LOMBARD ODIER
INVESTMENT MANAGERS

Biodiversity investment case study

Innovative urbanisation

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Biodiversity is essential to economic output and planetary stability. In the circular bioeconomy, which exists in balance with nature, we have identified an investment universe of more than 500 companies globally with over USD 5 trillion in market capitalisation.[1] It currently supports up to 6-7% of economic activity but has the potential to underpin 30%.

In this case study, we discuss the benefits of managing healthy ecosystems and integrating green projects that support biodiversity in urban areas. We assess commercial solutions – such as analytical services, engineering and environmental remediation – that address the intensifying demand for integration of ecosystems in our urban environments to create more habitats, and develop innovative urbanisation that decontaminates, restores and protects ecosystems within cities, safeguarding biodiversity and the benefits it delivers to society and the economy.

Innovative urbanisation forms one of the 12 sub-themes in our Circular Economy strategy.

FIG. 1 FOUR THEMES FIT FOR INVESTMENT

The circular bioeconomy
Biomaterials | Paper packaging | Water treatment

Resource efficiency
Better design | Better materials | Better processes

The outcome-oriented economy
Sharing and repair | Resale and off-price retail | Designed for longevity

Zero waste
Food waste reduction | Innovative urbanisation | Waste management & recycling

Source: LOIM. For illustrative purposes only.

[1] Source: LOIM as at January 2023.

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URBANISATION: A SUSTAINABILITY CHALLENGE

Modern cities have expanded at the expense of nature, claiming green spaces, disrupting and polluting ecosystems, and driving biodiversity loss. With space at a premium and the value of nature widely recognised, this damage must be reversed so that biodiversity preservation is embedded in current and new urban projects, and contaminated sites are remediated.

The expanding urban world. By 2050, the global population is projected to increase to about 9.8 billion people, with cities accommodating 6.7 billion, or two-thirds of the total.[2] Cities bring many benefits to society and the economy: trade and innovation, skills and ideas exchange, and cultural enrichment. But among their drawbacks is the destruction and fragmentation of natural habitats often resulting from urbanisation, which is a major cause of biodiversity loss.[3]

For instance, the number of different species in an ecological community, landscape or region is typically 50% lower in cities than in intact natural habitats.[4] As cities and urban areas consume space and resources and generate pollution, the displacement or termination of biodiversity disrupts broader ecosystem services – from pollination, water purification and pest control to nutrient cycling and air cleansing – that society and the economy depend on.

New model needed. If cities grow at a similar speed as in recent decades, they could consume 290,000 km^2, an area larger than New Zealand, by 2030.[5] Urban expansion is likely to affect more than 25% of all endangered or critically endangered species in sites monitored by the Alliance for Zero Extinction, either directly or indirectly, by 2030.[6]

Many cities have developed over centuries without an understanding of their environmental impact. As knowledge accrues, more cities – ancient and new – are working with nature. From Singapore's Gardens by the Bay to Nottingham's regeneration of an empty shopping centre into woodlands, wetlands and wildflowers, and New York's 1.5-mile-long High Line gardens, nature and its biodiversity are being embraced by citydwellers. China's sponge cities, featuring parks and ponds that can absorb intense rainfall and recharge groundwater, are further examples of green infrastructure enabling cities to become more resilient to extreme weather and support biodiversity. Policymakers and companies are responding, seeking the expertise needed to make nature a force in the concrete jungle.

Contamination correlation. Industrialisation, which is closely linked with accelerating urbanisation, has not only claimed green spaces: industrial processes and accidents, and poor waste management, are major causes of soil pollution worldwide. In the European Union, the main contaminants that have escaped due to industrial activity are mineral oils, solvents, trace elements – including arsenic, cadmium, lead, nickel and zinc – and chemicals including polychlorinated biphenyls and perf- and polyfluoroalkyl substances. Across the bloc, there are about 2.8 million sites of suspected pollution, with 60% of polluted sites in Switzerland associated with industrial areas.[7] In the US, the Environmental Protection Agency oversees more than 1.3 million facilities to prevent contaminants being released into communities – and this total does not include legacy sites of pollution.[8] In Canada, there are 23,663 known and suspected contaminated sites.[9]

With greater understanding about the propensity of contaminants to bioaccumulate in plants and animals before spreading throughout food chains – causing extensive harm to ecosystems and their biodiversity – remediating polluted areas becomes more urgent. The potential for these sites to be reclaimed for urban-regeneration projects supporting both the needs of cities and nature is clear to many planning authorities.

Sponges needed. By reshaping natural landscapes, urban areas disrupt the quality, quantity and flow of water available to ecosystems. Where rainfall once seeped into the ground or became runoff to streams and rivers, impervious surfaces like buildings, streets and footpaths instead channel water into storm drains and sewerage systems. This diminishes groundwater, exposing soils and aquatic ecosystems in times of drought, and causes concentrated flows that can damage habitats and flood cities during heavy rainfall.[10] Also, nitrogen and phosphorus accumulate on hard surfaces instead of being cycled through soil and are ultimately carried by urban runoff into aquatic ecosystems, leading to nutrient loading.[11]

[2] Ritchie, H. and Roser, M. Urbanisation - Our World in Data. Accessed December 2022.

[3] Vricella, C. Effect of urbanisation on biodiversity. Published by State University of New York, 2017.

[4] McDonald, R. What we know (and don't know) about cities & biodiversity. Published in *Cool Green Science*. Accessed December 2022.

[5] Stockholm Resilience Centre. Cities risk swallowing extensive wildlife habitat by 2030. Accessed December 2022.

[6] Seto, K et al. Global forecasts of urban expansion to 2030 and direct impacts on biodiversity and carbon pools. Published in *Proceedings of the National Academy of Sciences of the United States of America*, vol 109(40). Accessed December 2022.

[7] Food and Agriculture Organisation of the United Nations. Global assessment of soil pollution. Accessed December 2022.

[8] Food and Agriculture Organisation of the United Nations. Global assessment of soil pollution. Accessed December 2022.

[9] Food and Agriculture Organisation of the United Nations. Global assessment of soil pollution. Accessed December 2022.

[10] California Water & Land Use Partnership. How Urbanization Affects the Water Cycle. Accessed December 2022.

[11] Beaulieu, J. et al. Urban stream burial increases watershed-scale nitrate export. Published in *Plos One*, 2015. Accessed December 2022.

NEW YORK BRINGS NATURE TO CITY DWELLERS, FROM ON HIGH

New York City shows how unused infrastructure can be redeveloped to support ecosystem services: the transformation of the disused rail route known as the High Line.

Opened in 2009, the High Line is a public park built on the historic freight rail track elevated 30 feet above Manhattan's West Side. The continuous, 1.45-mile greenway features over 500 species of plants and trees, offering visitors a chance to enjoy nature while gaining a different perspective of the city from above street level.

Walking the line

As the High Line threads through several Manhattan neighbourhoods, a combination of industry, art and nature permeates the route. You can walk on the original railroad tracks embedded in the path in some places, while enjoying art installations standing among the plantings.

At the edges, glimpses of the Hudson River emerge between contemporary apartment buildings designed by architects including Frank Gehry and Zaha Hadid.

All along are areas to linger, such as balconies offering views of the Meatpacking District and the Whitney Museum of American Art, seen through a thicket of birch trees. Benches overlooking the street provide a chance to rest as birdsong mingles with the muted traffic noise from below.

Once destined for demolition, the High Line has become a model for transforming unused industrial infrastructure.

The elevated rail line was built in the 1930s to eliminate street-level train crossings for efficiency and safety, following many fatal traffic accidents. The trains here delivered food to lower Manhattan, with the line connected to the upper-floor loading docks of factories and warehouses.

Along the route, you can see the former National Biscuit Company, or Nabisco. This building – now the Chelsea Market – is where the Oreo cookie was invented.

With the decline of manufacturing – and the rise of refrigerated trucking – the freight line fell out of use in the 1970s and '80s.

Regeneration

During two decades of disuse, proposals for the structure's reinvention included a rollercoaster and even a mile-long lap pool. Meanwhile, a thriving garden of wild plants had secretly taken over the tracks.

Inspired by this self-seeded landscape, locals Joshua David and Robert Hammond founded the non-profit Friends of the High Line and pushed for its reuse as open space. The group remains responsible for maintenance of the park, in partnership with NYC Parks. Most funding is from donations.

The park is essentially a living, green roof on top of the rail tracks. It has several layers, including a porous drainage layer, gravel, subsoil and topsoil. Some sections use recirculated water, and there are plans to harvest rainwater from the roofs of nearby buildings.

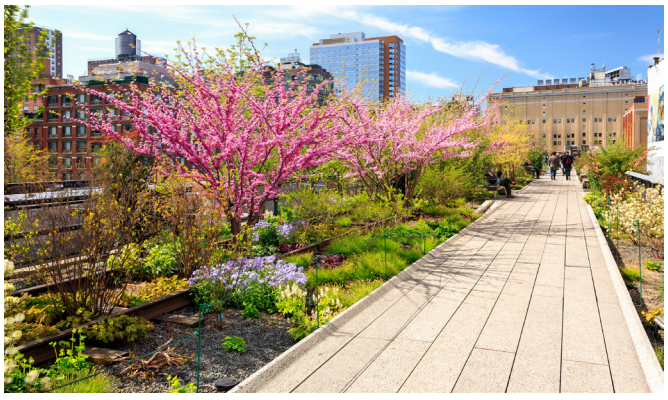
Planting designer Piet Oudolf chose a mix of native drought-resistant and foreign species of perennials, grasses, shrubs and trees for texture and colour variety. The park is arguably at its visual best in warmer months, when wisteria, hydrangea vine and clematis cascade over the railings and are visible from the street below.

But even in winter, the High Line offers a nature escape. In fact, the brown leaf litter and plant debris visible in colder months serve an important purpose: they provide critical shelter for hibernating bumble bees and other insects. Dried leaves, stalks and seedheads are also a habitat for birds.

The High Line says it aims to have as many endemic species of plants as possible to provide high-quality food sources for pollinators, and it avoids using synthetic pesticides and fertilisers.[12]

Be sure to stop by the High Line on your next visit to New York – to see this thriving urban landscape that emerged after the trains stopped running.

An aerial view of the High Line



Walking the High Line in spring

[12] The High Line. Sustainable practices. Accessed December 2022.

INNOVATIVE URBANISATION: A SUSTAINABILITY OPPORTUNITY

As the world continues to urbanise while targeting ambitious nature-preservation goals, policies, practical expertise and innovations that integrate nature into the built environment stand to attract greater demand.

Bringing nature back. According to the World Economic Forum, making infrastructure and the built environment sustainable is critical to halting biodiversity loss, and doing so could create more than USD 3 trillion in annual revenues and create 117 million jobs by 2030.[13] What are some of the solutions within the innovative urbanisation theme? Environmentally aware engineering and construction, analysis and testing, environmental remediation and water management are growth sectors, in our view. By sympathetically integrating nature into urban spaces, biodiversity can regenerate and support ecosystem services to society and the economy.

Analytical services. Analysis is essential to supporting biodiversity in the built environment. Pollutant levels and species populations must be monitored during redevelopments, remediation projects and new constructions – and on an ongoing schedule, to gauge progress in regenerating biodiversity among other environmental-health objectives.

Science has delivered innovations that companies and planning authorities are increasingly adopting. Two examples from the broad range of analytical approaches are:

- Analysing environmental DNA (eDNA) that has been shed naturally by animals, enabling populations to be tracked without catching and sampling wildlife
- Going further, metabarcoding uses eDNA analysis to track a range of species within an environment, improving the speed and scope of biodiversity analysis. Since not all eDNA samples are used and last a long time, they can be reassessed as a project continues and new questions emerge

Decontamination. Remediating past pollution, or properly managing current waste, is being carried out by planning authorities, utilities and businesses aiming to redevelop polluted land, restore nature in urban environments and control the current impact of waste on ecosystems. Old manufacturing facilities, processing plants, mining operations and landfills are typical sites of contamination. They are therefore prime candidates for remediation - the removal and treatment of polluted soil, sediments, surface and ground water.

Current business operations can also require such work – especially when toxic spills have occurred, premises are being expanded or micro-demolitions carried out. With space being a prized commodity as urban areas expand, combined with growing awareness about the benefits of integrating nature into cities, demand for environmental remediation is strengthening. Services instrumental in helping convert polluted sites into new projects or that ensure current operations continue – while bringing the benefits of biodiversity protection to cities – are part of a global market expected to grow at a compound annual rate of 8.07% to reach USD 172.6 billion by 2027.[14]

Green and sponge infrastructure. Taking multiple forms and delivering myriad benefits – such as regenerating biodiversity, improving air and water quality, reducing flood risk and enhancing wellbeing – green and blue infrastructure projects are in focus, from New York to Harbin and Auckland.

- **Green infrastructure** consists of networks of parks, gardens, woodlands, rivers and wetlands in urban environments, ideally connected by hedges or tree corridors. It also includes features like green roofs and walls, rain gardens and bug hotels – especially those accompanies by perennial flowerbeds encouraging local pollinators.
  Combined, green infrastructure supports biodiversity by harbouring animals, insects and natural vegetation. For instance, more than 20% of global avian species live in cities.[15] Converted plots, grass verges, reclaimed landfill and other unused spaces – even the old moat around the historic Tower of London – can become vibrant, wildflower-filled pollinator hotspots.
- **Sponge infrastructure** harnesses a city's natural resources – grass, soils and ponds – to absorb water and release it more slowly into waterways, reducing flood risk. Landscaping to enhance vegetated drainage, such as swales and tree trenches, and using permeable pavement in areas where hard surfaces are needed, also assist. The sponginess of cities is largely influenced by soil types, as sandy earth is more absorbent than clay; vegetation, because trees and shrubs soak up more runoff than grass alone; and the presence of ponds and lakes and whether they are connected to better manage flood risk. By helping to better manage flow and filter pollutants, such 'blue' infrastructure can be designed to work with the 'grey' infrastructure of built pipes to improve and preserve water habitats.

Supportive policies. The EU Green Infrastructure strategy aims to "promote the deployment of green infrastructure in the EU in urban and rural areas".[16] This will help fulfil the bloc's overall biodiversity

[13] World Economic Forum. The Future of Nature and Business. Published in 2020. Accessed December 2022.

[14] Market Growth Reports. Global remediation industry research report. Published in 2022. Accessed December 2022.

[15] Rai, S. and Verma, A. 5 reasons why cities need a healthy tree cover. World Economic Forum, 2022. Accessed December 2022.

[16] European Commission. The EU strategy on green infrastructure. Accessed December 2022.

strategy, which was adopted in 2021 and includes a European Platform for Urban Greening.[17,18] The EU's call for a 'Paris Agreement for biodiversity' was followed by the agreement by 195 countries at COP15 to protect and regenerate 30% of the planet's land and water by 2030,[19] indicating that country-level regulations are likely to apply. The UK provides an early example: biodiversity is a priority of the 2020 Environment Bill, which mandates a biodiversity net gain of 10% on all major development projects and is expected to take effect from November 2023.[20]

Such laws build on requirements from many countries, multilateral development banks or international organisations for environmental impact assessments (EIAs) to be conducted before urban or industrial development projects take place.[21] In Europe, EIAs address how proposed works directly and indirectly influence biodiversity in addition to land, air, water, climate, human health and cultural heritage.[22] In the UK, EIAs also consider how the impact of the development might combine with those of existing structures to create cumulative effects on biodiversity and nature, and whether any consequences could have transboundary implications.[23]

Like climate change, nature loss is a global issue. Since biodiversity hotspots can span national borders, collaborative policy responses will be needed to support strategies with sufficient breadth to protect biodiversity and keep ecosystems functioning in these vital areas.[24]

ALIGNED COMPANIES

Within the innovative urbanisation theme exist companies providing solutions to the problems caused by nature loss in cities. Below are examples of specialists in this area. These descriptions are provided as information only – the businesses are not necessarily held in our portfolios or represent investment recommendations.[25]

FOCUS AREA	COMPANIES
Urban planning	Building 'symbiotic biocities' is a focus for **Sweco**, a design, engineering, environment and regulatory consultancy. Circularity is central to the company's approach and shapes its services relating to architecture, construction, urban greening and agriculture, mobility and waste management. It also provides ecological-impact and biodiversity-net-gain assessments.
Habitat protection	Among the sustainability solutions provided by **TetraTech**, a consulting and engineering firm with commercial and government clients worldwide, are re-greening urban spaces, improving stormwater management and air quality. Part of the service offering from **Stantec**, a design and consulting company, is ecosystem restoration focused on re-establishing ecological functions in damaged or degraded environments through design, management and monitoring. Its projects have included: preventing sewerage overflows, removing invasive species, encouraging native plants and wildflowers, maintaining wetlands and restoring urban waterways to more natural and resilient conditions.
Environmental analysis	**Agilent** is an analytical development and manufacturing company focused on chemical analysis, life sciences and diagnostics. Its instruments provide testing for hard-to-find pollutants and a line of defence against toxic elements in food and water. **Bureau Veritas** is a certification company specialising in testing and inspection of corporate operational sites, products and supply chains so they conform to local and global regulatory and environmental standards.

[17] Morgenroth, J. et al. Urban tree diversity for sustainable cities. Published by Nordic Forest Research. Accessed December 2022.
[18] European Parliament. Biodiversity: MEPs demand binding targets to protect wildlife and people. Accessed December 2022.
[19] Convention on Biological Diversity. COP15: nations adopt four goals, 23 targets in landmark UN agreement for biodiversity. Published December 2022. Accessed December 2022.
[20] UK Government. Environment Bill 2020. Published January 2020. Accessed December 2022.
[21] National Environmental Policy Act. International Environmental Policy Assessment. Published by the US Department of the Environment. Accessed December 2022.
[22] European Commission. Environmental impact assessment. Accessed December 2022.
[23] UK Government. The town and country planning (environmental impact assessment) regulations 2017 screening matrix. Accessed December 2022.
[24] Elmqvist, T. et al. Urbanisation, habitat loss and biodiversity decline: solution pathways to break the cycle. Published in the "Routledge handbook of urbanisation and global environmental change". Accessed December 2022.
[25] Any reference to a specific company or security does not constitute a recommendation to buy, sell, hold or directly invest in the company or securities. It should not be assumed that the recommendations made in the future will be profitable or will equal the performance of the securities discussed in this document.

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