Nature Positive

Transforming theory to action

OCTOBER 2024

Foreword

As we confront an escalating environmental crisis, it is clear that while decarbonization is vital, it is not enough. Nature - our biodiversity, soil, water, and air - is under threat, and protecting and restoring these essential systems must become our next focus if we are to reach our global net zero goals. At Arcadis, we agree with our most visionary clients: nature is the next big priority. The shift towards nature-positive solutions is not just necessary; it's urgent.

International regulations and standards are increasingly driving this change. Frameworks like the Taskforce on Nature-related Financial Disclosures (TNFD) and the Corporate Sustainability Reporting Directive (CSRD) are pushing companies globally to take responsibility for their environmental impacts. These initiatives create urgency and a greater expectation of businesses to both commit to and act on tangible action. Recently the growing number of organizations making meaningful progress also inspires hope. These pioneers show us that it's possible to meet business objectives while enhancing the environment and society.

Arcadis understands the challenges our clients face, from regulatory demands to managing the risks of nature degradation. These risks are not just environmental - they impact physical assets, corporate resilience, supply chains and financial stability. In this context, policies aimed at "no harm" are no longer sufficient. We need a regenerative approach that actively restores the ecosystems we depend on, reversing biodiversity loss and reactivating the vital services that nature provides.

Achieving a nature-positive future by 2030, the global goal as set forth by the United Nations at the Kunming-Montreal Global Biodiversity Conference (COP15), requires urgent, transformative action. Arcadis stands ready to partner on this transformation, uniquely positioned to deliver nature-positive solutions, that extend beyond traditional design, engineering, architecture and consultancy. Using data-driven insights, our diverse teams - ecologists, engineers, architects, and economists - work hand-in-hand with clients to co-create truly tailored solutions that deliver both growth and environmental regeneration. From sustainable extraction and demolition practices, we see the potential for a planet-positive future if we act decisively now, together.

This white paper taps into our collective perspectives to explore what nature positivity means for our clients, sectors, and society at large. The road ahead may seem challenging, but the solutions are within reach. Now is the time to move from intent to action, transforming rhetoric into real-world impact.

Alan Brookes

Chief Executive Officer

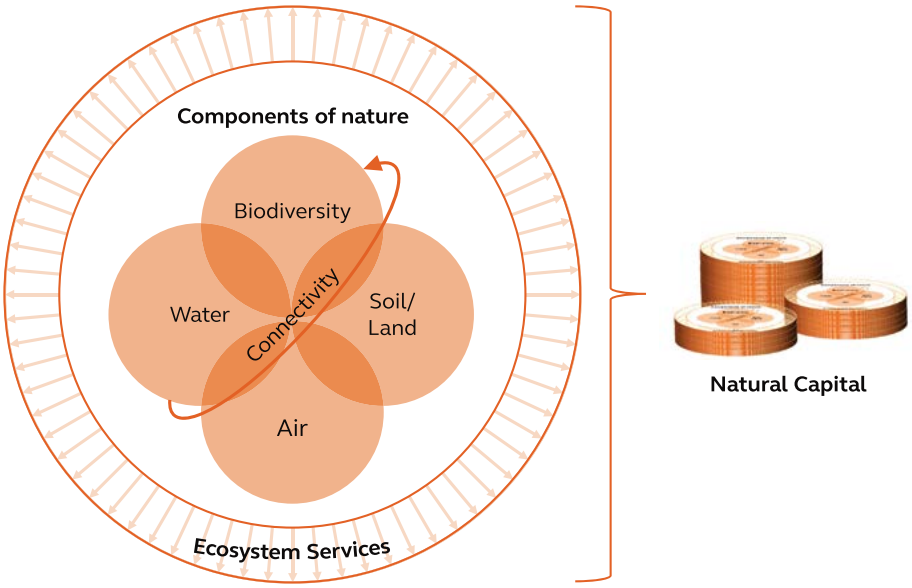
Background: Nature is in crisis and business must act

Healthy natural systems are the foundation of the services that sustain our society and economies, making their protection essential for a sustainable future. Today, customers, regulators, and investors are demanding more sustainable options, and businesses are in a unique position to drive this change.

Despite this growing awareness, human activity has historically neglected the value of nature's services, leading to significant environmental degradation. The vital services nature provides - such as clean water, healthy soil, fertile land, and fresh air - have largely been overlooked in economic assessments. Nature has been called the "forgotten partner" to achieve our global goals and this is just as true for business. Just as much as degradation of nature can have long term negative impacts on business supply chains and continuity, so can regeneration of nature benefit businesses, providing novel opportunities for sustainable growth. To restore balance, it is essential that humanity urgently shifts towards restoring, conserving, and sustainably managing nature.

Pantanal Biome, Brazil

Figure 1



At the heart of all these benefits lies biodiversity. The definition of nature includes non-living components of the natural world such as soil, land, water, air and the connection between and within these, as well as the living component that is biodiversity.

Figure 1 Nature is defined as the natural world, and the interactions it has with the abiotic (non-living) environment. There is often a focus on biodiversity (the living component of nature) which is understood to include humans. Natural Capital is the valuation of everything that comes from nature, from which humans derive a wide range of services, often called ecosystem services making human life possible.

By integrating nature into business strategies, companies can play a pivotal role in reversing environmental damage while also securing long-term economic success. Arcadis offers the practical solutions needed to transform these ambitions into action - helping businesses restore, conserve, and sustainably manage natural ecosystems. Together, we can create a thriving future where people, nature, and business prosper.

This paper goes beyond theory, analyzing the latest trends and engaging with stakeholders across various industries. It identifies both the global and industry-specific challenges businesses face, as well as opportunities to overcome them, such as nature-based solutions. '**Nature Positive**' offers a clear roadmap for the future, and we believe the time has come for businesses to take meaningful steps toward this goal, no matter where they currently stand on the journey.

We cannot afford to drive nature to collapse

Nature consists of ecosystems that supply essential services upon which society depends. Some of these services are obvious - like the food we eat - while others are less visible but equally crucial. Healthy soils filter and store water, sequester carbon, and offer flood risk mitigation, ensuring clean water supplies. Oceans play a central role in global nutrient, carbon and water cycles. Waterways not only serve as mobility routes for goods and people but also help regulate urban temperatures. Similarly, green spaces in cities also contribute to temperature regulation and provide areas for recreational activities, reducing stress and anxiety while also cleaning air and reducing noise pollution. Overall, healthy, functioning ecosystems draw down carbon and provide other critical synergies in addressing climate change, such as flood attenuation and passive cooling.

At the heart of all these benefits lies biodiversity. The definition of nature *(Figure 1)* includes non-living components of the natural world such as soil, land, water and the connection between and within these, as well as the living component that is biodiversity. Without biodiversity, impoverished landscapes would fail to provide vital services, collapsing into disrepair. A lack of biodiversity weakens nature's resilience, reducing its ability to maintain healthy soils, purify water, store carbon, and regulate climate. In short, biodiversity is more than just another component of nature - **it's the engine that drives ecosystem health and productivity, allowing our society to thrive.**

Arcadis' work with Immobel to undertake biodiversity reviews of new construction projects helped identify critical actions to minimize nature loss and improve ecosystem health. Using Arcadis' Biodiversity Net Gain Calculator, each project was analyzed for its environmental impact, ensuring Immobel was able to implement strategies that enhanced biodiversity, integrating nature-based solutions into the development process. This underscored the value of combining net-zero objectives with a nature-positive mindset, and how businesses can proactively protect natural habitats while advancing their sustainability goals.

While people have often been seen as separate to this biodiversity, people are also included in the definition of nature. People are an integral component of nature itself and have a significant impact on the safe and just functioning of ecosystems. Conversely degraded natural systems pose a risk to society and economies, with the World Economic Forum annual risk index finding that environmental risks continue to dominate the risks landscape for the next decade.[1] This year, the World Economic Forum specifically recognized biodiversity loss as the third most significant global risk for the coming decade.[2]

Despite how much the future of our society is intertwined with nature, our current trajectory is not yet aligned to a sustainable future for both. Species and ecosystems around the world continue to be in rapid decline, creating a biodiversity crisis, despite conservation efforts in the last decades.[3] Scientists have identified the boundaries for the global processes that determine the stability and resilience of our Earth system. In 2023, six of these planetary boundaries were already being crossed, five of which are linked to healthy natural systems (climate change, biosphere integrity, land-system change, freshwater change and biogeochemical flows).[4] The risk of leaving the safe operating space for the final three boundaries is increasing, with ocean acidification the closest to breaching the boundary. This shows that a significant transition to a resilient planet for life, including people, has not yet begun. Despite our current state, there is hope. It is still possible through systematic and strategic change for future populations to return to and live within those boundaries, if we act now.

Businesses have a key role in driving meaningful action

In 2020, the World Economic Forum identified that at least 50% of global gross domestic product (GDP) is moderately or highly dependent on nature,[5] a figure that has increased in more recent reports. Indirectly, all business and social activities rely on the continued resilience of our natural systems. In the UK alone, up to 12% of the country's GDP may be at risk by 2030 because of nature degradation; to put this in perspective this is larger than the loss from the global financial crisis or Covid-19.[6] Meanwhile, approximately 90% of the pressures on nature can be attributed to three socio-economic systems (food, land, and ocean use (1); infrastructure and the built environment (2); and extractives and energy(3)).[7]

There is an increasing recognition that the climate and nature crises are deeply interconnected, requiring a holistic and multifaceted approach to effectively address both challenges simultaneously. Businesses have made progress on their net-zero journeys to address the climate crisis but need to accelerate their advance on the path to Nature Positive. According to the Global Benchmarking Alliance, only 5% of companies have assessed their impact on nature. **Less than 1% of companies claim to understand their dependency on nature** leading to key gaps even amongst early adopters regarding water use, ecosystem conversion and respecting local communities' rights.[8] It is beneficial for businesses to connect their focus on net zero carbon with nature restoration.

For example, Arcadis' work with Immobel to undertake biodiversity reviews of new construction projects helped identify critical actions to minimize nature loss and improve ecosystem health. Using Arcadis' Biodiversity Net Gain Calculator, each project was analyzed for its environmental impact, ensuring Immobel was able to implement strategies that enhanced biodiversity, integrating nature-based solutions into the development process. This underscored the value of combining net-zero objectives with a nature-positive mindset, and how businesses can proactively protect natural habitats while advancing their sustainability goals.

Addressing biodiversity loss simultaneously presents a major opportunity for the global economy, estimated to generate up to US$10.1 trillion in annual business value and create 395 million jobs by 2030.[9] To ensure the sustainability of the ecosystem services that humanity relies upon, as well as to provide opportunities for businesses and communities to thrive, these business practices would need to go beyond conserving natural systems and increase the resilience of ecosystems. In essence, businesses must transition to be Nature Positive, which we define in the following section.

[1] WEF (2024) Global Risks Report 2024

[2] WEF (2024) Global Risks Report 2024

[3] IPBES. (2019). Summary for policymakers of the global assessment report on biodiversity and ecosystem services

[4] Katherine Richardson et al.(2023) Earth beyond six of nine planetary boundaries

[5] WEF (2020) Nature Risk Rising

[6] University of Oxford (2024) Nature degradation could cause a 12% loss to UK GDP

[7] WEF (2020) New Nature Economy Report II: The Future Of Nature And Business

[8] World Benchmarking Alliance (2024) Nature Benchmark

[9] WEF (2020) New Nature Economy Report II: The Future Of Nature And Business

Definition: Nature Positive is a global goal for all

In 2022, the world's nations gathered at the Convention of Biological Diversity's (CBD) COP15 to adopt the first Global Biodiversity Framework, along with a new set of global targets to reverse the declining health of our planet's nature. It is here that the term Nature Positive came to the forefront. The definition of Nature Positive in its truest form is the global goal set forward in this framework.[10] In 2024, countries gather in Cali, Colombia for the CBD COP16 to report back plans and progress to this framework for the first time.

Defining Nature Positive

Underlined by 23 targets, the Global Biodiversity Framework calls for the world to be "Nature Positive" by 2030, effectively reversing impacts to nature (using 2020 as a baseline) to improve natural systems rather than degrading them.[11] Looking further ahead, the framework aims for the full recovery of natural systems by 2050, in parallel with efforts to stabilize global carbon emissions by the same date.

This goal has been composed to guide businesses, as well as governments and civil society. The key is that it was designed to complement other global goals, informing actions across all three Rio Conventions of the UN (the CBD, the United Nations Framework Convention on Climate Change Paris Agreement and the United Nations Convention to Combat Desertification) as well as the Sustainable Development Goals.

Although Nature Positive is primarily defined as a goal, the term has evolved to represent an ambition - to give back more to nature than we take. A nature positive outcome is an observable improvement in the state of nature which can be measured using existing metrics, that has not resulted in a displacement of negative impacts elsewhere. The most relevant scale for observing these outcomes is across land/seascapes. In line with its goal-based definition, most large single assets cannot at this time be Nature Positive.

Currently a building cannot truly be Nature Positive, especially when we consider the impact of the value chain (a challenge discussed in detail in section 3), however it can include actions/components that contribute to nature-positivity (e.g. a green wall).

Businesses can contribute to nature positive outcomes, but not themselves become 'nature positive'. At a corporate or portfolio level, Nature Positive can be adapted as a goal, committing to avoiding negative and indirect impacts and investing in restoration, conservation and sustainable use of nature (*Figure 2*). The most relevant scale for achieving nature positive outcomes for a business is landscape level but business actions can also contribute to these landscape levels (e.g. site level, corporate level, sector level).

An exciting opportunity for when large scale assets can contribute to Nature Positive, is exploring where critical infrastructure such as roads or windfarms can act as nature-based solutions. In the next section, we define nature-based solutions and explore the main barriers to this becoming the norm.

Definitions:

Nature Positive
The goal to "halt and reverse nature loss by 2030, on a 2020 baseline, and achieve full recovery by 2050." (UN's Kunming-Montreal Global Biodiversity Framework)

Nature-based Solutions
"Actions to protect, conserve, restore, sustainably use and manage natural or modified terrestrial, freshwater, coastal and marine ecosystems, which address social, economic and environmental challenges effectively and adaptively, while simultaneously providing human well-being, ecosystem services and resilience and biodiversity benefits." (UNEA-5, 2021)

Green/Blue Infrastructure
"A strategically planned network of natural and semi-natural areas with other environmental features designed and managed to deliver a wide range of ecosystem services." (European Commission)

Natural Capital
The stock of renewable and non-renewable natural resources that combine to yield a flow of benefits to people. (Capitals Coalition)

[10] Nature Positive Initiative

[11] CBD (2022) Global Biodiversity Framework

Arcadis' work on the Marker Wadden Islands in Lake Markermeer illustrates how the integration of both natural and engineered solutions can enhance biodiversity and restore critical habitats while addressing water management challenges. By creating man-made islands that promote ecosystem recovery, Arcadis helped restore wetlands, benefiting both nature and nearby communities.

Figure 2

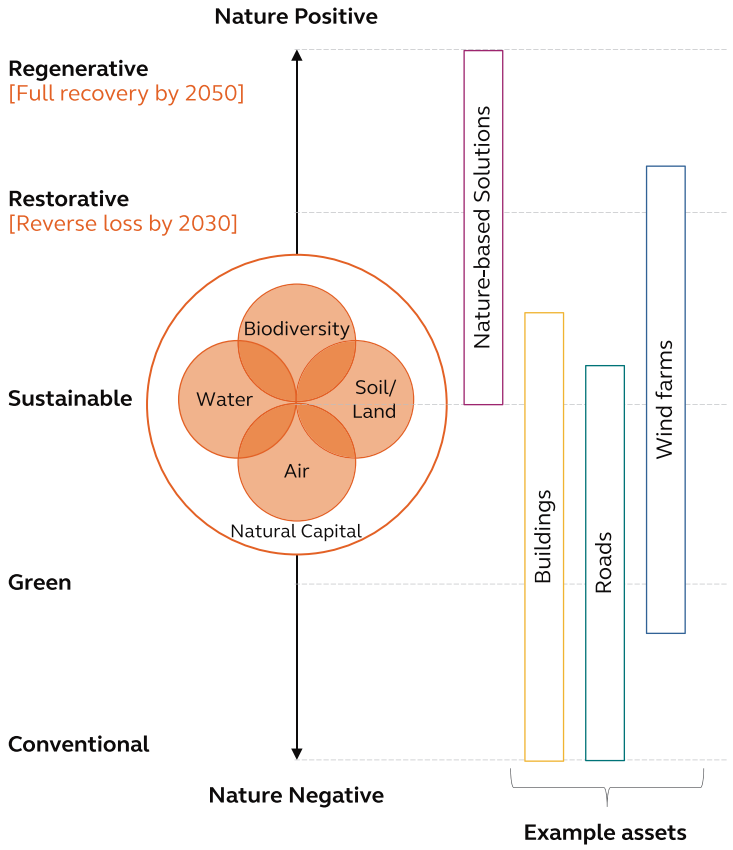


Figure 2 Nature Positive is a goal requiring a systematic transformation. In that definition, an asset or project cannot itself be Nature Positive. Instead, an asset can contribute to Nature Positive or mitigate negative impacts on nature. Currently, different assets are more likely to be contribute to Nature Positive as exemplified by buildings, roads and windfarms in this diagram. An exception is Nature-based Solutions, which as actions to restore, conserve and sustainably manage nature, are contributing to Nature Positive

Nature-based solutions provide multiple contributions to Nature Positive

There is one solution that by its very definition contributes to Nature Positive: nature-based solutions. Nature-based solutions address societal challenges through actions to protect, sustainably manage, and restore natural and modified ecosystems, benefiting people and nature at the same time.[12] These solutions at their core address societal challenges such as climate change or water security, benefit biodiversity and rely upon the conservation, sustainable management and increasingly the restoration of nature (although they can be implemented in conjunction with grey infrastructure). Such actions can transform landscapes to contribute to Nature Positive outcomes in an agile and resilient manner, delivering additional societal benefits. They are best designed and managed using evidence-based and community-led assessments.

A common misconception is that nature-based solutions are "purely green" interventions. Instead, they can also be hybrid solutions, mixing for example green and grey infrastructure to provide an overall benefit to nature (and otherwise aligns with the IUCN Global Standard for Nature-based Solutions).[13] For example, the restoration of coastal ecosystems such as mangrove forests, mudflats and coral reefs can provide communities with disaster risk reduction. However, the best solution in this case might include the construction of a sea wall in addition to the restoration of ecosystems.

It is also important to note that the definition of nature-based solutions, while formally defined by the United Nations in 2021,[14] has been misused in the past. Nature-based solutions do not include solutions simply inspired by nature (nature-inspired solutions such as biomimicry) nor solutions that are driven by natural resources (nature-derived solutions such as wind farms). Both nature-inspired and nature-derived solutions do not by definition support the ecosystems that they rely upon.[15]

[12] IUCN (2020) Guidance for using the Global Standard for Nature-based Solutions

[13] IUCN (2020) Global Standard for Nature-based Solutions

[14] UNEP (2022) Press release: UN Environment Assembly concludes with 14 resolutions to curb pollution, protect and restore nature worldwide

[15] IUCN (2020) Global Standard for Nature-based Solutions

Other approaches needed to contribute to Nature Positive

Businesses must take urgent action to reduce current pressures on biodiversity combined with restoration actions, at all scales (global, regional, local) and levels (site, landscape, corporate, value chain, sector) by means of a multi-stakeholder effort.

It is convenient to view nature-based solutions as the only path to achieving Nature Positive, and while a significant part of it, they are not enough. Fully realizing a Nature Positive goal requires the assessment, design, implementation and management of actions across the value chains. **Business should act towards Nature Positive outcomes through applying two leading frameworks: the mitigation hierarchy[16] and the conservation hierarchy.[17]** While the mitigation hierarchy provides a step-by-step approach for mitigating impacts, the conservation hierarchy goes beyond and includes actions to address historical, systemic and non-attributable biodiversity loss.

There are a considerable number of nature-benefiting solutions that aren't themselves based on nature (*Figure 2*). For example, focusing on the choice of materials and optimizing for value chain impact can contribute to Nature Positive. And in the absence of nature-based solutions, steps should also be taken to enable further Nature Positive contributions in the future. For example, a green wall on a building by itself is not a nature-based solution nor necessarily Nature Positive. It can however contribute to a Nature Positive target if designed properly and later may even contribute to larger nature-based solutions, thereby becoming a stepping stone in the greening of an entire city. Another way of viewing this is that green/blue infrastructure can be a nature-based solution, when it aligns with the IUCN Global Standard. However, even when this is not the case, green/blue infrastructure may still contribute to Nature Positive and thus should be prioritized over conventional pure grey solutions (*Figure 2*).

This combination of nature-contributing solutions with nature-based solutions is critical, including those nature-inspired and nature-derived solutions that also contribute to Nature Positive. Achieving Nature Positive requires a holistic, systematic approach that considers the broader impacts of nature-related decisions across various levels, from buildings and infrastructure to urban and regional planning.[18]

What does this mean for Arcadis and our clients

What site-level solutions are needed to transform entire sectors towards achieving the overarching Nature Positive goal? Several organizations have outlined steps businesses can take, while government efforts to develop Nature Positive economies have enabled certain first steps.

The World Business Council for Sustainable Development (WBCSD) provides sector-specific guidance in its Nature Positive Roadmaps,[19] while the World Economic Forum presents Nature Positive Industry Sector Transitions.[20] Both also align with the Capitals Coalition ACT-D framework: directing businesses to Assess, Commit, Transform, and Disclose on nature.[21] Certain subsector guidance has also been developed such as the Biodiversity Roadmap for the construction industry that Arcadis developed in conjunction with the Green Construction Board. [22]

Taking all of this guidance into account, the key characteristics of Nature Positive and measuring contributions to Nature Positive are summarized in the recent ALIGN discussion paper, led by Arcadis.[23] While the paper covers many important points, one conclusion that is particularly poignant here is that **businesses must take action to contribute to Nature Positive outcomes across their value chain where they have material impacts and dependencies on nature.**

Arcadis recognizes that clients and communities, along with nature, require a context-specific approach. In the following section, we reviewed existing literature and partnered with sector representatives to identify global and sector-specific challenges, opportunities and practical solutions.

[16] Cross Sector Biodiversity Initiative (2015) A cross-sector guide for implementing the Mitigation Hierarchy

[17] Millner-Gulland et al (2020) Four steps for the Earth: mainstreaming the post-2020 global biodiversity framework

[18] Arcadis (in review) Ten Questions Concerning Nature-based Solutions and Achieving Nature Positive in the Built Environment

[19] WBCSD Roadmaps to Nature Positive http://www.csbi.org.uk/wp-content/uploads/2017/10/Mitigation-Hierarchy-Executive-summary-and-Overview.pdf

[20] WEF (2023) Nature-Positive Industry Sector Transitions

[21] Capitals Coalitions Priority Business Actions for Nature

[22] Green Construction Board (2024) Biodiversity Roadmap

[23] Arcadis, ICF, UNEP-WCMC, Capitals Coalition, WCMC Europe (2024) Exploring measurement solutions for Nature Positive Commitments from Businesses- a discussion paper from the Align project, Aligning accounting approaches for nature

Business landscape: what are the challenges, opportunities and solutions to Nature Positive?

Common challenges that industries face on their path to Nature Positive

Throughout our research, clients have repeatedly told Arcadis that nature (specifically biodiversity and water) will be the next big focus alongside carbon. However, many still face significant challenges in meeting their decarbonization targets and regulatory requirements, not always recognizing the interdependencies between carbon and nature. Only a few companies worldwide have established targets for nature and even fewer for biodiversity specifically, although the Global Nature Benchmark indicates the number is steadily increasing.[24] This raises a critical question – what obstacles are preventing businesses from taking action on nature, and what risks are they running by not doing so?

Unlike carbon emissions, which have a uniform global impact metric and allow for scalable solutions, the effects of nature have highly local impacts and are more complex. Each region's distinct ecosystems pose significant challenges for global businesses in managing their environmental responsibilities. As a result, companies must adapt their strategies to address specific local conditions. However, some challenges related to nature are universal across industries. Every company's supply chain, directly or indirectly, depends on natural resources or ecosystem services. As regulations around nature tighten each year, businesses find their 'license to operate' increasingly impacted as pressure to disclose their impact on nature also increases from their customers and suppliers. At the same time, they are under growing scrutiny from a society that is more aware of the link between the climate crisis and the state of nature (specifically the biodiversity crisis), where a single misstep can significantly damage a business' reputation, and, in turn, its value.

24 World Benchmarking Alliance (2024) Nature Benchmark

An Arcadis-developed Biodiversity Measurement Navigation Wheel supports businesses to select the most suitable measurement tools for their specific needs amongst the multitude of options. Arcadis has led the work on methods and metrics in the EU Business@Biodiversity Platform for almost 10 years now, publishing annual or biannual update reports on the landscape of biodiversity measurement tools.

Measuring biodiversity

Measuring biodiversity impacts and dependencies, as well as the associated risks and opportunities is complex if compared to measuring carbon emissions. By now, it is accepted that biodiversity cannot be captured by means of one single metric. This is due to the multidimensional character of the concept of biodiversity, which is reflected in the CBD definition: "*Biological diversity means the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems.*" This definition already suggests that biodiversity covers ecosystem diversity, species diversity and genetic diversity. Yet there is more. State of biodiversity also depends on other factors such as extent, species population size and the functioning of ecosystems.

Until recently, a globally accepted biodiversity metrics framework was not available. This resulted in a proliferation of incomparable biodiversity indicators and related metrics. Recently, the Nature Positive Initiative (NPI) identified 636 biodiversity indicators and metrics.[25] This multitude leads to unnecessary confusion, increased risk of misinformed action and ultimately inaction of stakeholders. An Arcadis-developed Biodiversity Measurement Navigation Wheel supports businesses to select the most suitable measurement tools for their specific needs amongst the multitude of options. Arcadis has led the work on methods and metrics in the EU Business@Biodiversity Platform for almost 10 years now, publishing annual or biannual update reports on the landscape of biodiversity measurement tools.[26]

Dependence and resilience of the value chains

Recent reports have attempted to calculate the value at stake from business dependencies on nature, finding that the dependency in the supply chain of a sector is often higher than the dependency of the direct operations. Industries such as chemical and materials; aviation, travel and tourism; real estate; mining and materials; supply chain and transport; retail, consumer goods and lifestyle are moderately or highly dependent on nature. While the World Economic Forum calculated that 15% the direct gross economic value of these sectors is highly dependent on nature, over 50% of the associated supply chains of these sectors is highly dependent.[27] Even sectors with seemingly lower exposure will be impacted by the collapse of ecosystem services through supply chain linkages.

Amid the current climate and biodiversity crises, businesses must strengthen their supply chain resilience to survive—or better yet, thrive—in the coming decades. This isn't about implementing better technology or complex countermeasures - it's about restoring, nurturing, and enhancing the fundamental resources we rely on: soil, water, air, and biodiversity. Simply avoiding harm is no longer enough; a net gain is required to reverse the damage already done.

Transforming supply chains has been especially challenging, even for carbon, but it is possible. Examples of supply chains that benefit biodiversity do exist in the agriculture sector.[28] Purchasing and supply chain management for biodiversity enhancement examples while rare on the ground, tend to include both intra- and interorganizational action extending beyond a single businesses' boundary.[29] Coordinated action across supply chains and regions is crucial to overcoming the risk that the biodiversity poses to businesses.

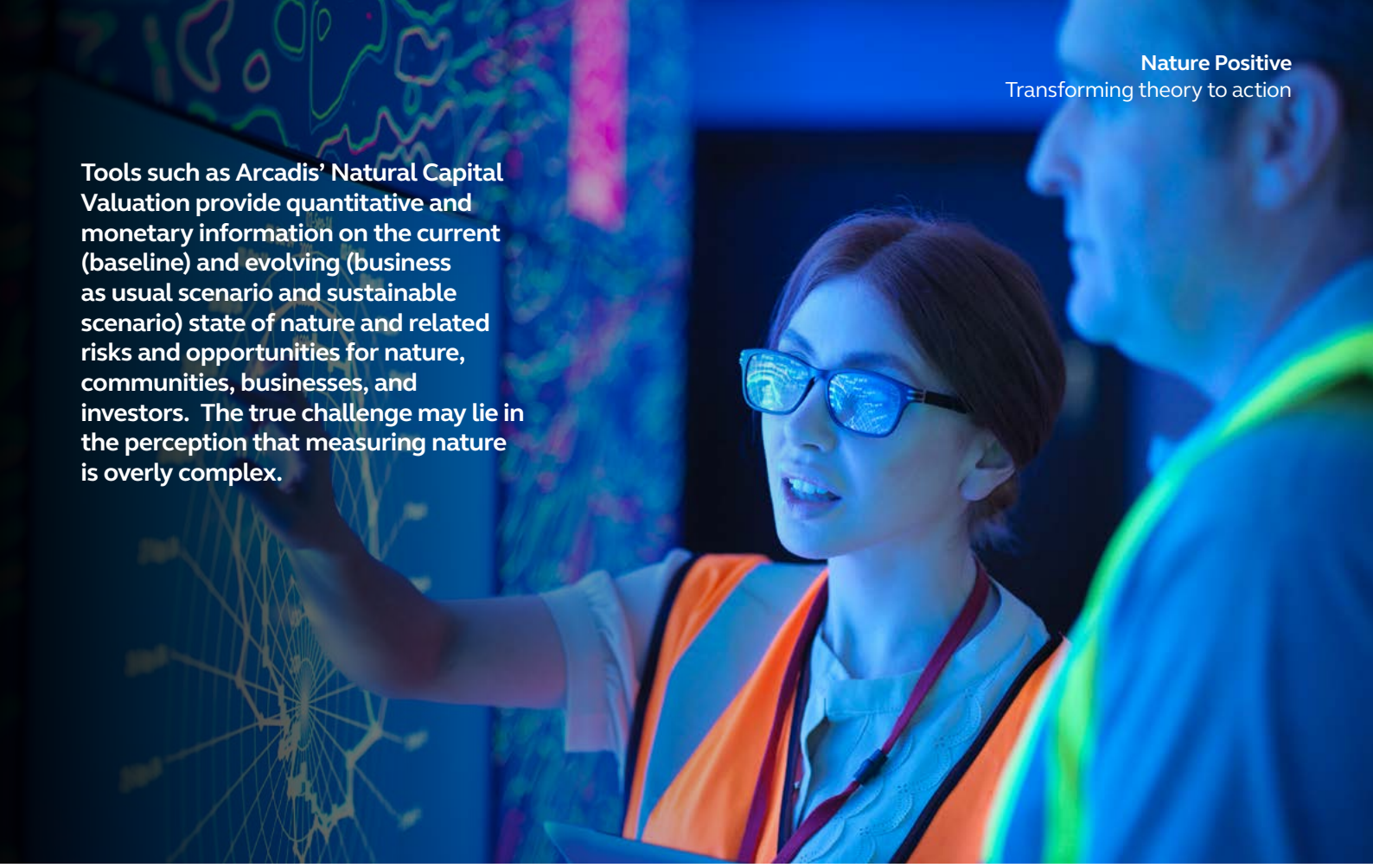
[25] NPI (2024) Introducing State of Nature Metrics NPI Newsletter Sept 2024.pptx (naturepositive.org)

[26] Johan Lammerant (2022) EU B@B Platform "Critical assessment of biodiversity accounting approaches for businesses"

[27] WEF (2020) New Nature Economy Report II: The Future Of Nature And Business

[28] WBCSD (2024) Nature-positive in agri-food value chains: the why and the how

[29] Salmi et al (2023) Biodiversity management: A supply chain practice view



Tools such as Arcadis' Natural Capital Valuation provide quantitative and monetary information on the current (baseline) and evolving (business as usual scenario and sustainable scenario) state of nature and related risks and opportunities for nature, communities, businesses, and investors. The true challenge may lie in the perception that measuring nature is overly complex.

Inconsistent policy and regulatory landscape

Arcadis found, in a paper developed for the Capitals Coalition, that while policy and regulations exist in support of Nature Positive, current monetary policy and regulation do not sufficiently promote the development of nature positive roadmaps.[30] Most of the nature-related global disclosure and target-setting frameworks that support Nature Positive are voluntary although there is growing pressure from public perception and investors for businesses to take them up. Frameworks such as the Taskforce for Nature-related Financial Disclosure (TNFD), Global Reporting Initiative (GRI) and Science-based Targets for Nature (SbTN) have seen adopters grow year on year.

Mandatory disclosures are not yet the norm for nature, but in some regions, this is beginning to change. The EU's Corporate Sustainability Reporting Directive (CSRD) requires around 5,000 businesses to disclose their material sustainability impacts and dependencies from 2025 onwards. Additionally, over half of the world's 2,000 most influential companies will be affected by the EU's Corporate Sustainability Due Diligence Directive (CSDDD). There are already countries with mandatory regulation related to Nature Positive, like the UK's recently launched Biodiversity Net Gain law, which for relevant new infrastructure projects mandates a 10% increase in biodiversity overall. As countries start to report their progress on the Global Biodiversity Framework, Arcadis expects a trend of further regulation to support actions for Nature Positive.

Initial analysis by Arcadis for WBCSD indicated that many companies face challenges around prioritizing actions for regulatory and disclosure needs. Compliance will grow as a challenge as regulation becomes mandatory at scale, but currently it also presents an opportunity. Early adopters can ease this process by following established, often voluntary guidelines (such as those laid out in TNFD) to measure and understand their dependencies and impacts. This provides reliable and verified information to investors, while also offering a competitive advantage.

Arcadis also found that many viewed the complexity of nature as the main barrier for assessing a business' dependencies, impacts and opportunities related to nature (especially considering the multiple components that make up nature). Yet there are established approaches for doing just that. Natural capital is the economic value that natural resources in a given area provide to society.[31] Tools such as Arcadis' Natural Capital Valuation can use this to provide quantitative and monetary information on the current (baseline) and evolving (business as usual scenario and sustainable scenario) state of nature and related risks and opportunities for nature, communities, businesses, and investors.[32] The true challenge may lie in the perception that measuring nature is overly complex.

[30] Groot et al (2024). SUSTAIN "Changing rules of the game – Reforming targets, regulations, and incentives to promote Nature Positive outcomes

[31] Capital Coalitions Natural Capital Protocol

[32] See here for more information on the Natural Capital Valuation.

Arcadis, supported a global infrastructure investor in assessing material sustainability topics including biodiversity risks across its portfolio, identifying opportunities to integrate Nature Positive practices that safeguard both assets and ecosystems. This strategic approach ensures investments are not only financially sound but also resilient to nature-related risks.[37]

Impact of finance priorities

The financial sector can and will play an important role in achieving Nature Positive. Focusing on just 40 countries representing 80% of the world's GDP, a UN report estimates that USD 7.4 trillion would need to be invested between now and 2030 to achieve nature-related SDGs.[33] In turn, this would generate an economic equivalent of USD 152 trillion, providing a strong long-term financial incentive. Beyond the bottom line, this investment alone would mean avoiding 4.5 million premature deaths through the provision of ecosystem services sustained by those investments. The potential that the finance community offers to Nature Positive is reflected in the UN Kunming-Montreal Global Biodiversity Framework', most notably target 19 to mobilize USD 200 billion/year for biodiversity from all sources, including USD 30 billion specifically through international finance.[34]

The investor community itself also faces nature-related risks, **with recent research demonstrating a positive correlation between biodiversity risk and stock price crashes**.[35] Conversely it is these risks, which are perhaps driving some of the action from the finance sector in committing to nature targets. In the Finance for Biodiversity Pledge, 177 financial institutions representing over 28 countries and over USD 24 trillion in assets have committed to protect and restore biodiversity through their finance activities and investments.[36]

There are still multiple barriers to unlocking this financing, many of which hope to be addressed in the 2024 CDB COP16 in Colombia. One of the challenges of closing the nature investment gap is the generally longer timescale at which nature increases or starts to deliver ecosystem services than expected for financial return. This is especially true in the case of restoration as actions work with an already compromised baseline. Increasingly, innovative financing incentives and mechanisms are being developed to address barriers, such as mechanisms where access to funding can only occur when nature related requirements are met or by mobilizing high integrity nature-based markets. Recent increases in publications from the finance community on the topic of biodiversity also indicate building consensus around action to be taken to address these risks.

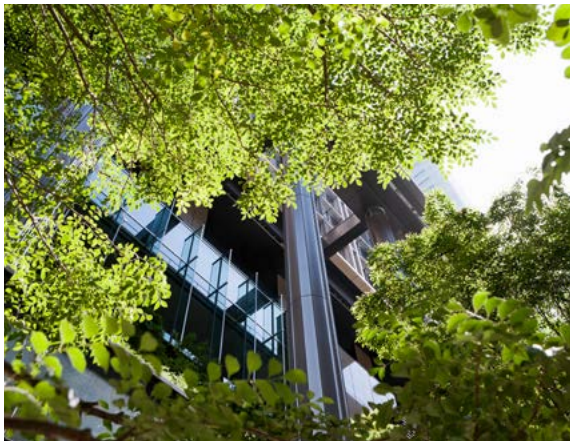
Communication missteps and potential reputational impact

Businesses face a tough time in finding the right balance when managing their reputation on environmental, social and governance (ESG) matters. There are the more obvious risks associated with inaction, where people and the environment are threatened or affected, with the consequent economic cost. Taking the wrong action carries its own risk. This is further complicated by the fact that miscommunication in either scenario can expose companies to even further risk.

The dangers of "greenwashing" are well-recognized, but there is growing concern about the emerging issue of "green hushing" - where businesses withhold information about their sustainability efforts and achievements out of fear of backlash. This will be particularly critical for sectors that have traditionally struggled with reputation but play a renewed role in society.

In the realm of public perception, there is value in transparency, and the voices of civil society, academia and non-governmental organizations (NGOs) play an important role in a sea of information. Constructive criticism remains an essential part of the dialogue and there is a growing need for earlier and more frequent engagement from all sides. In the UK, National Highways works with the Wildlife Trust to maintain and enhance biodiversity of the land surrounding network.[38]

To bolster a company's credibility in claiming contributions to nature-positive outcomes, demonstrable actions that show measurable positive impacts on nature are key.[39] Best practices involve using directly measured metrics of biodiversity, organized in an accounting system, to evidence these contributions, alongside metrics of pressures and responses. Where direct measurements of the state of nature are not feasible, companies should still strive to provide evidence linking their actions to positive impacts.



[33] GGKP (2024). Closing the Gap: Investing in natural capital to meet the SDGs.

[34] UNEP FI (2023) Aligning financial flows with the Kunming-Montreal Global Biodiversity Framework

[35] Liang et al (2024) The role of biodiversity risk in stock price crashes

[36] For more information on Finance for Biodiversity.

[37] Finance for Biodiversity (2023) Nature Target Setting Framework for Asset Managers and Asset Owners

[38] National Highways and The Wildlife Trusts announce biodiversity boost across England

[39] Arcadis, ICF, UNEP-WCMC, Capitals Coalition, WCMC Europe (2024) Exploring measurement solutions for Nature Positive Commitments from Businesses- a discussion paper from the Align project, Aligning accounting approaches for nature

Challenges & opportunities by sector

Drawing on research, Arcadis has identified nature-related challenges that vary depending on the specific sector or activity. This paper focuses on sectors and activities critical for enhancing quality of life for all, while working towards Nature Positive.

We have categorized these into three groups based on fundamental human needs:

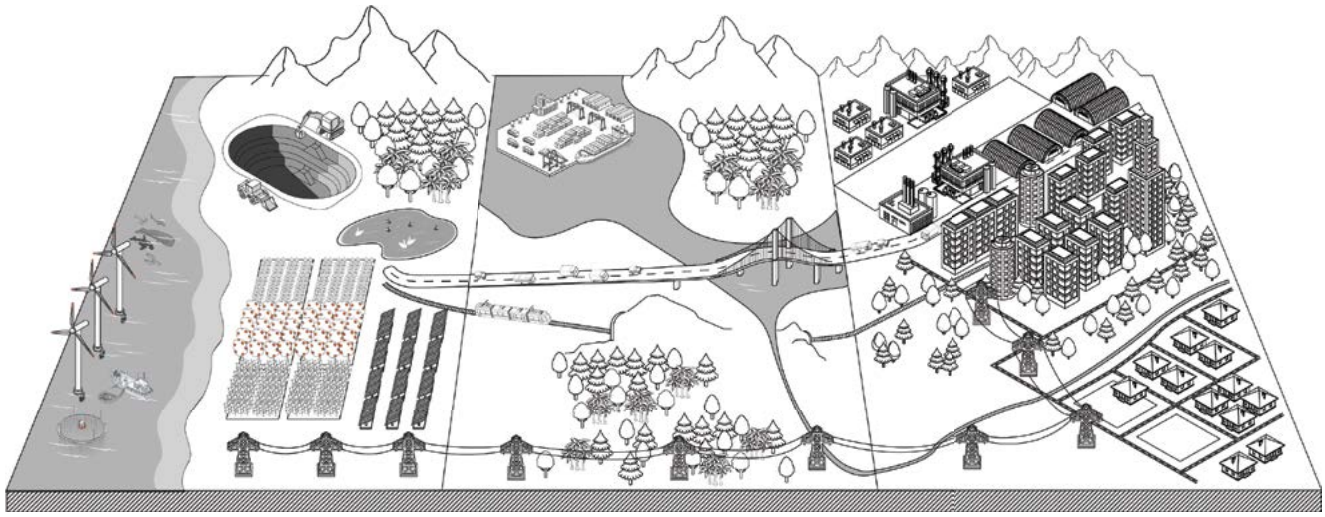
1 Organizations providing essential resources to feed, power, or build our society

2 Organizations offering critical infrastructure to move these resources and people

3 Organizations managing or operating urban environments where we live and work

Each group is defined by a core problem and its consequences on the environment, markets, and society. However, they are also comprised of pioneering organizations that are shifting their mindset and operations to contribute to Nature Positive. We go into each of these sector cluster-specific challenges and opportunities (*Figure* 3), and provide case studies that are illustrating steps towards Nature Positive.

Figure 3: Sectoral specific challenges and opportunities identified



Entities providing essential resources

Agriculture
Forestry
Fishing
Power Generation
Mining
Chemicals

From an **Extractive**
To a **Regenerative** mindset and way of sourcing

Entities offering critical infrastructure

Rail
Roads
Ports
Water
Power Transportation & Distribution
Internet

From an **Insertive**
To an **Integrative** mindset and way of deploying

Entities managing/operating urban environments

Municipal Services
Real Estate
Utilities
Health
Tourism
Manufacturing

From a **Preventive**
To a **Predictive** mindset and way of inhabiting

Entities providing essential resources to feed, power, or build our society.

Sectors involved: Agriculture, forestry, fisheries, power generation, mining and chemicals

CHALLENGE

Maintaining an extractive mindset and way of sourcing

With the world's population projected to reach a peak of 10.4 billion people[40] by century's end, resource consumption will rise significantly, putting further pressure on nature.[41] The way that resources are currently extracted from land and water lead, not only to ecosystem degradation but also, to exacerbating social conflicts and human rights abuses.

SECTOR SPECIFIC CHALLENGES:

- **Sourcing natural raw materials and food:** Agriculture, driven by the demand for food, feed, fibre and bioenergy is the leading driver of land-use change.[42] Currently established practices encouraging monoculture farming deplete ecosystems, increasing reliance on artificial inputs like pesticides and fertilizers, which further risks long-term sustainability.
- **Sourcing energy:** By 2050, global energy consumption is expected to rise by almost 50% in comparison to 2020[43] , with electricity demand up by 30% by 2030.[44] The energy transition, one of the biggest challenges of our era, requires vast land and sea for renewable energy infrastructure. This strains environmental resources and creates spatial conflicts. Additionally, the energy sector's value chain is responsible for 10% of global biodiversity loss,[45] and this pressure will only increase as more energy will be required for electric vehicles and digitalization.
- **Sourcing minerals and metals:** The mining industry is increasingly important for facilitating the energy transition required for decarbonization. Traditional, harmful extraction methods are evolving in tandem with rising regulatory and reputational pressures. Mining disturbs less than 0.1% of the world's land, but often requires large contiguous plots of land, much of it in ecologically and culturally sensitive areas. Infrastructure development in these regions need to be managed in a way that preserves both nature and local communities, protecting long-term environmental and social devaluation. Sustainable mining practices here are key.[46]

OPPORTUNITY

Adopting a regenerative mindset and way of sourcing

With a population that continues to grow, it is inevitable that we will need more energy, more food, more minerals. Relying on finite resources and degrading the ecosystems that provide the renewable ones is possible in the short-term, but in the long-term, this business model is unsustainable with society and nature already feeling the impacts. While the initial focus is on minimizing footprints, there is an opportunity to re-align to regenerative systems. *(Figure 4)*

SECTOR SPECIFIC OPPORTUNITIES:

- **Sourcing energy in a regenerative way**
  The initial focus for this sector is to minimize direct land-use change, by placing infrastructure in locations with minimal detrimental impact to nature. As the paradigm shifts to creating positive impact, there is an opportunity to use renewable energy generation for advance site regeneration and to create win-win scenarios. For example, agrivoltaics have demonstrated how agriculture and energy production are not mutually exclusive.[47] Similarly offshore wind foundation structures can create artificial reefs and reduce over-fishing – as trawling is limited in their proximity – aiming to benefit marine ecosystems. Specific opportunities also lie in redevelopment of existing infrastructure that has reached the end of its lifetime or has to be decommissioned.

  These sites can be redeveloped into nature-based solutions, such as the Centenary Riverside wetland Nature Park in the UK, where derelict steelworks now provide 1 in 100-year flood protection for an important economic development zone in Rotherham.[48]

[40] UN (2024), Population

[41] Rockström et al. (2023) Safe and just Earth system boundaries

[42] UN CCD (2024) Private Sector

[43] U.S. Energy Information Administration (2021). International Energy Outlook 2021.

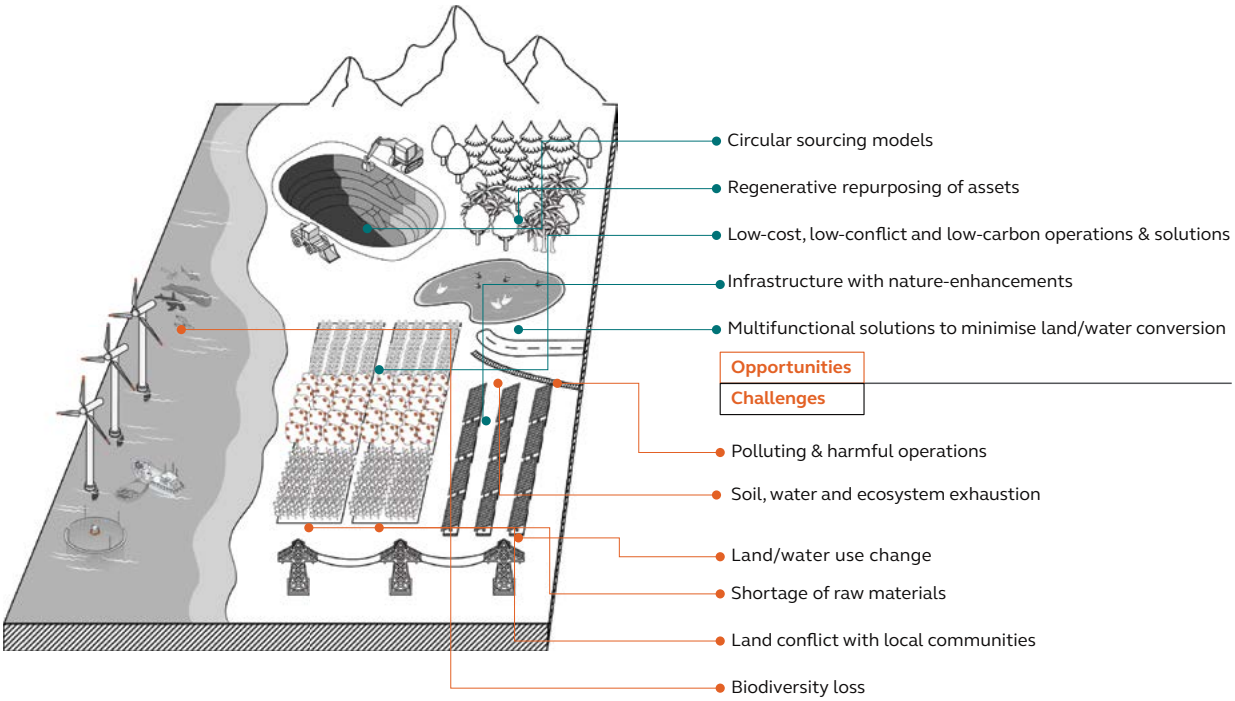
[44] EIA (2024) Electricity 2024 Executive Summary

[45] BCG (2021) The Biodiversity Crisis Is a Business Crisis

[46] ICMM Nature

[47] Elnaz et al (2019): Solar PV Power Potential is Greatest Over Croplands

Figure 4: Challenges and opportunities from entities sourcing key materials



In the Netherlands, Arcadis' Compressed Air Transport and Storage System, also known as eCats, is an application for energy storage that demonstrates how repurposing existing natural gas infrastructure not only reduces the need for new construction but also enables surplus renewable energy to be stored and reused efficiently. This circular approach helps meet growing energy demands while minimizing land use changes and reducing environmental impacts and the costs of decommissioning. Energy storage can also contribute to Nature Positive. LowCx3 (low carbon, low conflict, low cost) pumped storage hydropower uses reservoirs at varying elevations to store and generate electricity while enhancing aquatic and terrestrial habitats, and if implemented across the world, could reduce hydropower's impacts on free-flowing rivers by 90% - minimizing the need for additional wind and solar developments.[49] Some battery storage systems also integrate green infrastructure such as such as green roofs or walls, which provide habitats for various species, to reach biodiversity net gain in the UK.[50]

- **Sustainable mining: Sourcing critical minerals and metals in a regenerative way**
  The mining sector has made considerable progress in developing regenerative approaches driven by a strong need and opportunity to minimize its footprint - by redesigning and decarbonizing their operations, both for new openings and ongoing operation in existing sites when sourcing critical minerals. This can diminish disturbance of nature as well as the need for processing and transport of raw materials. Arcadis sees more companies adopting the International Council on Mining and Metals (ICMM) principles of environmental performance and conservation of biodiversity.[51]

  To contribute to a nature positive outcome, mining companies can focus on regenerative reclamation, which implies not only restoring the land to achieve biodiversity net gain, but also providing a positive impact for local communities. Transforming old quarries into conservation areas or urban parks, with local involvement, is an effective way to enhance the sector's reputation, like the project Arcadis did for Daye City in China.

  Innovative approaches, such as the Holcim Group's circular model, shift extraction from quarries to landfills by developing new products made from construction debris.[52] These practices not only have the potential to boost profitability and develop new revenue streams but also positively impact society and the environment, while decarbonizing mining operations. Furthermore, improving land management for both disturbed and undisturbed areas offer opportunities to enhance natural, social, and cultural values, potentially leading to new business models that benefit all stakeholders.

[48] IUCN (2021) Nature-based Solutions must be credible, measurable and inclusive

[49] WWF (2023): Connected and Flowing

[50] Renewable UK (2024): Harnessing Nature: How Biodiversity Net Gain Transforms Battery Energy Storage and Solar Planning Applications

[51] ICMM Guidance

[52] HOLCIM ECOcycle

CASE STUDY

Eneco Groep N.V. – Biodiversity Metric method to ensure nature-positivity for onshore assets

Eneco's ambition on biodiversity is that all its investment decisions on new renewables assets should have a net positive effect on biodiversity from 2025 onwards. Eneco wants to apply this for the construction, operational and decommissioning phases of new onshore renewable energy assets that have a material impact on biodiversity.

Arcadis has worked with Eneco to evaluate renewable energy projects using the United Kingdom's Department for Environment, Food and Rural Affairs. Evaluating projects via the Biodiversity Metric allows Eneco to assess solar, wind and heat projects proposed for development against nature restoration measures needed to achieve a net positive result for biodiversity.

With the use of this method, Eneco will go beyond legal compliance by investing in additional measures to achieve net positive. Nature recovery thereby is designed as packages integrated into a project and tailored to achieve habitat improvement for impacted species in such a way that a population increase of impacted species can be expected.

As a result of an expert dialogue facilitated by Arcadis in 2022, Eneco developed an internal Guidance, Monitoring Plan and Code of Conduct. By applying this approach, including the calculation of the cost of being biodiversity net positive, Eneco demonstrated its commitment to being a frontrunner in this field.

CASE STUDY

Designing with ecosystem services to improve treatment system efficiency for a chemical business in the US

Arcadis developed a reforestation project to restore a native tree canopy adjacent to our client's manufacturing facility located in the Southeast United States as part of a voluntary effort to enhance the site's treatment system and improve its ability to provide hydraulic control of impacted groundwater. Arcadis designed the tree cap to restore a forested canopy system with tree species native to the ecological region. Selection of native species for the design minimized the need for watering and other maintenance activities during establishment and facilitated restoration of a self-sustaining forested canopy requiring minimal long-term management. Furthermore, the use of native species helped improve biodiversity of flora and fauna on the site while avoiding the spread of invasive non-native species that are typically used in standard landscaping projects.

After four years of monitoring and implementing targeted corrective actions, the project reached an equilibrium state that fostered growth of a self-sustaining native forest canopy. The reforested area not only reduced contact of precipitation with the ground surface and increased evapotranspiration to improve treatment system efficiency but also established a diverse assemblage of native species increasing biodiversity and provisioning ecosystem services for the site. Within five years after discontinuing monitoring and adaptive management activities, aerial imagery indicated a fully developed canopy in the project area.

Entities offering critical infrastructure to move resources and people

Sectors involved:
Rail, Roads, Ports, Water, Power Transportation and Distribution, and Internet

CHALLENGE

Maintaining an insertive mindset and way of deploying

In a society that is growing in size and in connectivity, critical infrastructure to move resources and people faces growing demand. Although there are national specificities of how this infrastructure is delivered, business as usual tends to take an asset or project-based approach. The proposed infrastructure is inserted into land and seascapes as an additional overlay. Meanwhile, the value of this infrastructure is usually measured in terms of use and revenue, making it hard to demonstrate the value of additional benefits that a more regenerative approach could provide.(*Figure 5*)

SPECIFIC CHALLENGES:

- **Blocking habitat connectivity**
  It is not just connectivity of goods and people that are relevant to assess infrastructure projects; the connectivity of nature is often impacted by critical infrastructure. Fragmentation of landscapes caused by human activities such as linear transport infrastructure is the most prominent cause of reductions in habitat connectivity that is essential for healthy ecosystems.[53,54] Due to this artificial disconnection, animals crossing these linear assets create not only a hazard for road users but also result in biodiversity loss. For example, it is estimated that 194 million birds and 29 million mammals die on Europe's roads every year.[55]

  It isn't just the number that are killed by cars but the barriers to migration that large busy roads pose that are threatening species such as the mountain lion. Populations are hemmed in by highways leading to inbreeding, which the Centre for Biological Diversity says could cause the species to disappear within 15 years.[56]

  Other impacts include pollution from noise, light, vibration and chemicals, air and water quality degradation, the spread of invasive alien species and changes in hydrology and microclimate.[57]

  New regulatory frameworks in several countries in Europe and states of the US are establishing the requirements for ecosystem connectivity solutions. However, road and rail operators struggle to comply because they may not have the right technical capacity or sufficient funds to implement solutions.

- **Degrading and mis-managing land**
  Entities that operate large mobility infrastructure like roads, highways or rail tend to be large land tenants. For example, a transport department might operate over 50,000 miles of transport infrastructure and much of this might be in rural rather than urban areas. They own much more land than the ones their assets occupy however, to allow for road future expansion or new developments, or simply as a result of how land is sold in parcels. When acquiring land for new infrastructure projects, the owners are more willing to sell entire plots rather than portions.

  Those unused land plots are normally under-managed, leading to habitat degradation and ultimately to economic and natural capital value loss. The lack of maintenance, both on the assets and adjacent passive land, has several risks for their land tenants, like higher vulnerability to climate hazards such as flooding, or wildfires or damages caused by flora and fauna that directly affect their assets by and the security of their users. In the Netherlands, for example, beavers and badgers are burrowing into railway slopes creating soil displacement and damaging the rail, causing train delays and significant maintenance expenses.

[53] WBCSD (2023) WBCSD Roadmap to Nature Positive. Foundations for the built environment system

[54] Studies have found that roadkill was the most common cause of death in almost a third (28%) of 150 animal populations studied, ahead of causes like disease and hunting. In some animal populations, up to 80% of all deaths were due to collisions with vehicles. Moore, et al (2023), Demographic effects of road mortality on mammalian populations: a systematic review

[55] Grilo et al (2020) Roadkill risk and population vulnerability in European birds and mammals

[56] Center for Biological Diversity: Californian Mountain Lion

[57] IUCN (2023) Addressing ecological connectivity in the development of roads, railways and canals

OPPORTUNITY

Adopting an integrative mindset and way of deploying

Addressing the fragmentation and deterioration of our land requires implementing solutions that both adapt existing infrastructure and design new ones. These solutions must integrate more harmoniously with the environment and be easier to manage and maintain. This is primarily a systemic challenge with economic implications, requiring alignment among various stakeholders across sectors and the development of innovative business models to support these solutions. *(Figure 5)*

SPECIFIC SOLUTIONS:

- **Integrating permeable infrastructure solutions into the landscape**
  One opportunity for enhancing nature positivity in existing land transport infrastructure (LTI) is to restore permeability for biodiversity and reconnect fragmented ecosystems. Solutions like wildlife corridors - such as green bridges or underpasses - are effective but require new business models for funding and deployment due to their costs. A notable example is the Wallis Annenberg Wildlife Crossing at Liberty Canyon in California, which, upon completion in 2025, will be the world's largest fauna pass.[58] It is an example of successful public-private partnership funding and collaborative efforts that has leveraged the expertise and leadership of dozens of organizations and institutions spanning a 35-year initiative.[59]

In aquatic ecosystems, restorative solutions like the Marken Wadden islands worked on by Arcadis in the Netherlands - an artificial archipelago created from lakebed sand and clay - help balance disrupted habitats by providing fish, bird shelters, and ideal conditions for vegetation.

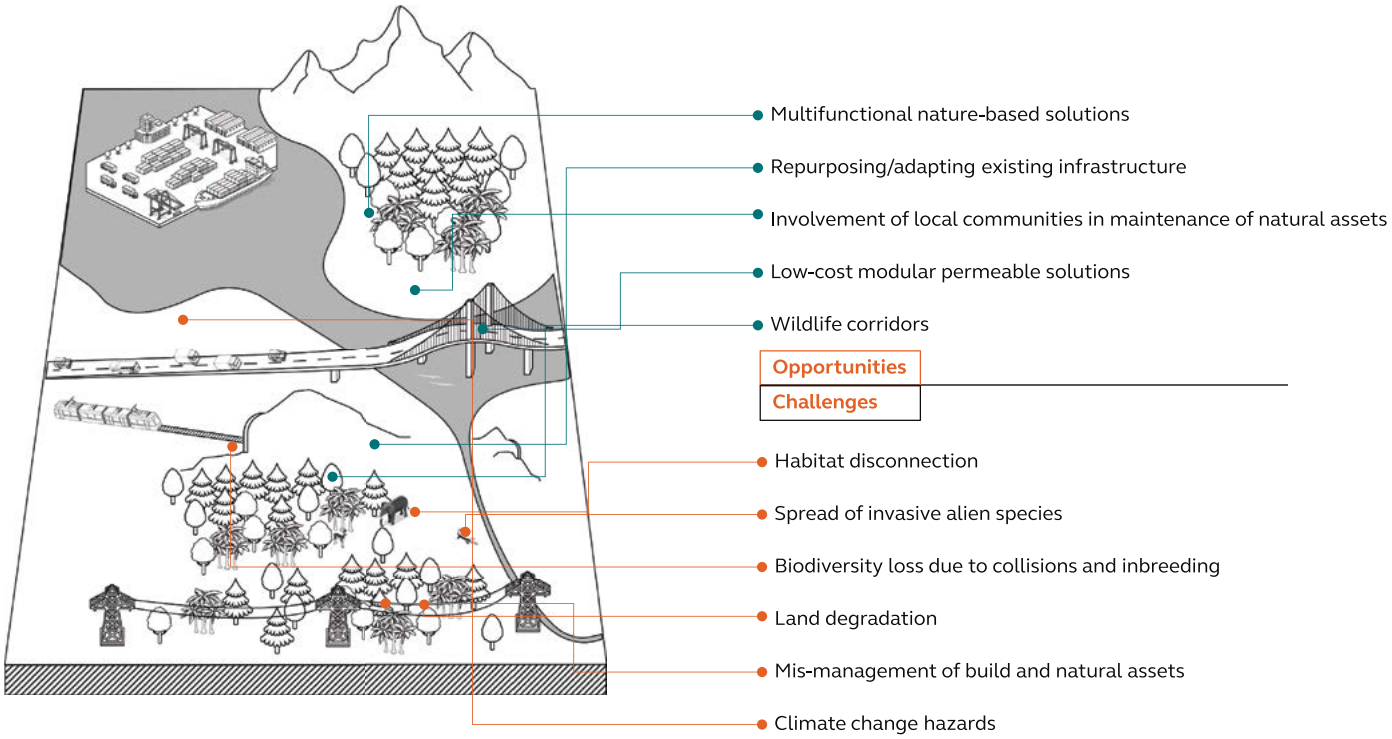
Another opportunity lies in designing new LTIs with an integrative, permeable approach. Ecologists and geologists play crucial roles in Architecture, Engineering, and Construction (AEC) companies, in understanding local ecosystems to inform engineers on the critical spots for ecosystem connectivity and possible climate hazards such as flooding, intense snow, wildfires or soil displacement. The Lower Thames Crossing in the UK exemplifies this approach by opting for a tunnel under the river rather than a bridge, balancing landscape value with environmental and social considerations.

These examples demonstrate that there is potential for innovation in developing new low-cost modular solutions that can be scaled and adapted to meet various ecosystem needs.

[58] National Wildlife Federation, Wildlife Corridors

[59] Santa Monica Mountains Conservancy

Figure 5: Challenges and opportunities from entities sourcing key materials



- **Integrating ecosystem services as part of the maintenance & management operations**
  An opportunity lies in how we can improve the maintenance and management of existing critical infrastructure and adjacent land from a nature-positive approach, to reduce the associated risks and costs. Arcadis, in response to the problem of beaver and badger damage on railway tracks in the Netherlands, has developed artificial burrows that are integrated into the track embankments and allow these species to continue to live in adjacent habitats without compromising the railway infrastructure. Another opportunity is related to how new infrastructure can be designed for low-maintenance and nature-positivity. Arcadis supported the road authority in the Netherlands in the planning of new roads to combat the spread of invasive species while simultaneously establishing natural corridors for local fauna. Cost-effective and low-maintenance infrastructure can be deployed with the use of nature-based solutions such as planting diverse flora across the roadsides to improve fire resistance (e.g. using local, humid plants that dry less and reduce the speed of expanding fire) or use their roots for soil fixation and slope stabilization for roads and dykes.

These green solutions require a different maintenance and management strategy than grey infrastructure; they tend to be more labor intensive[60] and thus open the potential to involve local communities in the task, thereby creating new job opportunities and leveraging community interest to preserve nature where they live and work. National Highways in the UK partners with Wildlife Trusts and local farmers and landowners to maintain land used for offsetting projects and other nature restorations.[61]

Integrating ecosystem services as part of the maintenance and management operations can also create new revenue streams for communities and boost local wealth when designed from the start in the business model. Arcadis participated in a project in Nepal where the slope stabilization of a road was designed with a bamboo forest that was harvested and maintained by the local communities, drastically reducing the maintenance costs. Engaging all stakeholders during the early design phase is crucial for these multifunctional society- and nature-positive solutions.

[60] WRI (2021) The Green Jobs Advantage: How Climate Friendly Investments are better Job Creators

[61] National Highways and The Wildlife Trusts announce biodiversity boost across England

CASE STUDY

Lower Thames Crossing (National Highways)

Arcadis worked with National Highways, delivery partners and stakeholders to produce a Green Infrastructure Study. This informed the design for habitat creation for the Lower Thames Crossing through identification of opportunities to link into, while supporting existing 'green' initiatives and projects along the length of the route. The project developed a landscape-scale approach to the planting proposals to connect new habitats into the wider landscape and join up fragmented woodland habitats. This follows the Lawton Principle, i.e. 'bigger, better, more joined up', by increasing habitat connectivity and providing greater resilience for both habitats and species. As well as extensive areas of planting as part of two new landscaped public parks - Chalk Park near Gravesend and Tilbury Fields in Thurrock, the project will plant over one million extra trees, 12 miles of additional species-rich hedgerows and seven new green bridges to allow people and wildlife to safely cross the route. High levels of invertebrate biodiversity informed proposals to use reclaimed materials such as chalk, sand and gravels, to mimic areas of brownfield habitat, and the provision of large areas of wetland habitat, wildlife ponds and new sections of watercourses that will support both wildlife and climate resilience.

CASE STUDY

Marker Wadden Islands

The Marker Wadden project is a groundbreaking initiative aimed at revitalizing the ecologically impoverished Lake Markermeer in the Netherlands. This ambitious project involved the creation of 1000 hectares of new land along five islands using 30M m3 of sand, clay, and fine sediment, transforming the lake into a dynamic area rich in animal and plant life.

Arcadis and Boskalis played pivotal roles in this work for Rijkswaterstaat and NatuurMonumenten. Arcadis contributed its expertise in designing and constructing the islands, ensuring they would not be eroded by wind or water. Boskalis, a leader in construction, dredging, and marine services, implemented innovative techniques to build the islands, including the use of fine sediment contained by ring dikes of sand.

The positive impact of the Marker Wadden project is significant. The newly created islands serve as a nature reserve where vegetation can grow, fish can spawn, and birds and other wildlife can flourish. This transformation has enhanced biodiversity and provided a sustainable future for the lake, benefiting both nature and society. The project stands as one of the largest ecosystem restoration efforts in Western Europe, showcasing the potential of collaborative environmental engineering

Entities managing or operating urban environments where we live

Sectors involved:
Municipal Services, Real Estate, Utilities, Health, Tourism, and Manufacturing

CHALLENGE

Maintaining a preventive mindset and way of habitation

Construction of cities can in general be characterized by the dominance of concrete, grey, solid structures. This intrusive paradigm is the foundation of the land and sea use change that severely impacted preexisting natural resources. Preventing nature from intruding into our well-planned orthogonal cities, or only letting it do so in a highly controlled manner, has disrupted ecosystem services. In seeking to reduce the risk of natural hazards (storm damage, wildlife conflict, flooding, etc.), often the natural services provided by these habitats are kept out as well (e.g., green spaces providing temperature regulation). Ultimately this mindset contributes to damaging the ecosystem services that humanity relies upon.

Public and private entities in large urban areas are now grappling with finding effective and affordable preventative solutions whether green or grey in their design, in replacement of those that have historically disrupted natural cycles and ecosystem services. Sustainable energy systems, new building design, retrofit, and low-emission transportation all represent powerful tools for urban sustainability. Integration with nature will also be required to avoid negative impact.*(Figure 6)*

SPECIFIC CHALLENGES:

- **Urban pollution**
  Air, water, light and noise pollution, along with waste management issues, poses significant challenges to city operations, the health and wellbeing of citizens, and the adjacent ecosystems.

  These pollution and waste issues not only degrade the quality of life for urban residents but also incur substantial economic costs for healthcare, environmental cleanup, and infrastructure maintenance. For instance, the social costs of the health impact of outdoor air pollution in Organisation for Economic Co-operation and Development (OECD) member countries, China, and India were approximately USD 1.7 trillion and USD 1.9 trillion, respectively, in 2010.[62]

- **Climate change**
  Climate change impacts exacerbate these urban challenges, introducing hazards such as flooding, soil erosion, displacement, wildfires, and the urban heat island effect. Flooding, worsened by poor drainage and impervious surfaces, leads to property damage, displaces residents, and raises the risk of waterborne diseases. Extreme weather, climate and water-related events caused 11,778 reported disasters globally between 1970 and 2021, with just over 2 million deaths and USD 4.3 trillion in economic losses - 39% of which occurred in the USA.[63]

  Soil erosion and displacement undermines the stability of buildings and infrastructure, while wildfires, driven by rising temperatures and prolonged droughts, threaten urban fringes, leading to loss of life, property, and biodiversity. The urban heat island effect exacerbates heatwaves, increases energy consumption for cooling, and heightens the risk of heat-related illnesses. These climate change hazards necessitate proactive measures to enhance urban resilience and protect vulnerable populations.

- **Urban living**
  Urban areas face a range of societal challenges, such as space limitations, a need for increased community involvement, and the mental health impacts of a lifestyle often removed from nature. These spacial constraints hinder the development of green spaces and affordable housing, exacerbating social inequalities and reducing residents' access to nature. The urban lifestyle, with its detachment from nature, has been liked to numerous mental health issues like anxiety and depression.[64] Reconnecting residents with nature through green spaces, community gardens, and nature-based solutions can help alleviate these mental health challenges, while also fostering wellbeing and community cohesion.

[62] Dechezleprêtre, et al (2019), The economic cost of air pollution: Evidence from Europe

[63] WMO (2023) Economic costs of weather-related disasters soars but early warnings save lives

[64] Sundquist et al (2024). "Urbanisation and Incidence of Psychosis and Depression: Follow-up Study of 4.4 Million Women and Men in Sweden.

OPPORTUNITY

Adopting a predictive mindset and way of habitation

Enhancing and restoring pre-existing natural ecosystems in urban environments is essential to bring back effective ecosystem services and to maintaining just and safe urban spaces. The Arcadis 2024 Sustainable Cities Index re-affirmed the previous observation that the planet pillar of sustainability (focusing on environmental factors) correlates strongly with overall success of a city.[65] This predictive approach assumes the need to keep dealing with the above-mentioned urban challenges in the future, by allowing nature to be part of the solution and not viewed as a constraint or the problem.

As space is limited in cities, multifunctional solutions should be conceived that address multiple problems and provide benefits both for society and the environment Therefore Nature-based Solutions are ideal for the urban environment, especially for climate resilience. The Arcadis white paper, Nature-based Solutions for Climate Adaptation, specifically explores the different ways working with urban ecosystems can benefit cities.[66]

This section outlines the various advantages of enhancing natural elements to tackle the previously mentioned challenges within urban settings.(*Figure 6*)

SPECIFIC SOLUTIONS:

- **Green infrastructure**
  Allowing space for vegetation in the urban environment has several benefits. It is estimated that each hectare of urban green area provides a range of between USD 2,800 and USD 18,500 of benefits every year in terms of carbon storage, stormwater reduction and pollution removal.[67] Vegetation works also as an effective attenuator of air pollutants.[68] Green barriers, such as hedges and tree belts, are effective in reducing traffic noise.[69] Urban greening can also significantly mitigate urban heat island intensity resulting in the decrease of air temperature up to 4 °C.[70] The presence of urban greenery also has a positive effect on the mental health and wellbeing on the population[71] ultimately making cities a healthier place to live and work.

  Vegetation is also key for the existence of fauna and pest control. Birds and bats can significantly reduce the number of pests in urban gardens and parks, thereby reducing the need for chemical pesticides to manage invasive species or species that could be a threat for human health.

  When integrating vegetation and fauna in urban planning, co-benefits of natural systems are brought to the doors and windows of citizens' houses. While for full nature-based solutions, this integration has to be at sufficient scale (such as a network of green corridors across an urban area), contributions to Nature Positive can also be made at a site-specific level such as through green walls and roofs on buildings. In the Dutch City of Delft, the Urban Woods apartment complex is being built with a wooden core, which drastically reduces the building's embodied carbon (it will start its lifecycle with negative carbon emissions).[72] The design also results in a 60% reduction in water usage, a benefit to the surrounding biodiversity and promotes social cohesion. Technology is a key enabler here for green infrastructure; for example, by digitizing curb side regulations, the Arcadis CurbIQ solution helps cities better understand how their curbs are working today and gives them modern tools to improve operations in the future.[73]

  Urban forests have received special attention in recent years as they also contribute to global goals such as the Bonn Challenge, aiming to restore 350 million hectares of degraded/ deforested landscapes into restoration by 2030. For example, to address the increasing risk of heat stress, the Paris City Council decided to

[65] The Arcadis Sustainable Cities Index 2024

[66] Arcadis (2023) Nature based Solutions for Climate Adaptation

[67] Elmqvist, et al., 2015: Benefits of restoring ecosystem services in urban areas

[68] Vashist et al (2024). A comprehensive review of urban vegetation as a Nature-based Solution for sustainable management of particulate matter in ambient air.

[69] Abdolali et al (2022) Wave Attenuation by Vegetation: Model Implementation and Validation Study

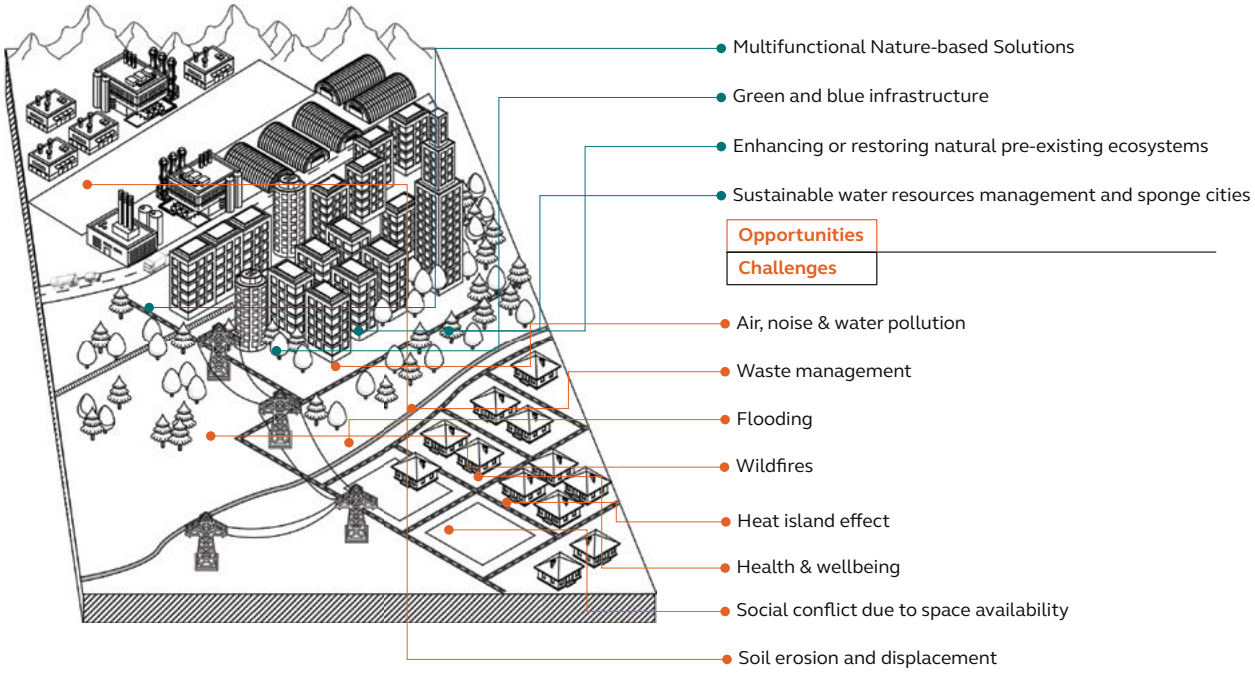
[70] Aflaki et al (2017) Urban heat island mitigation strategies: a state-of-the-art review on Kuala Lumpur, Singapore and Hong Kong

[71] Witney Fleming et al (2024), The nature gaze: Eye-tracking experiment reveals well-being benefits derived from directing visual attention towards elements of nature

[72] Wonderwoods

[73] Curb IQ

Figure 6: Challenges and opportunities from entities managing/operating in the urban environment



create five urban forests, transforming 100 hectares of asphalt to be transformed into forests by 2026.[74] A common challenge faced by urban forests is adapting the ground to accommodate larger trees which require a greater depth of soil. Redeveloping parts of the first floor of underground car parks allowed over 2500 m^2 of frees to be planted. Arcadis' support in providing scenario analyses, including the carbon footprint of any work required, allowed the plans to prioritize the re-use of some of the demolition materials. Beyond mitigating the effects of global warming and boosting land biodiversity, this project sets a new benchmark for decarbonization in urban environments, keeping citizens at the heart of the solution.

- **Sustainable water resources management**
  Water is essential for survival and prosperity but can cause significant damage in the urban environment if poorly managed. Sponge cities offer a solution by using permeable pavements and floodable spaces to absorb, store, and release rainwater, preventing flooding during storms while preserving water for future use. Wuhan, one of China's pioneering cities in the "Sponge City" program, exemplifies this approach. By 2020, the city had transformed 20% of its urban area into a sponge zones, enabling it to manage nearly 70% of stormwater and store enough water to fill 150 standard Olympic-sized swimming pools during peak rainfall events. This significantly reduced the city's reliance on traditional stormwater systems and mitigated urban flooding.[75]

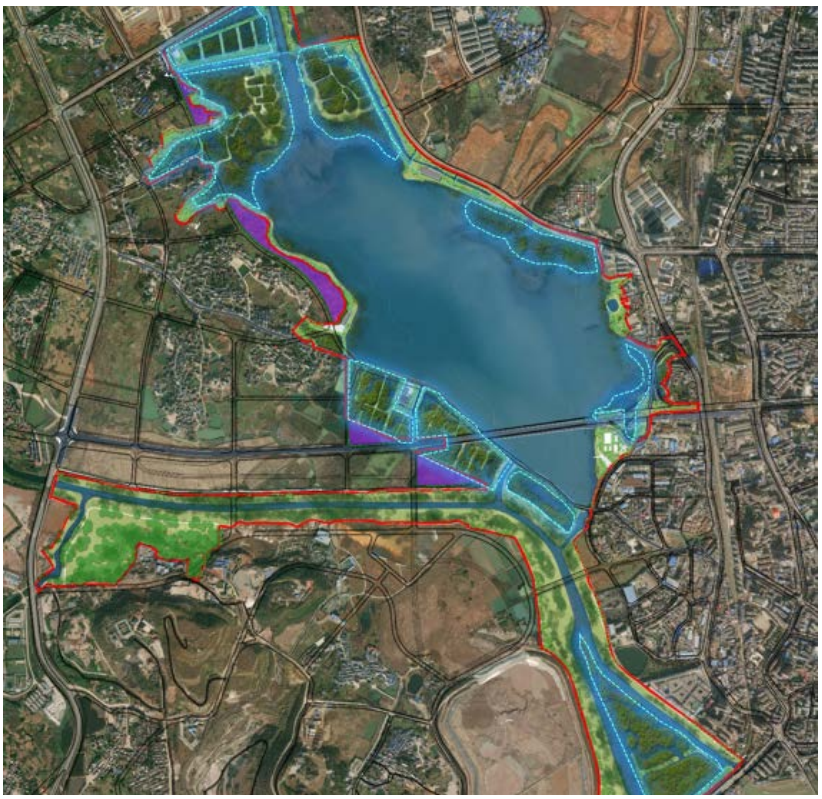
Some nature-based solutions also deliver on water security as well as multiple other benefits. The East Kolkata Wetlands in India provide a cheap, efficient and eco-friendly system of solid waste and sewer treatment system for the city of Kolkata, habitat for waterfowl and home for a large number of flora and fauna.[76] This wetland can process almost 750M liters of wastewater and sewage produced by the region's population every day and clean it in less than 20 days.[77] The Kolkata Wetlands also nurture the world's largest wastewater fed aqua culture system providing food provisions services.

[74] Urban forests of Paris

[75] Arcadis: Reaping the benefits of enhanced urban resiliency

[76] East Kolkata Wetlands

[77] The Guardian (2016): The miracle of Kolkata's wetlands – and one man's struggle to save them



CASE STUDY

London Strategic Sustainable drainage systems (SuDS) Pilot Project

Flood risk management authorities in London faced challenges in justifying investment in SuDS due to difficulties in demonstrating financial benefits. To address this, Arcadis partnered with Thames Water, the Environment Agency, Transport for London, and London Borough Councils to assess the natural capital value of SuDS. By calculating the financial worth of benefits such as flood risk reduction and environmental improvements, the team demonstrated the strong return on investment for SuDS. Hydraulic models and scenario-based planning showed how strategic placement could further enhance these benefits. This natural capital valuation helped secure over USD 1 million for SuDS retrofits and led to the project winning the EA Flood & Coast Excellence Award 2021 for Surface Water Management.

CASE STUDY

Urban Planning for Daye City

The Ecological Restoration of Mines and Wetlands in Daye City, Hubei, China is a landmark project designed to restore the city's natural environment while promoting biodiversity and sustainable urban development. Daye, historically known for its mining industry, has suffered significant ecological damage due to extensive mining activities. The project aims to secure an over USD 110 million loan from the French Development Agency to remediate polluted mine sites, restore wetlands, forests, and watersheds, and create a green belt around the city's lake. This initiative will transform Daye into a healthier, more vibrant city while fostering urban biodiversity.

Led by a collaboration between Arcadis experts from France, China, and Belgium, alongside local stakeholders, the project will implement nature-based solutions to rehabilitate degraded landscapes and towards sustainable mining practices. Restoration of wetlands and watersheds will enhance biodiversity, improve water quality, and strengthen climate resilience. The creation of green spaces and public areas will not only offer ecological benefits but also improve the quality of life for residents by creating recreational spaces and cleaner environments.

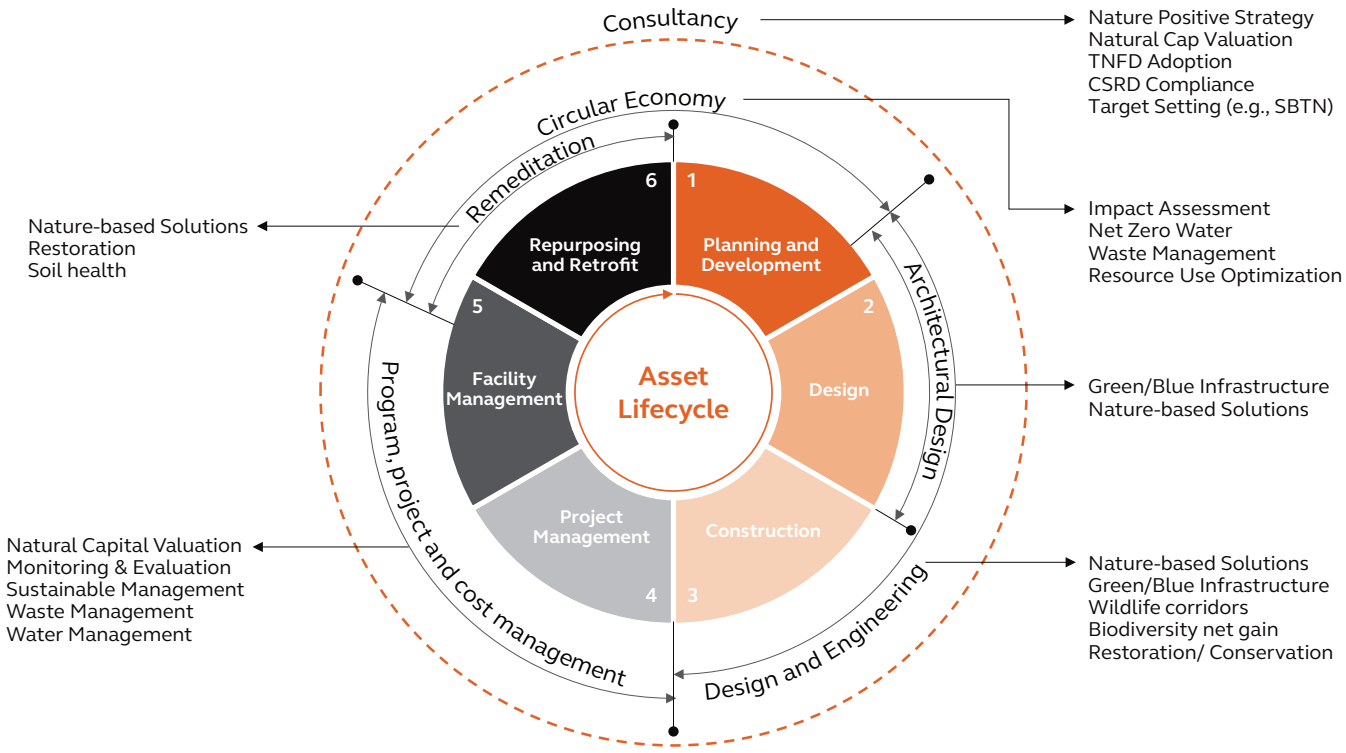
In addition to ecological restoration, the project aims to preserve Daye's industrial heritage, blending its historical identity with a greener future. This initiative serves as a model for other industrial regions transitioning to nature positivity, demonstrating how urban biodiversity and sustainable development can coexist.

Proven Pioneers: our expertise in action

It is now more urgent than ever for solutions to contribute to a nature positive transition

The path towards Nature Positive is complex, but the solutions required for the journey are ready to be deployed across asset lifecycles (*Figure* 7). It is clear that actions that contribute to Nature Positive can simultaneously provide long-term, sustainable answers to our global needs. Arcadis has been partnering on the most transformative projects of our time, across sectors and regions, to realize the benefits and value of working with nature. Recognizing that there is no one-size-fits-all solution, our experts focus on delivering client and ecosystem tailored solutions across the asset management cycle – from strategy and planning, through to implementation and delivery. In this section, we explore a few of these considerations.

Figure 7: Arcadis solutions across asset lifecycle



Assessing impact: Taking a whole of life approach to inform decision-making

The narrow boundaries of where to measure impact on nature open up the risk of problem shifting (also referred to as maladaptation[78]). Doing good in one area could shift harmful impacts to another, even creating greater degradation of nature. Similarly, to the trend of taking a 'whole of life carbon' approach, global frameworks are starting to expand the definition of measuring nature impact to the full supply chain. For example, altering land use of the site of a new wind farm might greatly differ in the change of impact that can be made by using different materials in the construction of the farm.

CASE STUDY

Natural Capital Valuation for The European Bank for Reconstruction and Development (EBRD)

Under the aegis of The European Bank for Reconstruction and Development (EBRD), Arcadis and IDEEA Group developed the Natural Capital Valuation (NCV) model to provide stakeholders with the means to include financing and nature conservancy in decisions. The model identifies and values nature-related risks at a landscape scale, to identify and prioritize nature positive investments and assess/improve a project's nature performance.

Committing to Nature Positive: Integrating nature into business strategy

A nature strategy is an essential step for companies. While it is currently optional in disclosure frameworks such as CSRD, there are advantages to planning for Nature Positive alignment. Without an overarching and evidence informed strategy, businesses may risk smaller positive actions not realizing their full potential and potentially putting themselves at risk of being unprepared for future mandatory disclosures. A key aspect is also the alignment between Nature Positive and net zero carbon and water strategies, especially considering the overlap of the nature-climate nexus.

CASE STUDY

Bringing soil health into a nature strategy for a food sector business

Arcadis is providing methodological and strategic support for a multinational client in the food sector's nature strategy. This included a methodology to assess risks related to soil health in the main sourcing landscapes which informed action plans for priority landscapes focused on regenerative practices. A TNFD risk workshop involving local agronomists and board-level members also contributed to corporate strategy recommendations, including key business insights and next steps, presented at the board level. Further nature strategy-related risk assessments and recommendations, such as for water and biodiversity, will be developed in the subsequent phases.

Transforming systems: Advising, designing and managing nature and assets with sustainability in mind

It is not enough for businesses to assess their nature impacts and commit to a path to Nature Positive. To achieve Nature Positive, ecosystems need to be conserved, restored and sustainably managed. These on-the-ground (or under-the-water) actions should focus on triggering longer term changes in businesses and policy. For example, new standards for sustainable materials may be developed if the design of larger projects dictates the usage of these innovative materials. Nature-based Solutions are an often overlooked yet vital opportunity to optimize contributions to Nature Positive. And where a fully-fledged nature-based solution cannot yet be realized, green-blue infrastructure can provide an essential stepping stone, especially when implemented in an urban planning approach.

[78] United Nations Human Settlements Programme. Nature Based Solutions to Build Climate Resilience in Informal Areas.

CASE STUDY

Design and planning for a nature-inclusive residential area in Barneveld, The Netherlands

Photo Republic/ Marco de Swart

In the centre of The Netherlands, the municipality of Barneveld looked at turning agricultural fields into a new residential area called 'Bloemendal'. Surrounded by nature, the municipality also wanted Bloemendal to become a sustainable and nature-inclusive residential area with high biodiversity. Since 2020, Arcadis' ecologists worked with the municipality to develop, implement and monitor nature positive solutions, to make Bloemendal unique and eco-friendly. In seven phases, around 1,600 houses will be built by 2030 in a way to bring people and nature together.

In Bloemendal's first phase, existing natural elements such as older trees and a stream have been incorporated. Dry riverbeds and ponds were created to collect rainwater, to combat floodings and drought. A variety of native and insect-friendly trees along the new infrastructure and a mixture of wildflowers and herbs attract insects and other wildlife, including protected species of birds and bats. To accommodate them, houses incorporate nestboxes tailored for these species. And to prevent wildlife incidents, eco-passages were created to provide safe passage underneath roads for small mammals like martens. Arcadis continues to support the municipality in the development of the coming phases to create inspiring nature positive solutions for all.

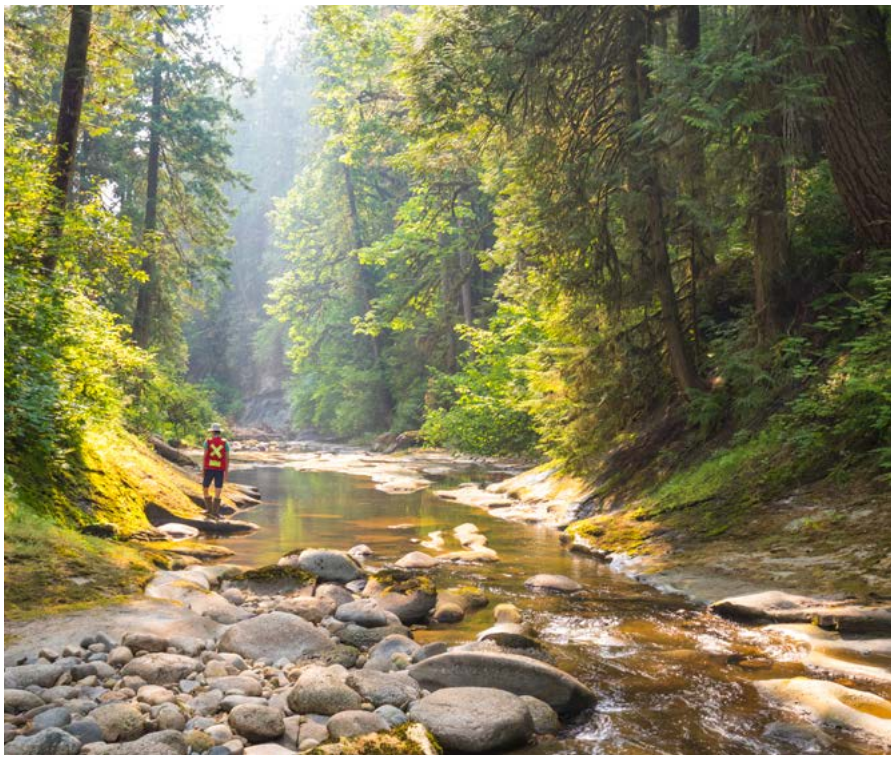
Disclosing the journey: Setting targets and communicating nature results in alignment with global standards

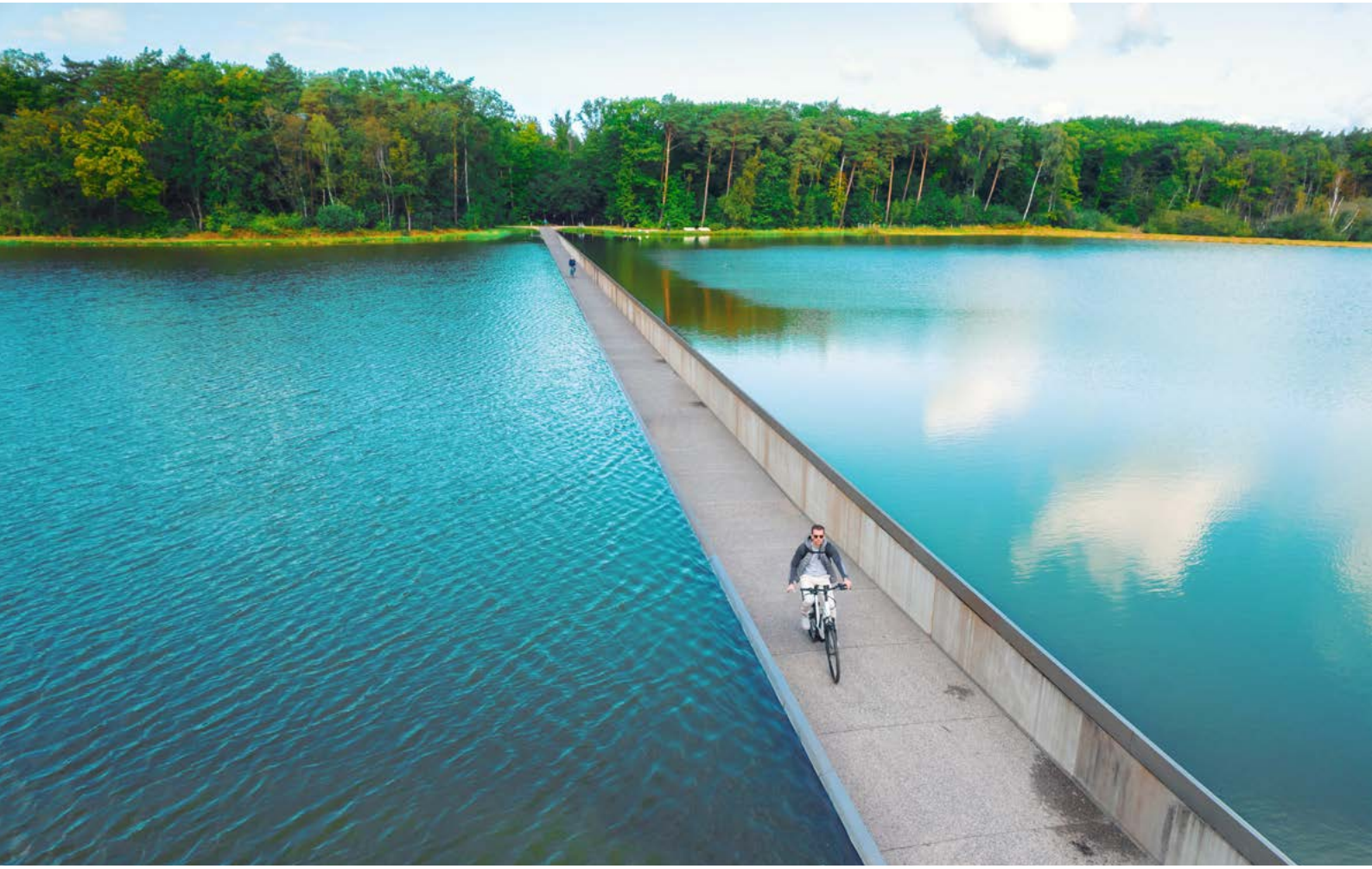
Whether a business is just starting to assess its impact on nature or is already implementing solutions, there are increasing expectations from regulators, customers and investors for each step along the Nature Positive journey to be disclosed. This is a challenging feat with the complex network of nature-related disclosure frameworks and regulatory requirements not yet fully aligned. These global frameworks currently set the standard on what is expected from businesses in terms of Nature Positive contributions, ensuring that the best intentions do not run awry.

CASE STUDY

Analysing business readiness for TNFD disclosure

WBCSD is a membership organization made up of 230+ businesses committed to driving society towards a net-zero, nature-positive, just future for everyone. Arcadis analyzed the readiness of these members and showed that despite the membership being advanced compared to the market norm, there were still sector-specific challenges from the TNFD framework. Feedback was provided to TNFD, asking for further guidance on methodologies such as measuring land, freshwater and ocean use change, invasive alien species and the state of nature. For instance, the analysis identified a specific gap in businesses assessment of plastic pollution materiality.





A promising path forward

The path forward to switch from harming nature to working with nature, and the potential benefits of doing so are clear and more urgent than ever. We stand at a transformative moment where businesses, governments, and communities must work together to reverse biodiversity loss and restore ecosystems on a global scale. Achieving this will require both bold commitments and immediate, decisive actions.

Integrating nature into core business models can help companies not only mitigate risks, but also unlock new advantages for growth and resilience. These efforts must span across sectors, leveraging innovative technologies and data-driven insights to deliver sustainable solutions that benefit both the environment and society.

Arcadis is uniquely positioned to guide and partner with organizations on this journey – from strategy through to implementation of Nature Positive approaches and solutions. Our multidisciplinary teams are ready to support businesses in assessing impacts, committing to regenerative practices, transforming systems through innovative design, and disclosing progress transparently. We have the solutions and expertise - what's needed now is the resolve to act.

Acknowledgement

About Arcadis

Arcadis is a leading global sustainable transformation partner. Proven pioneers for a sustainable future, partnering on the most transformative projects of our time. We deliver intelligent products and solutions to the challenges of climate change, energy affordability and livable cities. From reducing flood risks in the Netherlands to revolutionizing urban transit in Sydney, our world-changing work leaves a positive and lasting impact. We are 36,000 people, active in more than 30 countries. We support UN-Habitat with knowledge and expertise to improve the quality of life in rapidly growing cities around the world.

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Arcadis. Improving quality of life