimulate the level of collaboration and innovation necessary to create a new plastics economy. It aligns with the principles of the circular economy to help tackle the root causes of global challenges, including biodiversity loss, climate change, and pollution
    - The Ellen MacArthur Foundation's Plastics Pact Network is a globally aligned response to plastic waste and pollution, which enables knowledge-sharing and coordinated action. It is a network of national and regional (multi-country) initiatives which brings together key stakeholders to enable the transition to a circular economy for plastic that keeps plastics in the economy and out of the environment
- To develop the reusable universal bottle in Latin America, Coca-Cola formed an agile team with senior representation from marketing, finance, commercial, quality, and technical areas, helping to get fast company-wide buy-in

ACKNOWLEDGEMENTS

We are very grateful for the support we have received in producing this paper. Thanks to the leading academic, industry, NGO, and government agency experts who provided invaluable perspectives:

Alliance of Bioversity International and CIAT
Roseline Remans
Senior Scientist

ARUP
Richard Boyd
Senior Engineer

Tom Gray
Senior Ecological Consultant

Brambles
Iñigo Canalejo
Director of Sustainability & Government Affairs EMEA

DSM
Kimberley Chan
Global Lead Resources

DS Smith
Sam Jones
Senior Sustainability Manager

European Forest Institute
Marc Palahi
Director

Fashion Pact
Kristen Nuttall
Project Lead, Task Force

Natalie Della Valle
Project Coordinator

Forests, Trees, and Agroforestry
Yves Laumonier
Senior Scientist

Future Table
Lorin Fries
Founder and Lead Partner

H&M Group
Jennie Granström
Business expert, animal welfare, material ethics and biodiversity

Ichthys Aquaponics
Mark Austin
Executive Management

IKEA Group
Malin Nordin
Development Leader for Circular IKEA

Sofia Gape
Project Leader Sustainability Range and Supply

Caroline Reid
Sustainability Development Manager

Lotta Holmberg
Global Engagement Leader, Sustainability

Inditex
Luis Coloma Yepes
Head of Environmental Sustainability

Integrate
Maria Cunha
Researcher

IPBES
Professor Sandra Diaz
Co-chair of IPBES 2019 Global Assessment Report
Professor of Ecology at Córdoba National University

Kering
Helen Crowley
Head of Sustainable Sourcing & Nature Initiatives

Kontoor Brands
Jordan Brewster
Global Sustainable Business

NatureWorks
Erwin Vink
Sr. Sustainability Manager

Novamont
Giulia Gregori
Strategic Planning and Corporate Communication Manager

Philips
Thijs Maartens
Sustainability & Circular Economy Lead

Schneider Electric
Daniele Bufano
Sustainability Transformation Director

SBTN
Jess McGlyn
Corporate Engagement Lead

Samantha, McCraine
Technical Coordinator

Erin O'Grady
Coordinator

The Finnish Innovation Fund Sitra
Tim Forslund
Circular Economy Specialist

Stora Enso
Antti Marjokorpi
Senior Vice President, Sustainability, Group Forest Operations

Solvay
Isabelle Gubelmann-Bonneau
Senior VP Head Circular Economy

Thomas Andro
Sustainable Development Officer
Head of Solvay Way

Textile Exchange
Liesl Truscott
Director of European & Materials Strategy

Marissa Balfour
Biodiversity Specialist

Jessica Garcia Lama
Benchmark Manager

The Coca-Cola Company
Dr. Ben R. Jordan
Senior Director, Environmental Policy

The Nature Conservancy
Robert Jones
Global Aquaculture Lead

Timberland
Zachary Angelini
Senior Environmental Stewardship Manager

Elisabetta Baronio
Sustainability & CSR Manager at EMEA

Marianella Cervi
Sustainability and Circular Economy at VF Corporation

United Nations University Institute for Integrated Management of Material Fluxes and of Resources (UNU-FLORES)
Dr. Nora Adam
Partnerships and Liaison Officer

University of Oxford
Dr. Michael Obersteiner
Director of the Environmental Change Institute, University of Oxford

Professor Yadvinder Mahli
Professor of Ecosystem Science
Programme Leader of the Ecosystems Group at ECI

University of Portsmouth
Dr. Joanne Preston
Reader in Marine Ecology and Evolution

UPM
Inka Musta
Senior Manager, Global Forest Affairs

Tuomas Niemi
Manager, Reporting and Standards

WWF European Policy Office
Sabien Leemans
Senior Biodiversity Policy Officer

GLOSSARY

Agroecosystems
Natural ecosystems that have been modified for the production of food or of materials such as fibres.[1] They include managed forests, plantations and orchards, pastures, rangelands, and croplands, and the organisms, including cultivated ones, living in them.[2]

Biodiversity
The variability among living organisms from all sources including, inter alia, terrestrial, marine, and other aquatic ecosystems, and the ecological complexes which they are part of. It includes diversity within species, between species, and of ecosystems.[3]

Direct drivers
Drivers (natural and anthropogenic) that unequivocally influence biodiversity and ecosystem processes (also referred to as 'pressures').[4] The five direct drivers with the greatest global impact on biodiversity are: land-use change, climate change, pollution, natural resource use and exploitation, and invasive species.[5]

Indirect drivers
Drivers that do not impact nature directly, but rather affect the level, direction, or rate of direct drivers and are also referred to as 'underlying causes'.[6] Indirect drivers can also influence each other. Examples include socioeconomic and demographic trends, technological innovation, governance, and culture.[7]

Ecosystem
A dynamic complex of plant, animal, and microorganism communities and their non-living environment interacting as a functional unit.[8]

Ecosystem services
The benefits people obtain from ecosystems. These include: provisioning services such as food and water; regulating services such as flood and disease control; supporting services such as soil formation and nutrient cycling; and cultural services such as recreational, spiritual, religious, and other non-material benefits.[9]

Invasive alien species
Animals and plants that are introduced accidentally or deliberately into a natural environment where they are not normally found, with serious negative consequences for their new environment.[10]

Land use
The human use of a specific area for a certain purpose (such as residential, agriculture, recreation, industrial, etc.). It is influenced by, but not synonymous with, land cover.[11]

Land-use change
A change in the use or management of land by humans.[12] For example, clearing a natural forest area and converting it into an agricultural field.

Nature-positive
Nature-positive means halting and reversing nature loss by 2030, measured from a baseline of 2020. This Global Goal for Nature calls for no net loss of nature from 2020, a net-positive state of nature by 2030, and full recovery of nature by 2050.[13] It has become a movement, with leaders from governments, businesses, and civil society committing to action.[14]

Overexploitation
The harvesting of species and extraction of natural resources at rates faster than natural replenishing cycles.[15]

Regenerative production
An approach to managing agroecosystems that provides food and materials – be it through agriculture, aquaculture, or forestry – in ways that create positive outcomes for nature. These outcomes include, but are not limited to, healthy and stable soils, improved local biodiversity, improved water and air quality, and higher levels of carbon sequestration. They can be achieved through a variety of context-dependent practices and can together help regenerate degraded ecosystems and build resilience on farms and in surrounding landscapes. Farmers may draw on several different schools of thought –such as regenerative agriculture, restorative aquaculture, agroecology, agroforestry, and conservation agriculture – to help them apply the most appropriate set of practices to drive regenerative outcomes in their agroecosystems.

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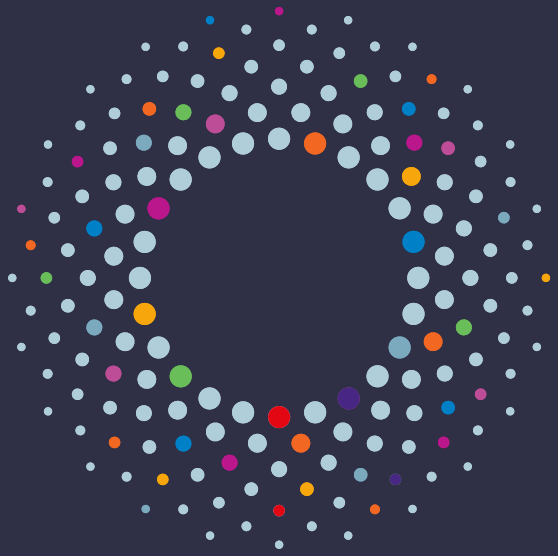

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Charity Registration No.: 1130306
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