ELLEN MACARTHUR FOUNDATION

THE NATURE IMPERATIVE

How the circular economy tackles biodiversity loss

SECTOR DEEP-DIVE

Plastic packaging

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 fundamental shift as it creates value in ways that rebuild biodiversity and provide other society-wide benefits.

Our 'take-make-waste' economy is increasingly recognised 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. More than 90% of this biodiversity loss is due to the extractive, polluting, and wasteful way we use resources in the economy.

To halt and reverse biodiversity loss, we need to fundamentally transform our production and consumption systems, and the circular economy offers an actionable framework for such transformative change. By decoupling economic prosperity from resource consumption and environmental degradation, the circular economy presents 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.

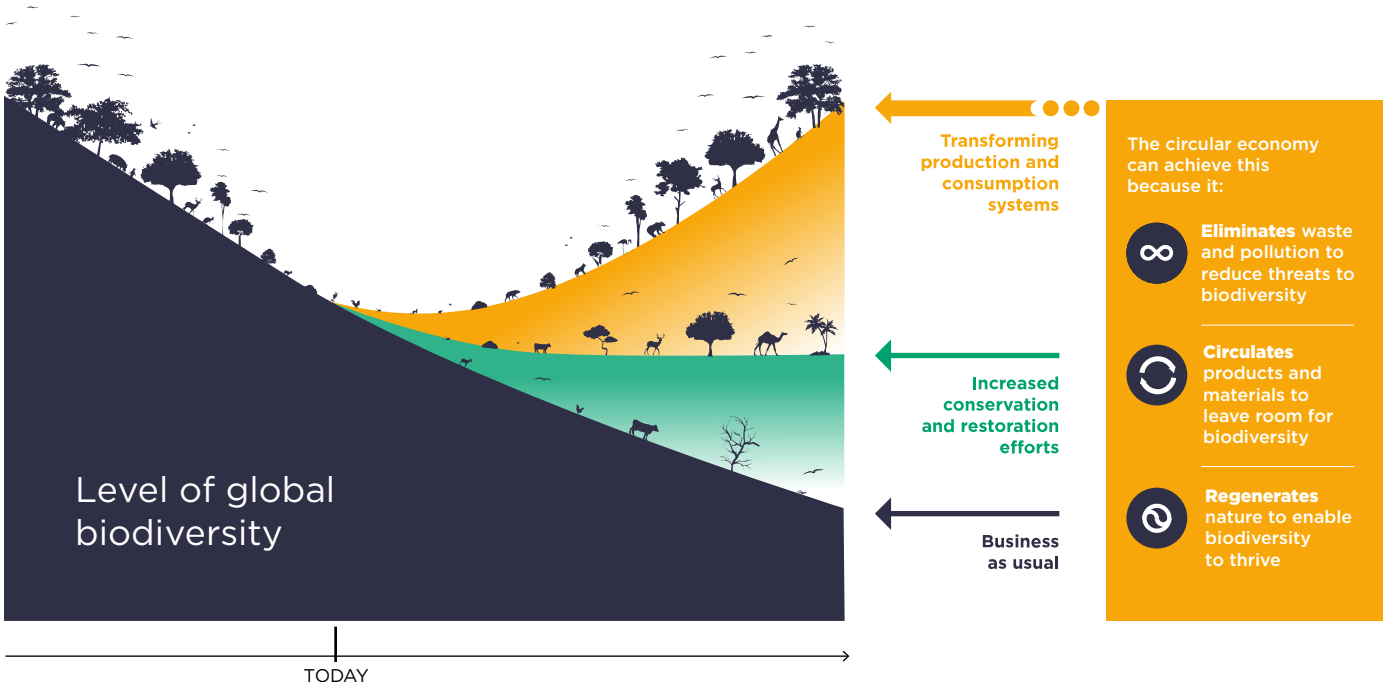
It is by applying the three principles of the circular economy together, that the root causes of biodiversity loss can be tackled:

- **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 for reuse, recycling or composting allows them to circulate in the economy without 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. 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 the need for land expansion..

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



I 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.

To effectively halt and reverse biodiversity loss, multiple stakeholders will need to be engaged. Businesses can join the dots between their biodiversity ambitions and circular economy plans, by assessing their biodiversity impacts and dependencies and setting targets, identifying circular economy opportunities that help meet those targets, and collaborating across value chains to develop innovative solutions. Meanwhile, policymakers can play an instrumental role in developing a conducive policy context for this transformative change by adopting a circular economy approach based on five universal policy goals.

To learn more about how the circular economy can be harnessed to halt and reverse global biodiversity loss, and get a deeper understanding of what this looks like across the Fashion, Plastic Packaging, and Built Environment sectors, visit the Ellen MacArthur Foundation page for the full paper The Nature Imperative: How the circular economy can help tackle biodiversity loss, or one of the other individual sector deep-dives, or explore our library of case examples.

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.[16] 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.[17]

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.[18] 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.[19]

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.[20] However, with the projected growth of bio-based plastics,[21] 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[22]

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[23]

Pollution

- Globally, 86% of plastic packaging is not collected for recycling: 40% is landfilled, 14% incinerated, and 32% leaks into the environment[24]
- If no action is taken, by 2050, there could be more plastic than fish in the ocean[25]
- Conservative estimates suggest that there could already be 14 million tonnes of microplastics on the ocean floor.[26] 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[27]

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[28]

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[29]

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.[30] 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.[31]

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.[32] 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.[33]

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.[II] 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.[III] 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. [IV]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.[V]

Image: Notpla

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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.[34] 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.[35] 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.[36] 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%.[37]

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.[38] 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.[39]

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.[40] 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.[41] 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.[42] 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.[43]

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.[44]

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.[45] 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[46]
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[VI]

- 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

VI 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

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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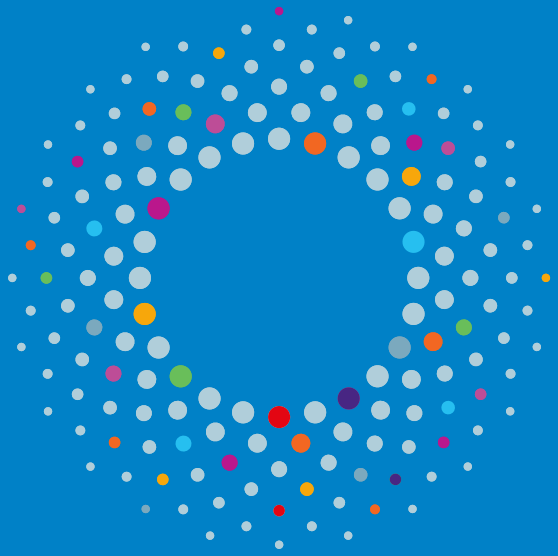

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