In collaboration
with Oliver Wyman

WORLD ECONOMIC FORUM

Nature Positive:
Role of the Automotive Sector

INSIGHT REPORT

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Images: Getty Images

Contents

Foreword

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The automotive sector is crucial not only in helping to drive economic growth but also in enabling safe, sustainable and connected mobility on a global scale.

Today, the sector stands at a pivotal moment as it transitions rapidly from internal combustion engine (ICE) vehicles to electric vehicles (EVs). This transformation is driven by an urgent, society-wide need to reduce greenhouse gas (GHG) emissions and combat climate change. Consistent governmental support is needed to accelerate this transition and EV adoption, including through investment in fast-charging infrastructure.

However, climate change is not the only planetary crisis our sector faces. Climate mitigation and adaptation efforts must go hand-in-hand with strategies to protect and restore nature and biodiversity. Understanding the interplay between these issues and implementing solutions that address both areas is essential for managing trade-offs and risks.

Our sector's activities both impact and depend on nature, in particular, due to the key materials we use in our operations. This report clearly defines the priority actions the automotive sector needs to take to contribute to the nature-positive movement, meet the goals of the Kunming-Montreal Global Biodiversity Framework and halt and reverse nature loss by 2030. In the coming years, the sector needs to continue to reduce the impacts of operations and materials, become more circular, transform its product offering and conserve and restore nature.

At Volvo Cars, alongside our ambition to become a circular business and reach net-zero GHG emissions by 2040, we are committed to avoiding and reducing our negative impacts on biodiversity throughout our value chain while making positive contributions towards nature recovery. For example, we aim to reach 30% average recycled content across all vehicles produced, reuse or recycle at least 99% of all waste from our operations by 2030 and reduce water withdrawal in our operations by 50% per car by 2030, compared to 2018 levels. Volvo Cars is also proud to be the first global car maker to adopt the Taskforce on Nature-related Financial Disclosure's (TNFD) Recommendations to enhance transparency about our progress and support nature disclosure.

A transition of this scale isn't straightforward, and collaboration will be essential to success. Therefore, we call on our peers in the automotive sector to join us in these efforts. Only by working together across the industry, the value chain and with customers can we overcome the challenges ahead and build a sustainable, resilient future for our planet.

Foreword

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On 22 July 2024, Earth recorded its hottest day on record according to the World Meteorological Organization, and August 2024 marked the 15th consecutive month of record-high global temperatures. Ocean temperatures are higher than they have ever been in modern times, causing rising sea levels, more intense storms and faster-than-usual ice loss in the Arctic in June, according to the National Snow and Ice Data Center in the US. The world is seeing unprecedented levels of biodiversity and ecosystem loss, pollution and pressure on water availability.

The World Economic Forum's 2020 *Future of Nature and Business* report estimates that more than half of the world's gross domestic product (GDP) is moderately or highly dependent on nature and its services, meaning companies and investors cannot afford to delay actions to reverse climate change and prevent nature loss any longer. The world is at a tipping point and only accelerated action can prevent widespread, irreversible harm.

The international discourse on nature is indeed turning towards action. The 2015 Paris Agreement and the 2022 Kunming-Montreal Global Biodiversity Framework provided governments and businesses with goals and targets, and, at the 2024 United Nations (UN) Convention on Biological Diversity (CBD COP16) in Cali, Colombia, the focus turned to implementation as stakeholders turned up in force to discuss how to put nature plans into practice. Business momentum is picking up, but industries need sectoral guidance on strategic ways forward. This is particularly true when it comes to preventing nature loss, which will involve tackling an inherently complex set of issues.

The World Economic Forum, in collaboration with Oliver Wyman, has spent the past two years gathering data and insights through research, expert consultation and industry interviews. This work has paved the way for the Forum's 2025 Nature Positive Transitions: Sectors report series. Building from those released on the chemical sector, the household and personal care products sector, and the cement and concrete sector in 2023, these new reports focus on four sectors: mining and metals, automotive, offshore wind and ports. This initiative is part of a broader collaborative effort with Business for Nature and the World Business Council for Sustainable Development (WBCSD).

Halting climate change and preventing further nature loss are inextricably intertwined goals. Therefore, corporate and investor action to address these twin challenges must also be complementary and occur in tandem. Investing in nature is more than just good risk management. Companies that take bold steps today towards a net-zero, nature-positive business model will enjoy competitive advantages, drawing on more resilient and sustainable supply chains, a positive public image, innovative green products and greater support from the financial sector.

If we are to stay within safe and just Earth system boundaries and maintain a sustainable planet, there is no time to delay.

About the Nature Positive Transitions report series

Nature Positive: Role of the Automotive Sector is published by the World Economic Forum in collaboration with Oliver Wyman. It is part of the World Economic Forum's Nature Positive Transitions report series, which outlines the different pathways to halt and reverse nature loss by 2030 – the mission at the heart of the Global Biodiversity Framework.

The series consists of three transitions: business sectors, cities and financial institutions. These reports highlight the relevance of nature-related risks, identify the impacts and dependencies of the economy and society on nature, and provide guidelines for business, city and financial institution leaders on key actions to accelerate the nature-positive transition.

The Nature Positive Transitions report series builds on the New Nature Economy Report Series. For more information, please visit Nature Positive Transitions.

Sector reports:

- Nature Positive: Role of the Cement and Concrete Sector
- Nature Positive: Role of the Household and Personal Care Products Sector
- Nature Positive: Role of the Chemical Sector
- Nature Positive: Role of the Mining and Metals Sector
- Nature Positive: Role of the Offshore Wind Sector
- Nature Positive: Role of the Port Sector
- Nature Positive: Role of the Automotive Sector China Deep-dive

Cities reports:

- Nature Positive: Guidelines for the Transition in Cities
- Nature Positive: Leaders' Insights for the Transition in Cities
- Nature Positive: Financing the Transition in Cities
- Nature Positive: Cities' Efforts to Advance the Transition – Durban

Finance reports:

- Financing the Nature-Positive Transition: Understanding the Role of Banks, Investors and Insurers

Executive summary

There is an urgent need for the automotive sector to contribute to the nature-positive transition, to reduce its impacts on nature and unlock new opportunities.

The automotive sector plays a critical role in the transition to a nature-positive world. In 2023, global vehicle production reached 94 million,[1] contributing 3% of global gross domestic product (GDP),[2] and the sector is projected to grow rapidly at a rate of 6-7% annually until 2030.[3,4] This growth is fuelled by a growing global middle class, an expansion of emerging markets and a shift in consumer preferences towards sustainable mobility. The shift can be seen in the surge of electric vehicle (EV) sales from 1 million to 14 million per year between 2017 and 2023.[5]

This progress is supported by governments across the world, with 43 countries collectively committed to accelerating the transition towards 100% zero-emissions vehicles.[6] These goals have also been integrated into national policies in key markets, including the EU, the UK, Canada and the US, which aim to scale up zero-emissions vehicles and circularity.[7]

Despite these efforts, the automotive sector still contributes to biodiversity loss through pollution, water use, land-use change and greenhouse gas (GHG) emissions across its entire value chain – from material sourcing to vehicle manufacturing and end-of-life management. This report summarizes the sector's key impacts and dependencies on nature and sets out priority actions that corporate leaders can take to transform their businesses. These include:

1. **Avoid and reduce impacts from operations**: Improve water stewardship, avoid and reduce pollution, strengthen biodiversity assessment, planning and management, and accelerate GHG emissions abatement.

2. **Avoid and reduce impacts from materials**: Expand circularity, innovate to avoid and reduce material waste across the value chain, engage with suppliers and source responsibly.

3. **Transform product offering**: Transition from internal combustion engine (ICE) vehicles to battery electric vehicles (BEVs) and other alternative solutions, expand into new business models like mobility- or component-as-a-service models and influence customer behaviour.

4. **Conserve and restore nature**: Support nature conservation and restoration with Indigenous Peoples and local communities, and invest in innovative biodiversity financing mechanisms.

5. **Drive cross-sector collaboration**: Embrace standards and transparency, educate customers, support downstream networks, scale up transition infrastructure and call on governments to strengthen nature-related policy.

These priority actions could unlock more than $960 billion worth of annual business opportunities by 2030 for companies operating across the sector's value chain, presenting significant possibilities for the automotive sector in the new nature-positive economy.

Introduction

Most top companies have climate targets, yet only 12% have one for biodiversity, despite the global economy's dependency on nature.

of the emissions reductions required by 2030 to keep global temperature increases under 2ºC will come from nature-based solutions.

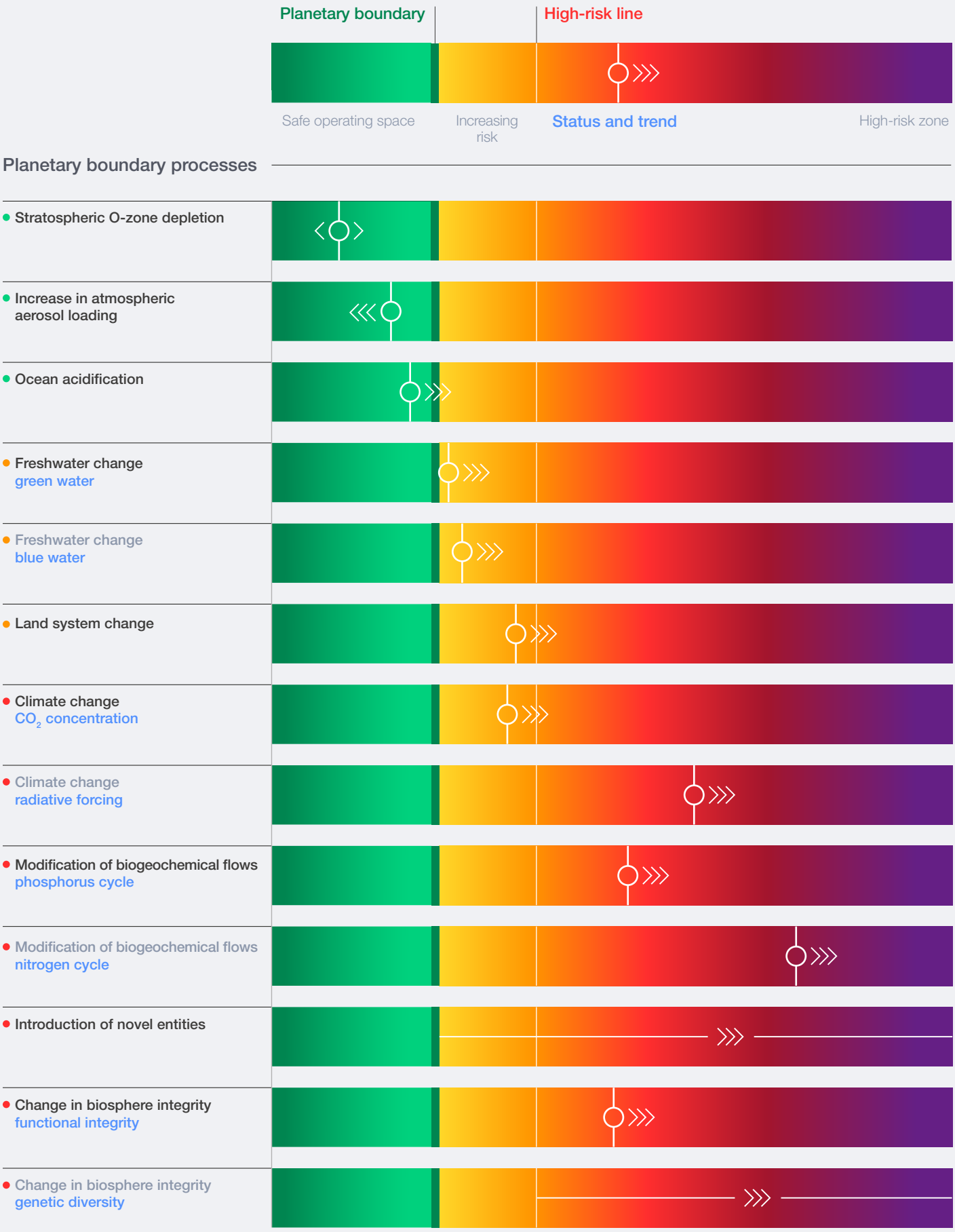
Nature is at a tipping point. Today, the resources humanity uses are equivalent to that of 1.75 Earths. This means that the ecological footprint, a measure that sums up the demands for biologically productive areas like food, timber, fibre, carbon sequestration and infrastructure, exceeds the Earth's capacity by 75%.[8]

Achieving net-zero emissions and halting biodiversity loss are highly interdependent priorities for both society and business. Climate change is one of the five key drivers of biodiversity loss,[9,10] and in turn, land-use change, principally agricultural commodity-driven deforestation, contributes 12-20% of global greenhouse gas (GHG) emissions.[11] At the same time, efforts to tackle climate change cannot succeed without safeguarding nature. It is estimated that 37% of the emissions reductions required by 2030 to keep global temperature increases under 2ºC will come from nature-based solutions.[12]

Recognizing the link between climate change and nature, standard setters are increasingly looking to align efforts, as seen in the linkages between the Science Based Targets initiative (SBTi) Forest, Land and Agriculture (FLAG) targets[13] and the land targets from the Science Based Targets Network (SBTN).[14] Efforts are also being made to integrate social and human rights perspectives to ensure that the nature transition is just, inclusive, and delivers tangible and sustainable benefits for people.

In September 2024, the Potsdam Institute for Climate Impact Research (PIK) published the first annual planetary health check, evaluating the status of the nine planetary boundaries – the Earth system processes essential for maintaining global stability, resilience and life-support functions – against safe operating limits. Overall, six out of nine planetary boundaries, such as land system change, freshwater change, and biosphere integrity, have already breached safe levels[15] (see Figure 1).

FIGURE 1 | **Planetary boundaries health check**



Source: Caesar, L., Sakschewski, B. et al. (2024). *Planetary Health Check: A Scientific Assessment of the State of the Planet*.

Why nature matters for businesses

The importance of nature for businesses and financial institutions is growing as the evidence for nature-related risks rises. In the World Economic Forum's *Global Risks Report 2025*,[16] five out of the top 10 risks over the next decade are environment related: extreme weather events, biodiversity loss and ecosystem collapse, critical change to Earth systems, natural resource shortages and pollution.

In parallel, the calls for rapid change are getting stronger and more frequent, coming from policy-makers, regulators, investors, companies, consumers and citizens (see Figure 2).

Companies that anticipate the risks of nature loss can minimize disruption from incoming policy and regulatory requirements, proactively manage nature-related physical, transition and systemic risks,[17] including dependencies on ecosystem services and assets, and benefit from early nature-related opportunities.

FIGURE 2 **Key nature-related dynamics impacting businesses**

Global Biodiversity Framework

- In total, 196 parties agreed on the landmark Kunming-Montreal **Global Biodiversity Framework** in December 2022.
- Target 15 of the framework explicitly calls for **mandatory assessment and disclosure** and for businesses to reduce their negative impacts on nature.

Guidance and standards

- **Taskforce on Nature-related Financial Disclosures (TNFD)** issued sector-specific guidance for 8 sectors and financial institutions.
- **International Sustainability Standards Board (ISSB)** incorporated nature and biodiversity requirements.
- **EU's European Sustainability Reporting Standards (ESRS)** started in 2024.
- **Science Based Targets for Nature (SBTN)** released updated target-setting guidance.

Businesses

Customers and employees

- Recent studies show **85% of consumers** indicate that they have shifted their purchasing behaviour to be more sustainable in the past five years.
- The Union for Ethical BioTrade (UEBT) **Biodiversity Barometer** has shown consistent growth in biodiversity awareness among consumers over the past decade.

Financial institutions

- In total, 177 financial institutions with €22.1 trillion in assets under management signed the **Finance for Biodiversity Pledge.**
- **Nature Action 100** harnesses investor influence on businesses.

Source: Convention on Biological Diversity. (2022). *Kunming-Montreal Global Biodiversity Framework*; Business for Nature. (2023). *A wake-up call for business: Target 15 commits governments to require nature-related disclosure from large companies and financial institutions*; Taskforce on Nature-related Financial Disclosures (TNFD); Reuters. (2022, 14 December). *Global sustainability rules body steps up focus on biodiversity*; European Financial Reporting Advisory Group (EFRAG). *EU Sustainability Reporting Standards (ESRS)*; Science Based Targets Network (SBTN). (n.d.). *For companies*; Nature Action 100; Finance for Biodiversity Foundation; Union for Ethical BioTrade (UEBT). *Biodiversity Barometer.*

> In the past three years, 177 institutions with €22 trillion in assets under management signed the Finance for Biodiversity Pledge.

Global Biodiversity Framework

The agreement of the Kunming-Montreal Global Biodiversity Framework[18] in December 2022 set the ambition to halt and reverse biodiversity loss, calling for a collective effort from all sections of society on the four goals and 23 targets by 2030.

Guidance and standards

Many regulators will soon require mandatory nature-related disclosure from companies, with regulations like the European Sustainability Reporting Standards (ESRS)[19] under the EU's Corporate Sustainability Reporting Directive (EU CSRD) and the EU Taxonomy for Sustainable Activities[20] pushing businesses to disclose their **impact** on nature and their **exposure** to nature and biodiversity loss. Standards are also being adopted in countries like India[21] and China,[22] requiring companies to disclose material sustainability information.

Companies are encouraged to start collecting data and building internal capacity in alignment with voluntary disclosure frameworks like the Taskforce on Nature-related Financial Disclosures (TNFD),[23] which has seen at least 502 organizations, including 129 financial institutions, commit to getting started with voluntary reporting of their nature-related issues.[24]

Financial institutions

Financial institutions are also recognizing the risks associated with nature, for example, 36% of Dutch financial institutions' assets were found to be highly dependent on nature,[25] and starting to take action. In the past three years, 177 institutions with €22 trillion in assets under management signed the Finance for Biodiversity Pledge, and institutional investors are convening through the Nature Action 100 programme to engage with companies and policy-makers on nature.[26]

The nature-positive transition will unlock new business opportunities for financial institutions. Innovative nature financing mechanisms, including biodiversity credits, impact investments and blended finance mechanisms, have seen significant growth in the past years, including 10% growth between 2022 and 2023.[27] Governments are developing the market infrastructure to mobilize private finance for nature conservation and restoration. For example, in 2023, the UK government introduced the Biodiversity Net Gain (BNG) legislation,[28] mandating that all new development projects achieve a 10% net gain in biodiversity, and the Australian government is in the process of establishing a Nature Repair Market[29] to enable individuals and businesses to voluntarily invest in nature repair projects across Australian land, waters, or a combination of both.

Financial institutions can start taking action by building internal capacity to act on nature, developing financing policies, strategies and transition plans that favour nature (including sector-, location- or asset class-specific policies where appropriate), embedding nature in risk management systems, developing robust nature-related reporting systems, and engaging with high nature-impact and high nature-risk businesses.

Consumers and employees

Similarly, wider society and other stakeholders, such as employees and consumers, are raising their expectations for corporate action to protect nature and biodiversity.

In the Union for Ethical BioTrade's 2022 Biodiversity Barometer, biodiversity loss was the second most urgent environmental concern for consumers after climate change. In countries such as Brazil and China, the concern comes out on top, with 54% of consumers wanting information on a product's impact on biodiversity. A survey by Simon-Kucher & Partners in 2021 showed that 85% of consumers have made changes to make their purchasing behaviour more sustainable in the past five years.[30]

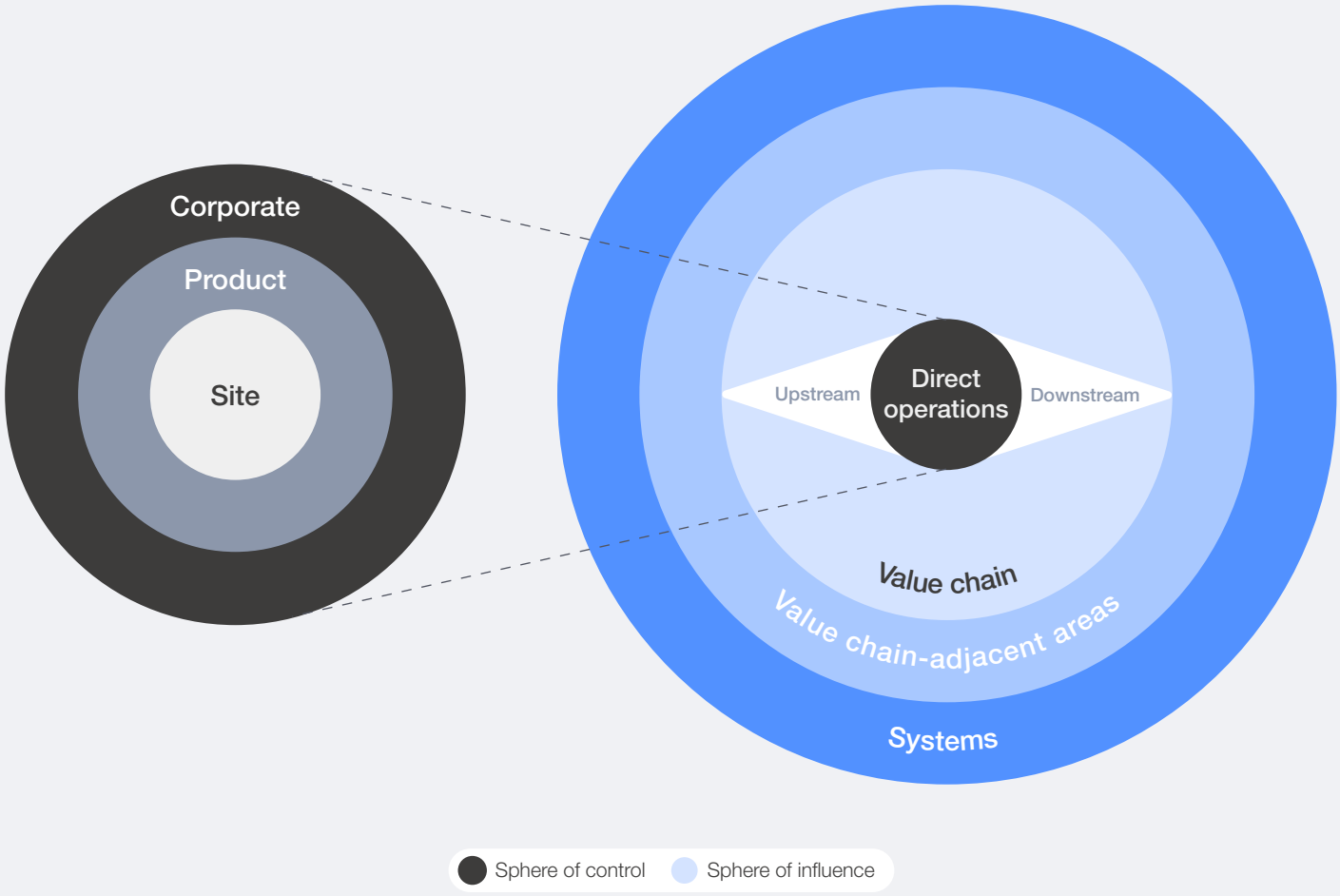
Additionally, employees are elevating their expectations regarding their employers' commitment to protecting nature and biodiversity. For example, a 2022 global survey by Deloitte[31] found that protecting the environment remains a top priority for Gen Zs and millennials, who want to see their employers prioritize visible actions that enable employees to get directly involved. A total of 64% of Gen Zs said they would pay more to purchase an environmentally sustainable product.

Setting credible nature strategies

Despite the increased momentum on nature over recent years, not enough is being done. While 78% of Fortune Global 500 companies have climate change targets, only 26% have freshwater consumption targets, and just 12% have targets for biodiversity loss.[32] Only 5% of companies have assessed their impacts on nature, with less than 1% understanding their dependencies.[33]

Companies can contribute to "Nature Positive" by establishing credible nature strategies, where "Nature Positive" represents a "global societal goal to halt and reverse nature loss by 2030 on a 2020 baseline, and achieve full recovery by 2050".[34] Individual companies, financial institutions and investors can contribute to this shared goal by adopting nature-positive strategies across their spheres of control and influence, including at sites of high-biodiversity importance, in their direct operations as well as across their value chains (see Figure 3).

FIGURE 3 | **Spheres of control and influence**



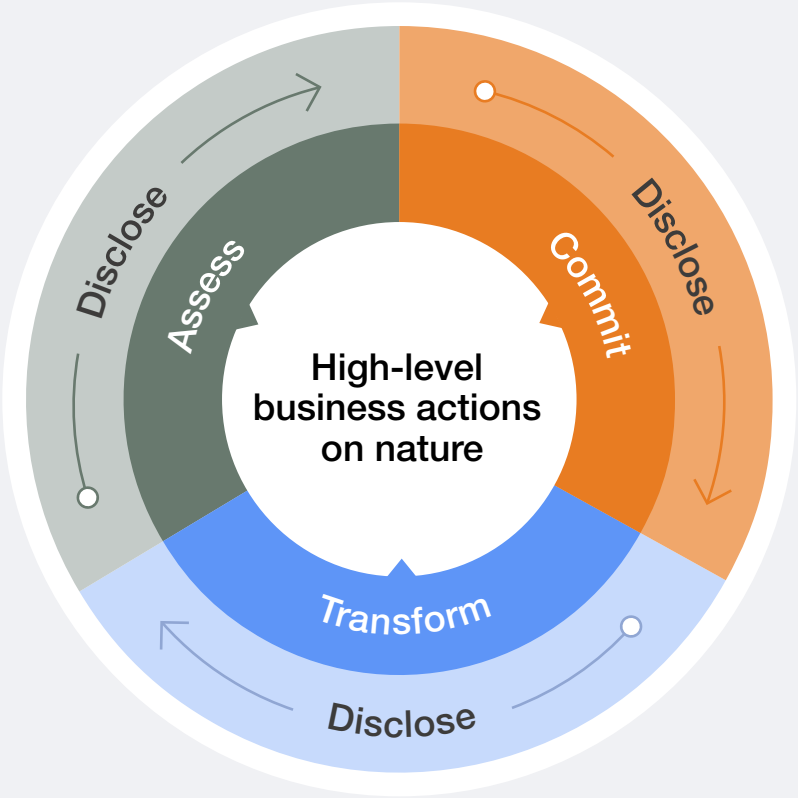
Source: Adapted from Science Based Targets Network (SBTN). (2020). *Science-Based Targets for Nature: Initial Guidance for Business, 2020.*

A credible corporate nature strategy should be built on four high-level steps: assess, commit, transform and disclose[35] (see Figure 4). Businesses can and should act now to:

- **Assess:** Conduct an initial materiality assessment to prioritize efforts; identify, measure, value and prioritize impacts and dependencies on nature; assess risks and opportunities; and consider climate and people within nature assessments.
- **Commit:** Define ambition and goals, and set transparent, time-bound, specific, science-based targets to put companies on the right track towards operating within the Earth's limits.
- **Transform:** Avoid and reduce negative impacts; restore and regenerate; shift business strategy and models; collaborate, both along value chains and at a landscape, seascape and river basin level; advocate for ambitious policies and initiatives; and embed nature within corporate governance.
- **Disclose:** Disclose material nature-related information across all three high-level actions above; seek out independent validation and verification to enhance the credibility of actions; and align reporting with major reporting standards such as TNFD, International Sustainability Standards Board (ISSB) or the EU's CSRD recommendations.

Momentum is building. In May 2023, 17 companies started a target validation pilot for the SBTN methods.[36] For more details, companies can refer to the *Nature Strategy Handbook*, a practical guide to support all businesses in developing a nature strategy.

FIGURE 4 | **ACT-D high-level business actions on nature**



Assess

Measure, value and prioritize your impacts and dependencies on nature to ensure you are acting on the most material ones.

Commit

Set science-based targets to put your company on the right track towards operating within the Earth's limits.

Transform

Avoid and reduce negative impacts, restore and regenerate, collaborate across land and seascapes, shift business strategy and models, embed nature in governance and advocate for policy ambition.

Note: Disclose material nature-related information across all three high-level actions above.

Source: Business for Nature. (n.d.). *High-level Business Actions on Nature.*

The need for a sectoral approach

As nature impacts and dependencies differ significantly across real economy sectors, sector-specific analyses and guidance can help companies understand their relationship with nature and the actions they can take to accelerate the transition to a nature-positive future.

To inform sectoral approaches, the World Economic Forum, alongside Business for Nature and the World Business Council for Sustainable Development (WBCSD), produced guidance on 12 global sectors as part of the initial phase of the Sector Actions Towards a Nature-Positive Future initiative. For each sector, the guidance outlines the priority actions companies should take to transform their operations and value chains to make a meaningful contribution towards the Global Biodiversity Framework and help halt and reverse nature loss by 2030.

In the second phase, the World Economic Forum has conducted analysis on four additional sectors: mining and metals, automotive, offshore wind and ports. This report, published in collaboration with Oliver Wyman, identifies and makes the business case for sector-specific priority actions in the automotive sector.

1 Where the sector is today

As the sector comes under growing scrutiny for its impacts on nature, companies need to transform business models and publicly report material nature-related information.

1.1 Sector overview

For the world to reach net zero by 2050, electric vehicles are required to account for 60% of all vehicle sales by 2030.

In recent decades, the automotive sector has grown in both size and variety. Today, travellers and cargo across the globe travel by road in a diverse range of cars, light-duty trucks and motorcycles, many of which are now powered by electricity with the advent of electric vehicles (EVs)[37] and other alternative solutions.

In 2023, the global automotive manufacturing market was worth over $2.6 trillion,[38] and the sector contributes approximately 3% to global GDP output.[39] In the same year, the number of vehicles produced was 94 million,[40] with half of production concentrated in Asia (in particular, approximately 35% in China, and around 15% in Japan and South Korea), around 20% in the EU and around 15% in North America.[41]

Following recent supply chain disruptions caused by the COVID-19 pandemic, macro-economic and geopolitical uncertainty, and high commodity and energy prices,[42,43] the automotive industry recovered and grew at a rate of 3% in 2023, in line with pre-2020 levels.[44,45] The sector is projected to experience strong growth of 6-7% per year until 2030,[46,47] driven by increasing demand for sustainable mobility options, a growing global middle class, expansion of emerging markets and shifting consumer preferences towards larger cars such as sport utility vehicles (SUVs).

In particular, the shift towards sustainable mobility has transformed the market for automotive vehicles. EV sales grew from 1 million to 14 million per year between 2017 and 2023, and EVs accounted for 18% of total car sales in 2023.[48] Of all the electric cars on the road today, over half are in China, and by 2023, the country had already exceeded its 2025 target for new EV sales. After China, the majority of other electric cars are in the EU (30%) and the US (12%). Sales of electric light commercial vehicles (LCVs) are also continuing to increase, nearly doubling in 2022 relative to 2021. At the global level, however, the LCV sales share still only represents 3.6% of sales.[49]

For the world to reach net zero by 2050 under the International Energy Agency's (IEA) Net-Zero Emissions by 2050 Scenario, EVs will need to grow at an annual rate of 40%, reaching 380 million EVs on the road by 2030 and accounting for 60% of all vehicle sales. While the rise of EVs is critical to ensuring the success of the energy transition and combatting air pollution, it can still have unintended consequences, including its own inherent resource demands and upstream and downstream environmental impacts.[50] Notably, this shift is driving rapidly increasing demand for critical minerals for batteries, with mineral requirements for clean energy technologies projected to increase by four to six times by 2040 and EVs and battery storage accounting for 25-45% of demand.[51] Indeed, in 2022, about 60% of lithium, 30% of cobalt and 10% of nickel demand was for EV batteries. Lithium demand exceeded supply despite global production nearly doubling between 2017 and 2022.[52]

Supply security is an increasing concern. This has resulted in the Group of Seven (G7) countries adopting a Plan for Critical Minerals Security and pledging $13 billion in support in April 2023. The Group of Twenty (G20) additionally emphasized the need for diversified, sustainable and responsible supply chains for the energy transition.[53]

“ The [automotive] sector depends on environmental assets and ecosystem services to function and grow across the value chain.

In a bid to improve supply security – by reducing dependency on imports – and develop local industries, countries are also increasingly shifting towards resource nationalism.[54] For example, the EU aims to relocate 40% of the refining and processing of raw minerals within the EU and increase battery manufacturing as part of the Critical Raw Materials Act,[55] and Net-Zero Industry Act.[56] This may not necessarily result in environmental benefits, however, depending on the type of ore that is imported. Indeed, World Wide Fund for Nature (WWF) analysis shows that, depending on the origin and type of raw materials, relocating lithium and nickel refining processes can either increase or decrease GHG emissions by a factor of five.[57]

Alongside EVs, the Intergovernmental Panel on Climate Change’s (IPCC) *Sixth Assessment Report* (AR6) report states there are also additional pathways to decarbonizing the automotive industry, including flexible-fuel hybrid EVs (FFV-HEVs), sustainable biofuels (in the short to medium term),[58,59,60] low emissions hydrogen and derivatives (including synthetic fuels).[61]

Like other sectors, the automotive sector is intrinsically interlinked with nature. The sector depends on environmental assets and ecosystem services (such as freshwater supply and rainfall regulation, global climate regulation, soil and sediment retention, flood protection and metal, mineral, energy and biomass provisioning)[62] to function and grow across the value chain. Examples of relevant nature services include supply of water for cooling during manufacturing processes and rubber biomass for tyres.

The sector also contributes to drivers of nature loss, notably pollution – including from end-of-life (EOL) vehicles – water use, land-use change and ecosystem disturbance, and GHG emissions across the value chain. Indeed:

- 8% of mining-related deforestation is attributable to the motor vehicle sector (the second largest contributor after the construction sector).[63]
- Life cycle analysis indicates that the production of cars requires over 400,000 litres of water across the value chain,[64,65] equivalent to over 10 years of household water supply for the average person in Europe.[66]
- Overall, road transport was responsible for 45% of global oil demand[67] and 16% of global GHG emissions in 2022, with cars and vans accounting for 10% of emissions.[68]

The Science-based Targets Network (SBTN) have classified several key materials required as inputs to the sector (including steel, aluminium, battery materials, rubber and leather) as “high-impact commodities” for nature.[69]

To address its impacts and dependencies on nature, the automotive sector will face significant challenges due to the complexity of companies’ global supply chains. On average, an automotive manufacturer may have 18,000 suppliers across the full value chain,[70] with around 20,000 parts in a typical passenger car.[71] Manufacturing cycles are long and complex, with the process typically taking four to six years from initial concept to market. It is, therefore, critical that companies plan ahead to account for long lead times. This report aims to support businesses in the sector to incorporate nature into their forward-looking business strategies.

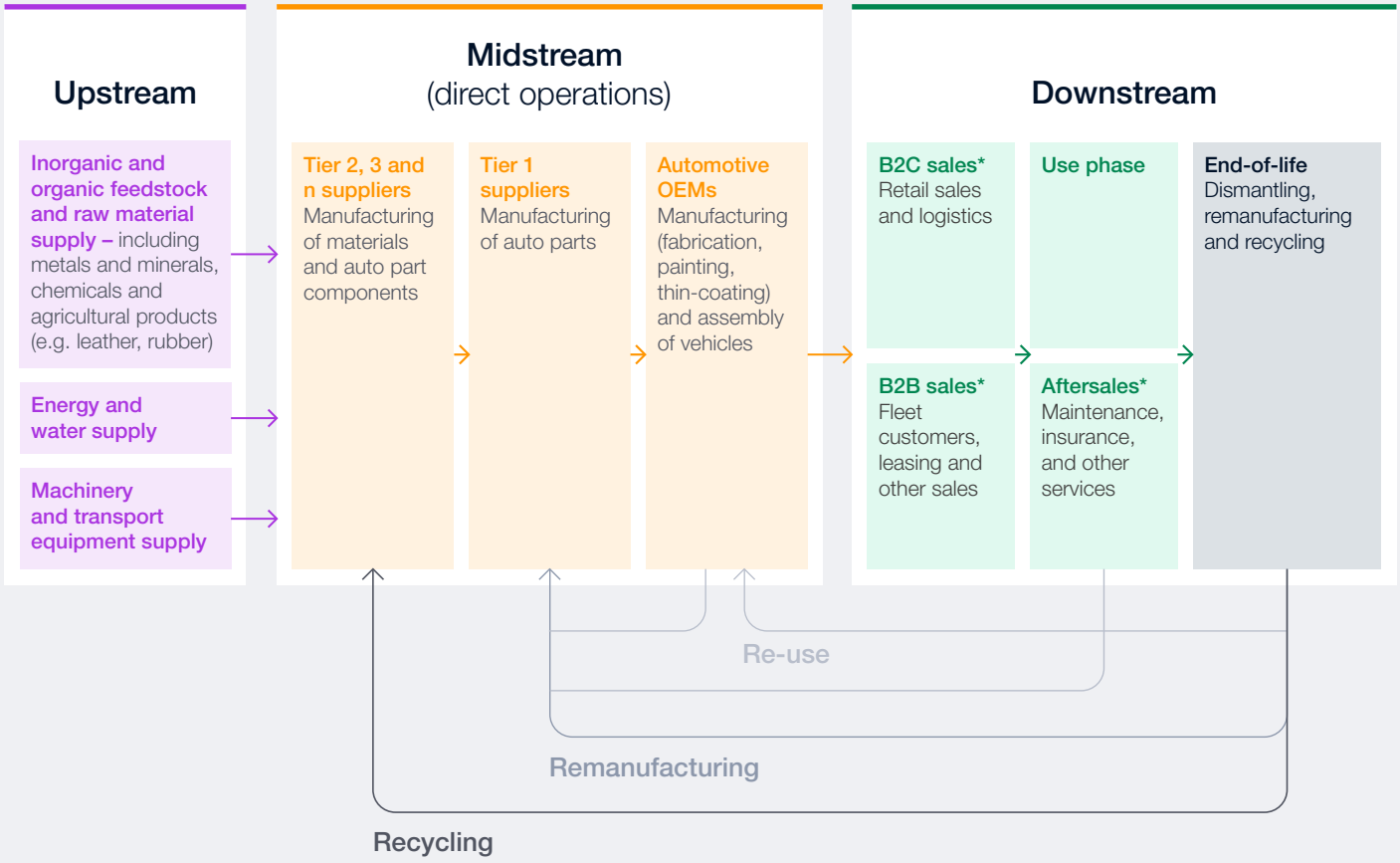
BOX 1 Definition of the automotive sector

The scope of this report is defined by the Sustainability Accounting Standards Board (SASB) Sustainable Industry Classification System (SICS),[72] and includes “Transportation – Auto Parts” and “Transportation – Automobiles”. This encompasses automotive parts production by tiers 1, 2 and 3, all the way to tier n suppliers, including battery production and technology development, and midstream vehicle manufacturing by original equipment manufacturers (OEMs) of light-duty passenger vehicles and trucks, 2/3-wheelers and compact tractors.

In addition, this report will consider the full value chain for automobiles, including industries that provide inputs to automotive parts manufacturers or original equipment manufacturers (OEMs), downstream product distribution and aftersales, vehicle use and end-of-life (EOL) management. Raw material extraction within the mining and metals sector is considered a key driver of the automotive sector’s nature footprint and is covered in more detail in the Forum’s *Nature Positive: Role of the Mining and Metals Sector* report.

This report focuses directly on the automotive sector. It is, however, important to consider these recommendations within the broader context of the mobility system transition, alongside other factors such as the role of various vehicle modalities (for example, public transport) and infrastructure transformation.

FIGURE 5 | **Simplified value chain of the automotive sector**



*Sales and aftersales may be conducted by OEMs (midstream) or by independent retailers/service providers (downstream).

1.2 Progress is promising but needs to accelerate

43
governments
pledged to accelerate the transition to 100% zero-emission cars and vans.

Globally, significant progress has been made to provide policy and regulatory support for the transition from internal combustion engine (ICE) vehicles to zero-emissions vehicles (ZEVs), and 43 governments pledged to accelerate the transition to 100% zero-emission cars and vans.[73]

These goals have been integrated into national policy in several key markets. For example, the EU adopted the "Fit for 55" proposal in 2023 to ban sales of ICE cars and vans by 2035, and Canada and the UK have also adopted zero-emissions vehicle regulations that aim to phase out sales of ICE vehicles by 2035. Iceland, Austria, the Netherlands, Ukraine and Israel have committed to 2030 phase-outs, while Norway is even more ambitious, aiming for 100% ZEV sales by 2025. In 2024, the US adopted new GHG emissions standards that, according to US Environmental Protection Agency (EPA) estimates, will lead to EVs representing 35-56% of new light-duty vehicle sales by 2032.

In many countries, supporting ZEVs is not only seen as a key part of the energy transition, but also as a way to reduce energy imports and air pollution, improving health outcomes for citizens. This is particularly relevant for fast-growing developing countries, such as China, Indonesia, Viet Nam, Ghana, Pakistan and others, that are implementing regulations, tax benefits and strategic targets to support ZEV sales.

Beyond GHG emissions, much of the focus of policy and regulation to date has been on circularity, with a view to securing critical minerals supply. As momentum following the United Nations Convention on Biodiversity's (CBD) 15th and 16th Conference of the Parties (COP 15 and COP 16) drives countries to submit updated national biodiversity strategies and action plans (NBSAPs), society as a whole can expect to see further regulation supporting the goals of the Global Biodiversity Framework in coming years. For example, this regulation may focus on enhancing restoration

(Target 2), expanding conservation areas (Target 3), reducing pollution (Target 7) and disclosing impacts and dependencies (Target 15).

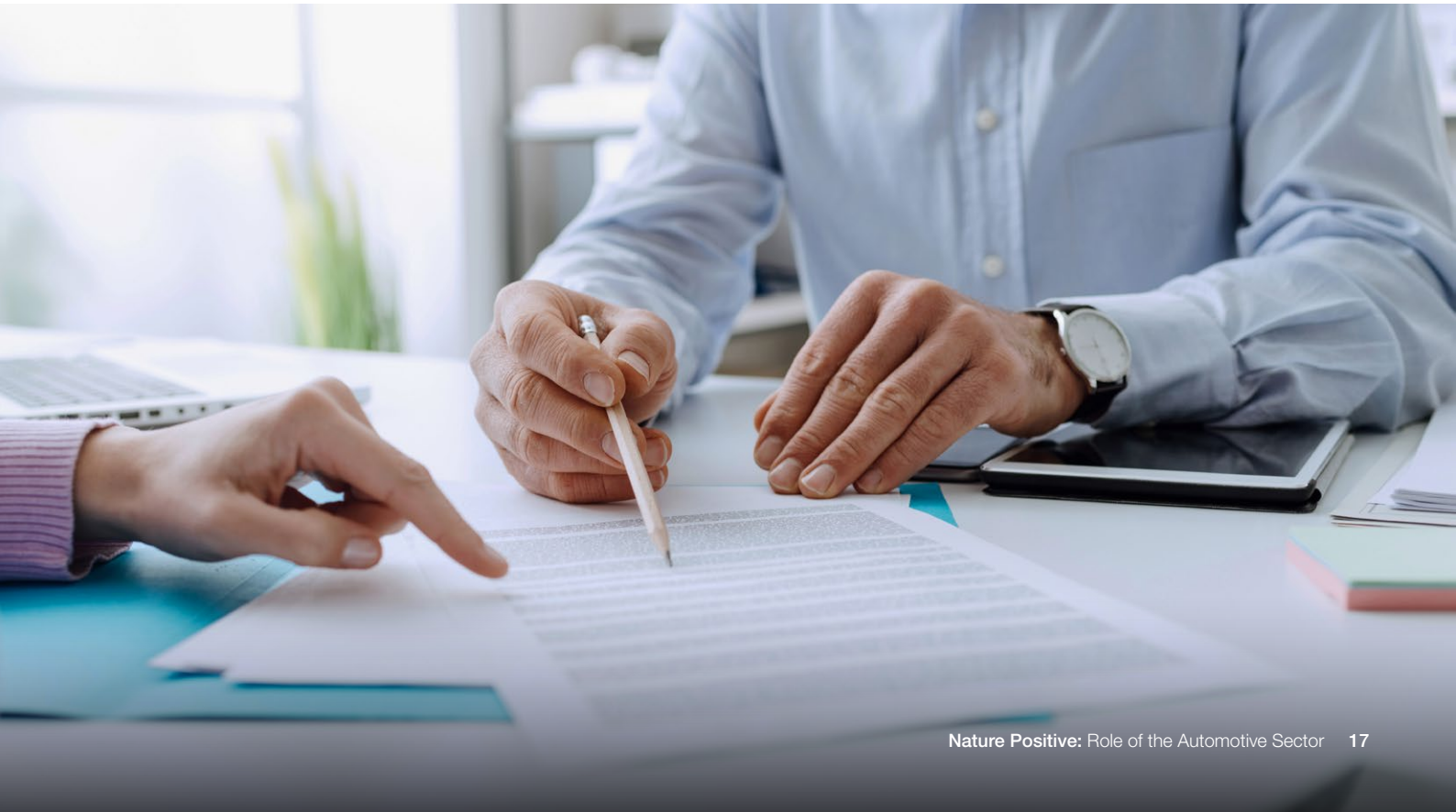
With growing expectations from financial institutions, employees and customers, as well as anticipated new policy and regulation worldwide, the business case for action on nature has never been stronger. Corporate leaders should start to assess, commit, transform and disclose – as per the ACT-D framework – in a more systematic way. As noted in the Introduction, companies need to: identify, measure, value and prioritize their nature-related impacts and dependencies across their value chains to ensure they act on the most material ones; set transparent, time-bound, specific, science-based targets when material; take actions to transform their businesses; and track performance to publicly disclose material nature-related information. For more information on tools and guidance available for the ACT-D set of high-level actions, see Table 1.

A range of other activities will also be needed to support the stages of ACT-D, including agreeing on definitions, determining materiality thresholds, mapping assets and operations, gathering information on existing nature-related activities, making the case for nature action internally within the organization (beyond disclosure), and establishing the vision of success.

TABLE 1 **Selected tools and guidance available for ACT-D high-level actions**

Assess	Consult the **locate-evaluate-assess-prepare (LEAP)** approach from TNFD. Follow the technical guidance to **assess**[74] and **prioritize**[75] from SBTN.
Commit	Follow the approach the International Union for Conservation of Nature (IUCN) is developing to **measure nature-positive**[76] and **set targets**. Set science-based targets, taking inspiration from the technical guidance provided for **freshwater** and **land** by SBTN.[77] For **climate**, refer to the guidance from the Science Based Targets initiative (SBTi).
Transform	Take inspiration from the World Economic Forum's Nature Positive Transitions: Sectors report series;[78] invest resources and commit management to deliver against clear targets.[79]
Disclose	Consult the final **recommendations**[80] from TNFD for nature-related disclosures. For climate, refer to the ISSB guidance on disclosure of **sustainability-related financial information** and **climate-related disclosures**.[81] Use CDP's **disclosure platform**, which includes guidance on climate change, forests, water security, biodiversity and plastics.[82]

Note: This table is non-exhaustive. For more tools and guidance, see *High-level Business Actions on Nature* and *The Nature Strategy Handbook*.



2 Nature-related impacts and dependencies

Without action, nature-related risks will escalate, threatening business models for a sector highly dependent on nature.

2.1 Double materiality

The principle of "double materiality", a concept at the heart of the EU's CSRD, defines a company's impact on the environment and its dependencies on it as highly interdependent (see Figure 6). In other words, the economic activities of businesses have impacts on both the environment and society (known as impact materiality), while concurrently, businesses also encounter risks (and opportunities) arising from their dependencies on the environment and society (known as financial materiality).

FIGURE 6 **Double materiality**

Source: World Economic Forum. Definition of double materiality sourced from: Deloitte. (2023). *Double Materiality: 5 challenging key aspects to consider*.

The automotive sector and its value chain are highly dependent on a number of environmental assets and ecosystem services, including:[83]

- **Freshwater supply and rainfall regulation:** The sector depends on freshwater as an important resource, including for input industry processes (such as chemical cracking) and automotive manufacturing processes (such as for pretreatment and cleaning of the body shell in paint shops, cooling in the manufacturing process and leak testing).
- **Climate regulation, soil and sediment retention, and flood protection:** Global climate regulation protects upstream industry operations – in particular, those sensitive to increased temperatures. For both upstream operations and midstream automotive manufacturing, mass stabilization and erosion control provide protection from landslides and other natural hazards. Finally, green infrastructure[84] and water flow regulation provide flood protection across the value chain. For example, in 2023, a flood event in Slovenia caused €30-50 million in damage to KLS Ljubno, an automotive parts manufacturer,[85] resulting in supply delays to OEMs such as Volkswagen Group and Skoda. This significantly affected production, for instance resulting in a loss of 150,000 vehicles

> More than 40% of the gross value-added across automotive companies' direct operations and supply chains is moderately dependent on nature.

at Volkswagen Group and supply chain impacts for the industry in the hundreds of millions of euros.[86,87]

- **Metal, mineral and energy resources:** Provision of metal and mineral resources for input materials and a stable supply of energy to operate are crucial. Energy is currently sourced from both renewable and non-renewable sources, with an increasing shift towards renewable sources as a decarbonization lever.
- **Cultivated biological resources:** The sector relies on the provision of rubber for tyres, crops for the production of fibres and dyes, and livestock farming for leather. For example, rubber shortages in recent years due to flooding and leaf disease have put pressure on tyre production supply chains.[88]

According to the World Economic Forum's report *Nature Risk Rising*, more than 40% of the gross value-added across automotive companies' direct operations and supply chains is moderately dependent on nature. These dependencies can materialize as risks to businesses if not properly assessed and managed and if action is not taken to safeguard nature. This strengthens the business case for investing in protecting and restoring nature to build sustainable, responsible and resilient supply chains and ensure the long-term viability of business models.

However, the automotive sector continues to impact nature, contributing to drivers of biodiversity loss such as pollution, water use, land-use change and ecosystem disturbance, and GHG emissions.[89] Wherever possible, automotive companies should avoid then reduce these drivers of nature loss in their operations and value chains, alongside related negative social impacts on communities at and around project sites, to mitigate risks and unlock nature-related opportunities across the value chain.

Company-specific impacts and dependencies vary by business model and position within the value chain, and companies should conduct individual assessments to understand their own unique interfaces with nature (see Box 2). For OEMs specifically, the shift in the automotive sector towards alternative business models, notably from ICE vehicles to EVs, will support the reduction of GHG emissions but may exacerbate other nature impacts. Automotive companies will need to perform a life cycle assessment of nature impacts to evaluate trade-offs in decision-making.

TABLE 2

Top four drivers of nature loss in the value chain of the automotive sector

	Upstream	Midstream (direct operations)	Downstream
Pollution	✓	✓*	✓*
Water use	✓	✓*	
Land-use change and ecosystem disturbance	✓		
GHG emissions	✓		✓*

Pressure materiality rating (ENCORE): High Medium

*Manually adjusted based on expert feedback. **Note:** See methodology in the Appendix. While GHG emissions are one of the highest materiality drivers of nature loss for the automotive sector, this is included last in this document given the automotive sector's net-zero transition has been covered extensively elsewhere.

BOX 2

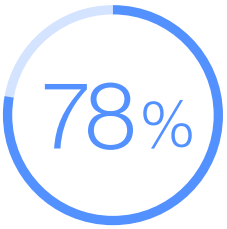
Conduct company-specific assessment of impacts and dependencies

The analysis of impacts and dependencies presented in Chapter 2 is a sector-average analysis for companies in the automotive sector, but company-specific impacts and dependencies will vary according to their activities, supply chains and operational locations.

Companies will need to conduct assessments to locate their interface with nature and evaluate their impacts and dependencies using company-specific operational and supply chain information. TNFD's LEAP approach,[90] as well as the SBTN's step 1 (assess)[91] and step 2 (prioritize)[92] are useful frameworks to guide companies through their own assessments.

The full methodology and results of this sector-average assessment can be found in the Appendix.

2.2 Pollution



A 2020 study by the Pew Charitable Trusts found that 78% of microplastic leakage into the ocean (approximately 1 million tons) was caused by tyre dust in 2016.

Pollution occurs across all stages of the automotive value chain.[93] Upstream production processes can lead to land, freshwater and ocean pollution, including through the release of chemicals that are harmful at high concentrations, persistent or toxic materials, highly saline water and run-off from livestock farming for leather. For example, the automotive industry uses 12% of global steel[94] (with steel making up 50-60% of the average vehicle)[95,96,97] and steel production generates 145 billion tons of wastewater per year.[98] Furthermore, upstream mining operations, energy, chemicals and fibre production can also release atmospheric pollutants, including dust, solvents and sulphur dioxide, which contribute to acid rain. Waste is also produced from non-product outputs, including ore heaps and tailings, resins, sludges, glass, metal and polymers.

In direct operations, the automotive manufacturing process itself can contribute to land, freshwater and ocean pollution, with metals and metal compounds making up 71% of the chemical waste managed by the automotive industry.[99] Other pollutants include atmospheric emissions from manufacturing processes and noise pollution. Waste is similarly produced from non-product outputs, including glass, metal, polymers, cardboard, rubber and leather. For example, 750,000 tonnes of waste was generated during car production in the EU in 2022.[100]

Finally, the downstream use of vehicles can have material impacts on both the environment and human health. Downstream, land, freshwater and ocean pollutants include particulate matter and chemicals, such as microplastics from tyre wear, brake wear, dust resuspension, motor oil leaks and washer fluids. Indeed, a 2020 study by the Pew Charitable Trusts found that 78% of microplastic leakage into the ocean (approximately 1 million tons) was caused by tyre dust in 2016.[101] Reducing mileage, better water sedimentation disposal and other known solutions can all help address this challenge. The study found, however, that without novel innovation for tyre design and manufacturing, tyre dust will remain the largest contributor of microplastic leakage into the ocean. Microplastics are not just a problem in the ocean. The impact of microplastics in terrestrial environments is being studied, with indications that they can cause impacts on soil health and nutrient cycling, alongside other processes.[102] Likewise, fluid pollutants such as motor oil also flow into waterways, where 1 gallon of used oil can contaminate 1 million gallons of water.[103]

Non-GHG air pollution (including pollutants such as nitrogen dioxide, particulate matter, hydrocarbons and carbon monoxide) is also a material impact from downstream vehicle use. Road transport was the largest source of nitrogen oxides in the EU in 2020 and was responsible for 37% of emissions,[104] with 52,000 deaths attributed to nitrogen dioxide in the EU in 2021.[105] Globally, roadside traffic was responsible for 25% of particulate matter (PM2.5) pollution in urban areas, with the majority estimated to be non-exhaust matter. Exposure to ambient particulate matter has been ranked as the seventh most important risk factor for mortality, causing an estimated 4.2 million premature deaths globally in 2015.[106]

Other forms of pollution caused by the use phase of vehicles include noise pollution and waste. The improper disposal of EOL vehicles generates 7-8 million tons of waste globally every year.[107] Soil contamination from lead battery manufacturing and recycling is of particular concern in many developing African countries lacking adequate infrastructure for proper disposal and treatment of vehicles, which are often imported from regions like the US and EU. As developed markets transition away from ICE vehicles, care must be taken to avoid burdening less developed markets with their disposal.[108]

Many countries have implemented policies and regulations that place controls on pollution levels in the automotive sector. For manufacturing, regulations are strongest in the EU, where the Industrial Emissions Directive requires companies to implement the best available techniques (BAT) to cut the use and impacts of hazardous chemicals.[109] For downstream pollution, the US Environmental Protection Agency strengthened standards on air pollutant emissions for light- and medium-duty vehicles in 2024,[110] and the EU revised the Ambient Air Quality Directive in 2024 to impose stricter limits on pollutants.[111] Countries have also imposed regulations on automotive noise levels. For example, China adopted new regulations in 2021,[112] and in the EU there are also requirements for noise labelling in dealerships.[113]

More still needs to be done, however. Both regulators and automotive companies, in partnership with other stakeholders, need to continue to advance action to mitigate pollution and its environmental and social impacts across the value chain, and avoid the longer-term liability of EOL vehicle waste.

2.3 Water use

Car production requires 400,000-450,000 litres of water (mainly for metals sourcing and electrical component manufacturing).

The automotive sector relies heavily on water for production. Indeed, 30 million m^3 (cubic metres) of water were used in vehicle manufacturing in the EU in 2022,[114] and the sector has a CDP Water Watch impact rating of "very high" (the second highest category).[115] The midstream manufacturing of each vehicle requires 5,000 litres of water,[116] however, life cycle analysis indicates that car production requires 400,000-450,000 litres of water (mainly for metals sourcing and electrical component manufacturing), which indicates that 99% of water is consumed upstream.[117] This total is equivalent to over 10 years of household water supply for the average person in Europe.[118]

Upstream, water is critical for mining operations and energy, chemicals, fibre, rubber and tyre production. It's also essential for livestock farming for leather, and forest products for packaging. Where operations lie in arid places, impacts can be magnified locally. For example, the World Resources Institute found that 16% of critical mineral mines, deposits and districts are located in highly water-stressed areas, and in these locations, at least 40% of water supply is required to meet existing demand each year.[119]

In automotive manufacturing operations, some of the primary uses of water include machinery and part cooling, paint shops,[120] leak testing, and pretreatment and cleaning of the body shell. Similarly, impacts can be magnified where operations lie in arid places. For example, in 2022, 23% of water used in Volvo Cars' own operations was drawn from areas with high or very high water stress across Europe, North America and Asia.[121]

2.4 Land-use change and ecosystem disturbance

Across the value chain, from raw materials to EOL vehicles, land-use change is primarily driven by upstream input industry activities. In particular, the production of high-impact commodities such as metals, rubber and leather, pulp and paper for packaging, and energy supply, can result in:

- Land clearance and ecosystem fragmentation
- Soil degradation, erosion and compaction, and increasing flows of sediment into nearby rivers
- Increase in non-natural fires and landslides from the use of heavy machinery and explosives
- Disruption or diversion of surface water regimes and groundwater systems

Impacts are highly material-specific and clearly attributable to the automotive sector. For example:

- For **metals**, 8% of mining-related deforestation is attributable to the motor vehicle sector (the second largest contributor after the construction sector).[122]
- Approximately 70% of natural **rubber** is used to produce tyres.[123] Meanwhile, 90% of global rubber is produced in South-East Asia, where

mature plantations cover 14.2 million hectares (ha) of land. Remote sensing estimates suggest that more than 4 million ha of forest there have been converted for rubber cultivation since 1993, an area roughly the size of Switzerland. Of this, more than 1 million ha are in Key Biodiversity Areas.[124] In addition, rubber demand is expected to grow by nearly 20% from 2019 to 2027, from $28.65 billion to $33.87 billion.[125]

– For **leather**,[126] a fifth of all bovine leather produced globally from cattle for the meat industry is estimated to go into cars, including over 40% of all leather produced in Brazil, where cattle ranching is the number one direct driver of deforestation. Automotive manufacturers can engage with meat producers to support deforestation-free cattle supply chains.

For upstream inputs from the mining, agriculture or forestry sectors, the area of influence of projects is generally larger than the direct physical footprint due to both indirect and cumulative impacts. In particular, infrastructure development can attract human populations to remote locations, causing new threats or exacerbating pre-existing threats, such as over-exploitation (e.g. hunting, fishing, logging), introduction of invasive or exotic species (e.g. through inadvertent introduction by humans) and habitat loss for other land uses (e.g. agricultural expansion).[127,128,129]

Activities can also violate the rights of Indigenous Peoples as well as of local communities, for example, where operations affect areas of high ecological, cultural or community significance. These impacts can be more pronounced when local communities and rightsholders are not meaningfully engaged, when Indigenous Peoples' rights to self-determination and free, prior and informed consent (FPIC) are not respected,[130] or when robust human rights due diligence activities are not undertaken to avoid causing or contributing to negative human rights impacts.

Alongside upstream impacts, direct operations and downstream activities can also lead to land-use change and ecosystem disturbance. For example, this can occur when land is cleared to make way for manufacturing sites, warehouses and dealerships. Likewise, the increase in the size of average vehicles is leading to increased size and quantity of vehicle infrastructure (including roads and new car parks).

CASE STUDY 1

Managing leather-related deforestation risk in automotive supply chains

Some companies have started to take action to identify and eliminate deforestation in supply chains. For example, Mercedes-Benz sources a small share of the leather in its supply chain from Brazil (approximately 5%). Of this, more than half of the hides are sourced from closed-cycle farms, which allows complete traceability back to the cattle's birth farm.

In addition, work is being done to create greater transparency for the other hides. To this end, Mercedes-Benz has signed a memorandum of understanding with a local supplier and an international non-governmental organization (NGO), committing to working together to pursue deforestation-free supply chains for leather.

The collaboration includes the implementation and verification of tracking systems for the traceability of refined leather back to its origin. For this purpose, the origin of the hides is documented and checked for violations using satellite images and other data. This procedure is also monitored by third parties. Skins identified as critical are excluded from further processing into products for Mercedes-Benz, with the aim being to gradually increase the proportion of these audited hides.

Source: Mercedes-Benz Group. (n.d.). *Against deforestation.* https://group.mercedes-benz.com/responsibility/sustainability/climate-environment/against-deforestation.html.

2.5 GHG emissions

Road transport was responsible for 45% of global oil demand and 16% of global GHG emissions in 2022, with cars and vans alone accounting for 10% of emissions.

The automotive sector releases GHG emissions across the entire value chain, from the production of key materials such as steel and aluminium to the manufacturing of automotive parts and vehicles to the transport of finished goods and end use. Road transport was responsible for 45% of global oil demand[131] and 16% of global GHG emissions in 2022, with cars and vans alone accounting for 10% of emissions.[132]

Scope 1 and 2 emissions are primarily generated by energy-intensive manufacturing processes, such as material transformation (smelting, stamping, casting and forging) and handling, heating and cooling.[133] Scope 3 emissions, however, typically make up over 80% of total GHG emissions in the automotive sector, and for some individual manufacturers, this can be as high as 99%.[134]

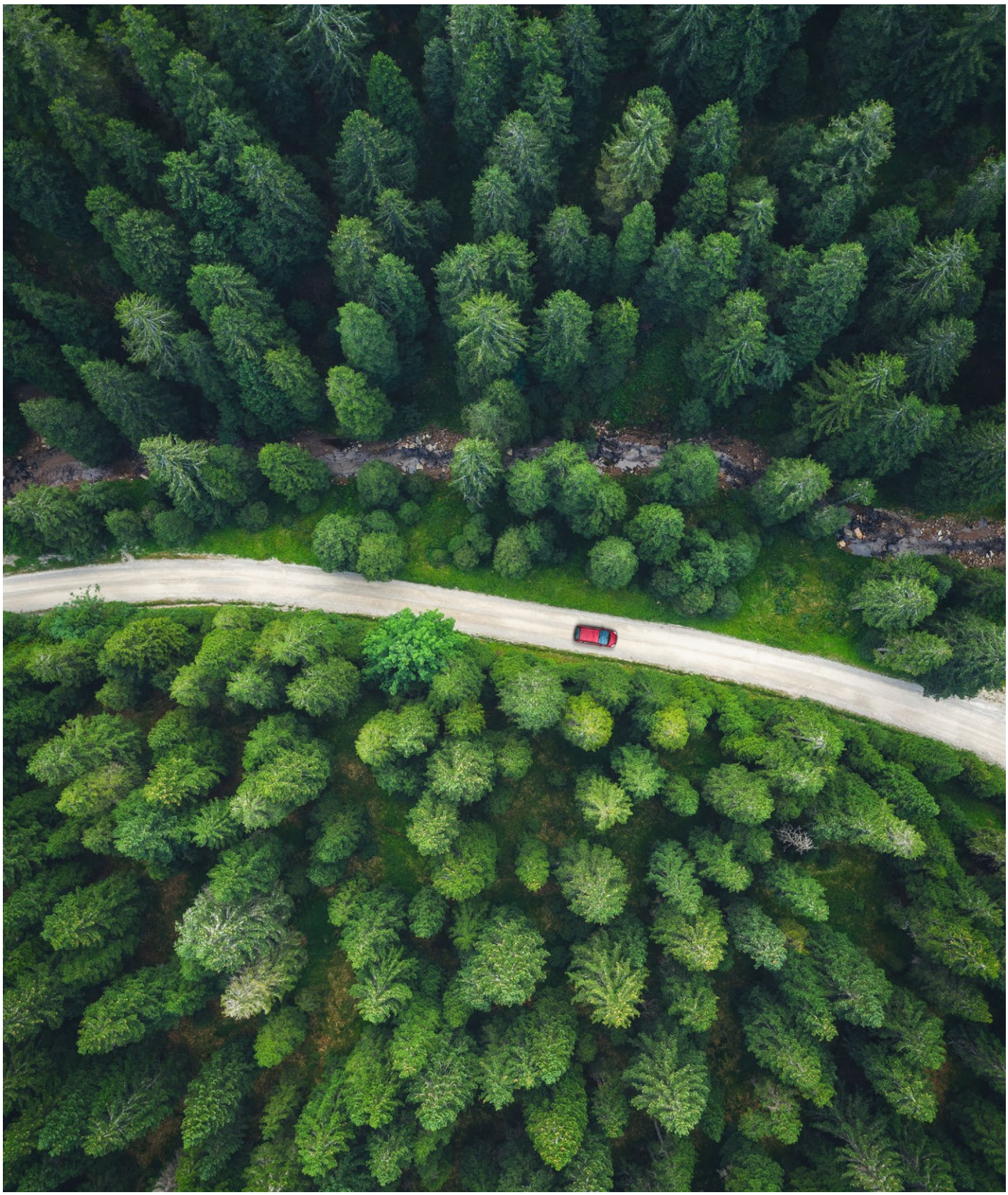
The distribution of GHG emissions across the value chain differs between ICE vehicles and BEVs (and other alternative solutions).[135] In particular, ICE vehicles currently generate 65-80% of their lifetime emissions from exhaust emissions as the car burns fuel and another 18-22% of emissions from the production of materials (primarily from steel and aluminium). With a mass-market transition to BEVs, however, more than 60% of automotive life cycle emissions are expected to come from materials by 2040[136] (primarily from the batteries, then steel and aluminium).[137]

Many companies in the sector have set emissions reduction targets for direct operations (Scope 1 and 2) and across the value chain (Scope 3) and are starting to take action. In particular, efforts to date have focussed on direct emissions reduction. Emissions reduction targets range across companies, for example:

- Volkswagen Group aims to reduce average CO_2 emissions by 30% per vehicle over the entire life cycle by 2030 against a 2018 baseline.[138]
- Mahindra aims to reduce Scope 1 and 2 emissions by 47% per equivalent product unit and reduce Scope 3 emissions by 30% per sold product unit by 2033 against a 2018 baseline.[139]
- Volvo Cars aims to reduce CO_2 emissions by 65-75% per car by 2030 against a 2018 baseline.[140,141]

3 Five priority actions

By taking five priority actions on nature, the sector can unlock over $960 billion of value by 2030.



Automotive companies can contribute to a nature-positive future by prioritizing actions to: 1) avoid and reduce impacts from operations, 2) avoid and reduce impacts from materials, 3) transform product offering, 4) conserve and restore nature, and 5) drive cross-sector collaboration (see Figure 7).

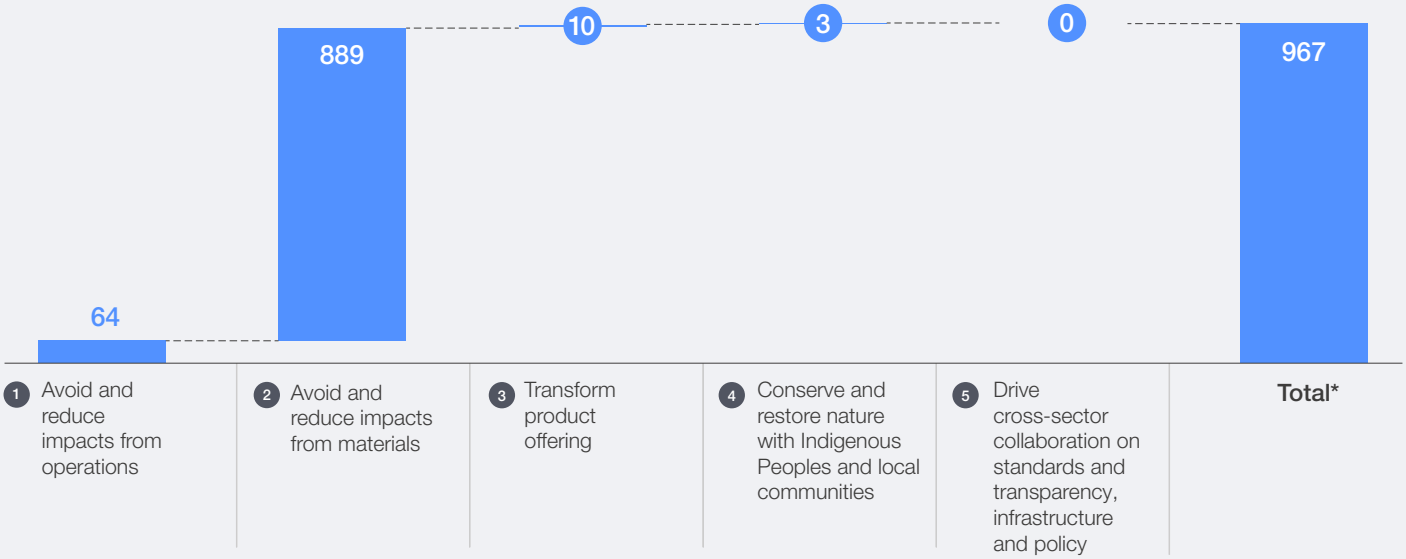
Given how much of the sector's impacts are seen upstream and downstream, these priority actions require companies to actively engage with suppliers, customers, peers and other industries to transform their value chains. **Most of these actions are already being employed or gradually rolled out by businesses, this report calls for accelerated efforts in the automotive sector.**

FIGURE 7 **Five priority actions for the automotive sector**

The nature-positive transition can also present enormous opportunities for companies in this sector. The Forum's *Future of Nature and Business* report estimated that a full nature-positive transition in the global economy could create $10.1 trillion of annual business opportunities by 2030. More specifically, estimates show that undertaking the priority actions for the automotive sector could unlock more than $960 billion in value by 2030 for businesses operating across the sector's value chain. In particular, the circular economy transition represents the majority – $860 billion – of this potential value. See Figure 8 and Table 3 for more information.

There may also be other business opportunities that present themselves for the sector that were not covered in this sizing approach. Notably, the opportunity associated with transitioning product portfolios from ICE vehicles to BEVs and other alternative solutions included under priority action 3 was not considered in the original analysis and is therefore not covered in this sizing. BloombergNEF has estimated that global EV markets represent a cumulative $8.8 trillion opportunity from 2023 to 2030, equivalent to over $1 trillion per year, assuming a linear growth rate.[142] Conversely, it will take time for companies to begin to realize savings on materials from the scale-up of circularity as the ecosystem evolves, and there may also be negative countereffects (i.e. new car sales could decrease as circularity and new business models are scaled-up across the value chain).

FIGURE 8 **Business opportunities for the automotive sector by 2030 ($, billion)**



*Additional opportunites may exist not covered in this analysis. Total business opportunities are estimated gross value unlocked, with potential losses due to future circular economy (e.g. net fewer cars sold).

To calculate the opportunity summarized in the waterfall in Figure 8, the following opportunities from the *Future of Nature and Business* report were identified as relevant (see Table 3). Further information on the calculation methodology can be found in the Appendix.

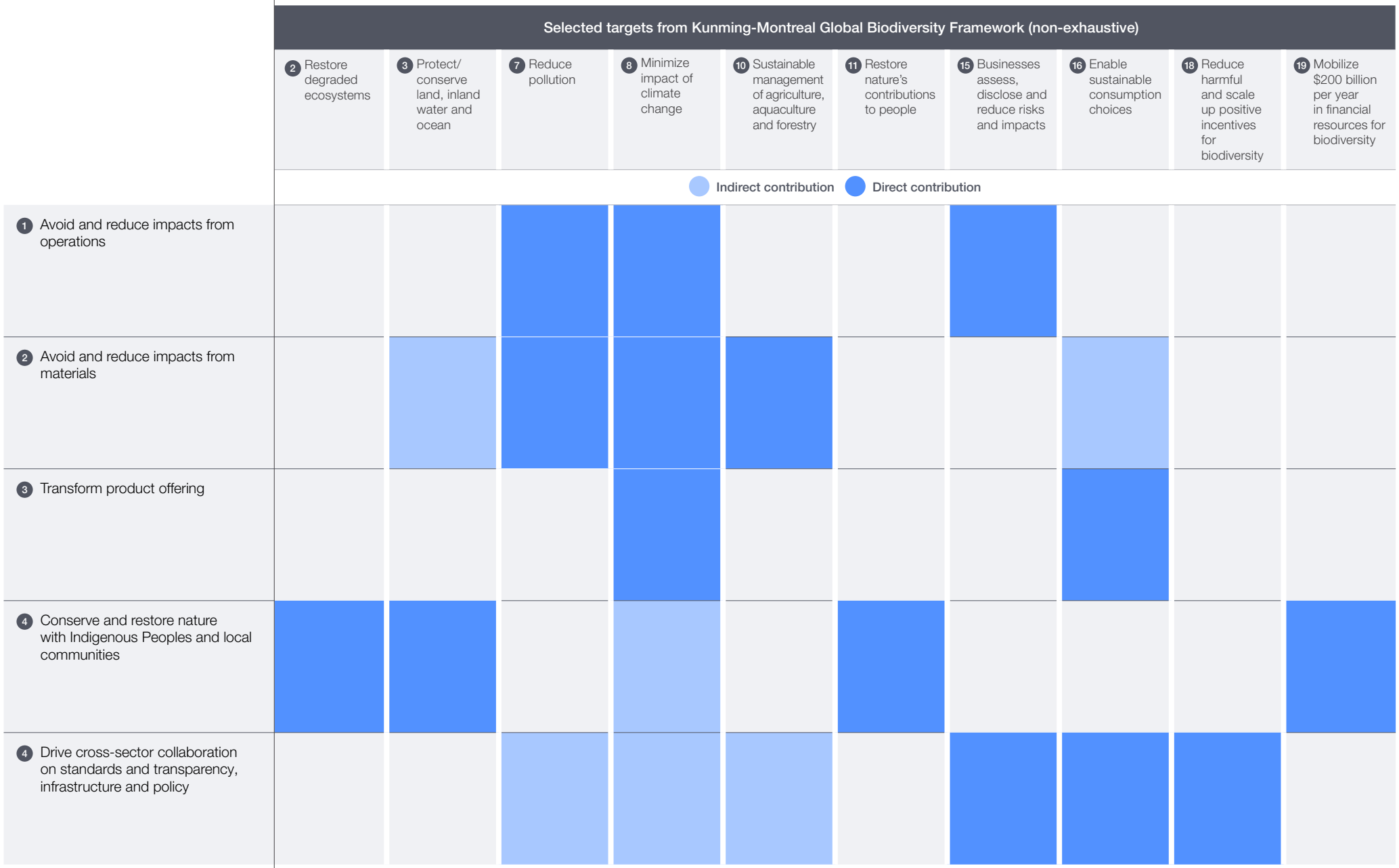
TABLE 3 **Deep-dive on business opportunities for the automotive sector**

Priority action	Business opportunity from *Future of Nature and Business* report	Original size in *Future of Nature and Business* report ($ billion)	Adjustment factor to size share of automotive sector	Opportunity size for automotive sector ($ billion)
1 Avoid and reduce impacts from operations	Wastewater reuse	50	Automotive sector share of global GDP: 3.46%	1.73
	Expansion of renewables	650		22.48
	Energy efficiency – buildings	825		28.53
	Energy efficiency – non-energy intensive sectors*	337		11.64
2 Avoid and reduce impacts from materials	Circular economy – automotive	870	Total sector share of global GDP (excl. mining and metals): 98.99%	861.23
	Additive manufacturing	135	Automotive sector share of global GDP: 3.46%	4.67
	Technology in energy and extractives supply chains	30		1.04
	End-use steel efficiency	210		7.26
	Reducing packaging waste	70		2.42
	Technology in large-scale farms	195		6.74
	Technology in smallholder farms	110		3.80
	Livestock intensification	65		2.25
3 Transform product offering	Green long-range transport	220	Automotive sector share of global GDP: 3.46%	7.61
	Fourth Industrial Revolution-enabled long-distance transport	75		2.59
4 Conserve and restore nature with Indigenous Peoples and local communities	Nature climate solutions	85		2.94
5 Drive cross-sector collaboration on standards and transparency, infrastructure and policy				

*Additional opportunity beyond *Future of Nature and Business* report analysis.

Taking these five priority actions across operations and the wider value chain will help companies in the sector avoid or reduce the four drivers of biodiversity loss (pollution, water use, land-use change and ecosystem disturbance, and GHG emissions) across the four nature realms (land, ocean, freshwater and atmosphere), mitigate risks to operations and unlock commercial opportunities. These actions will also contribute to the targets of the Global Biodiversity Framework, which aims to halt and reverse biodiversity loss by 2030 (see Table 4).

TABLE 4 | **Mapping of five priority actions to GBF framework**



For each action, companies should also set measurable and time-bound targets and report against the progress regularly to increase their accountability (see Chapter 4 for more details).

Priority action 1

3.1 Avoid and reduce impacts from operations

> To protect nature and minimize the vulnerability of the sector to increasing risks from reduced water availability and quality, companies should conduct water risk assessments across the value chain.

Companies should follow the mitigation hierarchy at the site level, in a landscape context, taking into consideration direct, indirect and cumulative impacts. They should first **avoid** impacts, then **reduce** impacts, **restore**, and finally **compensate**[143] for unavoidable residual impacts.[144, 145,146,147,148] Mitigation efforts should align with a No Net Loss (NNL) or BNG goal for each project.[149]

Improve water stewardship

To protect nature and minimize the vulnerability of the sector to increasing risks from reduced water availability and quality, companies should conduct water risk assessments across the value chain. In particular, for direct operations, companies should conduct site-level water audits and risk assessments with a catchment-based approach and establish strategies to sustainably and responsibly manage water supplies, prioritizing sites in basins facing water stress.

There are a number of actions companies can take to improve water stewardship, in particular:

- **Reduce water consumption**, including by replacing water-cooling processes with air cooling or investing in updating or replacing water-using equipment to maximize efficiency. For example, Mahindra has installed an Electro Deposition Reverse Osmosis (EDOR) water recovery system at a sheet metal paint shop, which has increased overall paint recovery and reduced freshwater use by 22%.[150]
- **Switch from freshwater to alternative water sources**, including by harvesting rainwater or treating wastewater. For example, Mercedes-Benz collaborated with a municipal wastewater disposal company to replace freshwater with treated wastewater at their Sindelfingen plant, saving a total of 123,000 m^3 of freshwater in 2023.[151]
- **Recycle water back into operations**, for example, by introducing closed-loop recycling systems or recycling treated wastewater back into operations.
- **Implement nature-based solutions**, enhancing natural flood plains and riparian ecosystems to alleviate flood risks.[152]
- **Support water replenishment across landscapes** in priority watersheds in partnership with environmental NGOs, local governments and communities.

Many companies have set targets to reduce freshwater withdrawal or average water use per vehicle. For example, Volvo Cars aims to reduce water withdrawal by 50% per car by 2030 (versus a 2018 baseline)[153] and Pirelli aims to reduce water withdrawal by 43% by 2025 (versus a 2015 baseline).[154] Other companies have established pilot plants that embed reduced water withdrawal and optimized water management. For example:

- Hero Motor's latest plants have been developed with a "green building" concept and are "zero liquid discharge". Each uses rainwater harvesting systems to capture 2,500,000 m^3 of water each year and is equipped with an effluent treatment plant that recycles 90% of wastewater back into operations, with the remaining 10% being reused for horticultural activities.[155]
- Hyundai has also established a zero-liquid discharge system to reuse and recycle 100% of the water they use at their Hyundai Motors India (HMI) plant and the Asan plant in South Korea. The company achieved this by adopting practices such as harvesting rainwater and expanding reservoirs.[156]

Avoid and reduce pollution

Beyond the water stewardship actions outlined above, which can also help tackle water pollution, the following actions can directly support pollution reduction:

- **Improve monitoring of air emissions and other pollutants**, for example, by implementing regular inspections to identify and tackle leaks.
- **Transform production processes and innovate to tackle pollutants**, in particular, air pollutants from paint shops. This can be achieved, for instance, by increasing application efficiency and adopting sustainable chemical or non-chemical paints. For example, Mahindra applied a combination of new materials, automation and upgraded technology at their Chakan paint shop to reduce volatile organic compound (VOC) emissions by 52%. This initiative also improved chemical resistance and longevity and reduced paint cost by 17%.[157]
- **Divert hazardous waste from landfills to recycle through authorized providers** and take measures to avoid spillages (for more information on actions to address material waste, see priority action 2).

In addition, the World Economic Forum's Alliance for Clean Air unites business leaders and policy-makers to reduce air pollution across global value chains. A science-based guide has been developed, which businesses can use to understand their impact on air pollution, and unlock a new path to accelerate climate targets.

BOX 3 **Tools to improve water stewardship**

Several tools are available to help companies identify, assess, prioritize and take action on water-related material risks, including:

- Aqueduct from the World Resources Institute (WRI)[158]
- WWF's Water Risk Filter[159]
- SBTN's technical guidance on freshwater[160]
- The Alliance for Water Stewardship's (AWS) Water Stewardship Standard[161]
- CDP's Water Impact Index[162]

Strengthen biodiversity assessment, planning and management

For all owned land, businesses should conduct site-level biodiversity assessments such as species monitoring, evaluate dependencies on critical ecosystem services and develop biodiversity management plans, starting with priority sites such as those at or near areas of high ecological, cultural or community significance. Examples of such areas include International Union for Conservation of Nature (IUCN) categories I-IV Protected Areas, Key Biodiversity Areas and World Heritage Sites.[163]

BOX 4 **Guidance and tools to improve biodiversity assessment and prioritization**

Various standards and guidelines exist to support companies. For example, the following resources outline the approach companies should take for biodiversity assessment and prioritization:

- TNFD's LEAP approach[164]
- SBTN's technical guidance to assess[165] and prioritize[166]

The following tools and datasets are also available to support a more detailed assessment:

- WWF's Biodiversity Risk Filter[167]
- The Integrated Biodiversity Assessment Tool (IBAT)[168]
- United Nations (UN) Biodiversity Lab spatial data[169]
- IUCN Global Ecosystem Typology 2.0[170]
- Global Forest Watch[171]

Accelerate GHG emissions abatement

There are a number of actions that companies can take to reduce GHG emissions as part of an integrated approach to transport and energy decarbonization and electrification. Companies can:

Decarbonize heat and power sources:

- Electrify heat production or switch to low-carbon fuels.
- Innovate to decarbonize welding processes by using gas.
- Increase the use of renewables for vehicle manufacturing and assembly, ensuring procurement is in line with standard due diligence and economic requirements, and embeds criteria to identify projects that optimize environmental sustainability, social equity and climate resilience.[172,173,174] For example, Volvo Cars already use 98% renewable electricity in their own operations,[175] and Toyota and Volkswagen Group also use 100% renewable electricity across at least all EU production sites.[176,177]

Optimize production processes:

- Energy efficiency could represent over half of carbon emission reduction contributions across all industries by 2050. Energy also accounts for at least 5% of an average manufacturing company's costs, and energy efficiency measures could save between 10% and 20% of those costs.
- To achieve energy savings, companies can improve the sizing, control, optimization and retrofitting of existing carbon-intensive equipment; implement energy management systems and standards; install energy recovery systems, such as waste heat recovery; and establish smart use strategies and optimize equipment.
- For example, Mahindra installed a unit to recover and re-use waste heat from chassis production pre-treatment, which resulted in a 23% reduction in natural gas consumption by their hot water generator.[178]

Decarbonize logistics and transport for materials and completed vehicles:

- Optimize routes and use efficiency, and collaborate with other automotive companies and industries to identify transport-sharing opportunities.
- Use lower-impact transport options where possible. For example, companies like Volkswagen Group are already using rail instead of heavy goods vehicles (HGVs).[179]
- Use low-carbon fuel substitutes (such as ethanol, natural gas, biofuels, hydrogen and electricity) in HGVs and support shipping providers to transition to low-carbon or carbon-free fuels.

See the World Economic Forum's *The "No-Excuse" Framework to Accelerate the Path to Net-Zero Manufacturing and Value Chains* report for more detail. The World Business Council for Sustainable Development's (WBCSD) Switch platform also provides access to knowledge support and tools for companies decarbonizing and electrifying buildings, transport and energy.[180]

Priority action 2

3.2 Avoid and reduce impacts from materials

Key materials include steel, aluminium, battery materials, polymers, rubber and leather.

Expand circularity and innovate to avoid and reduce material waste across the value chain

The circular economy has the potential to reduce life cycle emissions per passenger kilometre (km) by up to 75% by 2030.[181] Circularity also presents an opportunity to improve profitability by approximately 1.5 times across the value chain and to increase revenues per vehicle by around 10 times over the life cycle to 15-20 times its sales price. New circularity value pools mainly materialize in life cycle services (e.g. repair, reuse, remanufacturing and recycling) and as-a-service models (e.g. leasing/subscription, car sharing and mobility-as-a-service).[182,183]

To reduce material use, in particular primary and non-renewable material use, and capture these new value pools, automotive companies can:

- **Establish circular inputs**, working towards circular material stock where all materials are 100% recyclable, and starting with select materials (e.g. aluminium).

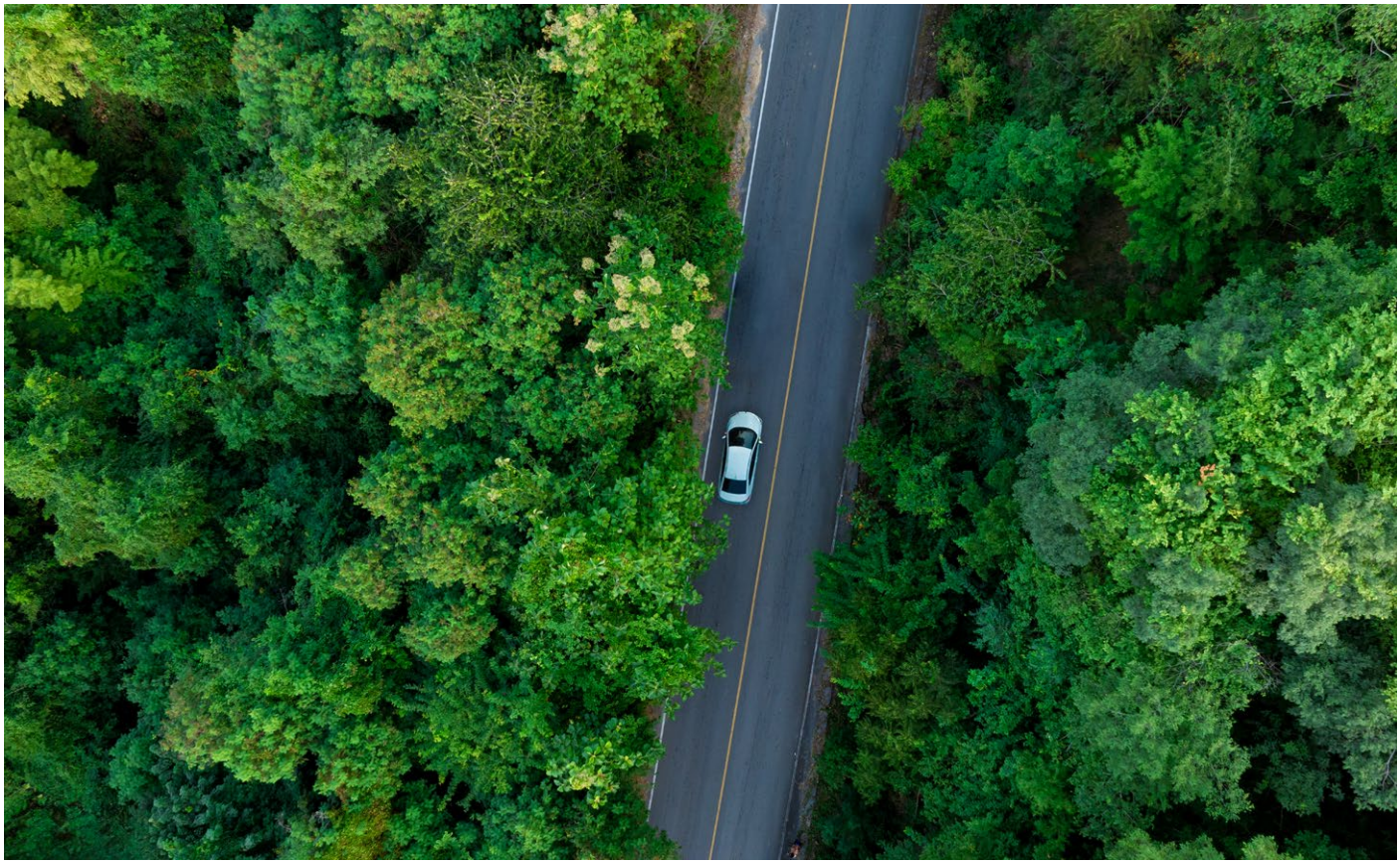
- **Innovate product and process design** for:[184]
  - **Resource efficiency**: This can be achieved by automating manufacturing, reducing yield losses in operations and reducing packaging use. For example, 85% of Mahindra's sites already send zero waste to landfill (ZWL), instead redirecting it to reuse or recycling operations. They aim to reach 100% of ZWL sites by 2030.[185]
  - **Use of recycled and renewable materials**: This can be achieved by co-designing materials with upstream providers to improve recycling rates, adjusting material specifications so that a higher scrap intake is possible, innovating to accelerate the use of scrap steel[186,187] and replacing existing materials with alternatives. The latter can be implemented, for instance, by switching from virgin plastics to recycled plastics and bio-based materials or using soybean-based foam in seating and headliners.[188]
    - For example, Continental Tire has produced and tested the first tyres with treads made from 100% dandelion-derived rubber polymers.[189] To accelerate this agenda, WBCSD's Tire Industry Project is working to identify and address the potential human health and environmental impacts associated with tires.[190]
    - More broadly, many automotive companies, including Volvo Cars,[191] Mercedes-Benz,[192] Renault[193] and Stellantis,[194] and tyre companies such as Pirelli[195] and Michelin,[196] aim to use between 30% and 40% reused, repaired, recycled or renewable materials in new models or fleets by 2030.
  - **Circularity**: Investments should be made in circularity, including by promoting standardization and compatibility of products and processes, and designing products for repair, disassembly and remanufacturing. For example, this can be accomplished by designing modular vehicles[197] to facilitate dismantling and part replacement.
  - **Long and extended life:** Product longevity should be prioritized, for instance by designing for reliability, durability, customer attachment and trust, and facilitating maintenance, repair and upgradability.
- **Invest in reuse, remanufacturing and EOL management at scale**:
  - Invest in automated processes, new technologies for reuse and remanufacturing, and large-scale facilities to increase cost competitiveness.
  - Establish efficient mechanisms for vehicle collection and disassembly, for example, through digital asset tracking.
  - Define requirements for EOL material processing to reduce downcycling.
  - Develop improved waste collection and sorting systems in factories for processing scrap and EOL materials to increase process efficiency and enable higher-value recovery.
  - Establish alliances to ensure quality scrap is returned to material suppliers without contamination and is available for reuse.
  - Invest in enhanced scrap treatment facilities to better manage the increased volume and diversity of scrap.
  - For batteries specifically, collaborate with other automotive companies and industries to establish a system for battery recycling. This is currently challenging given high costs and a lack of standardization across manufacturers – however, battery recycling could be cost-effective given the value of the metals within, and could support supply security of critical minerals.

As a next step, several companies are establishing pilot plants to expand circularity, for example:

- Renault created the Refactory in Flins, France, a plant dedicated to vehicle revalorization business models, which aims to dismantle an average of 10,000 vehicles and recondition 45,000 vehicles annually by 2023, and repair 20,000 electrical batteries per year by 2030.[198]
- Several companies have set up facilities focussed specifically on battery circularity, including Volkswagen Group, which opened their first pilot facility for recycling high-voltage vehicle batteries in Salzgitter, Germany, in 2021.[199] Another example is Mercedes-Benz, which is constructing a pilot plant for recycling lithium-ion battery systems in Kuppenheim, Germany.[200]

Others have also formed partnerships to promote circularity scale-up or support established consortiums to advance research and development (R&D). For example, Volkswagen Group has established a research consortium, HVBatCycle, which aims to prove that the most valuable components of traction batteries can be recovered and reused multiple times through recycling.[201]

Companies will need to identify appropriate solutions for the initial financing of circularity levers. Third-party investors and public funds could play a critical role by financing large-scale capital projects or funding research into promising technologies.[202]



Companies should identify, assess and disclose their nature-related impacts, dependencies, risks and opportunities across the supply chain.

Engage with suppliers and source responsibly

Companies should identify, assess and disclose their nature-related impacts, dependencies, risks and opportunities across the supply chain (see Table 1 for more information), incorporating environmental data from suppliers and starting by assessing priority sites and high-impact commodities.[203] Where sourcing location data is available, companies can also use other available resources to screen supply chain risks (see Case study 1).

To improve access to and quality of data, companies should educate suppliers on environmental data requirements and develop common data requests, supporting capacity-building and harnessing collective buying power to drive transparency (see more detail on improving standards and transparency in priority action 5). For example, BMW Group, Scania, Volvo Cars and Volkswagen Group were lead partners in creating a joint supplier questionnaire for parts procurement, which is increasingly becoming the industry standard.[204]

In addition, companies can incorporate nature-related performance criteria into the supplier due diligence and management processes, for example, by adding requirements to be deforestation-free[205] or fossil-free, favouring non-overexploited raw materials or not sourcing materials from IUCN categories I-IV Protected Areas, Key Biodiversity Areas and World Heritage Sites.[206] For example, Mercedes-Benz require all sourced cobalt and lithium to be from Initiative for Responsible Mining Assurance (IRMA)-certified sites.[207] Alternatively, companies can provide incentives, such as shorter payment periods, to suppliers who advance nature action.

Finally, companies can strategically engage with suppliers to advance nature action, either individually or by joining forces with other purchasers. This can be done by integrating nature requirements with existing climate sourcing requirements. For example:

- Companies such as Mercedes-Benz, Volkswagen Group, BMW Group and Scania have formed partnerships to purchase low-carbon steel. For example, Scania set a joint target with SSAB to decarbonize all steel deliveries by 2030.[208]
- Volvo Cars, General Motors, Scania, Mahindra and Ford are members of the World Economic Forum's First Movers Coalition (FMC), and use their purchasing power to decarbonize steel, aluminium or both.
- More than 500 of Volkswagen Group China's suppliers have signed a declaration committing to switching to renewable electricity.[209] By 2025, Stellantis aim to ensure that suppliers (Level 1 and Level 2) aligned with 80% of their annual purchase value have CO_2 reduction targets compliant with the Paris Agreement, and they mean to increase this share to 95% by 2030.[210]

Priority action 3

3.3 Transform product offering

Transition product portfolio

Companies should transition product portfolios from ICE vehicles to battery electric vehicles (BEVs) and other alternative solutions.[211] This should follow a life cycle assessment of environmental impacts, including an evaluation of trade-offs between GHG emissions and other nature impacts. This process should be informed by certain considerations, such as efficiency of energy use (acknowledging analysis showing that EVs outperform other options in this area),[212] and regional context, e.g. the local renewable energy penetration (see Case study 2 for more detail on impact accounting methodologies).

For example, Volvo Cars aims to reach 100% EV sales by 2030 and Hyundai by 2035. Other companies are following, aiming for 30% to 50% electrification by 2030 or full electrification by 2035 to 2050.[213,214,215]

There are also opportunities to reduce nature impacts by optimizing and limiting the size and weight of vehicle bodies, as well as key components such as batteries, thereby decreasing the need for materials and reducing fuel consumption. For any portfolio shifts, it is critical that companies plan ahead for transitions and account for long lead times, as vehicles typically take four to six years from initial concept to market.

CASE STUDY 2

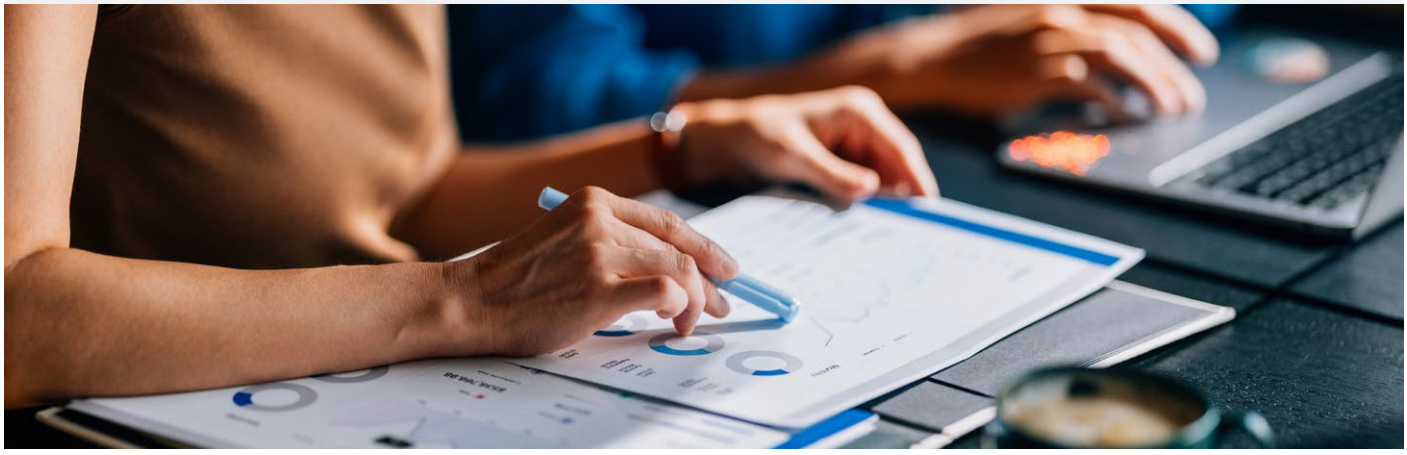
Implementing impact accounting across the automotive supply chain

To better measure and value corporate impacts on nature and society, the Value Balancing Alliance (VBA), a coalition of around 30 multinational companies, is pioneering impact accounting in its mobility cluster. It aims to contextualize sustainability data and translate it into comparable monetary values, reflecting corporate impacts across the entire value chain.

Many nature-related impacts in the automotive industry originate within the value chain. Therefore, targeted efforts to reduce environmental impacts require a comprehensive understanding of the most material impact drivers, sectors or regions. Combining VBA's impact accounting methodology with extended input-output modelling,[216] Mobility Cluster member ZF Group employed the following four steps to identify hotspots:

1. **Mapping tier 1 suppliers**: Aligned purchasing data with Exiobase sectors and countries to connect suppliers to relevant environmental data
2. **Modelling the supply chain**: Modelled environmental impacts from tier-1 to tier-n suppliers, using input-output modelling
3. **Measuring environmental impacts**: Used VBA impact accounting methodology to estimate impacts, capturing the regional context and differences
4. **Identifying key impacts**: Identified the impact drivers, sectors and regions that have the most material environmental impacts to guide strategic priorities, enabling a resource-oriented analysis, assessing impacts related to materials like metals and wood

In addition to the hotspot analysis, impact accounting can also be used to measure and compare different nature impacts, such as GHG emissions and land-use change. This can help companies to evaluate nature-related trade-offs for potential supply chain interventions.



Expand into new business models and influence customer behaviour

In addition, companies can expand into new business models to extend life, facilitate improved recycling and optimize customers' use patterns (with users' cars currently being parked 95% of the time on average).[217,218] These include:

- **Mobility-as-a-service models**: Examples include vehicle-on-demand (such as car rental, car sharing, peer-to-peer sharing and micro-mobility) and mobility-on-demand (such as ride-hailing, ride-sharing and demand-responsive transport/ride pooling). For instance, the ALIKE project plans to put 10,000 autonomous shuttles on Hamburg's roads by 2030, supported by the federal government, the Hanseatic City of Hamburg and a consortium of industry partners, including vehicle manufacturers such as Volkswagen Group.[219]
- **Component-as-a-service models**: Examples include battery swapping or providing a guarantee on battery service. For instance, in China, NIO had completed over 40 million battery swaps by March 2024 and offers different tiers of battery-leasing subscription models. NIO has also partnered with other Chinese automakers, including Changan, Geely, Chery and JAC, in 2023 to develop battery swap standards and expand the battery swap station network in China.[220]
- **Leasing and subscription ownership models:** Shared mobility models, such as leasing and subscription ownership, optimize customer use patterns and reduce ownership of underused vehicles.

Priority action 4

3.4 Conserve and restore nature with Indigenous Peoples and local communities

Support nature conservation and restoration

In pursuing conservation and restoration efforts, companies should first take steps to rigorously apply the mitigation hierarchy at a site level and address the impacts of their own activities (avoid, reduce, then restore). Then, they should compensate for unavoidable residual impacts as a last resort after all other attempts at preventing or reducing impacts have been considered.[221,222] Efforts should be aligned with a NNL or BNG goal for each project.[223] It is important to note that there are certain cases where compensation is not appropriate and should not be used.

Compensation efforts should follow specific principles, such as those outlined by The Nature Conservancy,[224] United Nations Environment Programme (UNEP),[225] IUCN[226] and the Business and Biodiversity Offsets Programme (BBOP),[227] including additionality, equivalency, location and temporal considerations. In many regions, compensation is supported by government policies. The number of countries with biodiversity offset policies doubled from 60 to 115 from 2001 to 2017. However, there are still regions where more regulatory development is needed or compliance is weak and where companies can work with governments to strengthen policies as well as policy compliance and implementation.[228]

In addition, **companies are also encouraged to contribute to systems-wide conservation and restoration within and beyond their own value chains**,[229] and target investments towards contributing to government targets under their National Biodiversity Strategies and Action Plans (NBSAPs). Companies should adopt holistic, ecosystem-wide approaches, incorporating Indigenous ecological knowledge that promotes balance and sustainability.

> Companies are also encouraged to contribute to systems-wide conservation and restoration within and beyond their own value chains.

This includes investing in credible and effective nature-based solutions (through place-based conservation and restoration or landscape and jurisdictional approaches), and partnering with environmental NGOs, local governments, Indigenous Peoples and other local communities, such as through the World Economic Forum's 1t.org initiative. As supporting guidance, companies can refer to the *Global Standard for Nature-based Solutions* published by IUCN, which proposes eight criteria and 28 indicators to deliver results that are "environmentally sound, socially just and economically feasible".

Companies can start by establishing flagship projects, either by enhancing existing beyond-value-chain carbon abatement investments or launching new nature-based solutions that contribute to net-zero and nature-positive movements. For example, Volkswagen Group has established a Biodiversity Fund with an annual allocation of up to €25 million for external projects starting in 2025,[230] and as a member of the 1t.org Corporate Alliance, Mahindra has committed to planting 1.5 million trees a year, with the aim to plant five million trees annually by 2026. It has already planted a total of 20 million trees in Araku, India as part of Project Hariyali.[231] Where possible, companies should prioritize projects in locations relevant to their upstream, downstream or own operations, where investments can also provide risk mitigation benefits (e.g. protection from flooding).

Invest in innovative biodiversity financing mechanisms

A 2020 report estimated there is an average global biodiversity financing gap of $711 billion per year required for the protection, restoration and enhancement of nature,[232] where the private sector has a key role to play in helping bridge this gap by investing in a nature-positive transition. Target 19 of the Global Biodiversity Framework proposes several innovative ways to mobilize public- and private-sector resources. For example, companies could consider investing in payment for ecosystem services, green or blue bonds, nature restoration funds and voluntary biodiversity certificates or credit markets. Through careful assessment of the advantages and disadvantages of available products, companies can contribute to meaningful long-term biodiversity conservation that is aligned with both their internal values and targets as well as national objectives. The Forum has published a *Private Sector Roadmap to Finance and Act on Nature*.

Priority action 5

3.5 Drive cross-sector collaboration on standards, transparency, infrastructure and policy

Embrace standards and transparency

As outlined in priority action 2, companies should identify, assess and disclose their nature-related impacts, dependencies, risks and opportunities across the supply chain and engage with suppliers. Companies can also use external assurance frameworks to secure a guarantee on the implementation of responsible production standards, such as IRMA, The Copper Mark and the Aluminium Stewardship Initiative.

In order to further improve access to and quality of data and enable data sharing across the value chain, companies can engage and collaborate with others, including upstream and downstream companies, traders and distributors, financial institutions, industry associations and NGOs, to:

- **Develop environmental data management and sharing technologies** to improve traceability through the value chain (see Case study 3 for more detail)
- **Establish common impact assessment methodologies** to drive standardization and convergence
- **Establish data needs of downstream customers** and collectively develop solutions to address these needs

For example, for batteries specifically, a consortium of 11 partners, including BMW Group, Umicore and BASF, has received €8.8 million in funding from the German government. They used this to develop a common classification and set of standards for gathering and disclosing data on batteries, releasing a study in 2024 that outlined the benefits and challenges of digital product passports for batteries.[233,234] In addition, the Global Battery Alliance's Battery Passport[235] aims to improve transparency in critical minerals sourcing by collecting and reporting data on the make-up, manufacturing history and sustainability of a battery across its life cycle.

CASE STUDY 3

Harnessing data systems in the automotive value chain

To support the connection and sharing of data in the automotive sector, companies across the value chain, including BMW Group, Mercedes-Benz and Volkswagen Group, collaborated to launch the open data ecosystem Catena-X in 2021.

In the past, many OEMs and first-tier suppliers built their own digital platforms for data exchange with their partner networks. Each partner in the network had to deal with a variety of different systems, standards and approaches, which restricted scalability and multi-tier collaboration. As a result, a new collaborative network approach was necessary to address these shortcomings.

The Catena-X network aims to cultivate interoperability across all stages of data-based value chains in order to build resilient supply chains and support systematic decarbonization. Companies can exchange data with other network participants in a way that is standardized, secure and simple, based on the principle of data sovereignty. Solutions are being implemented in the system over time to facilitate common goals, supported by common standards for use.

Use cases currently in development include traceability of components, environmental and social governance (ESG) monitoring, product carbon footprint calculation, circularity and digital product passports. Use cases like circularity and digital product passports will also allow automotive manufacturers to track the life cycle of a car's battery, from production to EOL. When the battery reaches the end of its useful life in a vehicle, this will enable it to be reused in stationary energy storage applications or recycled to recover valuable materials like lithium and cobalt, closing the loop on battery resources.

The Catena-X association is now supported by 189 partners who have the opportunity to participate in developing standards and use cases, and after the initial concept was developed in Germany, it is now being expanded to Europe, North America and Asia (including China).

> Automotive companies have a role to play in collectively calling for more progressive policies and regulations that set the minimum standards for the sector.

Educate customers, support downstream network and scale up transition infrastructure

To de-risk commitments and tackle nature-impacts across the value chain, companies can:

- **Educate and support customers to make more environmentally friendly choices**.[236] This can be achieved, for example, by producing an accurate reflection of products' carbon footprints and other nature-related impacts (such as water use) in prices and labelling either in dealerships or in-app for mobility-as-a-service models. Alternatively, companies can collaborate with downstream distribution networks to support customers in identifying appropriately sized vehicles and battery ranges, and understanding availability of charging infrastructure to combat range anxiety.

- **Engage with downstream distribution and aftersales network**, and help them to deploy site-level biodiversity assessment and develop management plans across all owned land, starting with priority sites.

- **Support scale-up of energy grid integration infrastructure**, including smart charging and vehicle-to-grid technology. For example, BMW Group, General Motors, Honda, Hyundai, Kia, Mercedes-Benz and Stellantis have formed a new charging network joint venture that aims to expand access to high-powered charging in North America by installing at least 30,000 charge points.[237] Volkswagen Group's Electrify America covers more than 4,250 fast chargers in North America.[238]

In collaboration with other automotive companies, call on governments to strengthen nature-related policy

Automotive companies have a role to play in collectively calling for more progressive policies and regulations that set the minimum standards for the sector. Indeed, companies can advocate for governments to:[239,240]

- **Incentivize rapid deployment of zero and low-emission vehicles**, for example, through the provision of preferential access to premium urban locations and parking, supported by structured fees (which are cheaper for EVs or other low-emissions vehicles).

- **Accelerate technological development to increase scale**, and incentivize industry consortium efforts to invest in circular materials production (prioritizing batteries, aluminium and steel), materials and energy decarbonization, advanced recycling and sorting technologies (including enabling recycling of EOL batteries and vehicles), flexible production technology (e.g. 3D printing), alternative drivetrains, product passports and mobility platforms.

- **Support sustainable critical mineral supply**. In particular, countries considering relocating extraction and processing should assess trade-offs and risks, weighing the benefits of increasing supply security against the potential environmental implications. WWF analysis shows relocating lithium and nickel refining processes can either increase or decrease in GHG emissions impact by a factor of five.[241]

- **Enable data transparency and sharing efforts** for automotive value chain actors, re-examining the underlying premise of anti-trust regulation and how it fits into a world of scaling clean technologies. Achieving this goal will require immense collaboration across the supply chain and between competitors.

- **Incentivize leasing, subscription and mobility-as-a-service models** to optimize materials efficiency and energy consumption.

See the World Economic Forum's *The Road Ahead: A policy research agenda for automotive circularity* for more detail on how to adapt policy tools to promote circularity, material and energy efficiency and support sustainable markets for circular cars and services, and *Paving the Way: EU Policy Action for Automotive Circularity* for a European-specific policy roadmap.

4 Get started

The imperatives to tackle carbon emissions and nature loss are interdependent. Companies should integrate their nature-positive and net-zero strategies.

Making transformative changes to business models by 2030 demands significant time and resource investments from companies.

While many companies in the automotive sector have already embarked on their nature journey and embraced the five priority actions, making transformative changes to business models by 2030 demands significant time and resource investments from companies.

Delivering net-zero emissions and tackling nature loss are highly interdependent goals. Climate change is a main driver of biodiversity loss, and efforts to tackle climate change cannot succeed without safeguarding nature. Therefore, the nature-positive transition aligns closely with companies' net-zero commitments and should be integrated into their climate transition plans. Likewise, companies should ensure that social objectives are integrated for a just and equitable nature-positive transition.

Guidance is emerging on how to develop nature transition plans or adapt net-zero transition plans to include nature and biodiversity commitments and objectives, supported by several institutions. For example:

- **It's Now for Nature's** *Nature Strategy Handbook* is a practical guide to support businesses across sectors in developing a nature strategy.
- **TNFD** will publish new guidance in 2025 on recommendations for nature transition plans for real-economy companies and financial institutions. This document was launched for public consultation in October 2024.
- **CDP and WWF** are developing transition planning recommendations, including practical guidance on tools and methodology.
- **Glasgow Financial Alliance for Net Zero (GFANZ)** has published a framework for net-zero transition planning for financial institutions and will release guidance on integrating nature into these plans in early 2025.[242] This document was launched for public consultation in October 2024.

4.1 Align strategy with organizational maturity

Assessing organizational readiness and maturity can help a company understand its performance on the nature-positive journey and identify the most suitable guidance and tools to drive action. Table 5 details recommended actions to deliver a nature-positive strategy mapped to an organization's level of readiness and maturity.

TABLE 5 **Mapping the components of a nature-positive strategy against organizational maturity**

Components of a nature-positive strategy	Organizational maturity	
	Starting and developing	Advanced and leading
Summary	– Identify nature-related issues. – Set a high-level ambition and/or targets for nature. – Present stand-alone actions on nature.	– Integrate nature into strategy and governance. – Assess impacts and dependencies for all potentially relevant realms. – Set measurable and science-based targets for nature. – Implement strategic action, redefine industry business models and mobilize the whole value chain.
Foundations	– Employ sectoral averages for high-level screening to discern priority effects on nature. – Use secondary data for materiality assessments to gauge priority impacts and nature dependencies, considering factors like environmental pollution. – Use tools and guidance such as ENCORE,[243] SBTN's guidance for businesses, Aqueduct from WRI,[244] TNFD's upcoming transition planning guidance, WWF's biodiversity risk filter and water risk filter,[245] UN Environment Programme Finance Initiative's (UNEP-FI) report on high-risk sectors[246] and the Integrated Biodiversity Assessment Tool (IBAT).[247]	– Refine materiality assessment by measuring impacts and dependencies on nature using primary operations data and environmental indicators, and undertake an in-depth analysis of significant risks and opportunities, understanding their influence on financial statements. – Maintain a comprehensive grasp of organizational resilience with an actionable plan for managing nature risks and opportunities. – Perform thorough valuations of all priority areas, considering trade-offs, using value chain data and recognizing the mutual benefits for business and society. – Use tools and guidance such as ENCORE, SBTN's step 1 – assess, step 2 – prioritize and TNFD's LEAP approach, Aqueduct from WRI, WWF's biodiversity risk filter and water risk filter, UNEP-FI's report on high-risk sectors and the IBAT.

TABLE 5 **Mapping the components of a nature-positive strategy against organizational maturity** (continued)

Components of a nature-positive strategy	Organizational maturity	
	Starting and developing	Advanced and leading
Implementation strategy and engagement strategy	– Develop sustainable procurement policies with suppliers that have nature-focused elements. – Prioritize actions to avoid and reduce negative impacts in the company's direct operations and upstream supply chain. – Implement initial traceability for primary suppliers. – Be aware of NBSAPs and recognize the interdependence of nature and climate in advocacy efforts.	– Adopt a circular strategy and embrace regenerative principles by linking capital to nature-positive outcomes and by involving all stakeholders, including employees, clients and customers. – Establish advanced traceability for key materials and ensure supplier alignment, expand traceability throughout product life cycle and encourage innovative supplier collaborations. – Engage actively in NBSAPs, champion nature-positive outcomes and advocate for integrated reforms benefiting nature, climate and society.
Metrics and targets	– Set nature-positive goals on a timeline using the SMART (specific, measurable, achievable, relevant and time-bound) approach. – Validate commitments using third-party stakeholders.	– Detail and report on targets for nature-related risks and opportunities based on TNFD's *Recommendations*.[248] – Prepare for science-based targets on land and freshwater by using SBTN's step 3 – set targets.
Governance	– Assign a management member for nature-based risks, ideally overseeing both climate and nature. – Incorporate nature into environmental risk management, especially within enterprise risk management (ERM), environmental, social and governance (ESG) and sustainability teams. – Train governance roles on the connection between nature and wider ESG risks.	– Ensure board or senior management ownership of nature actions. – Tie performance on nature and climate to leadership incentives. – Set up governance structures for managing, reporting and overseeing nature-based risks and actions on nature across the organization, including informing relevant board-level committees.

4.2 A deeper look at metrics to support decision-making

Companies need to track and publicly report on their actions against relevant metrics to strengthen their credibility and ensure they deliver an effective transition.

TNFD's LEAP approach

TNFD offers sector-specific and sector-agnostic guidance on metrics, which should be the first port of call. A good place to start within TNFD's resources is the *Guidance for corporates on science-based targets for nature,* published jointly by TNFD and SBTN.[249] TNFD differentiates between assessment metrics and disclosure metrics along the four phases of the LEAP approach[250] (see Figure 9):

- **L**ocate interface with nature
- **E**valuate dependencies and impacts
- **A**ssess material risks and opportunities
- **P**repare to respond and report

FIGURE 9 **Types of metrics in TNFD's LEAP approach**

Types of metrics	Assessment metrics				Disclosure metrics
	Location prioritization metrics – Ecosystem integrity – Biodiversity importance – Physical water risks – Other corporate data	**Impact and dependency metrics** – Impact drivers – State of nature – Ecosystem services/ dependencies	**Risk and opportunity metrics** – Physical risks – Transition risks – Systemic risks – Nature-related opportunities	**Response metrics** – Governance – Strategy – Management actions	**Disclosure metrics** – Core global metrics – Core sector metrics – Additional metrics
LEAP approach	**Locate** interface with nature	**Evaluate** dependencies and impacts on nature	**Assess** material risks and opportunities	**Prepare** to respond and report	

Source: Adapted from Taskforce on Nature-related Financial Disclosures (TNFD). (2024). *Recommendations*.

Guidance on nature measurability is fast developing:

- The Capital Coalition's Align Project has issued a suite of publications on measuring and valuing biodiversity.[251]
- CSRD, Global Reporting Initiative (GRI) and TNFD's disclosures are organized around a series of metrics that can be used to anchor company assessments and support disclosure. These should be complemented with what the TNFD LEAP approach calls "response metrics" – the internal reporting on an organization's actions, policies, commitments, plans and targets to manage its nature strategy.
- CDP's corporate questionnaire also enables companies to disclose on climate change, deforestation, water security, plastics and biodiversity. CDP is partially aligned with the TNFD disclosure recommendations and is working towards full alignment.
- WBCSD has developed sector-specific metrics to measure the state of nature, and pressures and responses of the forestry, agri-food, built environment and energy sectors. In 2025, it plans to develop additional metrics for the pharma and chemicals sectors.
- The Nature Positive Initiative is developing indicators and metrics to define the state of nature and contributions to "nature-positive" outcomes. It will be launched in January 2025.

Differentiating between input and output indicators

There are a number of dimensions to indicators and metrics. They should be both qualitative and quantitative. They should also measure inputs and processes and – importantly – outputs and outcomes (see Table 6).

Companies should define a set of indicators and metrics according to the mitigation hierarchy (avoid, reduce, restore, compensate) to assess their activities and the impacts achieved.[252]

TABLE 6 **Input and output indicators and examples**

Indicator type	Example
Input and process indicators	Resources and activities that are deployed by a business in service of a certain priority action, for example: – Investment in water management systems – Number of knowledge products/research projects conducted by a company
Output and outcome indicators	Tangible results stemming from undertaking a priority action, for example: – Commitment to no conversion of natural ecosystems – Percentage of reusable, recyclable or compostable plastic packaging – Percentage of raw material certified by commodity-specific certifications in the supply chain (that are identified as critical suppliers based on materiality assessment and volume)

4.3 Map the transition on to business functions

Mapping the nature-positive transition on to distinct company functions requires a holistic approach to ensure that every division synchronizes its strategies with nature-positive aspirations.

TABLE 7 **Mapping strategies and actions by business function**

Business function	Potential strategies and actions required for a nature-positive transition
Sustainability	Develop the nature-positive transition plan for the business (together with the strategy function). Obtain a holistic understanding of impacts and dependencies of the firm's operations and products. Collaborate with other functions to drive the wider transition of the business. Drive nature conservation and restoration initiatives (such as wetlands for wastewater purification). Promote collective sector-wide positive action, such as sustainable raw material sourcing or collaboration on bio-based or recyclable material research. Monitor sustainable sourcing practices and raw material certification. Support and enable collaborations with NGOs as well as industry initiatives.
Strategy and corporate development	Develop the nature-positive transition plan for the company (together with the sustainability function). Conduct horizon scanning and comprehensive market research for new opportunities related to the nature-positive transition (e.g. markets, products, processes, technologies). Evaluate the risks and returns associated with more disruptive opportunities (e.g. circularity approaches, new products) and identify business cases in new nature-positive economies. Drive necessary organizational changes to align business operations with the requirements of the new nature-positive economy (e.g. establish cross-functional teams to address both climate and nature challenges internally and across your supply chain).

TABLE 7 | **Mapping strategies and actions by business function** (continued)

Business function	Potential strategies and actions required for a nature-positive transition
Finance and risk management	**Financial management** Revise capital planning assumptions for nature-positive related businesses cases (e.g. pay-off periods for investments may increase versus traditional capital expenditures). Consider impacts of nature-positive transition on balance sheet (e.g. high-polluting assets might have to be written off prematurely or written down on an accelerated timeline). **Investments** Increase capital spending on projects enabling the nature-positive transition of the business (e.g. retrofitting plants, supporting other nature-based solutions). – In particular, allocate funding to improve water stewardship measures, including water audits, wastewater recycling and water basin restoration. Allocate budget for innovation spending, such as for circular innovations and research into bio-based or recycled material for feedstocks. – Plan for the financial implications of incorporating circularity and sustainable product development. Commit to investments in nature conservation, restoration and nature-based solutions in collaboration with NGOs and local communities. **Financing** Consider that the cost of capital for high-polluting operations could increase. Consider that availability of capital may become contingent on credible nature-positive strategies. Use new sources of funding, such as green bonds and sustainability loans, nature-focused impact funds, blended funding and partnership with NGOs. **Risk management and disclosure** Consider that new nature-related risks may emerge that need to be managed (see TNFD framework), for example: – Physical and supply chain risks, such as decreased water availability or quality in the supply chain – Transition risks including demand shifts, regulatory risks and reputational risks Prepare required nature-related disclosures for audited statements for CSRD (and potentially under forthcoming requirements of the ISSB).
Procurement	Ensure procurement decisions are aligned with sustainability imperatives and strategy. Engage closely with upstream suppliers to discuss impacts and dependencies, as well as priority actions, and co-develop implementation strategies. Develop innovative working models or partnerships with suppliers to support the transition (e.g. upfront payments or co-financing).
Research and development	Invest in research for new nature-positive products and production techniques. Introduce new metrics to track the effect of R&D spending related to the nature-positive transition of the business, in addition to financial returns from R&D spending.
Operations (own)	Identify relevant indicators and establish applicable metrics as well as define the respective target ambition and baseline for each and subsequently report publicly on progress. Enhance efficiency of production processes (e.g. improved water management, including water recycling systems and close-loop systems in manufacturing; digitalization and automation in manufacturing processes; energy efficiency measures). Track water impacts (including use and recycling). Engage in conservation and restoration initiatives.
Operations (supply chain management)	Identify relevant indicators, establish applicable metrics, define the respective target ambition and baseline for each and subsequently report publicly on progress made. Collaborate with suppliers for sustainable sourcing and improved traceability. Support suppliers (where possible) in taking nature-positive actions for their own operations.

TABLE 7 | **Mapping strategies and actions by business function** (continued)

Business function	Potential strategies and actions required for a nature-positive transition
Human resources	Upskill workforce on nature and biodiversity topics (where relevant). Hire relevant external expertise (e.g. additional human resources might be required to prepare for upcoming nature-related reporting and disclosure requirements).
Sales and marketing	Promote products that have minimal impacts on nature and biodiversity and develop solutions that both reduce nature impact and offer additional utility or benefits to consumers. Provide disclosure on impacts and dependencies of products, especially as customers may expect more information on nature footprint, which requires transparent and traceable supply chains. Develop a holistic understanding of customer segments and willingness to pay for greener products.
Investor relations	Disclose nature-positive initiatives and their impact on company performance (e.g. company commitments to water stewardship, sustainable sourcing and circular economy practices). Highlight contributions to global frameworks like the Kunming-Montreal Global Biodiversity Framework. Manage investor engagement on nature topics to ensure transparency on priorities from both sides.
Public affairs	Advocate nature-positive action in the public space. Collaborate with policy-makers, regulators and other standard-setters to develop effective, progressive policies, regulations and standards supporting the transition of the sector (e.g. the United Nation's global plastics treaty).

Source: Adapted from McKinsey & Company. (2022). *The net-zero transition: What it would cost, what it could bring.*

Conclusion

International agreements such as the Global Biodiversity Framework are corralling global consensus on the urgency of tackling nature loss, and regulations are tightening to ensure more nature-friendly practices.

The automotive sector stands at a critical juncture in the transition to a nature-positive future. While progress towards ZEVs and circularity is under way, the industry still faces significant challenges regarding pollution, water use and land-use change throughout its value chain.

To lead in sustainability, automakers must prioritize avoiding and reducing the impacts of operations and materials, transforming their product offerings, conserving and restoring nature, and collaborating across sectors. A comprehensive approach, balancing GHG reductions with nature impacts, is essential to ensuring that the drive for net zero does not come at the expense of ecosystems.

Through collaboration with companies across the sector, with suppliers and customers, other industries, regulators, civil society and local communities, the automotive industry can champion a transformative shift that aligns with global biodiversity goals, securing a sustainable future for both business and the planet.

Appendix

Impacts and dependencies analysis

The sector-average assessment of the top drivers of nature loss shown in Table 2 is mostly based on ENCORE,[253] and follows a four-step process.

First, the relevant sub-industries were identified at an ISIC class level[254] for each stage of the value chain. After initially shortlisting the ISIC classes for the midstream section of the value chain (direct operations), the ENCORE upstream and downstream "links" were used to map each midstream ISIC class to relevant upstream and downstream ones. A manual review was also conducted to identify any other relevant categories, resulting in a total of 59 ISIC classes mapped to the value chain stages for the automotive sector.

Second, the ENCORE "pressures" were mapped to the five IPBES (Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services) drivers of biodiversity and ecosystem change.[255] Note, "Resource exploitation" was mapped solely to "Volume of water use", as the other pressures ("Other biotic resource extraction (e.g. fish, timber)" and "Other abiotic resource extraction") were not material for the automotive sector, and "Introduction of invasive species" was similarly excluded given the materiality was mostly low or below for all ISIC classes where a value was assigned. See Table 8 for the complete mapping.

Third, for each stage of the value chain and IPBES driver, an average of the ENCORE "pressure materiality rating" was computed across all the ISIC classes where a materiality value was assigned (i.e. not N/A or ND). This was summarized in Table 2 for those with medium, high or very high materiality.

Finally, this output was tested with business, civil society and academic industry experts via interviews and consultation workshops, and the final ratings were adapted based on the feedback provided. For the automotive sector specifically, this involved updating the "midstream, pollution", "midstream, water use" and "downstream, pollution" from low to medium materiality, and "downstream, greenhouse gas (GHG) emissions" section from medium to high materiality.

The impact and dependency descriptions in Chapter 2 also use the ENCORE "pressure materiality ratings", "pressure links", "dependency materiality ratings" and "dependency links" datasets alongside several other sources. These include CDP Water Watch, WWF Water and Biodiversity Risk Filters, academic papers, civil society reviews, company-specific insights and assessments, analysis by the World Economic Forum and industry expert interviews and consultation workshops. The results of this analysis were then used to inform the development of the priority actions.

TABLE 8 **Mapping from ENCORE "pressures" to five IPBES drivers**

IPBES drivers of biodiversity and ecosystem change	Relevant ENCORE "pressures"
Land-use change and ecosystem disturbance	– Area of land use – Area of freshwater use – Area of seabed use
Pollution	– Emissions of toxic soil and water pollutants – Emissions of nutrient soil and water pollutants – Emissions of non-GHG air pollutants – Generation and release of solid waste – Disturbances (e.g. noise, light)
Resource exploitation (water use)	– Volume of water use
GHG emissions	– Emissions of GHGs

Opportunity sizing

The Forum's *Future of Nature and Business* report,[256] published in 2020, identifies about 60 major business opportunities in the nature-positive economy and estimates their respective market sizes (defined as concentrated shifts in profit pools that generate specific opportunities for business). The sizing reflects the annual additional opportunity in 2030 based on estimated savings (e.g. value of land saved through restoration) or revenue upside (e.g. new market potential for new products). For each opportunity, the incremental size of the opportunity in a nature-positive versus a business-as-usual scenario is measured. The opportunities selected are based on existing, commercialized technologies. A detailed overview of this sizing can be found in the methodology note for the *Future of Nature and Business* report.[257]

Identifying the business opportunity potential of the priority actions for the automotive sector followed a two-step approach. First, relevant opportunities were selected from the *Future of Nature and Business* report and mapped to the priority actions identified in this report (see Table 3). Second, the market potential for the automotive sector was estimated across each selected opportunity, using relevant adjustment factors such as the sector's share of global GDP for sector-agnostic opportunities or the total excluding the mining and metals sector's share of global GDP for circularity-related opportunities.

This sizing approach may not cover the entire set of business opportunities for the sector. For example, the market potential of new technologies under development was not considered in the original 2020 report and is, therefore, not covered in this report. Similarly, the 2020 report did not aspire to exhaustively cover all present opportunities.

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